BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

SITTING AT PUNE

ORIGINAL APPLICATION NO. 77 OF 2023

Banda Nagaraj Kumar & Anr. ...Applicants

Versus

Maharashtra Maritime Board & Ors. ...Respondents

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Advocates for Respondent No. 1

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

SITTING AT PUNE

ORIGINAL APPLICATION NO. 77 OF 2023

Banda Nagaraj Kumar & Anr. ...Applicants

Versus

Maharashtra Maritime Board & Ors. ...Respondents

AFFIDAVIT-IN-REPLY OF MAHARASHTRA MARITIME BOARD, i.e., RESPONDENT NO. 1 TO THE ORIGINAL APPLICATION:

I, Shri. Nanasaheb Murlidhar Pawar, the Superintending Engineer and Authorised Signatory of Respondent No. 1, having my office address at Indian Mercantile Chambers, 2nd Floor, Ramjibhai Kamani Marg, Ballard Estate, Mumbai – 400 001, do solemnly state on oath and affirm as under:-

1. I am the Authorised Signatory of Respondent No. 1 having my address as mentioned above. I have gone through the above Original Application (the "**Application**") and the documents filed along with the said Original Application by the Applicants. I am familiar with the facts of the case from office records available with the Respondent No. 1 and am competent to depose to the facts in this Affidavit-in-Reply (the "**Reply**").

2. I am filing this Reply for the limited purpose of opposing the Original Application and the grant of any reliefs against this

Respondent No. 1. I crave leave of this Hon'ble Tribunal to file a further affidavit or affidavits, if circumstances so warrant.

3. At the outset, I deny all allegations, contentions and submissions made in the Application, which are contrary to or inconsistent with what is stated in this Reply. Further, I oppose the reliefs prayed for in the Original Application against the Respondent No. 1. None of the allegations, contentions or submissions in the Original Application which have not been specifically dealt with or denied by me, should be deemed to be admitted.

BRIEF BACKGROUND

4. Respondent No. 1 is a statutory authority constituted under the provisions of Maharashtra Maritime Board Act, 1996 tasked with developing, conserving, regulating, facilitating and administering the non-major port limits on the coast of Maharashtra. Respondent No. 1 ensures sustainable planned development of minor ports, maritime facilities and has successfully developed Green Field Ports, multipurpose terminals, captive jetties, navigational routes, shipyards and inland water transport.

NOTARY Mrs. SNEHAL C. SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA

5. In the present case, the Respondent No. 1 is the Project Proponent carrying out the construction of anti-sea erosion bund and Sea Front Development and beautification at Aksa Beach, Madh, Mumbai Suburban ("**the said Project**"). The purpose of the project is to *inter alia* construct anti-sea erosion bund as the site is an eroding site and existing structures therein are affected by erosion and to prevent existing electric poles from collapsing due to erosion. It is pertinent to note that Respondent No. 1 is a statutory authority implementing a public project for the benefit of the public and is as such not a private party and/ or executing a private project.

PRELIMINARY OBJECTIONS:

6. Before dealing with the Application on merits, I submit that the present Original Application ought to be rejected at the threshold on the basis of the following preliminary objections:

Barred by limitation:

7. The present Application has been filed under Sections 14, 15, 20 read with Section 18(1) of the National Green Tribunal Act, 2010 ("**the NGT Act**"). Section 14(3) of the NGT Act expressly states that no adjudication of dispute under this section shall be entertained

by the Hon'ble Tribunal unless it is made within a period of six months from the date on which the cause of action for such dispute arose. The proviso to Section 14(3) of the NGT Act provides that the Hon'ble Tribunal may, if it is satisfied that the Applicant was prevented by sufficient cause from filing the application within the said period, allow the application to be filed within a further period not exceeding sixty days. This Hon'ble Tribunal is a creation of the NGT Act which prescribes strict timelines under Section 14.

8. In the present case, the Respondent No. 1 made a proposal for the said Project to Respondent No. 2 first in the year 2017. Thereafter, Respondent No. 1 took all the steps for obtaining necessary permissions from the authorities and subsequently, the Respondent No. 4, the State Environmental Impact Assessment Authority ("**SEIAA**") granted the CRZ Clearance on 5th March 2019 for the said project. On close scrutiny of the averments and pleadings of the present proceedings, it is evident that the Applicant has sought to challenge the CRZ Clearance by way of the present Application. Hence, the cause of action at the most arose for any concerned party to file an application under Section 14 of NGT Act on 5th March 2019. However, the present Application was filed only on 10th May 2023 which is *ex facie* beyond the period of limitation stipulated

under Section 14(3) of the NGT Act and the proviso thereto. The Respondent No. 1 states that this Hon'ble Tribunal ought not to entertain the captioned Application on the sole ground of limitation and the same deserves to be dismissed at the very threshold.

No Appeal filed against the grant of CRZ Clearance:

9. The Respondent No. 1 states that the Respondent No. 1 has obtained the CRZ Clearance prior to commencement of the said Project. On bare perusal of the pleadings as well as the prayers of the present Application, it is evident that the Original Applicants have sought to raise various grievances and issues with respect to the said CRZ Clearance. It is trite law that a party ought not to be permitted to challenge the CRZ Clearance except by way of filing an Appeal. A challenge to a CRZ Clearance is as and by way of an Appeal under the NGT Act. However, in the present case the Original Applicants is attempting to invoke the jurisdiction of this Hon'ble Tribunal under Section 14 and 15 read with Section 18 of the NGT Act to challenge a grant of CRZ Clearance instead of filing an Appeal. In fact, as per Order dated 19th May 2023 passed in the present proceedings, it has been clarified by the advocates of the Applicants that Section 16 which provides for appeal under the NGT Act has been wrongly mentioned in the original application. The Respondent

No. 1 submits that on this ground alone, the captioned Application ought to be dismissed at the threshold.

OA No. 64 of 2021:

10. Respondent No. 1 submits that a similar issue was raised relating to anti-sea erosion bund in Village Versova, Mumbai as alleged in Original Application No. 64 of 2021. In the said OA No. 64 of 2021, the Petitioner therein prayed for directions to *inter alia* stop the construction of anti-sea erosion bund on sandy beach at CTS No. 1047 of Village Versova, Mumbai and demolish the said construction and restore the site. This Hon'ble Tribunal vide Order dated 23rd May 2023 decided the issue and held that anti-sea erosion bund has been clearly permitted by SEIAA under whom the activity therein was going on and has been completed to a large extent. The Hon'ble Tribunal noted that the project was of public importance which has almost been completed or is on the verge of completion and hence, did not pass any adverse order impacting upon the project therein. The Hon'ble Tribunal also noted that it is a permissible activity under the CRZ Notification and is a necessity considering the situation at the ground level. In the present case as well, the anti-sea erosion bund is being constructed as a necessity so that there is no damage to propriety and life. Hereto annexed and

marked as "**Exhibit - A**" is a copy of the Judgment dated 23rd May 2023 passed in OA No. 64 of 2021.

ON FACTS/ MERITS

11. It has been prayed, on the basis of the preliminary objections set out above, that the present Application be dismissed. However, without prejudice to what is stated above, the Respondent No. 1 states that even on merits, the Applicants have failed to make out a cogent case which deserves any relief or interference from this Hon'ble Tribunal.

Clearances obtained by the Respondent No. 1 for construction of said Project:

12. Respondent No. 1 states that it has obtained CRZ clearance, under the applicable CRZ Notification for the construction of Anti Erosion bund and beautification. The expert bodies and authorities, Respondent No. 2-MCZMA and Respondent No. 4-SEIAA, by a reasoned speaking permission have granted CRZ Clearance to the Respondent No. 1 to carry out the construction of the said Project.

13. In the year 2017, the Respondent No. 1 first made a proposal to the Respondent No. 2 - the Maharashtra Coastal Zone Management Authority ("**MCZMA**") for the proposal of beautification of Aksa

Beach at Madh, Mumbai which involved the construction of a gabion wall. The Respondent No. 2 considered the proposal in their 115th Meeting held on 17th and 18th January 2017 and instructed the Respondent No. 1 to explore other solutions instead of solid construction on the beach (*annexed at Annexure-A3 of the Application*). Thereafter in the year 2018, Respondent No. 1 made an application to Respondent No. 2 for the said Project for construction of anti-sea erosion measure at Aksa Beach involving construction of pathway, parapet wall, providing solar streetlight in light of the erosion problem prevalent at Aksa Beach. Respondent No. 2 considered the said proposal in its 127th Meeting held on 2nd November 2018 and decided to recommend the proposal to Respondent No. 4 – SEIAA for CRZ Clearance (*annexed at Annexure-A4 of the Application*). The Respondent No. 4 – SEIAA considered the proposal of Respondent No. 1 in its 158th Meeting dated 27th February 2019 and on 5th March 2019 and granted CRZ Clearance to the Respondent No. 1 for the said Project. Hereto annexed and marked as "**Exhibit - B**" is a copy of the Form 1 along with Environmental Impact Assessment ("EIA") Report submitted to Respondent No. 2 "**Exhibit - C**" is a copy of the 158th Minutes of Meeting of SEIAA dated 27th February 2019 and "**Exhibit - D**" is a

copy of the CRZ Clearance dated 5th March 2019 issued by Respondent No. 4 to Respondent No. 1.

14. On 27th August 2020, Respondent No. 1 made an application to Respondent No. 2 – MCZMA for amendment in CRZ Clearance dated 5th March 2019 so as to incorporate additional scope in the said project. Hereto annexed and marked as "**Exhibit -E**" is a copy of the Application for CRZ amendment, Form 1, EIA Report.

15. On 24th November 2020, Respondent No. 2 considered the proposal for amendment in CRZ Clearance in its 148th Meeting and noted that Respondent No. 1 needed to superimpose the layout of the project on approved CZMP 2011 in 1:4000 scale to ascertain the project activities viz a viz its CRZ status and thereafter, deferred the proposal for compliance (*annexed at Annexure-A5 of the Application*). On 30st March 2021, Respondent No. 1 submitted the superimposition of layout of the project on approved CZMP 2011 in compliance of the 148th MCZMA Minutes of Meeting dated 24th November 2020 which clearly indicates that the proposed activity is in CRZ-II area and is a permissible activity. Hereto annexed and marked as "**Exhibit - F**" is a copy of the Superimposed Layout of Project on approved CZMP 2011 in 1:4000 scale along with the cover letter dated 30st March 2021.

16. On 10th and 11th June 2021, Respondent No. 2 deliberated the said proposal in its 155th Meeting and decided to grant recommendation to the proposed activities of landscaping, playground/ recreational ground/ garden from CRZ point of view (*annexed at Annexure-A6 of the Application*). In pursuance thereof, on 30th June 2021, Respondent No. 2 granted CRZ Clearance to the proposed activities of landscaping, playground/ recreational ground/ garden from CRZ point of view. Hereto annexed and marked as "**Exhibit - G**" is a copy of the CRZ Clearance dated 30th June 2021 issued by Respondent No. 2 to Respondent No. 1.

The said Project is a permissible activity under the CRZ Notification

17. The Ministry of Environment and Forest ("**MoEF**") issued the CRZ Notification for the purpose of declaring coastal stretches as coastal regulation zone and for classification of lands falling into various CRZ categories such as CRZ I, II, III, IV, etc. Under the notification, every activity in CRZ areas could be categorized as prohibited, permitted and regulated activity under the Notification. The said project of construction of an anti-sea erosion bund is a permissible activity under CRZ Notification 2011 as well as 2019.

The relevant clauses of CRZ Notification 2011 as well as 2019 are reproduced hereinbelow:

CRZ Notification 2011

"*3. Prohibited activities within CRZ – The following are declared as prohibited activities within the CRZ-*

(iv) Land reclamation, bunding or disturbing the natural course of seawater except those-

> *(b)* ***measures for control of erosion, based on scientific including Environmental Impact Assessment (hereinafter referred to as the EIA) studies***"

CRZ Notification 2019

"*5.1.2 CRZ-IB - The inter tidal areas:*

Activities shall be regulated or permissible in the CRZ-I B areas as under:-

> *(i) Land reclamation, bunding, etc. shall be permitted only for activities such as,-*
>
> ***(d) measures for control of erosion;***"

18. Sub-clause (iv)(b) of Regulation 3 provides that land reclamation, bunding or disturbing the natural course of seawater is a permissible activity under the CRZ Notification where it is a measure for control

of erosion based on scientific EIA studies. The Respondent No. 1 has conducted the EIA studies which is a pre-requisite for CRZ Clearance and a detailed EIA Report was submitted to the authorities who considered the said report and thereafter duly granted the CRZ Clearance.

19. Respondent No. 1 states that the construction of the said project is a permissible activity under the provisions of the Coastal Regulation Zone Notification 2011 as well as 2019.

Studies conducted by Expert Bodies confirms the need of the said project

20. Respondent No. 1 sought advice of an expert body, Department of Water Resources, River Development and Ganga Rejuvenation, Central Water and Power Research Station, Pune ("**CWPRS**") for the design of coastal protection work at Aksa Beach. Accordingly, CWPRS carried out a detailed mathematical study for protection measures for Aksa Beach. Hereto annexed and marked as "**Exhibit - H**" is a copy of the CWPRS Report dated 13th January 2022.

21. On 6th April 2023, the Respondent No. 1 wrote to the Indian Institute of Technology, Bombay ("**IIT Bombay**") to provide expert opinion about the appropriability of location of placement of the

said project. In pursuance thereof, a site visit was conducted by the officials of IIT Bombay on 10th April 2023 to assess the site condition and status of the said project and accordingly, on 17th April 2023 a site report was submitted to Respondent No. 1. The report makes a categorical finding that Aksa Beach is an eroding site and the existing structures are affected by erosion. This was also demonstrated by looking at the beach profile of Aksa Beach from the year 2004 to 2022. The Report analysed the site condition before construction of the said project wherein it was found that the electric poles at the site were found exposed due to erosion and at several places the severe erosion led to failure of foundation and falling of electric poles. Hence, there is need to provide anti-sea erosion bund to protect existing as well as future infrastructure from collapsing due to erosion and the alignment chosen to construct the anti-erosion measure seem appropriate as the existing electric poles were collapsing due to erosion. Hereto annexed and marked as "**Exhibit - I**" is a copy of the Report dated 17th April 2023 submitted by IIT Bombay to Respondent No. 1.

22. On 28th April 2023, CWPRS conducted another site visit to review the construction of coastal protection work and *inter alia* opined that the seawall/ toe-berm protection was necessary to protect boundary

wall and the proposed beautification. Hereto annexed and marked as "**Exhibit - J**" is a copy of the CWPRS Report dated 12th May 2023.

23. Respondent No. 1 submits that Respondent No. 1 sought expert opinion to review the construction of the said project and the expert bodies have opined after due study of the project that there is a necessity of anti-sea erosion bund at the project site.

The construction of the said Project is almost complete

24. On 16th March 2022, a Work Order was issued by Respondent No. 1 for the said Project. The Respondent No. 1 submits that the construction of the said project commenced in terms of the work order and is almost on the verge of completion. The details of the progress of the work for the said Project is detailed hereinbelow in a tabular form for ease of reference:

Sr. No	Name of work	Scope of work	W.O Amount/ Date (Amount in Lakhs)	Completed scope of work	Percentage of work completed
1.	Providing anti sea corrosion measures from 0/00 m to 0/475m at Aksa Beach, Madh, Mumbai Suburban.	• UCR Wall 375m • Anti-Sea Erosion Bund	438.18 16.03.22	• UCR Wall 360 m • Anti-Sea Erosion Bund	95%

				360 m	
2.	Providing anti sea corrosion measures from 0/475m to 0/950m at Aksa Beach, Madh, Mumbai Suburban.	• UCR Wall 375 m • Anti-Sea Erosion Bund	438.18 16.03.22	• UCR Wall 375 m • Anti-Sea Erosion Bund 375 m	98%
3.	Providing Sea front development and basic facilities for tourists at Aksa Beach, Madh, Mumbai Subutban	• Pathway using cobble stone • Landscaping • Electrification • Irrigation • Open Gym.	414.79 16.03.22	• Pathway – 375 m • Electric Pole – 61 nos.	25%
4.	Beautification & other allied facilities at Aksa Beach, Madh, Muma	• Pathway using cobble stone. • Landscaping • Fixing Gazebo & Bamboo Shalks • Fixing Sculptures	412.90 16.03.22	• Pathway 295 m • Seating benches – 66 nos.	23%

25. The above table clearly shows that the construction of the said Project is almost complete, and the Applicant is attempting to challenge it now at a belated stage. Hereto annexed and marked as "**Exhibit - K**" are photographs showing the current status of the said Project.

26. The Respondent No. 1 states that it has carried out the work of the said Project after receiving CRZ clearance from the expert Authorities. The Applicants have failed to show any arbitrariness, malafide or perversity in the decision-making process of granting permission for the said Project. Therefore, this Hon'ble Tribunal ought not to interfere with the decision.

27. It is worth noting that the Respondent No. 1 has till date spent amounts to the tune of Rs. 11,83,85,204/- (Eleven Crores Eighty-Three Lakhs Eighty-Five Thousand Two Hundred and Four Rupees) out of the public exchequer for implementing the said project. The Respondent No. 1 further submits that this Hon'ble Tribunal ought not to grant any stay in the project as a single day's delay will escalate the cost for the Respondent No. 1.

28. The Respondent No. 1 submits that the Respondent No. 1 has dealt with all the allegations raised by the Applicants in the aforementioned manner and expressly craves leave to file a detailed parawise reply, if circumstances so warrant.

29. In light of the above facts and circumstances, the Respondent No. 1 states that the captioned Application as filed is completely baseless, misconceived and deserves to be dismissed as evidently the

Respondent No. 1 is at the last stage of completion of the said Project, which is a project of public importance. Therefore, this Hon'ble Tribunal ought not to grant any relief in the captioned Application which will otherwise stall the implementation of the said project which is being constructed for the benefit of the public. Therefore, the Respondent No. 1 prays that the present Original Application be dismissed.

Solemnly affirmed at ....Mumbai

This 27 day of June 2023.

NOTARY
Mrs. SNEHAL C. SAWANT
Gr. Mumbai
Maharashtra
Reg. No. 15639
Expiry Dt. 26/11/2024
GOVT. OF INDIA

(Shri. Nanasaheb Murlidhar Pawar)
Authorised Signatory of Respondent No. 1

Advocates for Respondent No. 1

Before me

VERIFICATION

I, Shri. Nanasaheb Murlidhar Pawar, the Superintending Engineer and Authorised Signatory of Respondent No. 1, having my office address at Indian Mercantile Chambers, 2nd Floor, Ramjibhai Kamani Marg, Ballard Estate, Mumbai – 400 001, do hereby state that I have submitted this Affidavit on solemn affirmation and oath. I have verified that the facts are true to my personal knowledge. I have not suppressed any material fact known to me and relevant to this matter.

Date:

Place: 27 JUN 2023

NOTARY Mrs. SNEHAL C. SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA

(Shri. Nanasaheb Murlidhar Pawar)
Authorised Signatory of Respondent No. 1

ORIG. PAN CARD / AADHAR CARD / DRIVING LICENCE
VOTERS ID No. ACMPP 7816 P SEEN & RETURNED

Advocates for Respondent No. 1

Before me

Original Authority letter / Board Resolutions / Power of Attorney dated 26/6/2023 seen.

BEFORE ME
Mrs. SNEHAL C. SAWANT
B.Com. L.L.B.
NOTARY GOVT. OF INDIA
Regd. No. 15639
101, Visaria Chambers, 1st Floor, 74, Janmabhoomi, Fort, Mumbai-1

Noted & Registered
Reg. No. 32
Page No. 29/430
Date 27 JUN

NOTARY Mrs. SNEHAL C. SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA NOTARIAL NOTARIAL NOTARIAL

NOTARY Mrs. SNEHAL C. SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA NOTARIAL NOTARIAL

27/6/23

सत्यमेव जयते

GOVERNMENT OF MAHARASHTRA, HOME DEPARTMENT (PORTS & TRANSPORT)

MAHARASHTRA MARITIME BOARD

Indian Mercantile Chambers, 2nd Floor, Ramjibhai Kamani Marg, Ballard Estate,
Mumbai - 400 001. **Tel.**: 022-69041777 **Fax** : 022-69041740
Website : https://mahammb.maharashtra.gov.in
Email: ceo.mmb@maharashtra.gov.in / ceommb@gmail.com

TO WHOM IT MAY CONCERN

I, the undersigned, Dr. Manik Gursal, being the Chief Executive Officer Maritime Board, Mumbai hereby authorize Shri. Nanasaheb Murlidhar. Pawar, the Superintending Engineer of Maharashtra Maritime Board, to sign written submissions, Affidavit in reply, undertaking etc. on behalf of Maharashtra Maritime Board in the Original Application No. 77 of 2023 filed by Banda Nagaraj Kumar & Anr. v/s Maharashtra Maritime Board in the National Green Tribunal Sitting at Pune.

Any and all acts carried out by Shri. Nanasaheb Murlidhar Pawar, the Superintending Engineer on behalf of the undersigned shall have the same effect as acts of own. This Authority Letter shall be valid till disposal of the above mentioned Original Application by the Hon'ble National Green Tribunal Stting at Pune or until this authority is withdrawn by the Chief Executive Officer, Maharashtra Maritime Board.

Yours faithfully,

(Dr. Manik Gursal)
Chief Executive Officer
Maharashtra Maritime Board,Mumbai.

Date: 26th June, 2023
Place: Mumbai

(Mr. Shri. Nanasaheb Murlidhar Pawar,)
Superintending Engineer

Attested by me

(Dr. Manik Gursal)
Chief Executive Officer
Maharashtra Maritime Board, Mumbai.

EXHIBIT-A

27/6/23

(Pune Bench)

BEFORE THE NATIONAL GREEN TRIBUNAL
WESTERN ZONE BENCH, PUNE

[THROUGH PHYSICAL HEARING (WITH HYBRID OPTION)]

ORIGINAL APPLICATION NO.64 OF 2021 (WZ)

Mr. Zoru Darayus Bhathena,
Age : 46 years, Occu. Business,
R/o T-149, Meherabad, Azad Road,
Juhu Koliwada, Mumbai – 400 049
Tel. 9821145767
Email : zoru@hotmail.com .....Applicant

Versus

1. State of Maharashtra,
   Public Works Department,
   Through the Coastal Engineer,
   New Administrative Building,
   3rd Floor, Near Chetna College,
   Bandra €, Mumbai – 400 051

2. Collector, Mumbai Suburban District,
   Administrative Building, 10th Floor,
   Govt. Colony, Near Chetana College,
   Bandra (E), Mumbai – 400 051

3. Maharashtra Coastal Zone Management Authority,
   Environment Department, Government of Maharashtra,
   15th Floor, New Administrative Building,
   Mantralaya, Mumbai – 400 032

4. State Level Environmental Impact
   Assessment Authority, Environment Department,
   Room No.217, Annex, Mantralaya,
   Mumbai – 400 032

5. State of Maharashtra,
   Environment Department,
   Through its Secretary,
   Room No.217,
   New Administrative Building,
   Mantralaya, Mumbai – 400 032

6. Assistant Commissioner,
   Municipal Corporation of Greater Mumbai,
   K – West Ward,
   Paliram Road, Near S.V. Road,
   Andheri (W), Mumbai – 400 058

7. Maharashtra Maritime Board,
   Indian Mercantile Chambers,
   3rd Floor, 14, Ramjibhai Kamani Marg,
   Ballard Estate, Mumbai – 400 001 ....Respondent(s)

CORAM: HON'BLE MR. JUSTICE DINESH KUMAR SINGH, JUDICIAL MEMBER
HON'BLE DR. VIJAY KULKARNI, EXPERT MEMBER

Applicant	:	Ms. Ronita Bhattacharya, Advocate
Respondents	:	Mr. Saket Mone, Advocate along with Mr. Abhishek Salian, Advocate for R-1/PWD Mr. Aniruddha Kulkarni, Advocate for R-3/MCZMA, R-4/SEIAA and R-5/Environment Department Mr. Sameer Khale, Advocate for R-6/MCGM

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Reserved on : 28.04.2023

Pronounced on : 23.05.2023

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JUDGMENT

1. This Application is filed under Section 18 of the National Green Tribunal Act, 2010, with the prayer that a direction be issued to respondent No.1 – Public Works Department, State of Maharashtra to forthwith stop proceeding with the construction of the unauthorized anti-sea erosion bund and dumping of construction debris, rocks or tetrapods on sandy beach at CTS 1047 of village Versova, Mumbai. It is further prayed that the respondent Authorities be directed to demolish all newly made existing illegal construction relating to the unauthorized anti-sea erosion bund and remove the debris, rocks or tetrapods from the site and restore it.

2. The facts of this case, in brief, are that Versova beach is a natural sandy beach which stretches from Versova creek in the North to Juhu Irla creek in the south, located in north west Mumbai. Respondent No.1 is raising construction of a thick, wide, 1.2 kms long Reinforced Cement Concrete (RCC) wall under the guise of anti-sea erosion work on the site and is dumping debris and tetrapods on the beach sand in violation of the CRZ Clearance dated 27.08.2018. This activity is in breach of CRZ

Notification, 2011. Respondent No.1 has not obtained requisite clearance from National Wildlife Board under the Wildlife Protection Act, 1972 nor has it conducted any Environment Impact Assessment study as required under CRZ Notification, 2011. The photographs have been annexed showing the location of the present ongoing work of anti-sea erosion bund, where there is existing compound wall along the coastline. The work undertaken involved construction on beach sand inside the High Tide Line (HTL) which has also altered the natural and geomorphological character of the beach. During low tide, when water recedes, sandy beach gets exposed. The plot of the land in question falls between Low Tide Line (LTL) and High Tide Line (HTL), which is CRZ-IB area. Because of the said area being sandy beach and the presence of turtle nesting sites, the plot also falls under CRZ-IA. The existing compound/boundary walls of the buildings fall under CRZ-II and therefore, permission from MCZMA is necessary. Respondent No. 1 put up a proposal for construction of anti-sea erosion bund from Sagar Kutir to Hindu Smashanbhumi at Versova at Mumbai.The anti-sea erosion bund, which was proposed to safeguard the premises along the coastline from further damage caused by the tidal impact on the boundary walls. The total project was stated to be 48,000 sq. mtrs i.e. about 1200 mtrs in length and the project's width is 40 mtrs. As per approval of CZMP of Mumbai, the site falls in CRZ-I(B) and CRZ-II area. In 116th meeting of MCZMA – respondent No.3, it noted that respondent No.1, vide letter dated 23.01.2017, forwarded an opinion of the Central Water and Power Research Station (CWPRS) dated 23.01.2017, recommending that a soft solution in the form of sand nourishment or provision of sand dunes or use of geo textile solutions of plantation/vegetation would not be suitable in view of higher waives and high tidal range because of the said area being densely populated. The MCZMA observed clearly that repair of existing retaining walls can be

undertaken and not a fresh construction, which is evident from the rejection of soft solutions like sand nourishment or provision of sand dunes or use of geo textile solution of plantation/vegetation. What was authorized was only repair of the existing wall which cannot be equated to a fresh construction. The remarks of the CWPRS were to the effect that in view of the higher waives, high tidal range and limited sediment movement, soft solutions would not be suitable and hence, a long-term solution was recommended, which was accepted by the MCZMA during its meeting on 22.03.2017, but no data on the studies undertaken to justify higher range of tides was provided. The MCZMA decided to recommend the proposal of "reconstruction of the existing anti-sea erosion wall" to the State Level Environment Impact Assessment Authority (SEIAA) subject to compliance with certain conditions. The MCZMA felt that only a retaining wall for protection was required; however, walkway on the retaining wall could not be allowed in CRZ-I area, the same being prohibited activity. Following were the recommendations made by the MCZMA while sanctioning the construction :

"(i) Proposed reconstruction of anti-sea erosion wall should be in accordance with provisions of the CRZ Notification, 2011 (amended from time to time);

(ii) Walkway is not permitted on the anti-sea erosion bund as it is not permissible activity in CRZ I intertidal area;

(iii) Recommendation of the CWPRS should be followed for the reconstruction/ redevelopment of the wall;

(iv) Location/ design of the bund should be in such way that there would be minimum reclamation on the beach (i.e. CRZ I area);

(v) Construction debris should not be dumped in the beach area or in Mangroves area;

(vi) Suggestions/objections of the residents of the proposed stretch may be considered, before starting the reconstruction/redevelopment work of the wall."

3. Pursuant to the above recommendations, the SEIAA – respondent No.4 granted CRZ clearance on 27.08.2019 for construction of anti-sea erosion bund from Sagar Kutir to Hindu Smashanbhumi at Versova. Further it is submitted that the CRZ clearance is simply for reconstruction/repair of the existing compound wall and that no Environmental Impact Assessment (EIA) study was conducted for the said project. The CRZ permission could not have been granted for construction of new anti-sea erosion wall at different location, in the middle of the sandy beach, nor has any permission been granted for placing cement tetrapods on the seaward side to build wall illegally. Sub-para 3 (iv) of para 4.2 of the CRZ Notification, 2011 clearly stipulates that disturbing the natural course of seawater is only permitted for measures of control of erosion, if it is based on scientific studies, including EIA studies. The MCZMA has been considering EIA reports submitted by the Project Proponents in respect of anti-sea erosion work but in the case in hand, no such study has been done. No such EIA report was conducted nor placed before the MCZMA as regards repairs of the construction of the existing wall. The construction of RCC wall has divided the beach into two parts, completely preventing the flow of seawater to the entire beach. This wall is at places more than 5 metres high. The beach section that has been walled in on the landward side, has been reclaimed and the ground is raised to about 10 feet higher than the rest of the beach on the seaward side, which has completely stopped any deposition of sand on the beach and the tetrapods have sunk into the seaward side due to erosion of sand below them. Respondent No.1 is erecting entirely new wall, which is separate from the existing wall, which is proposed to

be 9.0 metres in height and has multiple layers of tetrapods and stones on the seaward side of the wall. The explicit rejection of a walkway by the MCZMA was to avoid ecological damage caused by the structures in CRZ-I areas. We also find that there is an averment on record to the effect that original compound wall is in dilapidated condition, which could not have been repaired and that if any efforts were made to repair the same, the entire wall would collapse; hence, this application with the above prayers.

4. This application was first considered by our predecessor Bench on 13.09.2021 and notices were directed to be issued to the respondents.

5. As per the service-affidavit, service on all the respondents is sufficient.

6. The **stand taken by respondent No.1 – PWD** is as follows:

. The answering respondent received request from the representatives of the people residing at Versova beach to the effect that there was often flooding at the Versova beach causing huge loss to their property, which needed to be immediately redressed, pursuant to which a need was felt that there was requirement of protection to be provided. Hence, the answering respondent issued a letter to the Central Water and Power Research Station, Khadakwasla (CWPRS) on 08.03.2016, requesting for a suitable design for providing coastal protection through anti-sea erosion bund at Sagar Kutir to Hindu Smashanbhoomi, Versova. The CWPRS, vide their letter dated 11.04.2016, provided suitable design for constructing coastal protection at the site in question. In the year 2016, respondent No.1 conducted EIA studies. On 27.12.2016, the answering respondent applied for CRZ Clearance from MCZMA for constructing the present project. On 24.01.2017, CWPRS issued a letter to the answering respondent stating that in view of the higher waves, high tidal range and limited sediment movement, a soft solution in the form of sand nourishment by provision of sand dune or use of geotextile

solutions, planation vegetations will not be suitable for this type of densely populated areas, because soft solutions are of recurring type and may last only for a short period, hence, it recommended that the design already provided by it may be implemented, which would provide a long-term solution. The MCZMA directed the answering respondent to provide a detailed design of the anti-sea erosion bund considering the mix of soft solution and hard structures by CWPRS. The recommendation made by CWPRS was accepted by MCZMA on 27.06.2017 and decided to recommend the proposal of reconstruction of existing anti-sea erosion wall to SEIAA subject to compliance of certain conditions. On 18.09.2018, the SEIAA granted CRZ Clearance to the answering respondent for carrying out the construction of the present project. Around the year 2019, the answering respondent convened a meeting with citizens residing near Versova beach, wherein the citizens requested to optimize the size of the sea-wall to ensure maximum beach width for recreational activities, which was taken care of by the CWPRS. Further it is submitted that the CWPRS is an expert body and the answering respondent has carried out the construction of the project in question as per the design provided by CWPRS. Therefore, judicial review of such decision rendered by an expert body is impermissible. The answering respondent has already spent an amount of Rs.40.52 Crores till October, 2021 from the State Exchequer , which is public money and looking to the fact that the project is of public importance, which is being carried out following all due process, the application may be rejected.

8. Respondent No.1 – PWD has submitted additional affidavit on 21.01.2022 wherein it has been submitted that CWPRS recommended that optimum space is required to be there between the existing compound wall and the new structure (retaining wall) in order to avoid damage to existing compound wall. Further it is mentioned that the space

kept in between the two walls is not a walkway but a minimum distance which ought to have been maintained considering the technical and practical feasibility. In fact, the provisions of promenade, which required developing concrete pathway/walkway as stipulated in the earlier design, was eliminated and the space was filled with sand as a soft solution. The current wall constructed on the site at minimum distance of 5.5 mtrs from old wall as compared to minimum distance of 10 mtrs as proposed in the original design. It is further mentioned that entry to the site, will be restricted to the public after completion of the said project. The answering respondent is in process of considering planting trees/plants/shrubs in the said area between the two walls, which are suitable to grow in the coastal weather, as suggested by the CWPRS.

9. The **stand of respondent No.3 – MCZMA** is as follows:

. The project in question has been granted as per para 4(i)(f) of the CRZ Notification, 2011, which provides erosion control measures to be taken as permissible activity. It is further mentioned that only the retaining wall for protection was required; however, walkway on the retaining wall could not be allowed in CRZ-I area, being a prohibited activity. After deliberation, the answering respondent recommended the proposal for reconstruction of anti-sea erosion wall to the SEIAA subject to compliance of certain conditions. AS per the conditions, respondent No.1 – PWD should have followed the recommendations of CWPRS for reconstruction and re-development of wall. The location/design of the wall should be in such way that there would be minimum reclamation of the beach.

10. We have heard the arguments of the learned counsel for the parties and perused the evidence on record.

11. The issue, which falls for our consideration to be decided in this application, is as follows:

"Whether the anti-sea erosion bund is permissible activity at the site in question, which is admittedly falling in CRZ-I(B) and CRZ-II area as per the approved CZMP of Mumbai ?"

12. On this point, the learned counsel for the applicant has drawn our attention to Clause 3 sub-clause (iv) sub-clause (b) of the CRZ Notification, 2011, which provides for "*measures for control of erosion, based on scientific, including Environmental Impact Assessment (hereinafter referred to as "EIA") studies*". Having drawn our attention to this provision, it is argued that though this activity of making construction of anti-sea erosion bund is permissible activity as per above provision, it should be undertaken only after EIA study, which is not done in the present case. But we find that there is EIA study conducted in the present matter, which is at pages 230 to 319 of the paper-book.

13. Regarding the same, the learned counsel for respondent No.1 has taken the stand that this activity is covered under Clause 4, sub-clause (i) sub-clause(f), which provides as follows:

"Construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, break waters, groynes, erosion control measures"

Having drawn our attention to the above provision, it is argued by him that erosion control measure is the specific activity, which is permitted here in CRZ area and therefore, the MCZMA as well as SEIAA both have rightly granted permission/CRZ clearance for raising a kind of construction which is being raised by them and it has already been completed about 90% or thereabout.

14. We are of the view that this activity is permissible as has been stated by the learned counsel for respondent No.1. The view taken by the learned counsel for the applicant cannot be said to be true because EIA

study has already been done in this case. Therefore, we decide this issue in the affirmative.

15. The second issue/point which has been vehemently pressed by the learned counsel for the applicant is that there was no walkway to be permitted between the old compound wall and the new retaining wall, which is being constructed by respondent No.1.

16. In this regard, we find that the position is made absolutely clear by respondent No.1 through their affidavit dated 21.01.2022 that the space, which is provided between the existing compound wall and the newly constructed retaining wall, was necessary as per the recommendation made by CWPRS in order to ensure safety of existing compound wall and that it would not be allowed to be used by the people as a walkway because CWPRS has also proposed that the said area should be filled with sand and the plantation should be done thereon of the kind which is suitable for coastal area, which is under consideration of respondent No.1. We find that this recommendation by the CWPRS is very pertinent to be implemented by respondent No.1 in order to remove the apprehension of the applicant that the same could be used as a walkway/road after completion of the project. The learned counsel for the applicant has also shown several photographs wherein the said passage is being used for four wheelers, therefore, we also have apprehension that this might be misused in course of time by the people of the local area and therefore, it is bounden duty of respondent No.1 – Project Proponent to ensure that the said area is not allowed to be used as a walkway or motorway but the same should be used for plantation which would grow there easily.

17. During argument, the learned counsel for the applicant has relied upon the judgment of this Tribunal dated 11.04.2022 passed in ***Original Application No.4 of 2013 (SZ) with Appeal No.18 of 2017 (SC) (C.H.***

Balamohan Vs. Union of India and Ors.), wherein attention is drawn to paragraphs 5, 70 and 83 in order to fortify her view that if local residents demand any action to be taken by respondent No.1 and other agencies to give them protection against high tides, would not entitle such authorities to resort to environmentally destructive steps such as raising the construction with the help of cement-concrete, etc. in otherwise sensitive area, because that would lead to impairment of environment. In this case, which has been cited, the communities, which were affected, had demanded their homes to be protected by whichever way possible, based on which, hard structures were being put in place, which would lead to damage to the coastal environment, which was deprecated by the Tribunal. In this very judgment, it is also recommended that the general principle should be of "work with nature", which would be a better approach for cost-effective and sustainable coastal protection measures. Having relied on this, the learned counsel for the applicant states that in the present case, respondent No.1 should not have gone for raising of RCC and constructed new retaining wall, rather soft steps should have been taken to remedy the situation by making plantation and other such measures which would protect the local residents.

18. We do not agree with the argument of the learned counsel for the applicant in this regard because the facts of the said case on which the learned counsel has relied upon are totally different from the set of facts of the present case. In the present case, there was already a long compound wall giving protection to the local residents against high sea tides which had broken because of which the demand was there for its repair or reconstruction or some other provision to be made. Therefore, in such a situation, we think that the steps which have been taken have been taken on the basis of scientific study made by the CWPRS.

19. One important argument made by the learned counsel for the applicant is that the permission granted to respondent No.1 is only for repairs of the old compound wall and not for raising a new construction of anti-sea erosion retaining wall. In this regard, she has drawn our attention to page 49 of the paper-book, which is minutes of the 115th meeting of MCZMA held on 17.01.2017 and 18.01.2017, wherein at item No.12, the proposed construction of anti-sea erosion bund from Sagar Kutir to Hindu Smashanbhumi at Versova by respondent No.1 is dealt with and it is recorded therein that it is necessary to protect the shore by constructing anti-sea erosion bund. Total area of project is 48,000 sq.mtrs and approx.. length is 12 mtrs. As per the approved CZMP of Mumbai, the site falls in CRZ-IB and CRZ-II area. The Authority deliberated in this matter and observed that there should be combination of hard and soft solutions for arresting the sea erosion of Versva beach stretch. Combination of sea wall along with plantation, creepers, etc.. along the Versova beach would be more ecologically friendly solution in the matter. Considering this, respondent No.1 needs to revise the proposal incorporating soft engineering solution and revert.

20. The learned counsel drew our attention to page 51 of the paper-book, which is minutes of the 116th meeting of MCZMA held on 22.03.2017 and 23.03.2017, wherein at item No.6, the MCZMA held that respondent No.1, vide letter dated 23.01.2017, forwarded opinion of CWPRS dated 24.01.2017, which had recommended that in view of higher waves, high tidal range and limited sediment movement, a soft solution in the form of sand nourishment of provision of sand dune or use of geo textile solution of plantation/vegetation will not be suitable for these types of densely populated areas. Further it was held that these soft solutions are recurring type and may last only for a short period. Therefore, respondent No.1 was again requested to consider the proposal

to provide for long term solution provided by CWPRS earlier. The Authority – MCZMA deliberated the recommendations of the CWPRS and felt that the proposed bund could be constructed using mix of soft solutions and hard structures. Repair of existing retaining walls can be undertaken and the proposal was thereafter deferred.

21. Next the learned counsel for the applicant has drawn our attention to page 53 of the paper-book, at which there are minutes of the meeting of MCZMA dated 28.06.2017 to 30.06.2017 and at item No.13, the present project was considered. It was held that considering the possible coastal hazards in the area, it was felt by the MCZMA that only retaining wall for protection is required. However, walkway on the retaining wall cannot be allowed in CRZ-I area. Based on this recommendation, the SEIAA considered the matter in its 138th meeting held on 27.08.2018 and decided to grant CRZ Clearance on 18.09.2018, which states the CRZ Clearance for construction of anti-sea erosion bund from Sagar Kutir to Hindu Smashanbhumi at Versova in Mumbai. Having drawn our attention to these documents, it is vehemently argued by the learned counsel for the applicant that this construction which has been permitted regarding anti-sea erosion bund was nothing but permission granted regarding improvements which were wrongly incorporated by the Project Proponent – respondent No.1 and under the garb of it, it has constructed absolutely new anti-sea erosion bund. She has relied upon the following judgments:

(i) Ratheesh K.R. and Ors. v. State of Kerala and Ors. 2013 SCC OnLine Ker 14359

In above case, the Hon'ble High Court of Kerala has observed as follows:

> *"107. At this stage, we must deal with the argument raised before us by the company. It is submitted that a world class resort has been put up which will promote tourism in a State like Kerala which does not have any industries as such and where tourism has immense potential and jobs will be created. It is submitted tht the*

Court may bear in mind that the company is eco-friendly and if at all the Court is inclined to find against the company, the Court may, in the facts of this case, give direction to the company and the company will strictly abide by any safe-guards essential for the preservation of environment.

108. We do not think that this Court should be detained by such an argument. The Notification issued under the Environment (Protection) Act is meant to protect the environment and bring about sustainable development. It is the law of the land. It is meant to be obeyed and enforced. As held by the Apex Court, construction in violation of the Coastal Regulation Zone Regulations are not to be viewed lightly and he who breaches its terms does so at his own peril. The fait accompli of constructions being made which are in the teeth of the Notification cannot present, but a highly vulnerable argument."

(ii) Kerala State Coastal Zone Management Authority Vs. State of Kerala, Maradu Municipality and others (2019)7 SCC 248

The Hon'ble Supreme Court in above case held as below:

"The area in which the respondents have carried out construction activities is part of the tidally influenced water body and the construction activities in those areas are strictly restricted under the provisions of the CRZ notifications. Uncontrolled construction activities in these areas would have devastating effects on the natural water flow that may ultimately result in severe natural calamities. The expert opinions suggest that the devastating floods faced by Uttarakhand in recent years and Tamil Nadu this year are the immediate result of uncontrolled construction activities on river shores and unscrupulous trespass into the natural path of backwaters. The Coastal Zone Management Plan (in short "CZMP") has been prepared to check these types of activities and construction activities of all types in the notified areas. The High Court has ignored the significance of approved CZMP."

(iii) C.H. Balamohan V. Union of India and Ors. Original Application No.04/2013 (SZ) with Appeal No.18/2017 (SZ), decided by this Tribunal on 11.04.2022

This Tribunal (Special Bench), in the above matter, held as under:

"We have given due consideration to the issue of protection of the beaches from human induced erosion caused by hard structures. It is a fact that these hard structures may prevent erosion at the said stretch temporarily but the adverse impact of such measures are felt upstream or downstream where erosion starts. Thereby such hard measures only transfer the problem of shoreline change until and unless a holistic study is undertaken keeping in view that sediment cells and appropriate scientific measures taking into consideration both soft and hard. The problem exhaustively highlighted by the applicant, noted above raises substantial question of environment. We are satisfied that the same needs to be addressed by all coastal

States/UTs for protection of beaches from human induced erosion caused by hard structures."

(iv) Omkar Mahadeo Supekar and Anr. Vs. Municipal Corporation of Greater Mumbai and Ors. 2022 SCC OnLine Bom 1008

In the above judgment, the Hon'ble High Court of Bombay held thus:

"21. Of major concern is the fact that the word "construction" is nowhere defined in DCR 2034. In absence thereof, a plain and natural meaning will have to be assigned. The Oxford English Reference Dictionary, Edition 1995 defines `construct' and means make by fitting parts together, build, form. Similarly, in Concise Oxford Dictionary, Twelfth Edition, 2011, `construct' means build or erect. Thus, simply stating, construction is the act to build or erect.

23. Although the acclaimed project undertaken by respondent – MCGM suggests `rejuvenation and reinvigoration' of the physical and natural environment of Powai Lake, Mumbai, but the obtaining situation as discernible and decipherable from photographs, which is not disputed, shows land filling/reclamation, metallic frames raised on water body for dumping stones and laying of tar road along with peripheral area of the lake which cannot by any stretch of imagination be termed or construed `rejuvenation and reinvigoration' of the physical and natural environment of Powai Lake. Common sense would prompt a disturbing conclusion that construction of cycle track or any slightest disturbance to the otherwise serene water body of the surrounding area would have far-reaching effects on the ecology and aquatic life of the lake, which already has excessive silting, sewage ingress and extended hyacinth growth leading to eutrophication of the lake water. Needless to say, the respondent-MCGM in the present case has induced itself to undertake the reclamation under the garb of use of `Gabion Technology'. To show and submit that the project is being carried out to create a community access to the lake front and to enable access to the lake front for maintenance of lake, its periphery and for preservation of erosion, siltation and encroachment, is a bit hard to swallow, considering the material on record."

(v) Najama Gulab Bagwan and Ors. Vs. Laxmibai Rangildas Gujar since deceased by her heirs and LRs Vinodkumar Rangildas Gujar and Ors. 2005 SCC OnLine Bom 912

In the above case, the Hon'ble High Court of Bombay held as under:

"9. Another aspect of the word "repairs" and "reconstruction" has been considered by the Bombay High Court in Ramakant (supra) and as relied by both the parties, is reproduced as under:

> *"7. The expression "repairs" and "reconstruction" are not defined in the Act. Therefore, in order to construe provisions of the Bombay Rent Act where the same words occur, one has to*

take recourse to the ordinary dictionary meaning of such words, and to find out what is the connotation which is in conformity and in harmony with the Act. The meaning of such words which further the purposes of the Act and its scope is the meaning that has to be adopted. The Act intends to give protection to tenants from their eviction by the landlords. Therefore, eviction of the tenant is permissible only when the grounds laid down in the Act itself are satisfied.

8. "Repair" means, according to the New Webster's Dictionary, to restore to a sound or good state after decay, injury, dilapidation, or partial destruction; to make amends for, as for an injury, by an equivalent; to give indemnity for. It also means restoration to a sound or good state of a part which requires reparation. The word "repair", therefore, connotes in common parlance an idea of mending or removing any damage or danger of injury to a particular thing.

By implication, such word indicates that for repairs, the thing should still has existence. If the thing cease to exist, there will be no question of mending or correcting it. In turn, the meaning of "reconstruction" is given in the same dictionary as the act of constructing again or rebuilding. This words, therefore, implies that something that had existence has disappeared and is completely renewed."

22. Based on the above rulings, it is vehemently argued by the learned counsel for the applicant that there is distinction between "repair" and "reconstruction".

23. We find that in the present case, there is no such ambiguity which needs to be answered because in our estimation, the construction of anti-sea erosion bund has been clearly permitted by the SEIAA under which present activity has been going on, which has been completed to a larger extent. Regarding this activity being in accordance with the provisions of law, we have already noted above. Particularly in view of the fact that this project is of public importance which has almost been completed or is on the verge of completion, we do not think it appropriate to pass any adverse order impacting upon the project in question.

24. None of the above judgments, relied upon by the learned counsel for the applicant, is applicable in the set of facts of the present case.

25. In the result, this Original Application deserves to be rejected and is accordingly rejected. No order as to costs.

Dinesh Kumar Singh, JM

Dr. Vijay Kulkarni, EM

May , 2023
O.A. No.64/2021 (WZ)
npj

EXHIBIT - B
4 2716/23

FORM 1

1. **Basic Information**

Name of the Project: CONSTRUCTION OF ANTI SEA EROSION MEASURE

Location / site alternatives under consideration: at AKSA BEACH, Dist. MUMBAI SUBURBAN.

Size of the Project: Length 300 m.

Expected cost of the project: 98 LAKHS

Contact Information: MAHARASHTRA MARITIME BOARD, MUMBAI

2. **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, etc.)**

Sr No	Information/Checklist confirmation	Yes / No	Details there of approximate quantities 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	Clearance of existing land, vegetation and buildings?	**No**	
1.3	Creation of new land uses?	**No**	
1.4	Pre-construction investigations e.g. bore Houses, soil testing?	**Yes**	
1.5	Construction works?	**Yes**	
1.6	Demolition Works?	**Yes**	
1.7	Temporary sites used for construction works or housing of construction workers?	**Yes**	

1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	**Yes**	
1.9	Underground works including mining or Tunneling?	**No**	
1.10	Reclamation Works?	**No**	
1.11	Dredging?	**No**	
1.12	Offshore Structures?	**Yes**	
1.13	Production and manufacturing processes?	**No**	
1.14	Facilities for storage of goods or materials?	**No**	
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	**Yes**	
1.16	Facilities for long term housing of Operational workers?	**No**	
1.17	New road, rail or sea traffic during Construction or operation?	**No**	
1.18	New road, rail, air waterborne or other Transport infrastructure including new or altered routes and stations, ports, airports etc?	**No**	
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	**No**	
1.20	New or diverted transmission lines or pipelines?	**No**	
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	**No**	
1.22	Stream crossings?	**No**	
1.23	Abstraction or transfers of water form ground or surface waters?	**No**	
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	**No**	
1.25	Transport of personnel or materials for construction, operation or	**Yes**	

	decommissioning?		
1.26	Long-term dismantling or decommissioning or restoration works?	**No**	
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	**No**	
1.28	Influx of people to an area in either temporarily or permanently?	**No**	
1.29	Introduction of alien species?	**No**	
1.30	Loss of native species or genetic diversity?	**No**	
1.31	Any other actions?	**No**	

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):

Sr No	**Information/Checklist confirmation**	**Yes / No**	**Detailsthereof approximate quantities wherever possible) with source of information data**
2.1	Land especially undeveloped or agricultural land (ha)	-	
2.2	Water (expected source & competing users) unit: KLD	**40KLD**	
2.3	Minerals (MT)	-	
2.4	Construction material – stone, aggregates, and / soil (expected source – MT)	**Yes**	
2.5	Forests and timber (source – MT)	**No**	
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	**1MW**	
2.7	Any other natural resources (use appropriate standard units)	-	

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.**

Sr No	Information/Checklist confirmation	Yes / No	Detailsthere of approximate quantities 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**	
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	**No**	
3.3	Affect the welfare of people e.g. by changing living conditions?	**Yes**	The Employment will increase, the earning capacity of people will increase
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	**No**	
3.5	Any other causes?	**No**	

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

Sr No	Information/Checklist confirmation	Yes / No	Detailsthereof approximate quantities wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	**No**	
4.2	Municipal waste (domestic and or commercial wastes)	**No**	
4.3	Hazardous wastes (as per	**No**	

	Hazardous Waste Management Rules)		
4.4	Other Industrial Process Wastes	**No**	
4.5	Surplus product	**No**	
4.6	Sewage sludge or other sludge from effluent treatment	**No**	
4.7	Construction or demolition wastes	**No**	
4.8	Redundant machinery or equipment	**No**	
4.9	Contaminated soils or other materials	**No**	
4.10	Agricultural wastes	**No**	
4.11	Other solid wastes	**Yes**	

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

Sr No	**Information/Checklist confirmation**	**Yes / No**	**Detailsthereof approximate quantities wherever possible) with source of information data**
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	**No**	
5.2	Emissions from production processes	**No**	
5.3	Emissions from materials handling including storage or transport	**No**	
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**	
5.6	Emissions from incineration of waste	**No**	
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	**No**	
5.8	Emissions from any other sources	**No**	

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

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	No	
6.2	From industrial or similar processes	No	
6.3	From construction or demolition	No	
6.4	From blasting or piling	Yes	
6.5	From construction or operational traffic	Yes	
6.6	From lighting or cooling systems	No	
6.7	From any other sources	No	

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:

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	No	
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	Yes	
7.3	By deposition of pollutants emitted to air into the land or into water	No	
7.4	From any other resources	No	
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	

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

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	**No**	
8.2	From any other resources	**No**	
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	**No**	

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

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
9.1	Lead to development of supporting. lities, 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**	
9.2	Lead to after-use of the site, which could have an impact on the environment	**No**	
9.3	Set a precedent for later developments	**No**	
9.4	Have cumulative effects due to proximity to other existing or planned	**No**	

	projects with similar effects		

3. Environmental Sensitivity

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
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	**No**	
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	**Yes**	
5	State, National boundaries	**No**	
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	**Yes**	
7	Defence installations	**No**	

8	Densely populated or built-up area	No	
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	No	
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	No	
11	Areas already subjected to pollution nor environmental damage. (those where existing legal environmental standards are exceeded)	No	
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	

Executive Engineer
Maharashtra Maritime Board

(Signature of Project Proponent)

27/6/23

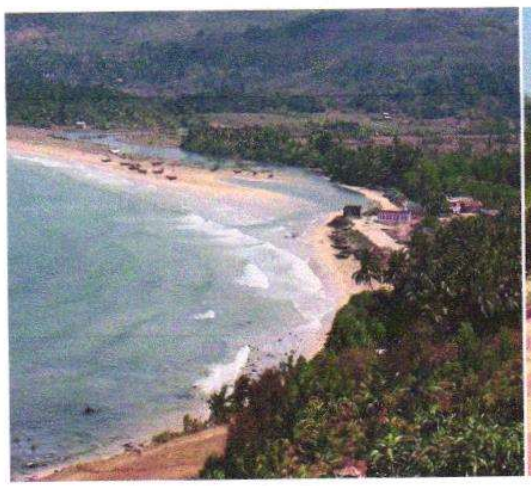
ENVIRONMENTAL IMPACT ASSESSMENT

Draft Final Report

ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION OF ANTI SEA EROSION MEASURE AT AKSA BEACH, TAL.MUMBAI, DIST. MUMBAI SUBURBAN

Prepared For:

EXECUTIVE ENGINEER, MAHARASHTRA MARITIME BOARD, MUMBAI



ABBREVIATIONS

CRZ	– coastal regulation zone
EIA	– environmental impact assessment
EMC	– environmental management committee
EMP	– environmental management plan
km	– kilometer
m	– meter
mm	– millimeter
m/s	– meters per second
PMU	– program management unit
TA	– technical assistance

NOTES

(i) The fiscal year (FY) of the government begins on 1 April and ends on 31 March. FY before a calendar year denotes the year in which the fiscal year starts, e.g., FY2008 begins on 1 April 2008 and ends on 31 March 2009

(ii) In this report, "$" refers to US dollars.

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EXECUTIVE SUMMARY

The government of India has initiated a program for the protection of the coasts from erosion due to the effect of tidal waves. These are stone structures with geotextile layer at the bottom which stop the wave from entering the beaches thus helping mitigation of this problem of erosion.

The Environmental Impact Assessment (EIA) report deals with the positive and negative environmental and social impacts of construction of anti sea erosion measures on the nearby environment. It includes the impact on surrounding air and water. It also includes the impact caused by the sound arising from the construction works. The report analyses the environmental impact and gives mitigation measures for the negative impacts and enhancement of the positive ones. The Impact on animals and various flora in the surrounding area have also been included in the following report. The EIA team carried out consultations with various local agencies, local authorities and the affected people.

Both the government's as well as MMB's policies have been considered during the assessment of the project. The assessment aims at meeting the requirements of both the bodies. The report has been prepared by keeping in view the clauses under Environmental protection Act(1986) which involves investments upto Rs.50 crores.

CHAPTER 1
INTRODUCTION

1.1 General

Aksa Gaon, Madh is a Locality in Mumbai City in Maharashtra State, India. It belongs to Konkan region . Harvali , Ambojwadi , Marve Village , Shiddi Sai Kurupa , Sai Krupa Nagar are the nearby Localities to Aksa Gaon Madh. Mira-Bhayandar,Vasai,Thane,Mumbai are the nearby cities to Mumbai. It is near to arabian sea. There is a chance of humidity in the weather.Malad Rail Way Station , Goregoan Rail way Station are the very nearby railway station to Aksa Gaon, Madh. However Thane Rail Way Station is major railway station 20 KM near to Aksa Gaon, Madh.

Aksa Beach is a popular beach and a vacation spot in Aksa village at Malad, Mumbai, India. It is situated close to Malvani.It is a popular weekend destination . It is dotted with many private cottages and hotels, some of which are rented out to tourists and visitors. This beach has INS Hamla (a base of the Indian Navy) at one end and a small beach called "Dana Paani".

Location :

The Coordinates Aksa Beach ,Mumbai Suburban is 19°10'33.46"N and 72°47'43.26"E. It is accessible from Malad (West) station by select BEST buses from Borivali railway station, en route to Madh Island, and also by private transport and auto rickshaws. The beach is approximately 9 km from Malad station and 12 km from Borivali. It can also be reached from Andheri (West) railway station by BEST buses from Versova bus stop. From Versova village, local buses are available for Madh Island. It takes approximately 20 minutes.

Table 1.1
IDENTIFICATION OF PROJECT AND PROJECT PROPONENT

Sr No	Particulars	Details
1	Centre Name	Aksa Beach is situated in, Mumbai Suburban District, Maharashtra.
2	Name of the Department/Agency	Maharashtra Maritime Board (MMB)
3	Problem	To Construct Anti Sea Erosion Measure

Table 1.2
Detailed Information about the Project Site

Sr No	Particulars	Details
1	Highest High Tide Level (H.H.T.L)	4.21 m
2	Lowest Low Tide Level (L.T.L)	0.61 m
3	Wave height and its direction	-
4	Wave period	-
5	Bed Slope	--
6	Whether erosion take place due to periodical waves or dir to flood water attack	Yes
7	Construction Material available	Stones

1.2 Need for the Project

Maharashtra Maritime Board, Mumbai wishes to provide the facilities for constructing Anti Sea Erosion Measure, main objective of the provision of anti sea erosion measure is to protect people, livestock and agricultural fields from the sea coast erosion.

This tract is famous for its long coastline and convenient harbours. Also, a large number of commercial apartments are located along the coastline. The erosion of the land is frequently happening due to the waves of Sea water. Therefore, there should be some protection provided to reduce this erosion of the alluvial land soil. By considering the above scenario, the decision is taken to implement the Environmental Impact report for the construction of the Anti sea erosion measure at the coastal region situated at Aksa Beach in Mumbai Tehsil in Mumbai Suburban District of Maharashtra. The sea water levels and the wave data is preferred from the Tide Tables for year 2017, Non-major Ports, Maharashtra state.

1.3 Objectives of the Study

The objective of the Environmental Impact Assessment Study is to examine the likely effect of the proposed project will have on the existing quality of land, marine water, noise, air quality, marine as well as terrestrial ecology and socio-economic environment during construction and operation phases of the proposed measure. These impacts will be ascertained by superimposing

the impacts due to the planned activities on the baseline environmental status. An important objective of this analysis is to highlight the environmental benefits of the post project, which are likely to accrue as a result of Anti Sea Erosion Measure in the form of an Environmental Management Plan (EMP) have also been outlined as a part of the EIA report

The key components of the EIA study are as follows:

- Assessment of the existing status of Physico-Chemical, Ecological (Terrestrial and Marine) and Socio-Economic Aspects of Environment
- Identification of Potential Impacts on various Environmental Components due to activities envisaged during construction and operational phases of the proposed measure.
- Prediction of significant impacts on major environmental aspects.
- Delineation of Environmental Management Plan (EMP) outlining measures to minimize Adverse Impacts during Construction and Operational Phases of the Proposed Development activity.
- Formulation of Environmental Quality Monitoring Program for Construction and Operation phases.

1.4 Methodology for the EIA study

The purpose of this section is to enumerate the methodology adopted to conduct the Environmental Impact Assessment (EIA) study. The same is briefly described in the following paragraphs.

Scoping Matrix

A list of all likely impacts likely to occure as a result of operation and construction of the proposed Anti Sea Erosion Measure has been prepared. As a next step, a manageable number of attributes which are likely to be affected as a result of the proposed project were selected. The various criteria applied for the selection of the important impacts are as follows:

- Magnitude of Impact
- Extent of Impact
- Significance of Impact
- Special Sensitivity of Impact

Based on the preliminary site visit and applying the above mentioned criteria a "Scoping Matrix" was prepared for identification of impacts from as many sources possible on the different environmental aspects.

Table-1.3
Scoping matrix for the proposed project

Sr No	Activity	Impacts
	1. Actions affecting coastal marine ecology	
A	Impact on Marine Ecology	Considerably less Reduction in Primary Productivity
B	Disposal of dredging spoil in fisheries reproduction zones	Very less impact on fisheries
C	Disposal of dredging spoil	No significant Loss of fragile/precious marine ecology
D	Oil spill/leakage within measure area	Negligent damage to marine ecology
	2.Action affecting Recreational/ Beach/along the costal zone-relatively less impact of disposal of reclamation of materials	
	3. Actions affecting Physico-Chemical Aspects	
A	Groundwater abstraction	Considerably less Increase in salt water intrusion
B	Disposal of Sewage and solid Wastes	Very less Water pollution and adverse impacts on marine ecology
C	Increase in Vehicular Traffic	No significant Air and noise pollution leading to discomfort to the population in the adjoining area

	4. Factors affecting the Socio-Economic Environment	
A	Increased Boat traffic in the sea	- Relatively Improvement in employment potential - Upgradation of infrastructure facilities - Very less Occupational health problems
B	Land acquisition	- No significant Loss of agricultural land and other properties - Less Acquisition of other infrastructural facilities
C	Increase in traffic	- Less Traffic congestion due to less population - Considerably low pedestrian hazards due to traffic movement

CHAPTER 2
PROJECT INFORMATION

2.1 General Information on Anti Sea Erosion Measure in India

Aksa Beach is situated in Mumbai Tehsil in Mumbai Suburban District of Maharashtra being known for its Beaches, as a part of infrastructural activities, it has been proposed construction of Anti Sea Erosion Measure to protect people, livestock and agricultural fields from the sea coast erosion. Maharashtra State has 720 Kms long coast, which is divided, among 5 Districts as under:

a) Sindhudurg - 120 Kms.
b) Ratnagiri - 238 Kms.
c) Raigad - 121 Kms.
d) Mumbai - 114 Kms.
e) Thane - 127 Kms

Out of the coastal length of 720 kms, about 262 kms length is vulnerable to erosion. Out of this, the protection work for 127 kms, has been tackled so far. The length of 135 kms is yet to be protected.

Major uses of coastal zones include commercial and industrial development along the coastal belt, human habitation, military defense, extraction of living and non-living resources, recreational facilities, ecological balancing & waste disposal, in addition to the construction of Port and Harbours. For all this development, more and more land along the coastal belt is being attacked by the humans. In all the States, including Maharashtra, this is on rise due to increased human activity because of the excessive use of coastal belt for socio-economic reasons.

Erosion of the coast depends on many factors such as:

a) Storm waves causing variation in wave energy and / or direction or wave attack
b) Variation in discharge of sediments from creeks / rivers.
c) Variation in the sea tide levels
d) Morphological changes in off shore and near shore, including seasonal topography, Movement of the littoral drift.

The best natural defense against erosion is an adequate beach, which causes waves to dissipate their energy, without eroding the coast. Unfortunately, such adequate beaches are not available at most of the places. Moreover, creating a beach artificially is not always economically feasible. Therefore, it is necessary to evolve a scientific solution to combat erosion and protect the coast line. Erosion along the coast length facing at open Sea, anti sea erosion work is mostly required.

The overall objective of the project is to create suitable infrastructure to mitigate the effects of cyclones in the coastal states of India.

National Disaster Management Authority (NDMA) under the aegis of Ministry of Home Affairs (MHA) shall implement the Project in coordination with participating State Governments, and the National Institute for Disaster Management (NDMA) in the first phase.

The Project has identified 13 cyclones prone States and Union Territories (UTs), with varying levels of vulnerability. These States/UTs have further been classified into two categories, based on the frequency of occurrence of cyclones, size of population and the existing institutional mechanism for disaster management.

These **categories are:**

Category I: Higher vulnerability States i.e. Andhra Pradesh, Gujarat, Orissa, Tamil Nadu and West Bengal.

Category II: Lower vulnerability states i.e. Maharashtra, Goa, Karnataka, Kerala, Daman & Diu, Pondicherry, Lakshadweep and Andaman & Nicobar Islands.

Andhra Pradesh and Orissa are the first two States to take up project implementation. The duration of the project is three years consisting of Phase – I and Phase – II program.

Planning Commission has given approval of the Project.

The key objectives of the Project are as follows:

1. Reductions in cyclone vulnerability of coastal states, through creation of appropriate infrastructure which can help mitigate the adverse impacts of cyclones.
2. Strengthening of cyclone warning systems enabling quick dissemination of warnings and advisories from source/district/sub-district level to the community and vice versa for their timely reception and adequate response.

2.2. Coastal zone

This zone extends to about 10-15 km from seacoast and generally has low altitude and about 2500 mm rainfall. Most of the activities in this area are connected with sea.

This area contains numerous beaches, creeks, sea forts, harbors, hot water springs, caves, temples and other religious places, places of scenic beauty as well as birthplace of some great personalities. The possible tourist activities include inland and sea water ways, sailing, boating, water sports like water scooter, canoeing, fishing, camping, marinas, coastal resorts and marine parks; but the major problem is the lack of easy accessibility and road network.

2.3 Proposed Project Description:

Project Details For Construction Anti Sea Erosion Measure, At Aksa Beach

The project proponent has a desire to construct Anti Sea Erosion Measure, at Aksa Beach is situated in Mumbai Suburban District of Maharashtra. The proposed construction of Anti Sea Erosion Measure is benefited to protect people, livestock and agricultural fields from the sea coast erosion.

This project involves repairs of old bund ,construction of pathway, construction of parapet wall, providing solar street light ,length 300 m. The estimated cost of project- 98 lakhs.

Based on the requirements and existing conditions following aspects have been considered in the development proposal

Project Rationale

This section will highlight the goals and objectives of the proposed project. It will also include discussion on the significance of the project in terms of the need for the project in the local as well as the national level, it will also highlight the proposed project in line with existing development plans of the State and Central government and in accordance with the existing or envisioned land use plans.

Process Description

The technology to be used for the project and the process components of the project focusing on the materials input and output from the process components including products, fuels, feedstock and utility requirements, descriptions of the process to be used will also be provided. The process emissions including air, liquid, and associated wastes, and associated pollution abatement equipment will be discussed.

Pre-Construction

This section shall discuss / describe the various components of the projects. This section shall also discuss the major activities to be undertaken during the construction phase, which shall include but not be limited to:

- Site mobilization
- Road construction / improvement
- Camp construction
- Site clearing
- Construction of the major facilities / project components
- Construction of support services e.g. Water & Power supply & Telecommunications, etc.

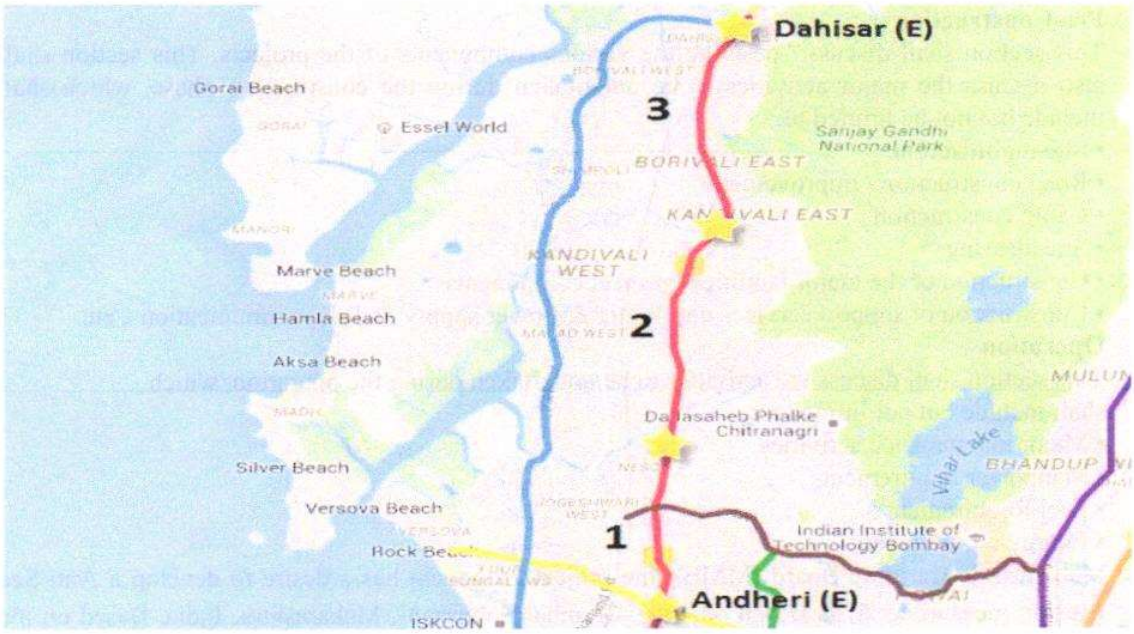
Operation

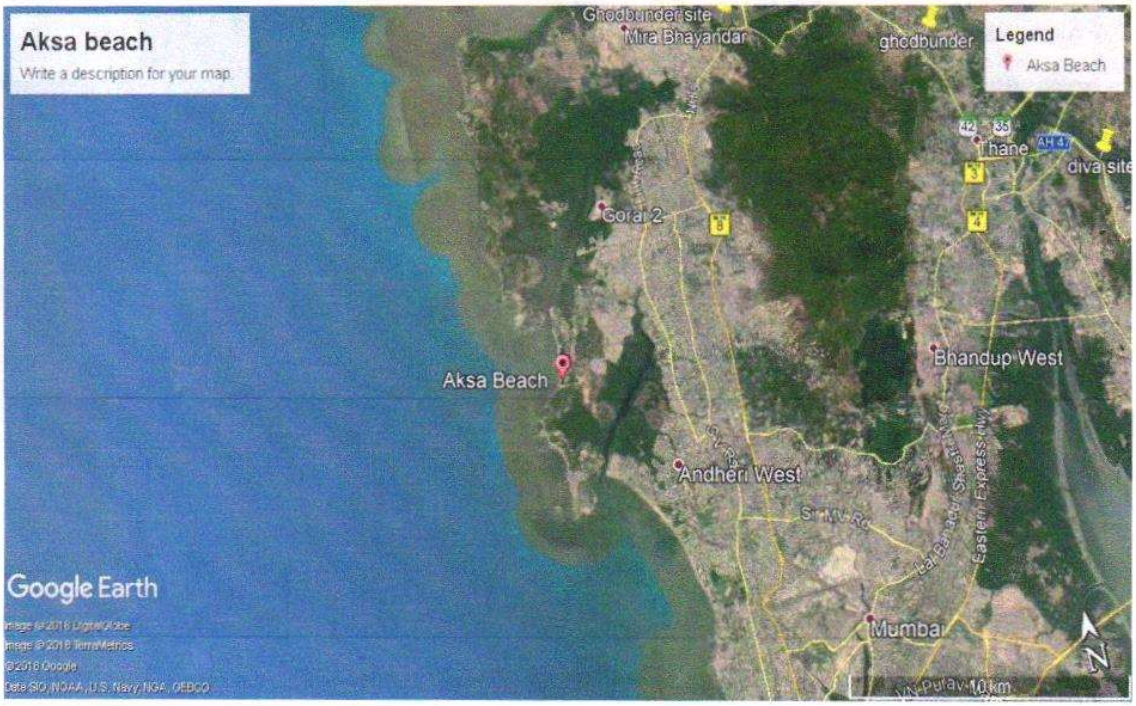
This section shall discuss the activities to be undertaken during the operation, which shall include but not limited to:

- Major maintenance activities
- Manpower requirements
- Fuel Requirement
- Energy requirements

Maharashtra Maritime Board (MMB), the project proponent has a desire to develop a Anti Sea Erosion measure at Aksa Beach, District–Mumbai Suburban , Maharashtra, India. Based on the requirements and existing conditions aspects have been considered in the development proposal.

2.4 LOCATION OF PROJECT

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CHAPTER 3
MUMBAI AT A GLANCE

1. GENERAL INFORMATION	
Location	North latitude- 18° 53' & 19° 19' East Longitude- 72° 47' & 72° 59'
Geographical Area :	603 sq. km. (Mumbai City- 69 sq. km.; Mumbai Suburb- 534 sq. km.
Population	1,77,02,761
Normal Annual Rainfall	1800 mm to 2400 mm
Temperature	Maximum- 32.2° C; Minimum- 16.3°C
2. GEOMORPHOLOGY	
Major Physiographic unit	2; Hill Ridges with intervening Valleys and Coastal Plains.
Major Drainage	2; Mahim and Mithi
3. SOIL TYPE 2; Medium to deep black and reddish colored soil	
4. GROUND WATER MONITORING WELLS (As on 30/11/2007) Dugwells : 5	
5. GEOLOGY	
Recent	Alluvium
Upper Cretaceous To Lower Eocene	Basalt (Deccan Trap), Rhyolite and Trachyte
6. HYDROGEOLOGY	
Water Bearing Formation	Basalt–Jointed/Fractured/Weathered Vesicular and Massive Basalt River/Marine Alluvium- Sand and Gravel
Premonsoon Depth to Water Level (May-2007)	2.77 to 6.42 m bgl
Postmonsoon Depth to Water Level (Nov.-2007)	1.80 to 7.10 m bgl
Premonsoon Water Level Trend (1998-2007)	Fall: 0.11 to 0.38 m/year
Postmonsoon Water Level Trend (1998-2007)	Rise: 0.09 m/year Fall : 0.02 to 0.26 m/year
7. GROUND WATER QUALITY Suitable for drinking but high concentration of pollutants at many places.	
8. MAJOR GROUND WATER PROBLEMS AND ISSUES Pollution of ground water as well as surface water due to dumping of sewage and industrial effluents. In addition to this various industrial effluents from oil refineries, reactors, fertilizers have polluted the ground water. As a result the concentration of heavy metals in ground water in the surrounding areas of creek has been observed beyond the prescribed limits. Ground water exploitation for commercial purpose like construction purposes, hotel industry and for domestic purpose of the housing societies is carried out in entire district and the water is extracted from existing dugwells and borewells.	

SOME HERITAGE PLACES IN MUMBAI DISTRICT

Haji Ali Dargah

The Haji Ali Dargah is amosque and dargah (tomb) located on an islet off the coast of Worli in the Southern part of Mumbai. Near the heart of the city proper, the dargah is one of the most recognisable landmarks of Mumba

The Haji Ali Dargah was constructed in 143 in memory of a wealthyMuslim merchant, Sayyed Peer Haji Ali Shah Bukhari, who gave up all his worldly possessions before making a pilgrimage to Mecca. Hailing from Bukhara, in the ancient Persian Empire (present day Uzbekistan), Bukhari travelled around the world in the early to mid 15th century, and then settled in present day Mumbai.

Marine Drive

Marine Drive is a 4.3-kilometre-long boulevard in South Mumbai in the city of Mumbai. It is a 'C'-shaped six-lane concrete road along the coast, which is a natural bay. The road links Nariman Point to Babulnath and Malabar Hill. Marine Drive is situated over reclaimed land facing west-south-west. A promenade lies parallel to this road. Marine Drive is also known as the Queen's Necklace because, if viewed at night from an elevated point anywhere along the drive, the street lights resemble a string of pearls in a necklace. In 2012, the Municipal Corporation of Greater Mumbai announced that the entire road would be resurfaced, 72 years after it was originally laid.

Shree Siddhivinayak Ganapati Mandir

The Shree Siddhivinayak Ganapati Mandir is a Hindu temple dedicated to Lord Shri Ganesh. It is located in Prabhadevi, Mumbai, Maharashtra.[1] It was originally built by Laxman Vithu and Deubai Patil on November 19, 1801. Though it is one of the richest temples in Mumbai, the current generation of Patil is staying in state of despair near the temple.

The temple has a small mandap (hall) with the shrine for Siddhi Vinayak ("Ganesha who grants your wish"). The wooden doors to the sanctum are carved with images of the Ashtavinayak (the

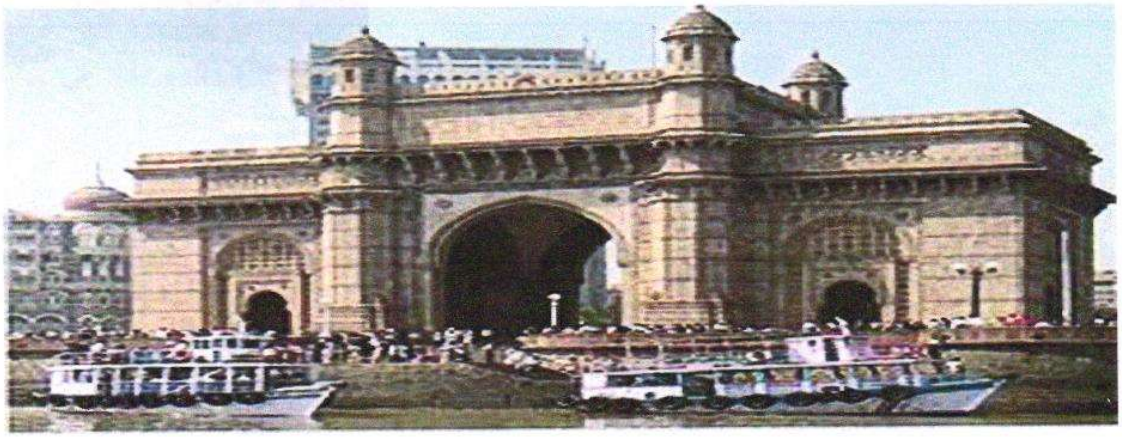
eight manifestations of Ganesha in Maharashtra). The inner roof of the sanctum is plated withgold, and the central statue is of Ganesha. In the periphery, there is aHanuman temple as well.

Juhu

Juhu is a suburb of Mumbai. It is most famous for the sprawling Juhu beach. It is surrounded by the Arabian Sea to the west, Versova to the north,Santacruz and Vile Parle to the east and Khar to the south. Juhu is among the most affluent areas of the city and home to many Bollywood celebrities. The nearest railway stations are Santacruz, Andheri and Vile Parle on the Western Line and Harbour Line of the Mumbai Suburban Railway.

Gateway of India

The **Gateway of India** is a monument built during the British Raj in Mumbai(formerly Bombay), India. It is located on the waterfront in the Apollo Measureerarea in South Mumbai and overlooks the Arabian Sea. The structure is abasalt arch, 26 metres (85 feet) high. It lies at the end of Chhatrapati Shivaji Marg at the water's edge in Mumbai Harbour. It was a crude jetty used by the fishing community which was later renovated and used as a landing place for British governors and other prominent people. In earlier times, it would have been the first structure that visitors arriving by boat in Mumbai would have seen. The Gateway has also been referred to as the Taj Mahal of Mumbai, and is the city's top tourist attraction.



CHAPTER 4
BASELINE ENVIRONMENTAL CONDITIONS

4.1 General

The main aim of the Environmental and Social Impact Assessment (ESIA) study is to ascertain the existing baseline conditions and to assess the impacts of all the factors as a result of the proposed construction of anti sea erosion measure at Aksa Beach is situated in, Mumbai Suburban. The changes likely to occur in different components of the environment viz. Natural Physical Resources, Natural Ecological (or Biological) Resources, Human/Economic Development Resources (Human use values), Quality of life values (socio-economic),would be studied and assessed to a reasonable accuracy. The environment includes Water Quality, Air Quality, Soils, Noise, Ecology, Socio-economic issues, its effect on Archaeological /historical monuments etc.

The information presented in this section stems from various sources such as reports, field surveys and monitoring. Majority of data on soil, water quality, air and noise quality, flora and fauna were collected during field studies. This data have been further utilized to assess the incremental impact, if any, due to the project. The development/compilation of environmental baseline data is essential to assess the impact on environment due to the project.

As the construction site at Aksa Beach Mumbai Suburban is situated in Mumbai Tehsil in Mumbai District of Maharashtra comparatively a small construction activities, the assessment of baseline environmental setting is an essential component of any EIA study. As a part of the study, a Scoping Matrix was prepared, based on which, various parameters to be covered for assessment of baseline environmental setting were identified. The assessment of environmental impacts due to construction and commissioning of the proposed Anti Sea Erosion Measure requires a comprehensive and scientific consideration of various environmental aspects and their interaction with natural resources, namely, physico-chemical parameters i.e. meteorology, geology, soil, land use and water quality, biological parameters i.e. terrestrial flora and fauna, marine flora and fauna, fish species, etc. and socio-economic parameters i.e. demography, occupational profile, etc. As a part of the study, a large quantum of related data as available with various departments was collected. Field studies for primary data generation on various aspects too were conducted as a part of the EIA study.
Major portion of the study area is under water, i.e. Arabian sea.
As a part of the EIA study, the Baseline Status has been ascertained for the following aspects:

- Meteorological data

i) Wind speed and direction

ii) Rainfall, humidity, temperature and visibility

iii) History of Cyclones

- Land Environment
- Marine Water Environment

i) Coastal hydrology

ii) Bed sedimentation contamination

- Biological environment – Flora & Fauna
- Marine/Coastal ecology
- Air Environment
- Noise
- Existing Solid waste disposal facilities
- Socio-economic and occupational health environment
- Public Utilities

Detailed Description Of Baseline Status:

4.2 Meteorological Data - Rainfall, Humidity, Temperature And Visibility

4.2.1 Climate

The climate of the district is characterized by an oppressive summer, dampness in the atmosphere nearly throughout the year and heavy south – westmonsoon rainfall from June to September. The mean minimum temperature is 16.3°C and the mean maximum temperature is 32.2°C at Dadar.

4.2.2 Rainfall

The normal annual rainfall over the district varies from about 1800 mm to about 2400 mm. It is minimum in the central part of the district around Kurla(1804.9 mm). It gradually increases towards north and reaches a maximum around Santacruz (2382.0 mm).

Table 4.1 Total Monthly Rainfall At Station: Colaba

Parameters	Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly	2009	0.000	0.000	Trace	0.000	002.3	265.9	771.3	204.5	519.1	158.3	120.2	Trace
total rainfall	2010	Trace	Trace	000.0	000.3	000.0	947.4	1099.0	849.8	272.9	122.4	053.7	000.0
(mm)	2011	000.0	000.1	000.0	000.0	000.7	461.2	--	--	--	--	--	--

Table 4.2 Monthly Total Rainfall at Station: Santacruz

Parameters	Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly	2009	000.0	000.0	000.0	000.0	000.3	216.4	1142.2	290.3	322.2	223.3	77.5	Trace
total rainfall	2010	000.0	Trace	000.0	000.7	000.0	712.1	1250.4	1036.5	328.9	064.0	047.2	000.0
(mm)	2011	000.0	000.0	000.0	000.0	Trace	661.7	--	--	--	--	--	--

4.2.3 Temperature

The Climate of Mumbai is a tropical wet and dry climate. Mumbai's climate can be best described as moderately hot with high level of humidity. Its coastal nature and tropical location ensures temperatures won't fluctuate much throughout the year.

The mean average is 27.2°C and average precipitation is 242.2 cm (95.35 inches).The mean maximum average temperatures in about 32°C (90°F) in summer and 30°C (86°F) in winter, while the average minimums are 25°C (77°F) in summer and 20.5°C (68.9°F) in winter. Mumbai experiences four distinct seasons: Winter (December–Feb); Summer (March–May); Monsoon (June–Sep); and Post-Monsoon (Oct–Dec).

Table 4.3 Monthly Mean Maximum and Minimum Temperature At Station: Colaba

Parameters	Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly mean	2009	32.0	30.7	32.6	34.2	34.7	33.8	29.5	31.2	31.1	32.7	32.8	32.2
maximum	2010	32.0	30.4	32.1	34.3	35.3	32.4	29.9	29.9	31.7	33.0	33.3	30.9
temperature (0 c)	2011	30.7	31.2	33.6	33.2	34.2	31.8	--	--	--	--	--	--
Monthly mean	2009	19.4	19.5	22.5	24.6	26.7	27.7	25.6	26.2	25.8	24.6	23.8	22.3
minimum	2010	21.3	21.8	24.2	26.5	28.5	26.6	25.3	25.6	25.9	25.9	24.9	20.6
temperature (^{0}c)	2011	18.6	20.8	23.4	25.3	27.6	26.7	--	--	--	--	--	--

Table 4.4 Monthly Mean Maximum and Minimum Temperature At Station:Santacruz

Parameters	Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly mean maximum temperature (0 c)	2009	32.9	32.6	34.3	35.4	33.9	33.6	29.8	31.1	31.2	33.3	32.9	32.1
	2010	32.5	31.6	33.6	34.6	34.7	33.0	30.3	29.8	31.5	33.0	33.6	30.8
	2011	31.6	32.1	35.3	33.2	33.5	32.0	--	--	--	--	--	--
Monthly mean minimum temperature 0 (c)	2009	17.9	18.1	21.8	25.1	27.3	27.8	25.4	26.1	25.4	23.1	22.1	19.2
	2010	18.8	19.0	22.2	24.8	27.8	26.1	24.9	25.1	25.2	24.7	23.4	17.4
	2011	14.9	17.2	20.1	23.8	26.8	26.2	--	--	--	--	--	--

Sea Temperature

Table 4.5 Mumbai sea temperature

Mumbai sea temperature[5]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
25 °C (77 °F)	25 °C (77 °F)	26 °C (79 °F)	27 °C (81 °F)	29 °C (84 °F)	29 °C (84 °F)	29 °C (84 °F)	28 °C (82 °F)	28 °C (82 °F)	29 °C (84 °F)	28 °C (82 °F)	26 °C (79 °F)

4.2.4 Humidity

The air is humid throughout the year. Relative humidity is on an average over 80 per cent. During the south-west monsoon season. In the rest of the year the relative humidity is between 65 per cent and 75 per cent.

Table 4.6 Monthly Mean Relative Humidity at Station: colaba

Parameters	Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly mean	2009	81	86	79	79	79	85	93	91	92	86	85	84
relative humidity	2010	80	85	88	83	84	92	96	96	90	85	86	78
at 08:30 hrs (%)	2011	80	85	81	83	77	92	--	--	--	--	--	--
Monthly mean	2009	61	64	63	67	67	75	88	81	83	76	72	64
relative humidity	2010	63	62	70	74	72	84	91	90	82	72	73	59
at 17:30 hrs (%)	2011	63	62	58	74	68	84	--	--	--	--	--	--

Table 4.7 Monthly Mean Relative Humidity at Station: Santacruz

Parameters	Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Monthly mean	2009	78	77	73	70	69	74	88	84	87	79	77	75
relative humidity	2010	65	76	79	69	71	83	91	90	86	84	79	77
at 08:30 hrs (%)	2011	77	77	72	77	71	78	--	--	--	--	--	--
Monthly mean	2009	49	44	49	56	63	68	84	77	77	64	61	55
relative humidity	2010	47	52	54	61	66	75	84	83	75	68	69	57
at 17:30 hrs (%)	2011	45	46	45	65	65	79	--	--	--	--	--	--

4.2.5 Cloudiness

During the south-west monsoon season skies are heavily clouded to overcast. In May and October the clouding is moderate. Clear or very lightly clouded skies are common in the rest of the year.

4.2.6 Winds

Winds are very strong and blow from west or south-west during monsoon season. During the period from October to December winds are generally moderate but sometimes strong in October and blow from directions between north-east and south-east. In the three months from January to March the winds continue to be moderate and are predominantly from directions between north and east. In April while there is a slight strengthening of wind, the direction is variable. In May there is a further strengthening of winds and the directions are between south-west and north-west.

Table 4.8 Climate data for Mumbai

Climate data for Mumbai													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	37.1 (98.8)	39.6 (103.3)	41.7 (107.1)	42.2 (108)	41.0 (105.8)	37.1 (98.8)	34.8 (94.6)	33.5 (92.3)	36.4 (97.5)	37.9 (100.2)	37.4 (99.3)	39.8 (103.6)	42.2 (108)
Average high °C (°F)	30.7 (87.3)	31.2 (88.2)	32.5 (90.5)	33.0 (91.4)	33.3 (91.9)	32.1 (89.8)	30.0 (86)	29.6 (85.3)	30.4 (86.7)	33.2 (91.8)	33.5 (92.3)	32.0 (89.6)	31.8 (89.2)
Average low °C (°F)	16.8 (62.2)	17.8 (64)	21.0 (69.8)	23.9 (75)	26.3 (79.3)	26.0 (78.8)	24.9 (76.8)	24.7 (76.5)	24.3 (75.7)	23.4 (74.1)	20.9 (69.6)	18.6 (65.5)	22.4 (72.3)
Record low °C (°F)	7.4 (45.3)	8.5 (47.3)	13.8 (56.8)	16.9 (62.4)	20.2 (68.4)	19.8 (67.6)	21.2 (70.2)	19.4 (66.9)	20.7 (69.3)	16.7 (62.1)	13.3 (55.9)	10.6 (51.1)	7.4 (45.3)
Rainfall mm (inches)	0.6 (0.024)	1.3 (0.051)	0.2 (0.008)	0.7 (0.028)	12.5 (0.492)	523.1 (20.594)	799.7 (31.484)	529.7 (20.854)	312.3 (12.295)	55.8 (2.197)	16.8 (0.661)	5.3 (0.209)	2,258 (88.898)
Avg. rainy days	0.1	0.1	0.0	0.1	0.7	14.5	23.2	21.4	14.4	3.0	1.0	0.4	78.9
% humidity	69	67	69	71	70	80	86	86	83	78	71	69	75
Mean monthly sunshine hours	269.5	257.6	274.3	283.7	296.2	148.6	73.4	75.9	165.1	240.2	245.8	253.2	2,583.5

4.3 Soil Characteristics

The predominant soil cover in Mumbai city is sandy, whereas in the suburban district, the soil cover is alluvial and loamy. Two types of soils have been observed in the district viz., medium to deep black and reddish colored soil. Soil sampling was done to further establish the baseline characteristics and to assess the anticipated impacts due to proposed project. The project corridor passes along built up (commercial, residential and industrial) and open land areas. In order to ascertain the soil quality, a representative soil samples were collected from two locations namely (i) Mudh and (ii) Ambojwadi were got analysed for the parameters. The analysis of test result indicates that soil is slightly alkaline, non-saline in nature, have good fertility and texture is medium loam to sandy loam.

Table 4.9 Physico-Chemical Characteristics of Soils

S. I.	Parameters	Unit	Mudh	Ambojwadi
1.	pH		7.64	7.89
2.	Conductivity	mS/cm	0.086	0.268
3.	Chloride	mg/100 gm	29.36	90.75
4.	Calcium as Ca	mg/100 gm	50.48	139.38
5.	Sodium	mg/100 gm	3.98	16.58
6.	Potassium	Kg/ha	130.52	792.03
7.	Organic matter	%	0.52	0.98
8.	Available Nitrogen as N	Kg/ha	221.26	351.18
9.	Available Phosphorus	Kg/ha	4.70	5.53
10.	Bicarbonates	mg/100 gm	76.73	211.86
11.	Orthophosphate	mg/kg	14.41	16.95
12.	Moisture Content	%	6.58	3.37
13.	Magnesium	ppm	173.35	236.39
14.	Texture			
	i) Sand	%	56.00	62.30
	ii) Silt	%	31.00	28.30
	iii) Clay	%	13.00	9.40

4.3.1 Seismicity

Mumbai lies in the Bureau of Indian Standards (BIS) in Seismic Zone III, which means the city is at moderate risk. The last time Mumbai witnessed seismic activity was in 2005. Three consecutive tremors of 4-5 magnitude were witnessed. Mumbai lies over more than 10 seismic fault lines. Major fault lines lie along the Thane creek, Ulhas river, the Aksa Beach and Malad creeks and the lakes. To the west, a fault line stretches from Colaba to Vasai, touching Malabar hill.

4.4 Physiography of Mumbai

The physiographic feature of the Mumbai district is flat terrain flanked by north –southtrending hill ranges. The hill ranges are almost parallel ridges in the eastern and western part of the area.

The Powai – Kanheri hill ranges are the other hill extending in the eastern and central part running NNE – SSW. The maximum elevation of the area is 450 m above mean sea level (m amsl) at some of the peaks of hill ranges. Trombay island hasnorth – south running hills with maximum elevation of 300 m above mean sea level (m amsl). Malbar, Colaba, Worli and Pali hills are the isolated small ridges tending north – south in the western part of the district. The Powai – Kanheri hills form the largest hilly terrain in the central part of the Salsette island and are the feeder zone for the three lakes viz., Powai, Vihar and Tulsi. There are a number of creeks, dissecting the area. Among them, Thane is the longest creek. Other major creeks are Aksa Beach, Malad and Mahim which protrudes in the main land and give rise to mud flangs and swamps. The Mumbai area is drained by Mahim, Mithi, Dahisar and Polsar rivers. These small rivers near the coast, form small rivulets which inter mingle with each other resulting in swamps and mud flats in the low lying areas.

The entire Greater Bombay area is occupied by Deccan basalt flows and their acid and basic varients, poured out between the late Cretaceous and early Eocene times. The basaltic flows are horizontally bedded and are more or less uniform in character over wide areas. Certain extrusive and intrusive mafic types are associated with basalts and are found in the Bombay Islands and its vicinity.

4.4.1 Hard Rock Areas

4.4.1.1 Deccan Trap Basalt

The 'Pahoehoe' flows in the district consists of highly vesicular bottom layer having closely spaced horizontal joints but the thickness is generally less. The vesicles are generally filled with secondary minerals and green earths. In such cases, they do not serve as aquifer. However, such vesicular zones are weathered in most part of the area, thus, making them moderately permeable. But if, vesicles are not filled, they act as highly permeable aquifers. The simple and compound "Pahoehoe" flow comprises a basal vesicular zone, middle relatively massive portion followed by a vesicular top. The vesicles of "Pahoehoe" flows are generally not interconnected and thus there is a variation in water holding capacity from the base to the top of the flow.

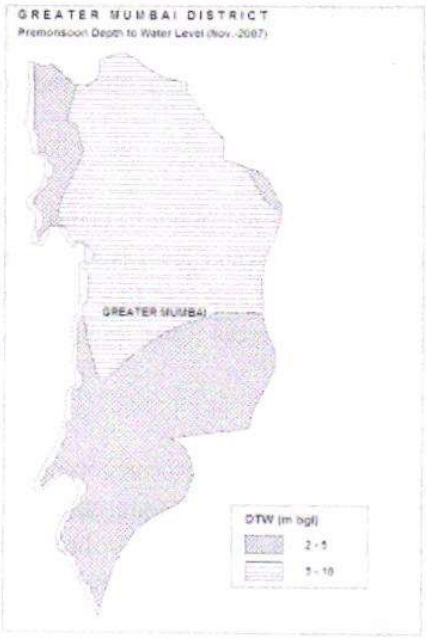
The ground water exists in fractures, joints, vesicles and in weathered zone of Basalt. The occurrence and circulation of ground water is controlled by vesicular unit of lava flows and through secondary porosity and permeability developed due to weathering, jointing, fracturing etc., of Basalt. The ground water occurs under phreatic, semi confined and confined conditions. The leaky confined onditions are also observed in deeper aquifers. Generally the phreatic aquifer range down to depth of 15 m bgl. The water bearing zone down to depth of 35 m bgl forms the semi confined aquifer and below this deeper aquifer down to depth of 60 m bgl is observed. The yield of the dugwells varies form 10 to 1000 m3/day, whereas that of borewells ranges between 50 and 1000 m3/day. It is expected that the potential of deeper aquifers would be much more limited as compared to the unconfined/phreatic aquifer.

4.4.1.2 Soft Rock Areas

4.4.1.2.1 Alluvium

River Alluvium patches along the course of rivers and Marine Alluvium in the coastal area, are highly potential aquifer but with limited areal extent. The ground water occurs under water table

condition in sandy / gritty layers. The alluvial fill of low lying areas underlain by weathered basalt has relatively better ground water potential.



4.4.2 Water Level Scenario

Central Ground Water Board periodically monitors 5 National Hydrograph Network Stations (NHNS) in the district, four times a year i.e. January, May (Premonsoon), August and November (Postmonsoon).

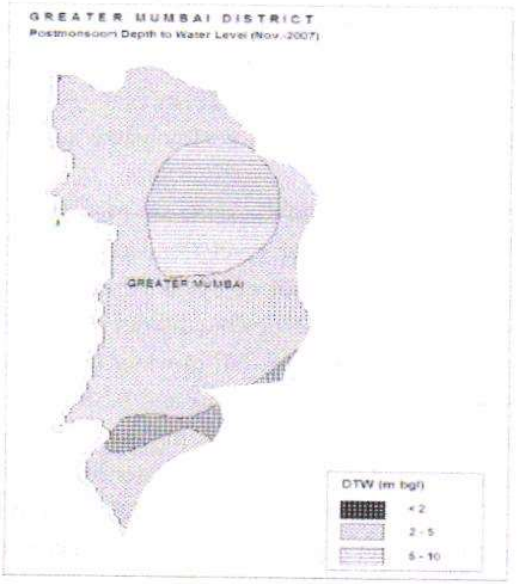


Figure-4: Depth to Water Level (Postmonsoon- Nov.2007).

4.4.2.1 Depth to Water Level – Premonsoon

The premonsoon depth to water levels monitored during May ranges between 2.77 m bgl (Church Gate) and 6.42 m bgl (A.M.C. Colony). The depth to water levels during premonsoon has been depicted in **Figure-3**. The shallow water levels between 2 and 5 m bgl are observed in southern part, whereas moderate water levels in the range of 5 to 10m bgl are observed in northern part of the area.

4.4.2.2 Depth to Water Level – Postmonsoon

The depth to water levels during postmonsoon ranges between 1.80 m bgl (Church Gate) and 7.10 m bgl (A.M.C. Colony). Spatial variation in postmonsoon depth to water level is shown in **Figure-4.** The water levels in major part of the district range between 2 and 5 m bgl. Shallow water levels of < 2 m bgl are observed in small area in southern part, whereas water levels of 5 to 10 m bgl are observed in north central part of the district.

4.4.2.3 Seasonal Water Level Fluctuation

Seasonal water level fluctuation between premonsoon and postmonsoon of have been computed. The rise in water levels in the range of 0.97 (Church Gate) to 1.85 m (Mahim) are observed, whereas fall in water level of 0.68 is observed at 1 NHNS located at A.M.C. Colony. In major part of the district rise within 2 m is observed, rise of 2 to 4 m is seen in extreme northern parts of the district, whereas fall of up to 2 m is observed in north central part of the district.

4.4.2.4 Water Level Trend (1998 – 2017)

Trend of water levels for premonsoon and postmonsoon periods for last ten years (1998-2017) have been computed for 4 NHNS. Analysis of long term water level trend data indicates fall in water levels has been observed in all the 4 NS and it ranges between 0.11 (Church Gate) and 0.38 m/year (A.M.C. Colony).. During postmonsoon period rise in water level of 0.09 m/year has been recorded at only 1 NHNS located at Mahroli (Chemur) while at 3 NHNS fall in water level have been recorded and it ranges between 0.02 (Colaba (Dandi)) and 0.26 m/year (A.M.C. Colony). Thus in major parts of the district, both during premonsoon and postmonsoon seasons declining water level trends have been recorded.

The premonsoon and post monsoon trend maps were also prepared and the same are presented in Figure. During premonsoon period entire district shows fall in water level trend of up to 20 cm/year, whereas during postmonsoon period rise in water level trend of up to 20 cm/year is observed in extreme northern part and central southern parts and the rest of the district shows fall in water level trend of up to 20 cm/year. water level trend data indicates fall in water levels has been observed in all the 4 NHNS and it ranges between 0.11 (Church Gate) and 0.38 m/year (A.M.C. Colony).. During postmonsoon period rise in water level of 0.09 m/year has been recorded at only 1 NHNS located at Mahroli (Chemur) while at 3 NHNS fall in water level have been recorded and it ranges between 0.02 (Colaba (Dandi)) and 0.26 m/year (A.M.C. Colony). Thus in major parts of the district, both during premonsoon and postmonsoon seasons declining water level trends have been recorded.

The premonsoon and post monsoon trend maps were also prepared and the same are presented in Figure. During premonsoon period entire district shows fall in water level trend of up to 20 cm/year, whereas during postmonsoon period rise in water level trend of up to 20 cm/year is observed in extreme northern part and central southern parts and the rest of the district shows fall in water level trend of up to 20 cm/year. Ground Water Quality Central Ground Water Board monitors the ground water quality of the district through analysis of water samples collected from its National Hydrograph Network Stations (NHNS) which represent the shallow aquifer of the district only. The objective behind quality monitoring is to understand an overall picture of ground water quality of the district. During year 2007, CGWB has carried out the ground water quality monitoring at 5 NHNS.

The results of chemical analysis shows that the ground water in the district is alkaline in nature. The concentration of major ions indicates that among the cations, the concentration of sodium and magnesium ion is almost same followed by calcium, while among the anions the concentration of bicarbonate ion is highest, followed by chloride, sulphate and nitrate ions. The suitability of ground water for irrigation purpose was not assessed as the entire area is urban.

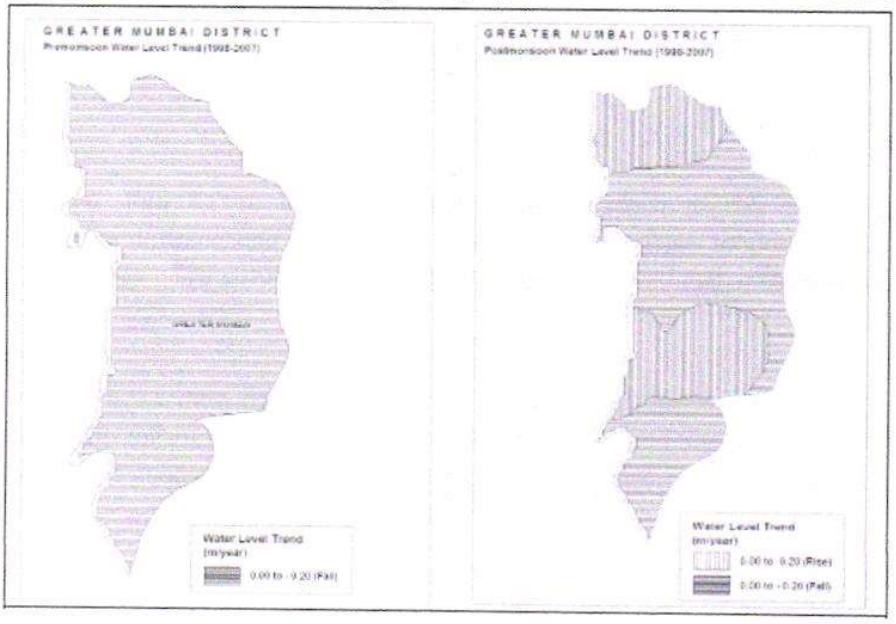


Figure-5: Premonsoon (L) and Postmonsoon (R) Water Level Trend (May and Nov. 1998-2007

4.5 Surface Water

4.5.1 physico-chemical

Temperature

The temperature of surface and bottom water samples ranged varies from 25.0 -25.6oC and 24.5 to 25.0oC with a difference of less than 1 oC between the surface and bottom waters.

pH

The pH of seawater at surface water samples ranged from 8.3 to 8.4, while in bottom water samples, it ranged from 8.1 to 8.2. The variation in pH is within normal limits.

Salinity

The variation in salinity in surface water samples ranged from 33.2 to 33.9 ppt. The salinity is marginally higher in bottom water samples. This phenomenon indicated mixing of surface and bottom waters. The salinity levels observed in the project area is typical of that observed in coastal area

Dissolved Oxygen (DO)

The DO level in surface and bottom water samples ranged from 6.0 to 6.7 mg/l, 5.2 to 5.6 mg/l respectively. The DO levels indicate the absence of pollution sources.

Biochemical Oxygen Demand (BOD)

The BOD values in surface and bottom water samples ranged from 3.7 to 4.1 and 3.2 to 4.6 mg/l respectively.

Total Phosphorous

Phosphate phosphorous in surface water samples ranged from 2.5 to 2.8 µg/l, which is marginally higher than the bottom waters (0.9 to 1.1 µg/l). The value of phosphate phosphorus in various samples was observed to be in the range normally observed in marine water samples.

Total Nitrogen

The concentration of nitrites in surface and bottom water samples ranged from 2-2.6 mg/l and 2.6 to 3.6 mg/l. Though surface and bottom water layers do not indicate significant difference, the relatively higher values in bottom waters suggest contribution from nitrogenous compounds in sediments.

Trace Metals

The trace metals such as lead, cadmium and mercury were analyzed in inshore and offshore water at various stations around the site. The concentrations of Cadmium and Lead ranged from 0.11 to 0.18 µg/l and from 0.13 to 0.24 µg/l respectively. The concentrations of mercury and nickel were in not detectable range. Three stations including the project site were selected for surface water sampling.

4.6 Ground Water

Ground water is often called underground water which occurs below the surface of the earth. Level of ground water is important from the viewpoint of agriculture. The rise in water- in any

season may be a fluctuating phenomenon of a short duration. Such a study may be of limited use in understanding the water balance of the study region. The study region receives the heavy rainfall. The groundwater is mostly tapped from percolation in wells and springs. Direction of groundwater is flow from east to west in the study region.

4.6.1 Ground Water Quality

Central Ground Water Board monitors the ground water quality of the district through analysis of water samples collected from its National Hydrograph Network Stations (NHNS) which represent the shallow aquifer of the district only.

The objective behind quality monitoring is to understand an overall picture of ground water quality of the district. During year 2017, CGWB has carried out the ground water quality monitoring at 34 NHNS.The results of chemical analysis show that the ground water in the district is alkaline in nature. The type of ground water observed is mostly of Ca-HCO3,whereas in few samples it is of Na-Cl type. The concentration of major ions indicates that among the cations, the concentration of magnesium ion is highest followed by sodium and calcium, while among the anions the concentration of chloride ion is highest, followed by bicarbonate, sulphate and nitrate ions.

4.6.1.1 Suitability of Ground Water for Drinking Purpose

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2003) were used to decide the suitability of ground water. The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TDS, TH, Ca, Mg, Cl, SO4, NO3 and F prescribed in the standards and is given in Table-1. The perusal of Table-4.10 shows that the concentrations of all the parameters in all the samples are within the MPL. Therefore, it can be concluded that the ground water quality in majority of the area is good for drinking purpose. The ground water quality of deeper aquifer is brackish to slightly saline in some localities such as Colaba, Dharavi and Khar as observed from BMC data. This may be due to ingression of sea water. In view of this it is suggested that borewells drilled especially along the coastal areas should be pumped at the optimum discharge, so that it does not result in sea water ingression, failing to do so may spoil the fresh water aquifers.

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. The classification of water was carried out as per the Bureau of Indian Standards (BIS) for drinking water to assess the suitability of ground water.

The perusal of Table 4.10 shows that 95 per cent of the sample falls in desirable limit of water quality standard, therefore, water quality is good for drinking purpose.

Table 4.10

Suitability of Ground Water for Drinking Purpose

Parameter	DL	MPL	Samples with conc. < DL	Samples with conc. in DL – MPL	Samples with conc. > MPL
TDS (mg/L)	500	2000	21	1	1
TH (mg/L)	300	600	23	Nil	1
Ca (mg/L)	75	200	23	1	Nil
Mg (mg/L)	30	100	22	2	Nil
Cl (mg/L)	250	1000	23	1	-
SO4 (mg/L)	200	400	22	1	1
NO3 (mg/L)	45		24	Nil	Nil
F (mg/L)	1.0	1.5	24	Nil	Nil

4.6.1.2 Suitability of Ground Water for Irrigation Purpose

The water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated crops. The quality of irrigation water depends primarily on the presence of dissolved salts and their concentrations. Sodium Absorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and suitability for irrigation.

Water Environment

Water environment consists of water resources and its quality. Its study is important from the point of view to assess the sufficiency of water resources for the needs of the project in its various stages of the project cycle and also to assess the impact of the project on water environment. Anticipated impacts of the proposed project on water environment have also been addressed.

Water Resources

Water supply to Mumbai district are from various sources viz. Tulsi Lake (18 MLD), Vihar (110 MLD), Tansa (477 MLD), Vaitarna (1070 MLD) and Bhatsa (1475 MLD). The Central Ground Water Board, Ministry of Water Resources, Government of India monitored ground water depth in May 2017 which is reported in subsequent section. 0m bgl are observed in northern part of the area. Spatial variation in postmonsoon depth to water level in major part of the district range between 2 and 5 m bgl. Shallow water levels of < 2 m bgl are observed in small area in southern part, whereas water levels of 5 to 10 m bgl are observed in north central part of the district.

Water Quality

The drinking water characteristics, their requirement and permissible limit have been discussed in the following table.

Table: 4.11 Drinking Water – Specification IS 10500:1991

S. No.	Substance or Characteristic	Requirement (Desirable Limit)	Permissible Limit in the absence of Alternate source
	Essential characteristics		
1.	Colour, (Hazen units), Max	5	25
2.	Odour	Unobjectionable	--
3.	Taste	Agreeable	--
4.	Turbidity (NTU), Max	5	10
5.	pH Value	6.5 to 8.5	No Relaxation
6.	Total Hardness (as CaCo) 3 mg/L, Max	300	600
7.	Iron (as Fe) mg/L, Max	0.3	1.0
8.	Chlorides (as Cl) mg/L, Max.	250	1000
9.	Residual, free chlorine, mg/L, Min	0.2	--
10.	Fluoride (as F) mg/L, Max	1.0	1.5
	Desirable Characteristics		
11.	Dissolved solids mg/L, Max	500	2000
12.	Calcium (as Ca) mg/L, Max	75	200
13.	Magnesium (as mg) mg/L, Max	30	100
14.	Copper (as Cu) mg/L, Max	0.05	1.5
15.	Manganese (as Mn)mg/L, Max	0.10	0.3
16.	Sulfate (as SO) mg/L, Max 4	200	400
17.	Nitrate (as NO) mg/L, Max 3	45	No Relaxation
18.	Phenolic Compounds (as C H OH) mg/L, Max 65	0.001	0.002
19.	Mercury (as Hg) mg/L, Max	0.001	No relaxation
20.	Cadmium (as Cd) mg/L, Max	0.01	No relaxation
21.	Selenium (as Se) mg/L,Max	0.01	No relaxation
22.	Arsenic (as As) mg/L, Max	0.01	No relaxation

23.	Cyanide (as CN) mg/L, Max	0.05	No relaxation
24.	Lead (as Pb) mg/L, Max	0.05	No relaxation
25.	Zinc (as Zn) mg/L, Max	5	15
26.	Anionic detergents (as MBAS) mg/L, Max	0.2	1.0
27.	6+ Chromium (as Cr) mg/L, Max	0.05	No relaxation
28.	Poly nuclear aromatic hydrocarbons (as PAH) g/L, Max	--	--
29.	Mineral Oil mg/L, Max	0.01	0.03
30.	Pesticides mg/L, Max	Absent	0.001
31.	Radioactive Materials		
	i. Alpha emitters Bq/L, Max	--	0.1
	ii. Beta emitters pci/L, Max	--	1.0
32.	Alkalinity mg/L, Max	200	600
33.	Aluminium (as Al) mg/L, Max	0.03	0.2
34.	Boron mg/L, Max	1	5

Fishing Season

Fishing season commences from September and lasts till the end of May. There is practically no fishing in the monsoon except in the creeks.

Sharks, skates, rays, mackerels, sardines, *tuna, surmai,* pomfret, *karel, dagol* and catfish form the main varieties of the district: (1) Sharks, skates and rays: They are caught throughout the fishing season with the help of long-lines and bottom-set gill-nets.

(2) Mackerels and sardines: They are caught in *Rampan* nets from November to February.

(3) *Tuna* and *Surmai:* They are caught in the surface drift-nets from September to December.

(4) Pomfrets: They are caught in surface as well as bottom-set gill-nets from September to December and April-May.

(5) Silver bar or *karli:* These are mostly caught in bottom-sot gill-nets from January to May.

(6) *Dagol* and catfishes: These are mostly caught by long-lines throughout the fishing season.

Fishing ranks only next to agriculture in Kolaba district as far as means of livelihood are concerned. According to 1951-Census 8,146 people were engaged in fishing. Fishing is carried on in sea, creeks, lakes and rivers. The development of fisheries and encouragement and assistance to the fishermen of the district is entrusted with the Superintendent of Fisheries, Bombay, and Since 1959 a separate office has been opened at Alibag for this purpose.

Fish

Mumbai district is one of the most important maritime districts of the State with a coastal belt extending to about 100 miles, Fishing industry in the district is mainly dependent upon the exploitation of marine resources.

The district is considered under-developed in practically every field and fisheries are no exception to it. The area, though rich in fishes, has remained under-exploited mainly because of the age-old methods of fishing by sail crafts. In addition to this, state of under-development is due to lack of facilities in communication, transport and preservation. Illiteracy prevailing amongst the fishermen of the district is also one of the handicaps in the general development of fisheries. The ichthyological fauna of Kolaba is very rich comprising a good number of varieties.

Fishing Gear

Fishing gear of Kolaba district can be grouped under the following five main heads:—

(A) Gill nets; (B) Long lines; (C) Seine nets; (D) Bag nets; (E) Cast nets.

(A) Gill nets:

(1) *Wavri* net: This is a surface drift net used all along the coast. This net consists of 20-25 pieces. Each piece varies from ' 140' to 240' in length and 15' in breadth. Mesh size is 3" to 4" (stretched). The nets are made out of hemp and cotton twine, varying from 9-15 plies of 18 to 20 count. The fishermen are gradually changing over to nylon gill nets made out of 210 to 250 Danier yarn of 9-12 plies. The approximate cost of each piece is estimated at between Rs. 25 to Rs. 40 for hemp and cotton twine and between Rs. 80 to Rs 140 for nylon. The net is used for catching pomfrets, *tuna,* silver bar, *seer*fish etc. These nets are used from September to December and late in summer during April and May.

(2) *Pas* or *Saranga Jal.* This is also a type of surface drift net and, as the name indicates, is exclusively used for catching pomfrets. The net. consists of 20-40 pieces, each piece measuring 240' in length and 15' in breadth with mesh size of 5" to 6". The material used in the construction of the gear is similar to that used for *Wavri* nets described above.

(3) *Ghol* net: As the name suggests, the net is used mainly to catch Ghol fish. The net consists of 12 to 16 pieces, each piece measuring 120' in length and 10' in breadth with mesh size of 6".

(4) *Budi* net: This is a bottom set gill net made of hemp twine of 24 plies. As the net is used for catching big fishes like Sharks, Skates, Rays etc., the mesh size is 8" to 9". Each unit consists of 7 to 10 pieces, each piece measuring 100' in length and 12' in breadth.

(B) Long lines: (5) In this type of fishing Mustad hooks Nos. 1, 2, 3 and 6, 7, 8, 9 are most commonly used. Length of each line varies from 500' to 1,200' and about 100 hooks are suspended from one line. Seven to twelve such lines are used at a time. Hooks are baited with pieces of catfish, ribbon fish and squids depending upon the size of hooks to be used. It may be stated that this method of fishing has practically replaced fishing by bottom set gill nets, which are rather expensive compared with long lines. Main varieties of fish caught by long line fishing are catfishes, pom hole fishes and sharks.

(C) Seine nets:

In *Rampan* net of 100 pieces, *Karel* part consists of 60 pieces; *Modan* consists of 22 pieces and *Ghol* consists of 18 pieces. *Rampan'* nets which are used at Malvan and Devbag consist of 200 to 300 pieces of the abovementioned components. Approximately 30 to 40 persons are required for dragging the net. Material used for making the gear is hemp and cotton twine. The net is used for catching shoal fishes like *mackerel* and *sardines.*

(7) *Dhangad Jal:* This is another type of seine net consisting of seven to eight pieces, each piece measuring 100' in length and 12' in breadth having mesh size of 7" to 8". The net is constructed of hemp twine and is used for catching *karel* and *surmai.*

(*D*) *Bag nets:*

(8) *Dol:* This is a funnel-shaped net and consists of five distinct portions, *viz:* (1)*Mhor;* (2) *Chirate;* (3) *Katra;* (4) *Majola* and (5) *Khola.* The mesh size diminishes from *Mhor* to *Khola.* The length of the net varies from 80' to 120' and is fixed with the help of *sus* (barrels). Fishes caught in the net are jew fish, ribbon fish, *mandeli,*Bombay ducks and prawns.

(9) *Bokshi:* This is a miniature *dol* net operated in the creeks.

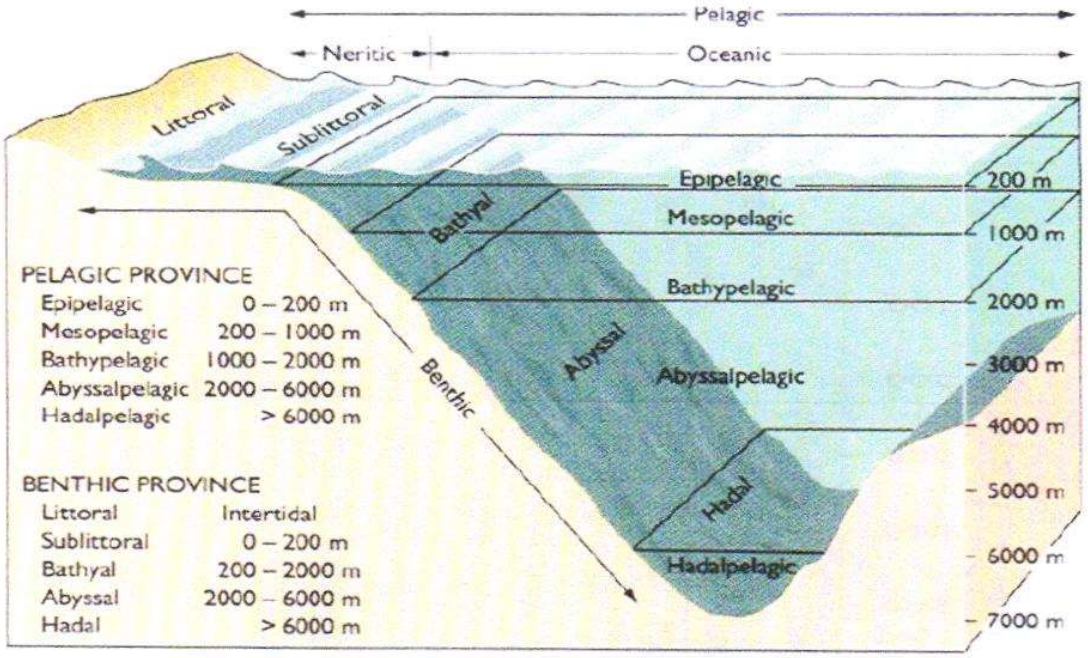
(*E*) *Cast nets:*

(10) *Pag:* The net is prepared from cotton twine and has a circumference of 125' and a radius of 12' to 18'. Mesh size varies from ⅛" to 1". Fishes caught in the net are sardines, mackerels and prawns

4.7 Marine/Coastal Ecology

Oceanic Zones

- Epipelagic – from surface to 200 m, the maximum depth of light penetration
- Mesopelagic – between 200 and 1000 m, no light
- Bathypelagic zone – between 1000 and 2000 m
- Abyssalpelagic zone – between 2000 and 6000 m
- Hadalpelagic zone – greater than6000m



(a) BIOZONES

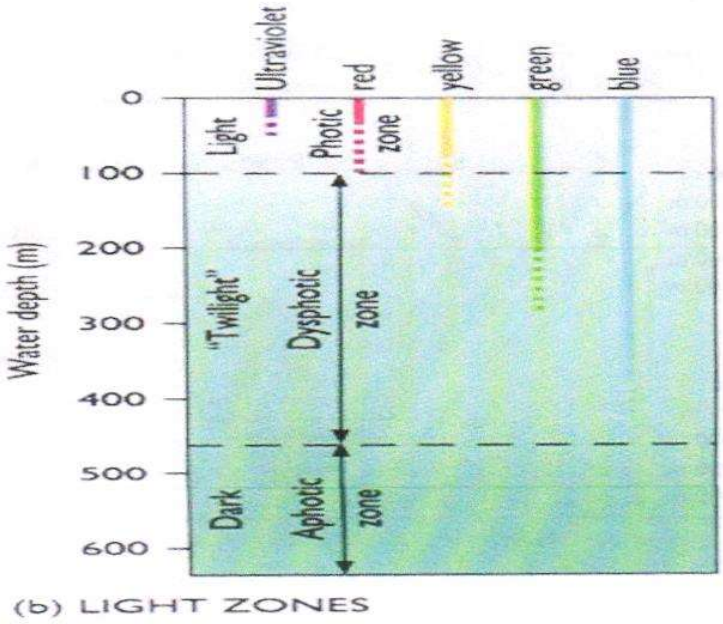
Table 4.12
Percentage of Marine Habitats

Zone	Depth (m)	Volume (%)
	Pelagic	
Epipelagic	0-200	3
Mesopelagic	200-1000	28
Bathypelagic	1000-2000	15
Abyssalpelagic	2000-6000	54
Hadalpelagic	>6000	<1
	Benthic	
Sublittoral	0-200	8
Bathyal	200-2000	16
Abyssal	2000-6000	75
Hadal	>6000	1

Light Zones

- Yet another way to classify the ocean
- Photic zone
  – light is sufficient for photosynthesis
  – to 100 (or 200 m)
- Dysphotic zone
  – light is too weak for photosynthesis
  – twilight zone

– < 5% sunlight
– 100 to 200 m
• Aphotic zone



(b) LIGHT ZONES

MANGROVES

Mangroves are an integral part of the landscape of Mumbai. However, they are fast disappearing owing to rampant construction and lack of governmental will for their protection. Mangroves are small sturdy woody plants which are found in low-lying shallow areas. Mangrove ecosystems serve as a buffer between land and sea. They actually protect the land from the impact of the sea and by trapping silt they also maintain the integrity of Mumbai's shoreline. For a major economic port like Mumbai, this is very crucial to maintain stability along the coastline and avoid accidents. However, the city has not yet learnt to appreciate this service done by mangroves.

Mumbai is surrounded by over 5000 acres of mangrove swamps spread over various areas like Mahim, Madh, Thane creek, Versova, Aksa Beach and Ghodmeasureer. Of these, Mumbai has lost almost 40% to reclamation of land for construction and developmental projects. About 300 acres was sanctioned to build the Esselworld amusement park in the Aksa Beach creek at Borivli and a golf course at Andheri. However, the biggest symbol of the destruction of mangroves is the Bandra-Kurla complex which was built on reclaimed land almost strangulating the mouth of the Mithi River. Creation of infrastructure is an important and totally justifiable end in a city like Mumbai which is aiming to gain an international look. However, unplanned urban development without respecting the course of nature will always backfire in the form of a disaster like 26/7. In a coastal city, wetlands, wastelands, saltpan lands and mangroves function as buffer zones against tidal movement. Each of these have been systematically destroyed which has resulted in

deterioration of land. In case of mangroves, land has been reclaimed in the name of slum rehabilitation and garbage dumps. Sadly enough, on these pretexts, valuable mangroves are destroyed to make way for high rises. Another fact which is not understood is that marshy land is not meant for extensive construction and concretization of such land reduces its water absorption capacity. This makes natural regeneration of underground aquifiers almost impossible. Secondly, construction debris and garbage is also dumped in mangrove swamps in a bid to reclaim land. Mangroves have been classified as a Coastal Regulation Zone-I (CRZ), which means that construction cannot take place without the express permission of the CRZ Authority. This makes all construction activity in mangrove areas a violation of CRZ rules. The Bandra-Worli sea-link and the Sewri- Nhava-Sheva sea link are examples of large-scale projects that shall considerably affect mangroves in those areas.The Bandra-Worli sea-link (BWSL) and the Sewri- Nhava-Sheva sea link have been mooted to provide an alternative to the transport problem in the city and for smoother movement of traffic. However, both these projects are in serious violation of several environmental laws namely the Coastal Regulation Zone (CRZ) rules and are single-handedly responsible for destruction of swathes of mangroves. As no mangrove forests are found near the project site, construction of the structure will cause no harm to the Mangroves.

Procedure for CRZ clearance

The coastal stretches in India are protected by Coastal Regulation Zones Notification, 2011 under Environmental (Protection) Act, 1986. The clearance process for CRZ is explained in the subsequent paragraph.

All projects attracting this notification and those activities not listed in the EIA notification, 2006 shall be considered for CRZ clearance as per the following procedure,

(i) The project proponents shall apply with the following documents seeking prior clearance under CRZ notification to the concerned State or the Union territory Coastal Zone Management Authority,-

(a) Form-1 (Annexure-IV of the CRZ notification);

(b) Rapid EIA Report including marine and terrestrial component except for construction projects listed under 4(c) and (d)

(c) Comprehensive EIA with cumulative studies for projects in the stretches classified as low and medium eroding by MoEF based on scientific studies and in consultation with the State Governments and Union territory Administration;

(d) Disaster Management Report, Risk Assessment Report and Management Plan;

(e) CRZ map indicating HTL and LTL demarcated by one of the authorized agency (as indicated in para 2) in 1:4000 scale;

(f) Project layout superimposed on the above map indicated at (e) above;

(g) The CRZ map normally covering 7km radius around the project site.

(h) The CRZ map indicating the CRZ-I, II, III and IV areas including other notified ecologically sensitive areas;

(ii) No Objection Certificate from the concerned State Pollution Control Boards or Union territory Pollution Control Committees for the projects involving discharge of effluents, solid wastes, sewage and the like.;
(iii) The concerned CZMA shall examine the above documents in accordance with the approved CZMP and in compliance with CRZ notification and make recommendations within a period of sixty days from date of receipt of complete application,-
(a) MoEF or State Environmental Impact Assessment Authority (hereinafter referred to as the SEIAA) as the case may be for the project attracting EIA notification, 2006;
(b) MoEF for the projects not covered in the EIA notification, 2006 but attracting para 4(ii) of the CRZ notification;
(iv) MoEF or SEIAA shall consider such projects for clearance based on the recommendations of the concerned CZMA within a period of sixty days.

4.8 Air Environment

The ambient air quality was monitored at given site i.e. Aksa Beach Mumbai Suburban Tal Mumbai as a part of the EIA study. The ambient air quality monitoring has been carried out with a frequency of two samples per week at four locations for a period of twelve consecutive weeks. The parameters monitored as a part of the study are listed as below:

- Suspended Particulate Matter (SPM)
- Respirable Particulate Matter (RPM)
- Sulphur dioxide (SO2)
- Oxides of Nitrogen (NOx).

Amongst the various types of pollution, air pollution is of greatest importance. It can be readily oticed as it causes immediate health problems. The hazardous gases that lead to pollution are oxides of carbon, nitrogen and sulphur **Table 4.13** Particulate matter also causes air pollution. **Table 4.13** indicates level of suspended particulate matter in cities of India. The emission due to auto-exhaust causes serious pollution of air due to formation of oxides of nitrogen and benzopyrene. **Table 4.13** indicates the level of BaP *i.e.* Benzopyrene in various towns of the world, and **Table 4.14** shows BaP level at various places in Mumbai. BaP is generated by incomplete combustion of petrol. This is a serious air pollutant as it

Table 4.13 Growth of air pollution (1978–1986) in µg/m3

S. No. Place/Town	SPM	SO2	NO–NOx
(A) Levels of air pollution in Mumbai (1986)			
Chembur	341	65	51
Lalbaug	454	128	-
Khar	349	11	77
Babula Tank	318	56	56
Parel	326	47	70
Dadar	-	60	-
Sewree	-	60	-
Ghatkopar	407	75	-
Sakinaka	-	49	
-(B) Levels of air pollution in India (1978) and abroad			
Bombay (Mumbai)	238	172	50
Calcutta (Kolkata)	500	58	51
Delhi		90	35
Kanpur	500	40	30
London	150	87	29
New York	-	135	42
Tokyo	-	59	62

Suspended particulate matter (SPM) in major cities in India (1978) µg/m3

City	*Urban area*	*Suburban area*	*Residential area*
Bombay (Mumbai)	123	150	221
Calcutta (Kolkata)	352	324	246
Delhi	361	256	391
US (EPA) Standard	75	75	75

Table 4.14 Benzopyrene levels in city of Mumbai

Place	*Range of concentration (µg/1000 m3)*	*Source of emission*
Lalbaug	165.0 to 861.0	Gas plant where coal is burnt
Dadar	7.1 to 16.2	The gas plant was shut down
Sion	15.0 to 36.0	Automobile exhaust
Koliwada	17.4 to 225.1	Kiln for firing pottery
Trombay	2.0 to 13.0	Petrochemical area
Bhandup	0.8 to 2.0	Residential area
Colaba	3.1 to 3.9	Coastal area

Respirable Dust Samplers APM-451 of Envirotech Instruments are being used for monitoring Suspended Particulate Matter (SPM), Respirable fraction (<10 microns) and gaseous pollutants like SO2 and NOx.

Three different Stations have been identified for checking the Ambient Air quality whose co ordinates and distance from project site have been mentioned in the following stations

Station	Distance from Project Site(Km)	Co-ordinates
PATELWADI	1.33	19°11'12.59"N 72°48'3.06"E
AMBOJWADI	1.39	19°10'30.97"N 72°48'29.61"E
MADH	1.47	19°9'50.43"N 72°47'22.23"E

Table 4.15

The ambient air quality standards specified by Central Pollution Control Board (CPCB) are enclosed as Annexure - I.

Sr No	SPM	RPM	SO2	NOx
Project site				
1	320	67	61	50
2	345	65	66	59
3	325	59	54	45
4	326	51	55	46
5	323	66	55	48
6	331	61	59	41
7	325	56	69	56

8	315	69	61	45
9	301	44	65	41
10	327	55	60	45
Patelwadi				
1	340	59	67	40
2	326	54	66	45
3	301	56	64	50
4	300	54	58	56
5	336	69	55	44
6	326	62	56	46
7	332	70	51	41
8	330	65	65	42
9	314	55	67	40
10	315	50	60	46
Ambojwadi				
1	333	50	61	50
2	349	64	59	56
3	335	69	55	44
4	298	51	51	46
5	329	56	52	43
6	345	61	52	40
7	341	65	51	49
8	326	56	57	44
9	316	54	63	57
10	324	41	63	55
Madh				
1	320	50	60	50
2	329	57	65	43
3	322	55	66	42
4	337	63	61	48
5	311	41	59	44
6	325	52	54	46
7	311	39	55	46
8	326	45	50	56
9	325	56	54	51
10	326	51	50	55

Table:-4.16
Observations on ambient SPM level:
The summaries of ambient SPM levels observed are given

STATION	MAXI.	MINI.	AVERAGE
PROJECT SITE	345	301	323.0
PATELWADI	340	300	320.0
AMBOJWADI	349	298	323.5
MADH	337	311	324.0

Ambient air quality status – SPM (Unit: µg/m3)

It is observed from Table-4.16 that the average concentration of SPM at various stations ranged from 320.0 to 324.0 mg/m3. The highest SPM level observed was 324.0 mg/m3.

Observations on RPM levels

The average concentration of RPM at various stations monitored ranges from 51 to 60 µg/m3 were below the prescribed limits for limit of 60 µg/m3 specified for industrial, residential, rural and other

Table No.:4.17
Observations on ambient Rpm levels

STATION	MAXI.	MINI.	AVERAGE
PROJECT SITE	69	44	56.5
PATELWADI	70	50	60.0
AMBOJWADI	69	41	55.0
MADH	63	39	51.0

Observations on SO2 levels

The average concentration of SO2 at various stations in the study area was much below the prescribed limits of 50 mg/m3 specified for industrial, residential, rural and other areas (Refer Annexure-I). The highest SO2 concentration of 10.5µg/m3 was observed at station near Project

site, which is again well below the prescribed limit of 80 µg/m3 specified for residential, rural and other area

Table No.:4.18
Observations on ambient SO2 levels

STATION	MAXI.	MINI.	AVERAGE
PROJECT SITE	69	54	61.5
PATELWADI	67	51	59.0
AMBOJWADI	63	51	57.0
MADH	66	50	58.0

TABLE-4.19
Observations on ambient NOx levels
Ambient Air Quality Status – NOx (Unit : µg/m3)

STATION	MAXI.	MINI.	AVERAGE
PROJECT SITE	59	41	50.0
PATELWADI	50	40	45.0
AMBOJWADI	57	40	48.5
MADH	55	42	48.5

SOURCE OF AIR POLLUTION

We have various sources for air pollution. These are burning of coal and coke, industrial emissions, commercial activities, thermal power generation unit and last but not the least is transportation. Table 1.8 lists various sources of atmospheric pollution (Fig. 1.1). Table 4.20 indicates as to how much air pollution is caused by burning sulphur containing fuels. Though wood causes zero pollution, its calorific value is poor, while fuel oil produces pollution due to SO2 but it has high calorific value. Transportation is a major source of pollution causing the highest pollution in metropolitan cities in India. Table lists the population of two wheelers in various cities of Maharashtra, while Table

Table 4.20 Source of growing atmospheric pollution in developed countries

Source	1973	1978	1983	1986	1990
Domestic sources	34.2	43.5	47.12	53.58	55.0
Commercial point	4.92	6.15	6.34	6.954	7.00
Industrial estates	43.8	50.2	56.4	64.4	70.0
Power generation	12.2	12.2	48.94	46.95	40.0
Transportation	39.8	64.6	10.63	13.14	15.6
Others	40.0	64.6	10.64	13.15	15.0

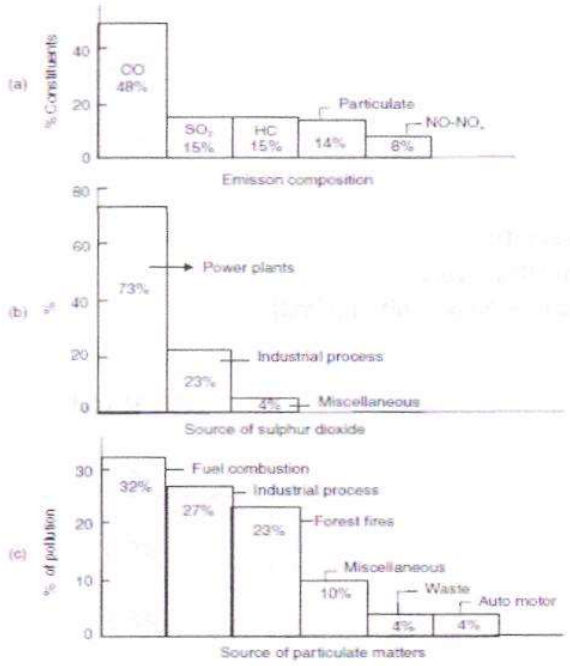


Fig. 1.1 Histograms for air pollutants

Table 4.21 Amounts of sulphur in fuels emitting SO2 gas

Substance	*% S*	*Calorific value*
Wood	0	18
Peat	1	18
Lignite	1.3	23.2
Bituminous fuel	1.6	25.5
Semibituminous fuel	1.2	36
Anthracite	1.0	34
Coke	<1.0	29
Crude oil	0.5–3.0	-
Fuel oil	2-4	43.5
Coal tar fuel	0.5	37.8

Town gas	-	18.6
Natural gas	Trace	34.0
Producer gas	-	4.5

Table 4.22 Population of two wheelers in various cities of Maharashtra (1970)

City	Number (approx.) (thousands)
Bombay (Mumbai)	**200.00**
Thane	**7.00**
Pune	**150.00**
Nagpur	**77.00**
Nasik	**14.00**
Aurangabad	**29.00**
Kolhapur	**21.00**

lists overall production of light vehicles in India, which are responsible for vehicle emissions. The growth rate shows that as the activity of production increases, vehicle pollution also rises. The photochemical smog which is obtained by combination of smoke and fog contributes several pollutants to air (Figs. 1.2 and 1.3) e.g. CO, CO2, NO–NOx, SO2, Hydrocarbon (HC), etc., as listed in Table 1.12. A typical petrochemical plant in Gujarat has shown different levels of air borne (SPM) particulate in the atmosphere (Table 1.13). The thermal power plants in India are responsible for causing extensive air pollution. A typical thermal power plant in the capital of India throws daily 80 tons of flyash and several tons of SO2 in the atmosphere. Amongst Indian cities, Delhi and Kanpur have the highest dust fallout, Mumbai emits highest SO2 emissions, while Kolkata contributes its share by emitting largest proportion of NO–NOx in the air.

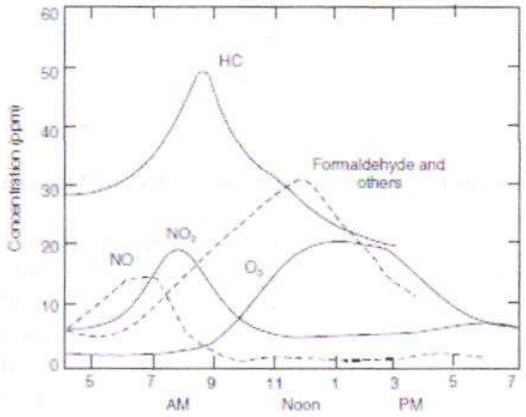


Fig. 1.2 Different pollutants in photochemical smog

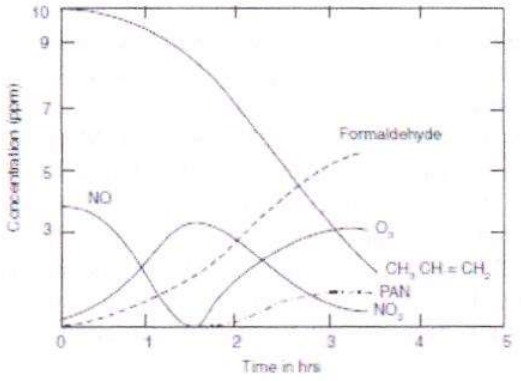


Fig. 1.3 PAN and other pollutants in smog

Table 4.23: National Ambient Air Quality Standards

Pollutant	Time	Concentration	
		Industrial, Residential, Rural & other Area	Ecological Sensitive area
Sulphur Dioxide (SO2) in µg/m3	Annual	50	80
	24 Hours	80	80
Oxides of Nitrogen (NOx) in µg/m3	Annual	40	30
	24 Hours	80	80
Particulate Matter size less than 10µm in µg/m3	Annual	60	60
	24 Hours	100	100
Particular Matter size less than 2.5µm in µg/m3	Annual	40	40
	24 Hours	60	60
Carbon Monoxide (CO) in mg/m3	8 Hours	02	02

Ozone (O3) in µg/m3	8 Hours	100	100
	1 Hour	180	180
Lead (Pb) µg/m3	Annual	0.50	0.50
	24 Hours	1.0	1.0
Ammonia µg/m3	Annual	100	100
	24 Hours	400	400
Benzene (C6H6) µg/m3	Annual	05	05
Benzo (a) pyrine (BaP) Particulate phase only, ng/m3	Annual	01	01
Arsenic (As) ng/m3	Annual	06	06
Nickel (Ni) ng/m3	Annual	20	20

Noise Environment

Baseline noise data has been measured using a weighted sound pressure level meter. The survey was carried out in calm surroundings. Sound Pressure Level (SPL) measurement in the outside environment was made using sound pressure level meter.

Table 4.24 Levels of noise pollution in general

Locality/Source	*Noise level, dB*
Garden	20
Bed rooms	25
Libraries	30
Living rooms	40
Conversation	60
Business office	67-70
Average street traffic	80-85
Heavy truck traffic	90
Pneumatic chipper	100
Pop music	110
Jet take off (at 100 m distance)	125
Jet engine (25 m distance)	130
Threshold of pain	140

Table 4.25 Noise level during festivals and normal times in Mumbai

Locality	*Noise level (dB)*	
	In festival	*Normal times*
Prabhadevi	101	70
Pedder Road	108	75
Opera House	98	70
Tejpal Ground	90	68

Goregaon (Dindoshi)	81	50
Goregaon (Charkop)	88	55
Colaba	57	40

Table 4.26: National Ambient Noise Quality Standards

Area Code	Category of Area	Limits in dB (A) Leq	
		Day time*	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence Zone**	50	40

Baseline noise data has been measured using a weighted sound pressure level meter. The survey was carried out in calm surroundings. Sound Pressure Level (SPL) measurement in the outside environment was made using sound pressure level meter. Hourly noise meter readings were taken at each site, and equivalent day time and night time noise levels were estimated.

TABLE-4.27
Ambient Noise Level In The Study Area (Unit : dB(A))

TIME	PROJECT SITE	PATELWADI	AMBOJWADI	MADH
6AM -7AM	61	60	59	61
7AM -8AM	63	63	60	63
8AM -9AM	64	65	63	65
9AM -10AM	66	67	66	67
10AM – 11AM	68	69	69	68
11AM - 12NOON	70	71	70	70
12NOON -1PM	68	69	68	69

1PM -2PM	66	68	66	68
2PM -3PM	64	65	64	66
3PM -4PM	62	63	63	65
4PM-5PM	62	62	62	63
5PM-6PM	66	65	66	65
6PM-7PM	67	67	67	68
7PM-8PM	69	69	71	72
8PM-9PM	71	70	69	73
9PM-10PM	69	69	66	70
10PM-11PM	67	68	65	68
11PM-12MIDNIGHT	65	67	63	65
12MIDNIGHT-1AM	64	65	60	63
1AM-2AM	63	63	62	62
2AM-3AM	62	61	63	60
3AM-4AM	59	59	59	57
4AM-5AM	58	57	57	56
5AM-6AM	56	56	57	55

WATER POLLUTION

Water pollution has been studied in great details. The indiscriminate disposal of water after use in the form of waste causes water pollution. The tragic incident of Minnamata in Japan is well known. A paper factory using mercury compounds carelessly dumped its waste effluents into the sea, it formed (CH3)2Hg and (CH3CH2)2Hg, which in turn was consumed by the sea fish. The Japanese people who consumed such fish showed symptoms of mercury poisoning like gingivitis, vomiting, fever, diarrhoea, paralysis of extremities, etc. There were several instances of marine flora and fish dying in the sea, on account of deoxygenation of water, perhaps due to thermal pollution. Most of the rivers in India are polluted due to industrial activity. In Mumbai, Ulhas river is polluted due to disposal of effluents from rayon and dyestuff industries. Some rivers in India with polluting industries shown in parenthesis, are listed: Ganga (jute, sugar), Sone (paper pulp), Gomati (paper), Yamuna (insecticides), Chaliyar (rayon waste),

Table 4.28 Typical concentration of trace constituents in photochemical smog

Constituent	Concentration, ppm
Oxides of nitrogen	20
NH3	2
H2	50
H2O	2 × 106
CO	4 × 103
CO2	4 × 104
O3	50
CH4	250
Higher paraffins	25
C2H4	25
Higher olefins	25
C2H2	90
C6H6	10
Aldehydes	60
SO2	20

4.9 Public Utilities

Road Connectivity

The following is an account of the State Highways and Major District Roads in Mumbai district. Roads in Mumbai district, as in other districts, are classified, according to their importance, into four categories:—

(i) National Highways, (ii) State Highways, (iii) Major District Roads, and (iv) Other District Roads.

National Highways have been defined as "main highways serving predominantly national, as distinct from State, purposes, running through the length and breadth of India, which together form a system connecting (by routes as direct as practicable) major ports, foreign highways, Capitals of States, and including highways required for strategic movements for the defense of India,"

State Highways have been defined as "all other main trunk or arterial roads of a State connecting up with National Highways or State Highways of adjacent States, district headquarters and important cities within the State, and serving as main arteries of traffic to and from District Roads.". These are usually maintained by State Governments and generally bridged and metalled and are completely motorable throughout the year, except that sometimes where there are causeways or submersible bridges, traffic may be interrupted in the monsoon for very short periods. State Highways usually have connections with National Highways.

"Major District Roads" are roughly of the same specifications as State Highways. These roads connect important marketing centres with railways, State Highways and National Highways.

"Other District Roads" are also of the same type as Major District Roads, except that they are subject to more frequent interruptions of traffic during the rains. They also serve market places.

They are generally unmetalled. The State Highways and, in most cases, the Major District Roads are also constructed and maintained by the State Public Works Department, and the cost, unlike in the case of the National Highways, is met out of State funds.

State Highways

Nagpur–Aurangabad–Mumbai express highway is a Maharashtra State Highway, as its area lies in the state of Maharashtra only, but built on the National Express Highway basis.

State Highway 42, commonly referred to as Ghodmeasureer Road or G.B. Road, runs entirely through the district of Thane. It is one of the major roads leading out of Thane city and connects to the Eastern Express Highway, becoming National Highway 3. It also connects to the Western Express Highway to become National Highway 8 at Ghodmeasureer leading to Gujarat.

The Mumbai Pune Expressway, (officially known as the Yashwantrao Chavan Mumbai Pune Expressway) is India's first six-lane concrete, high-speed, access controlled tolled expressway

National Highways

National Highway 4 (NH 4) is a major National Highway in Western and Southern India. NH 4 links four of the 10 most populous Indian cities - Mumbai,Pune, Bangalore, and Chennai. NH 4 is 1,235 km (767 mi) in length and passes through the states of Maharashtra, Karnataka, Andhra Pradeshand Tamil Nadu.

National Highway 8 (NH 8) is a 4-lane (6-lane between Delhi-Jaipur) National Highway in India. According to estimates, it is the busiest highway in the subcontinent, as it connects the national capital Delhi to the financial capital Mumbai, as well as important cities Gurgaon, Ajmer, Udaipur,Ahmedabad, Surat, Jaipur, Kotputli and Vadodara. The total length is 1,428 km (887 mi)

National Highway 17, commonly referred to as NH 17, is a busy National Highway in India that runs roughly north–south along the western coast of India, parallel to western ghats. It connects Panvel (South of Mumbai city) to Kochi in Kerala, passing through the states of Maharashtra, Goa,Karnataka, and Kerala. It is the 7th longest highway in India with a length of 1,296 km (805 mi). It has been now renumbered as NH-66.

By Rail

Mumbai is very well connected to rest of India by trains. Trains travelling from Central, East and West India arrive at the Chhatrapati Shivaji Terminus, or VT as it used to be called. Trains from the North arrive at Mumbai Central Station.

Air Transport

Mumbai is the gateway to India for a large number of travellers and is extremely well connected by air with most major destinations around the world as well as in India. The Chhatrapati Shivaji International Airport lies about 9.5 kilometres from the project site .

CHAPTER 5
ANTICIPATED ENVIRONMENTAL IMPACTS

5.1 General

Based on the project details and the baseline environmental status, potential impacts that are expected to accrue as a result of the proposed project have been identified. The Environmental Impact Assessment for quite a few disciplines is subjective in nature and cannot be quantified. Wherever possible, the impacts have been quantified. However, for intangible impacts, qualitative assessment has been done. This Chapter deals with anticipated positive as well as negative impacts due to the construction and operation of the proposed Anti Sea Erosion Measure at Aksa Beach Mumbai Suburban is situated in Mumbai Tehsil in Mumbai District of Maharashtra

5.2 Impacts on Land Environment

A) Construction Phase

Impacts due to construction activities

Pre-construction activities generally do not cause significant damage to environment. Preparatory activities like the use of existing access road, construction of storage sheds, etc. being spread over a large area, would have no further significant impact once the land is acquired and its existing use changes. Clearing, stripping and leveling of sites, construction of Anti Sea Erosion Measure, earth filling and excavation for foundations, will lead to some disturbance to the habitat. Since, the proposed project site lies within the given area, and at level of construction activities in the proposed project is not of such level and nature, to cause any significant adverse impact on this account. The natural drainage in the area is such that the entire water would outfall in the marine water. This could lead to marginal increase in turbidity levels. However, based on experience in similar projects, this impact is not expected to be significant.

Impact on land environment may also be caused by the quarrying activities in the nearby areas. However the quarrying activities were carried out in the Q zone identified as quarry zone in the revised land use plan -1973 well as G-1 and G-2 zones identified as green zones so as not to exhaustively demarcate the Q zone.

B) Operation Phase

The problem envisaged during operation phase could be the disposal of garbage or solid waste generated from various sources. The various sources of solid waste are the waste from activities of Anti Sea Erosion Measure construction, it shall mainly comprise of floating materials, packaging, polythene or plastic materials, etc. Therefore, a system needs be devised whereby

undue quantity of garbage is not permitted to accumulate in the project area and the same could be disposed of at designated sites in a proper manner.

5.3 Impacts on Water Environment

A) Construction phase

Impacts due to effluents from Labour Camps

The average and peak labour strength likely to be deployed during construction phase of the proposed Anti-Sea Erosion Measure will be about 25 and 35 respectively. Based on this the total water requirement for the labour population congregating in the area for constructing the proposed site that will stay during the construction phase are estimated as below:

Peak labor strength : 30

Labours likely to stay at construction site (50%) : 15

Married families (80% of 30) : 20

Single : 08

Husband and wife both working (80% of 20) : **12**

Families (40/2) : 10

Families where only husband is working (50% of 10) : **4**

Family size (assumed) : 4 …….(a) Add 5% for the service provider like shops,

repairing facilities : **4**

Total no. : 12+4+4= 20

Total Water requirement = 20 * 125 = 2500 lit per day

The sewage generated is normally taken as 80% of the total water requirement i.e. (0.8 x 2.5) = 2.00 m3/day. The domestic water normally contains high BOD, which needs proper treatment and disposal, otherwise, it can have an adverse impact on the DO levels of the receiving body. The disposal of sewage without treatment can cause problems of odour and water pollution. BOD is the major pollutant, as far as sewage is concerned. Normally untreated sewage would find its way to natural drainage system which ultimately confluences into the sea. However, these natural drains are seasonal in nature and are likely to remain dry in the non-monsoon

months. During this period, the flow of untreated sewage from the labour colonies in these drains can lead to development of anaerobic conditions, with associated water quality problems.

TABLE-5.1
Typical composition of untreated sewage

Parameters	Value
Total Solids mg/l	720
Total Dissolved Solids mg/l	500
Total Suspended Solids mg/l	220
BOD mg/l	220
Oils & Grease mg/l	100
Total Phosphorous mg/l	80
Total Nitrates mg/l	40
Bicarbonates mg/l	100
Carbonates mg/l	10
Nitrates mg/l	40
Phosphates mg/l	40
Chlorides mg/l	50
Sulphates mg/l	30
Calcium mg/l	40
Magnesium mg/l	40
Potassium mg/l	15

It is clear from Table-5.1 that BOD is the major pollutant, as far as sewage is concerned. Normally untreated sewage would find its way to natural drainage system which ultimately confluences into the sea. However, these natural drains are seasonal in nature and are likely to remain dry in the non-monsoon months. During this period, the flow of untreated sewage from the labour colonies in these drains can lead to development of anaerobic conditions, with associated water quality problems.

However, in the present case it must be mentioned that the total quantity of sewage (2.00 m^3/day) generated by the labour during construction phase is very small and is not expected to cause any adverse impact on the marine water quality. However, it is proposed to treat the sewage from labour camps before disposal. The details are outlined as a part of Environmental Management Plan (EMP) in Chapter-8 of this report.

However, in the present case it must be mentioned that the total quantity of sewage ($2.0m^3$/day) generated by the labor during construction phase is considerably very small and is not expected to cause any adverse impact on the marine water quality. Also, it is proposed to treat the sewage from labour camps before disposal. The details are outlined as a part of Environmental Management Plan (EMP) in Chapter-8 of this report.

B) Impacts due to Construction

Construction of Anti Sea Erosion Measure, deposition of rubble, compaction and other construction work, is water course re-suspension of sediments resulting in increase in turbidity. It also reduces sunlight penetrating into the marine water body. The vessels involved in construction and related activities are a possible cause of oil spills, garbage discharge, etc.

Runoff from construction site water is also another source of pollution. The impacts on this account are not expected to be significant. However, mitigation measures have been recommended as a part of the Environmental Management Plan to ameliorate even the marginal impacts.

Water Pollution due to Boat/Vehicles movement and other activities

The discharge from boats that could be source of water pollution include bilge water, ballast water, oily wastes, sewage, garbage and other residues from the boat. Spills of oil, fuel, etc. can also be the source of pollution. Appropriate measures have been recommended to control water pollution from Boats.

5.4 Impacts on Suspended Sediments and Turbidity Levels

Since the proposed site at Aksa Beach Mumbai Suburban in Mumbai Tehsil in Mumbai District of Maharashtra which has involved relatively a very small construction activities, and when dredging and disposing of non-contaminated sediments, the key impacts are the increase in suspended sediments and turbidity levels. Any dredging method releases suspended sediments into the water column, during the excavation itself and during the flow of sediments from hoppers and barges.

Increase in suspended sediments and turbidity levels from dredging operations may under certain conditions have adverse effects on marine animals and plants by reducing light penetration into the water column and by physical disturbance. The increase is likely to last for a period of 10-15 days after the cessation of dredging activities. This trend is noticeable under flood as well as ebb conditions. Increased suspended sediments can affect filter feeding organisms, such as shellfish, through clogging and damaging feeding and breathing process. Similarly, young fish can be damaged if suspended sediments become trapped in their gills and increased fatalities of young fish have been observed in heavily turbid water. Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging sites. The increase in turbidity results in a decrease in the depth that light is able to penetrate the water column which may affect submerged plants, by temporarily reducing productivity and growth rates. Since, the benthic fauna is moderately developed in the areas, hence impacts on this account are not expected to be significant. The degree of re-suspension of sediments and turbidity during dredging and disposal depends on:

- Sediments being dredged (size, density and quality of the material),
- Method of dredging (and disposal),
- Hydrodynamic regime in the dredging and disposal area (current direction and speed, mixing rate, tidal state), and
- Existing water quality and characteristics (background suspended sediment and turbidity levels).

Since, the area for construction activities is less i.e. Anti-Sea Erosion Measure, the degree of re-suspension of sediments and turbidity during dredging and disposal, hence no adverse impacts are anticipated.

5.5 Impacts on Marine Environment (Coastal Hydrology/Bottom Contamination)

Redox potential (eH) and pH are two variables that control the characteristics of chemicals and heavy metals in water and sediment. As long as the pH remains around 8 and eH< 150 mV , most of the chemicals and metals will remain bound to the solid phase without being released into the surrounding water. Only anoxic conditions reduce the eH below this level and hence if dissolved oxygen level is within the normal range, no leaching of chemicals and heavy metals is expected to occur.

In the present survey sites pH was 8.3 -8.4 and dissolved oxygen was 6.0 -6.7 mg/l which is normal for a marine ecosystem where there are no sources of pollution. Dissolved oxygen levels

are not reduced to anoxic conditions until and unless there is significant increase in organic pollution loading. In future, significant increase inorganic pollution loading is not expected. Under these circumstances, there is no possibility of any of the chemicals or metals being leached into the water. Moreover, sediment samples collected from all the sites we uncontaminated. As such no adverse impact due to dredging on the chemical characteristics of water or sediment is expected.

- Impacts due to contaminated sediments

Another possible impact is the release of toxicants from the sediment if the sediment is contaminated. In the case of contaminated sediment acute toxicity, chronic toxicity and bioaccumulations are the possible effects. But all these are short-term and insignificant and no serious effects have been reported from any earlier instances or experimental studies. In all the sites surveyed, the sediment samples analyzed did not show the presence of any appreciable levels of contamination and hence may not pose any such problems.

5.6 Impacts on Biological Environment (Coastal and Marine ecology)

- Impact on phytoplankton and primary productivity

Biomass of phytoplankton depends mainly on the availability of light in nutrient rich waters. Dredging and disposal may lead to increased turbidity and consequent reduction of light penetration for short periods. This may affect primary productivity and plankton biomass. However, turbidity due to dredging and dumping will be observed only in a localized area and only for a very short duration and also the proposed site at Aksa Beach Mumbai Suburban which has construction activities. Hence these impacts are not expected to be significant in nature.

- Impacts on benthos

The dredging and dumping generally affect the benthos. These are related to removal of the benthic organisms from the dredging site and burial of benthic organisms at the dumping site. The dredged material takes away most of the benthos along with it and while dumping it most of the organisms present are buried under the deposited material. This will result in reduced number and diversity of benthic organisms at the dumping site. However, earlier studies show that the dredged site will be colonized by benthic organisms within a very short time. Benthic fauna did not contain any rare or endangered species and consisted of common species only. It can be expected that these species will colonize within a short time from dislodging.

- Impacts on Fisheries

The most important impact on fishes may be suspended solid load or changes in the food chain. The high turbidity due to heavy suspended solid load during dredging or disposal of dredged materials results in clogging of gills of fishes thereby causing asphyxiation. But since fishes are free swimming they very well avoid such areas and move to safer areas. Once the turbidity is over due to currents, they come back to the area. Due to this capability of the fishes there is no significant adverse impact on fishes and fisheries is expected on fisheries as a result of dredging. Moreover, in the proposed area including the marine area proposed to be dredged, fisheries are not very well developed. Hence, significant adverse impacts are not anticipated.

5.7 Impacts on Air Environment

(a) Construction phase

- Impacts due to fugitive emissions

The major pollutant in the construction phase is SPM being air-borne due to various construction activities. The vehicular movement generates pollutants such as NOx, CO and HC. But, the vehicular pollution is not expected to lead to any major impacts.

The soils in the project area are sandy in texture, and are likely to generate dust as a result of vehicular movement. However, the fugitive emissions generated due to vehicular movement are not expected to travel beyond a distance of 200 to 300 m. The impact on air environment during construction phase is not expected to be significant, since there are no habitations in the vicinity of the site and also the proposed site at Aksa Beach ,Mumbai Suburban which has construction activities.

- Impacts due to construction equipment

As explained earlier, proposed construction site is very less requirement for Construction Equipment. The combustion of diesel in various construction equipment could be one of the possible sources of incremental air pollution during the construction phase. The fuel utilization rates of various equipments expected to be in operation during construction phase is given in Table. Under the worst case scenario, it has been considered that equipment used for construction of berth and earthwork at each site, are operating at a common point.

The combustion of diesel in various construction equipment could be one of the possible sources of incremental air pollution during the construction phase.

Under the worst case scenario, it has been considered that equipment used for construction of berth and earthwork at each site, are operating at a common point. The major pollutant likely to be emitted due to construction of diesel in various construction equipment shall be SO2. The

short-term increase in SO2 concentration has been predicted using Gaussian plume dispersion model. The results are summarized in Table-5.2

TABLE-5.2

Short-term (24 hr) increase in concentration of SO2 (mg/m3)

Wind Speed (m/s)	Distance			
	0.1	0.2	0.3	0.4
0.2	2.60*10^-34	1.27*10^-27	6.36*10^-6	5.19*10^-4
0.85	1.56 *10^-7	2.91*10^-4	2.43*10^-4	2.3*10^-4
1.53	4.08*10^-4	9.66*10^-4	2.33*10^-4	1.19*10^-3
2.78	6.03*10^-4	6.82*10^-4	1.44*10^-4	4.47*10^-5
4.30	5.22*10^-4	6.82*10^-4	1.44*10^-4	4.47*10^-5
5.98	3.91*10^-4	3.56*10^-4	7.05*10^-5	3.22*10^-4
7.00	3.78*10^-4	3.04*10^-4	6.04*10^-5	2.76*10^-5

5.8 Impacts on Noise Environment

(a) Construction phase

The major sources of noise during construction phase are due to operation of various construction equipment. The noise levels generated by various construction equipments are given in table 5.3 under the worst case scenario, considered for prediction of noise levels during construction phase, it has been assumed that all the equipments are operating at a common point. Likewise, to predict the worst case scenario, attenuation due to various factors too have not been considered for noise modeling.

TABLE-5.3

Average noise levels generated by the operation of various construction equipment

Equipment	Noise Level [Db(A)]
Floating pontoon with mixer machine and crane Winch machine	70-80
Transit Mixer	75
Dumper	75
Generators	85
Batching Plant	90
Air Compressors	115

TABLE-5.4

Predicted noise levels due to the operation of Various construction equipment

Distance (m)	Ambient Noise Level (dB(A)	Increase in noise level due to construction activities (dB(A))	Noise level due to construction activities (dB(A))	Increase in ambient noise level due to construction activities (dB(A))
30	45	70	70	25
50	45	66	66	21
100	45	60	60	15
200	45	54	55	10
500	45	46	49	4
1000	45	36	46	1
1500	45	36	45.5	0.5
2000	45	34	45	-

It is clear from Table 5.4 that at a distance of 100 m and 200 m from the construction site, the increase in noise levels will be about 10 dB(A) and 15 dB(A) respectively.

The other source of noise during construction phase will be due to movement of trucks, which will transport the construction material.

For prediction of worst scenario, it has been assumed that there will be an additional movement of 50trucks/hour. The variation in noise level due to increase in vehicular movement is given in Table-5.5

TABLE 5.5
Variation in noise level due to vehicular movement

Sr No	Distance (m)	Ambient Noise Level (dB(A))	Increase in noise level due to construction activities (dB(A))	Noise level during construction phase (dB(A))	Increase in ambient noise level due to construction activities (dB(A))
1	30	45	61	61	16
2	50	45	57	57	12
3	100	45	51	52	7
4	200	45	45	48	3
5	300	45	41	47	2
6	400	45	39	46	1

It is clear from Table-5.5 and the proposed site at Aksa Beach Mumbai Suburban which has construction activities, that the increase in noise level due to vehicular movement is not expected to be significant during construction phase. The increase in ambient noise level at a distance of 30 m, 50 m, 100 m and 200 m is 16 dB(A), 12 dB(A), 7 dB(A) and 3 dB(A) respectively. These noise levels have been assessed considering that there will be no attenuation due to various sources. However, if we consider the attenuation due to air, barrier, vegetation etc. then the increase in noise levels will be even less. The nearest residential areas are at a distance of about 1 km from the proposed project site. Hence, no adverse impacts are anticipated on noise levels due to the proposed project.

5.9 Impacts on Marine Ecology

The direct impact of construction activity for any project is generally limited in the vicinity of the construction sites only. The construction sites include berthing, storage and infrastructure facilities. There is no forest with tree cover in the vicinity of the project site.

The study area has no major forest cover. Hence, no significant impacts are envisaged on terrestrial flora as a result of the proposed project.

5.10 Impacts on Socio-Economic Environment

The construction stage the peak labour force, skilled and unskilled laborers, is estimated at about 15 since the proposed site at Aksa Beach, Mumbai Suburban which has construction activities. About 8 labour population are likely to come from nearby sites. The balance, i.e. 8 labour and their family members are likely to stay near construction sites. Thus, it is not necessary to develop adequate infrastructure facilities, so that the requirements of the immigrating labour population are met.

CHAPTER 6
ENVIRONMENTAL MONITORING PROGRAM

Usually, as in the case of the study, an impact assessment study is carried out over short period of time and the data cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring program of the environmental parameters is essential to take into account the changes in the environment. The objective of monitoring is:

• To verify the result of the impact assessment study in particular with regards to new developments.

• To follow the trend of parameters which have been identified as critical.

• To check or assess the efficiency of controlling measures.

• To ensure that new parameters, other than those identified in the impact assessment study, do not become critical through the commissioning of new project.

To monitor effectiveness of Control Measures:

Monitor daily, Assess effectiveness of the Control Measures being implemented, Explore the need to modify or add new Control Measures particularly if a violation is observed & Report weekly.

Regular monitoring of environmental parameters will be made to find out any deterioration in environmental quality Monitoring of the proposed project area will be regularly conducted. The attributes, which merit regular monitoring, are specified underneath

6.1 The Need

Monitoring is an essential component for sustainability of any developmental project. It is an integral part of any environmental assessment process. Any development project introduces complex inter-relationships in the project area between people, various natural resources, biota and the many developing forces. Thus, a new environment is created. It is very difficult to predict with complete certainty the exact post-project environmental scenario. Hence, monitoring of critical parameters is essential in the post-project phase.

Monitoring of environmental indicators signal potential problems and facilitate timely prompt implementation of effective remedial measures. It will also allow for validation of the assumptions and assessments made in the present study.

Monitoring becomes essential to ensure that the mitigation measures planned for environmental protection function effectively during the entire period of project operation. The data so generated also serves as a data bank for prediction of post-project scenarios in similar projects.

6.2 Areas Of Concern

From the monitoring point of view, the important parameters are marine water quality, ambient air quality, noise, etc. An attempt is made to establish early warning system which indicate the stress on the environment. Suggested monitoring parameters and program are described in the subsequent sections.

6.3 Marine Water & Sediment Quality

Construction phase

The chemical characteristics of marine water quality should be monitored once in three months and biological parameters once a year during project construction phases, close to the major construction sites. Both surface and bottom waters shall be sampled and analysed. The parameters to be monitored are as follows:

Marine Water

Physico-chemical parameters

- pH
- Salinity
- Conductivity
- D.O.
- BOD
- Phosphates
- Nitrates
- Sulphates
- Chlorides

Biological parameters

- Light penetration
- Chlorophyll
- Primary Productivity
- Phytoplanktons (No. of species and their density)
- Zooplanktons (No. of species and their density)

Sediments

Biological Parameters

- Benthic Meio-fauna

- Benthic Macro –fauna

Operation Phase

The chemical characteristics of marine water quality should be monitored once in three months and biological parameters once a year during project operation phase. Both surface and bottom waters should be sampled and analyzed. The parameters to be monitored are as follows:

Marine Water

Physico-chemical parameters

- pH
- Salinity
- Conductivity
- D.O.
- BOD
- Phosphates
- Nitrates
- Sulphates
- Chlorides

Biological parameters

- Light penetration
- Chlorophyll
- Primary Productivity
- Phytoplanktons (No. of species and their density)
- Zooplanktons (No. of species and their density)

Sediments

Physio-chemical parameters

- Texture
- pH
- Total Kjeldahl Nitrogen
- COD
- Sodium
- Potassium
- Phosphates
- Chlorides
- Sulphates

Biological Parameters

- Benthic Meio-fauna
- Benthic Macro –fauna

The marine water and sediment sampling and analysis be conducted by an external agency.

Table 6.1 Physico-chemical parameters

Experimental condition	Salinity (ppt)	DO (%)	Temperature (°C)	pH T	pCO_2(µatm)	A_T(µmol kg^{-1})	HCO_3^- (µmol kg^{-1})	CO_3^{2-} (µmol kg^{-1})	Ω Ca	Ω Ar
380 µatm Ambient	33 ± 1.4	96 ± 1.8	9.40 ± 0.36	7.7	376 ± 10	635 ± 29	590	12	0.29	0.18
380 µatm ambient plus 2°C	36 ± 1.5	98 ± 2.4	11.58 ± 0.69	7.7	376 ± 10	703 ± 79	642	17	0.39	0.25
550 µatm Ambient	33 ± 1.6	99 ± 2.2	10.01 ± 0.56	7.7	554 ± 63	971 ± 186	909	20	0.47	0.30
750 µatm Ambient	28 ± 4.1	99 ± 4.8	10.28 ± 0.34	7.5	769 ± 42	754 ± 55	726	8	0.21	0.13
750 µatm ambient plus 2°C	37 ± 3.8	98 ± 2.6	12.34 ± 0.43	7.4	769 ± 42	681 ± 42	649	9	0.21	0.13
1000 µatm Ambient	34 ± 4.6	99 ± 2.0	10.23 ± 0.40	7.3	1133 ± 32	698 ± 6	678	6	0.13	0.08
1000 µatm ambient plus 2°C	37 ± 2.1	98 ± 2.0	12.04 ± 0.35	7.2	1133 ± 32	642 ± 28	621	5	0.13	0.08
Loch Fyne Variability	19 ± 7.5	99 ± 13	15.70 ± 4.15	8.2	341 ± 103	1262 ± 416	1171 ± 430	34 ± 19	0.88 ± 0.47	0.52 ± 0.29
Loch Fyne (Lowest total alkalinity values)	18	116	12.80	8.1	251 ± 4	876 ± 13	798 ± 12	29.19 ± 0.44	0.68 ± 0.01	0.39 ± 0.01

6.4 Ambient Air Quality

Construction Phase

Ambient air quality monitoring is recommended to be monitored at four stations close to the construction sites. The monitoring can be conducted for three seasons. For each season monitoring can be conducted twice a week for 4 consecutive weeks.

Operation Phase

The ambient air quality monitoring will have to be conducted at four locations. Air quality could be monitored for three seasons in a year. High volume samplers can be used for this purpose. The frequency of monitoring shall be twice a week for 24hours for four consecutive weeks. The parameters to be monitored are PM10, PM2.5,SO2 and NO2.

6.5 Noise

Personnel involved in work areas, where high noise levels are likely to be observed during project construction and operation phases. For such in-plant personnel, audiometric examination should be arranged at least once a year.

The noise level monitoring during construction and operation phases will be carried out by the project staff and a noise meter can be purchased. Neighbourhood (upto radius of 1 km). It is recommended that during project operation phase, monitoring of sensitive areas like schools and medicare centre be conducted within a distance of 1 km radius of the measure to ascertain noise levels at receptors, taking note of any excessive build-up in any particular direction.

6.6 Greenbelt Development

Sites of greenbelt development should be monitored once in every month during project operation phase to study the growth of various species and to identify the needs if any, such as for irrigation, fertilizer dosing, pesticides, etc. The monitoring can be conducted by project staff.

6.7 Environmental Laws and Regulations in India

- The Air (Prevention and Control of Pollution) Act 1981, as amended by Amendment Act, 1987
- The Environment (Protection) Act, 1986
- The National Environment Tribunal Rules, 1995
- The Water (Prevention and Control of Pollution) Amended Rules, 1989
- The Noise Pollution (Regulation and Control) Rules, 2000

6.8 Summary Of Environmental Monitoring Programme

The summary of Environmental Monitoring Program for implementation during project construction and operation phases is given in Tables-6.1 and 6.2

Table 6.2

SUMMARY OF ENVIRONMENTAL MONITORING PROGRAMME

Sr No	Aspects	Parameters to be monitored	Frequency of monitoring	Location
1	Marine Water			
	Physico-chemical parameters	pH, Salinity, EC, TDS, Turbidity, Phosphates,Nitrates, Sulphates, Chlorides.	Once in three months	3 to 4 site
	Biological Parametres	Light penetration, Chlorophyll, Primary Productivity, Phytoplanktons, Zooplanktons	Once a year	3 to 4 site
2	Sediments			
	Physico-chemical parameters	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates	Once in three months	3 to 4 site
	Biological Parameters	Benthic Meiofauna, BenthicMacro-fauna	Once a year	3 to 4 site
3	Ambient Air Quality	SPM, RPM, SO2 and NOx	Summer, Post-monsoon and Winter seasons. - Twice a week for four consecutive weeks per season	Close to construction site(s)
4	Noise	Equivalent Noise Level	During Peak Construiction Activity	Construction site(s)

CHAPTER 7
NATURAL RESOURCE CONSERVATION AND OPTIMIZATION

To facilitate collection of environmental data and preparation of management plans, guidelines have been evolved and circulated to the concerned Central and State Government Departments. EIA has now been made mandatory under the Environmental (Protection Act, 1986 for 29 categories of developmental activities involving investments of Rs. 50 crore and above.

Once an application has been submitted by a project authority alongwith all the requisite documents specified in the EIA Notification, it is scrutinized by the technical staff of the Ministry prior to placing it before the Environmental Appraisal Committees. The Appraisal Committees evaluate the impact of the project based on the data furnished by the project authorities and if necessary, site visits or on-the-spot assessment of various environmental aspects are also undertaken. Based on such examination, the Committees make recommendations for approval or rejection of the project, which are then processed in the Ministry for approval or rejection.

In case of site specific projects such as Mining, River Valley, Ports and Harbors etc., a two stage clearance procedure has been adopted whereby the project authorities have to obtain site clearance before applying for environmental clearance of their projects. This is to ensure avoiding areas which are ecologically fragile and environmentally sensitive. In case of projects where complete information has been submitted by the project proponents, a decision is taken within 90 days.

7.1Monitoring

After considering all the facets of a project, environmental clearance is accorded subject to implementation of the stipulated environmental safeguards. Monitoring of cleared projects is undertaken by the six regional offices of the Ministry functioning at Shillong, Bhubaneshwar, Chandigarh, Bangalore, Lucknow and Bhopal. The primary objective of such a procedure is to ensure adequacy of the suggested safeguards and also to undertake mid-course corrections required, if any. The procedure adopted for monitoring is as follows:

- Project authorities are required to report every six months on the progress of implementation of the conditions/safeguards stipulated, while according clearance to the project.
- Field visits of officers and expert teams from the Ministry and/ or its Regional Offices are undertaken to collect and analyze performance data of development projects, so that difficulties encountered are discussed with the proponents with a view to finding solutions.

- In case of substantial deviations and poor or no response, the matter is taken up with the concerned State Government.

- Changes in scope of project are identified to check whether review of earlier decision is called for or not.

7.2 Coastal Area Management

Coastal States/UTs are required to prepare Coastal Zone Management Plans (CZMPs) as per the provisions of the Coastal Regulation Zone (CRZ) Notification 1991, identifying and categorizing the coastal areas for different activities and submit it to the Ministry for approval.

The Ministry has constituted a Task Force for examination of these plans submitted by Maharashtra and Gujarat States have been discussed in the meetings of the Task Force and these need to be modified. The Government of Orissa has submitted a partial plan covering only a part of their coastal area. In respect of West Bengal, a preliminary concept document of the CZMP has been submitted. Revised CZMP/clarifications have been received from the State of Goa and UTs of Daman & Diu, Lakshadweep and Andaman & Nicobar Islands. During the year, the Task Force had seven meetings and two site visits for consideration of the plans. Once the plans of the different States/UTs are finalized, the development activities in the coastal belt would be more forcefully regulated to ensure non-violation of CRZ Notification.

7.3 Island Development Authority (IDA)

The 9th meeting of IDA was held on 22.1.96 under the Chairmanship of the Prime Minister to decide on various policies and programs aimed at integrated development of the islands, keeping in view the relevant aspects of environmental protection, and also to review the progress of implementation and impact of the programs of development.

7.4 Studies on Carrying Capacity

Natural resources are finite and are dwindling at a fast pace. Optimization of natural resources for achieving the objective of sustainable development is therefore, self evident, this can be done only when environmental considerations are internalized in the development process. It has often been observed that one or more natural resource(s) becomes a limiting resource in a given region thereby restricting the scope of development portfolios. The Ministry of Environment & Forests has been sponsoring Carrying Capacity Studies for different regions. The studies involve:

- Inventorisation of the natural resources available;
- Preparation of the existing environmental settings;
- Perspective plans and their impact on natural resources through creation of "Business As Usual Scenario";

- Identification of "Hot Spots" requiring immediate remedial action to overcome air, water or land pollution;

- Formulation of alternative development scenarios including a Preferred Scenarios. A comparison between "Business As Usual" and the "Preferred Scenario" would indicate

The future course of action to be adopted for development of the region after the package has been discussed with the local people as well as the planners.

CHAPTER 8
MITIGATION MEASURES

8.1 General

The Environmental Management Plan proposes to integrate the baseline conditions, impacts likely to occur, and the supportive and assimilative capacity of the system. The most reliable way to achieve the above objective is to incorporate the management plan into the overall planning and implementation of the project.

The Environmental Management Plan (EMP) for the proposed construction site at Aksa Beach Mumbai Suburban (Mumbai) is classified into the following categories:

- Land Environment
- Water Environment
- Air Environment
- Control of Noise
- Greenbelt Development
- Socio-Economic Environment

The Environmental Management Plan has been covered for the following phases:

- Environmental Management Plan (EMP) for construction phase

- Environmental Management Plan (EMP) for operation phase

8.2 Environmental Management Plan (Emp) For Construction Phase

8.2.1 Control of environmental degradation due to congregation of labour population during construction phase

The aggregation of large labor population (20) and technical staff (5) during construction phase is likely to put significant stress on various facets of environment. The increase in total population due to congregation of work force and their families during construction phase is expected to increase by 60. The existing infrastructure in the immediate vicinity of the labour camps would come under severe stress as a result of immigration of labour population. The various issues covered in environmental management during construction phase are:

- Facilities in labor camps

- Sanitation and sewage treatment facilities
- Solid waste management
- Provision of community kitchen.

Facilities in Labour Camps

Normally, it has been observed in construction phase of many projects that labour camps are not well planned and are generally haphazard in their layouts, without adequate facilities. Since the proposed site at Aksa Beach Mumbai Suburban which has construction activities, it is recommended that project authorities can compulsorily ask the contractor to make semi-permanent structures for their workers. These structures could be tin sheds. These sheds can have internal compartments allotted to each worker family. The labour camp site should have electricity and ventilation system, water supply and community toilets.

Sanitation facilities

One community latrine can be provided per 20 persons. The sewage from the community latrines can be treated in a septic tank. The treated effluent from the septic tank can be connected to the existing sewerage system of the area. At peak construction phase, there will be an increase in population by nearly 50. To ensure that the sewage from the labour camps do not pollute the river water, it has been estimated that about 3 community latrines and a small septic tanks are proposed to be constructed.

Solid waste management from labor camps

As mentioned earlier during construction phase, increase in labour population is expected to be of the order of 30. The average per capita solid waste generated is of the order of 210 gm/day/person. The solid waste likely to be generated from labour camps shall be of the order of 0.012 tonnes/day. Adequate facilities for collection, conveyance and disposal of solid waste needs to be developed. For solid waste collection, 2 number of masonry storage vats, each of 2m3 capacity shall be constructed at appropriate locations in various labour camps. These vats shall be emptied at regular intervals and the waste so collected can then be transported to the landfill site, where solid waste from the city are disposed. One covered Mini Truck / Tractor to collect the solid waste from common collection point and transfer it to the disposal site shall be put to service. The truck can collect the solid waste from the construction site to the designated land fill sites where city's solid waste is being discharged.

8.2.2 Air Pollution Control

a) Control of Emissions

Minor air quality impacts will be caused by emissions from construction vehicles, equipment and DG sets, and emissions from transportation traffic since the proposed site at Aksa Beach Mumbai Suburban which has construction activities. Frequent truck trips will be required during the construction period for removal of excavated material and delivery of select concrete and

other equipment and materials. The following measures are recommended to control air pollution: The contractor will be responsible for maintaining properly functioning construction equipment to minimize exhaust. Construction equipment and vehicles will be turned off when not used for extended periods of time.

Air Pollution Control Measures

During the construction period, the impact on air quality will be mainly due to increase in Suspended Particulate Matter (SPM) along haul roads and emission from vehicles and construction machinery. Though an air quality during construction shows insignificant impact, nevertheless certain mitigation measures which shall be adopted to reduce the air pollution are presented below:

- The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste.
- The Contractor shall use construction equipment to minimise or control of air pollution.
- Contractor's transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India or the State Government from any transport during handling of materials, construction or storage activity.
- The DG sets to be installed to provide power backup will adhere to the emission standards.
- The Contractor shall use cover for materials of dust generating like debris and soil being transported from construction sites.
- All trucks carrying loose material should be covered and loaded with sufficient free-board to avoid spills through the tailboard or sideboards. Contractor shall install barriers around the open construction sites before commencing the work.
- The temporary dumping areas shall be maintained by the Contractor at all times until excavate is re-utilised for backfilling wherever necessary or as directed by Employer.
- The Contractor shall place material in a manner that will minimize dust production. Material shall be wetted each day, to minimize dust production.
- The Contractor shall sprinkle water at construction sites to suppress dust, The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction depots and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.

b) Air Pollution control due to DG sets

The Central Pollution Control Board (CPCB) has issued emission limits for generators upto 800 kW. The same are outlined in Table-8.1, and are recommended to be followed.

TABLE-8.1
Emission limits for DG sets prescribed by CPCB

Parameters	Emission limits (gm/kwhr)
NOx	9.2
HC	1.3
CO	2.5
PM	0.3
Smoke limit*	0.7

The above standards need to followed by the employers operating the DG sets.

c) Dust Control

The project authorities will work closely with representatives from the community living in the vicinity of project area to identify areas of concern and to mitigate dust related impacts effectively (e.g., through direct meetings, utilization of construction management and inspection program, and/or through the complaint response program). To minimize issues related to the generation of dust during the construction phase of the project, the following measures have been identified:

- Identification of construction limits (minimal area required for construction activities).

- When necessary, stockpiling of excavated material will be covered or staged offsite location with muck being delivered as needed during the course of construction.

- Dust sweeping - The construction area and vicinity (access roads, and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust. One sweepers will be employed for this purpose.

8.2.3 Noise Control Measures

The proposed site at Aksa Beach Mumbai Suburban which has construction activities, the contractors will be required to maintain properly functioning equipment and comply with occupational safety and health standards. The construction equipment will be required to use available noise suppression devices and properly maintained mufflers.

- Vehicles to be equipped with mufflers recommended by the vehicle manufacturer.

- Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible.

- Use of temporary sound fences or barriers to be evaluated.

- Notification will be given to residents within 300 feet (about 90 to 100 m) of major noise generating activities. The notification will describe the noise abatement measures that will be implemented.

It is known that continuous exposure to noise levels above 90 dB(A) affects the hearing of the workers/operators and hence has to be avoided. Other physiological and psychological effects have also been reported in literature, but the effect on earing acuity has been specially stressed. To prevent these effects, it has been recommended by international specialist organizations that the exposure period of affected persons be limited as specified by Occupational Safety and Health Administration (OSHA) in Table -8.2

TABLE - 8.2
Maximum Exposure Periods specified by OSHA

Maximum continuous equivalent noise level dB(A)	**Unprotected exposure period per day for 8 hrs/day and 5 days/week**
90	8
95	4
100	2
105	1
110	½
115	½
120	No exposure permitted at or above this Level

The above referred management measures shall be implemented by the Contractor involved in construction phase. The same shall be monitored on a regular basis by the project proponents.

8.3 Environmental Management Plan (EMP) For Operation Phase

8.3.1 Solid Waste Disposal

During operation phase, the municipal solid waste so generated will contain mainly vegetable matter followed by paper, cardboard, packaging materials, wood boards, polythene, etc. The total solid waste to be generated during project operation phase, about 0.10 t/day of solid waste will

be generated from domestic sources. Adequate facilities for collection and conveyance of municipal wastes generated at the disposal site shall be developed.
During project construction phase, the solid waste generated from labour camps, shall be disposed at designated landfill sites identified in consultation with the district administration. The solid waste collected in the form of sweepings consists mostly of spilled solids and organic matter of natural origin, and does not contain any toxic material. These sweepings will be used as landfill material after proper grading. There will be no solid waste for disposal. Thus there is no environmental impact envisaged due to solid wastes. A covered mini truck will be required to transport the solid waste from the project site area to the disposal.

8.3.2 Control of Water Pollution

Sewage generation

During project operation phase major source of water pollution shall be the sewage generated by the labor / staff involved in project related activities.
Adequate number of toilets shall be constructed nearby measure and the office area as a part of the project. The sewage from the community toilets shall be treated in the septic tank, which is proposed to be constructed during project construction phase. The treated sewage from septic tanks shall be disposed into the existing sewage network of Project Site Area.

8.3.3 Air Environment

Control of fugitive dust from stock piles

Environmental Management and Pollution Control pose a major concern to all. There is a need of efficient pollution control Technique, to meet the stringent norms as stipulated by the Pollution Control Board for dust control at open stock piles, conveyor transfer points, dump hopper loading points and other such dust generating locations in a bulk material handling plant
There are 3 different types of dust suppression systems.

- Using plain water

- Using plain water with chemicals

Since, the Construction Project Site is relatively small, the factors such as Increased Vehicular Traffic, Dust Control, Greenbelt Development and other types of aspects are considerably very low / negligible, Thus, the control measures have been taken into consideration as per site conditions during the construction phase.

CHAPTER 9
ECONOMIC ASSESSMENT

9.1 Economic and financial analyses were conducted for the project included under the investment program. The project will prevent losses that would otherwise occur without the project. The investment and ongoing maintenance costs of the project were weighed against these benefits. The main direct financial and economic impact of the project will be the protection of land, buildings, and infrastructure from future damage caused by coastal erosion and monsoon storms. The protected land will also augment the incomes and livelihoods of urban and rural households and businesses on the coastline. Tourism, rural farm and fishing households, ports, and factories and their owners, operators, and workers will benefit from the subprojects. Removing erosion risk will help encourage future investment in the coastal zone.

9.2 In addition to land protection, the project will support the long-term sustainability of the beaches. Previous protection programs have neglected the beaches and in many cases have caused increased degradation. The use of the new technologies and soft protection measures proposed under the project will sustain and enhance the beach areas. The beaches are key contributors to the economies in the tourist areas and essential for artisanal fishers. The tourism potential of much of the coastal area is high and the long-term economic and environmental benefits of sustaining the beaches through the project interventions will be very significant. The project will lead to the avoidance of resettlement costs that the state governments would be likely to incur if no action were taken to prevent the ongoing erosion processes. The project has been assessed on the basis of the more simply quantified benefits, which are enough to provide an adequate rate of return. The project implementation will also generate additional benefits that have not been quantified, such as

(i) indirect impact on employment, economic activity, and future investment;

(ii) improved security for households, businesses, and farms;

(iii) indirect benefits for the environment; and

(iv) long-term benefits that may accrue from institutional and knowledge upgrading.

9.3 Project interventions will maintain the status quo or restore the pre-erosion situation. The financial impact on the beneficiaries is therefore limited and will occur only in some contexts. Where an eroded beach will be restored, there will be a restoration of income for tourism establishments that lost business because of the erosion of the beach, and new businesses may also be opened. At some locations where future erosion is prevented, there will be no financial effect on businesses or other beneficiaries. Some interventions will reduce future government expenditures; these interventions will have a potential impact on government expenditures by

reducing future requirements for infrastructure replacement and the resettlement of affected populations.

The results of the economic analysis show that the project has economic internal rates of return of, 18.9%.The results are based on the per kilometer cost of the region to be protected. The project is more susceptible to variations in costs and benefits; this is partly a reflection of the high project cost in this case. Sensitivity analysis of benefit categories and other key variables shows that individual variables by themselves generally have little impact on the economic indicators. Economic risks to the viability of these subprojects are low, with an involved risk of large cost overruns.

CHAPTER 10
PUBLIC CONSULTATION AND DISCLOSURE

10.1 Public consultation and disclosure was completed during the project preparatory TA in each of the subproject areas. Individual subproject stakeholder meetings were held to disseminate the proposed project designs at three critical stages of the project:

(i) initial discussions and draft proposal,

(ii) interim stage during the design stage, and

(iii) the final draft stage.

Breakout groups proved useful in discussing the particulars of the designs and enabling individuals to question and debate. Stakeholder views and concerns were taken into account, assessed by the TA, and incorporated into the proposed designs. The specifics of these meetings are given in the subproject feasibility reports. Public participation and inclusion will be an important aspect in the continuation of the subproject implementation, and continued stakeholder meetings should be held during every stage of the investment program. The foremost requirement of the EMC is to provide a platform for all stakeholders to meet regularly to discuss and resolve issues. The outputs of the meetings will be directed at the removal of obstructions that may impede the progress of project implementation. The EMC will consist of members from the community and other stakeholders in the project.

10.2 A respected community leader will chair the committee. The place of meeting will be a convenient location accessible with ease to all "resource use" categories including the grassroots level. This committee will meet monthly during the preparation and implementation of the project. A formal awareness program will establish a foundation for the functioning of the EMC, and will include

(i) changing the way that coastal protection is perceived;

(ii) understanding the site, functions, and impact of the available coastal protection and management options;

(iii) viewing coastal protection as an investment in a valuable asset base;

(iv) exploring the potential for generating the maximum possible returns from the investments (e.g. community income generation activities);

(v) adopting a systematic approach based on long-term planning and action;

(vi) creating understanding that the environmental impact must be well predicted and taken seriously during planning;

(vii) understanding that early interventions can be more cost effective;

(viii) ensuring that interventions are maintained and sustained; and

(ix) ensuring that the EIA or initial environmental examination (IEE), EMP, and monitoring aspects are well understood and modified as necessary to acquire mutual cooperation.

10.3 The learning component will derive substantially both from the functioning of the EMC and from participatory monitoring. The monitoring will include a technical component that will provide scientific information of the EMC. All monitoring tasks will be assigned accordingly to appropriate technical agencies. The PMU will be responsible for hiring an appropriate technical agency to carry out the technical activities; the organization could be a state or national institute or private organization. The PMU, through direct government funds and loan funds, will finance the technical support organization. The PMU will provide funds for the functioning of the EMC and the monitoring activities on the basis of a budget request to be submitted by the EMC. A community- and stakeholder-based shoreline management organization will be established at an early stage to take on the responsibility and management of the completed project.

CHAPTER 11
SUMMARY

Project Stage	Project Activity	Potential Environmental Impact	Proposed Mitigation Measures	Institutional Responsibilities
Preconstruction	**Site preparation:** material and equipment staging areas and beach access locations	Possible removal of terrestrial habitat	Sites rehabilitated before contractor leaves site upon completion of construction activities. Planting and stabilization of site, including replacement of any native plant species	PMU Contractor
Construction	AKSA BEACH, ANTI EROSION MEASURE CONSTRUCTION	**Physical**		
		Air quality Reduction in air quality from exhaust fumes and dust at on-land construction sites	Adherence to national emission and ambient air quality standards Engines and generators turned off when not in use Equipment conforms to international standards. Dust suppression by regular sprinkling (i.e., morning and evening) or other means. Possibly, halt work during excessive onshore winds. Verbal social complaints dealt with immediately and efficiently.	PMU Contractor
		Noise Increased noise levels	Adherence to national noise standards Engines and generators turned off when not in use Equipment conforms to international standards. Vehicles and engines fitted with silencers Daily checks and remedy of potential sources of excessive noise especially out of	

			daylight hours. Complaints regarding noise dealt with professionally and with respect	
		Water quality High turbidity during sediment placement Possible turbidity from onshore activity Oil discharge during vessel and equipment operation Contaminants in sand Possible spills of fluids (e.g., oils, fuels) and sediment	Adherence to national water quality standards Supervision of all operation procedures to minimize spillage of sand and oil or fuel Soil erosion is to be considered with all onshore activities. Since the majority of large scale construction is offshore it is unlikely this will be an issue. Sediment is to be screened for potential contaminants and not used if present above thresholds identified in international standards Accidental spills contingency plans should be initiated immediately	PMU Contractor
		Sediment quality Chemical contaminants in sand	Adherence to international sediment quality standards Chemical testing of sand source before use—compounds to be tested in samples are to be based on initial assessment used to nourish beach specialists area Solid waste in dredged-material of potential contaminants of concern (e.g., oils and grease, PAH compounds, pesticides from upstream locations, heavy metals) in target area Removal of solid waste if present	PMU Contracted specialists PMU Contractor

			in dredged sediment	
		Biological		
		Marine biota and habitat In Measure Construction High turbidity and sediment settlement temporarily impair photosynthesis and biological production in adjacent offshore areas Possible leaks or spills—sediment, fuels, oil, other fluids	Develop mitigation components based on a review and characterization of fish and invertebrates that occur in the nearshore area including seasonal or migratory species and sensitive times and locations Reef structure is expected to be colonized by biota offsetting smothering of soft-sediment biota. Minimize sediment release during construction to reduce affected area outside immediate reef-site area Implement contingency plans if spills of sediment, fuels, oil, or other fluids occur	PMU Contractor PMU Contractor
		Terrestrial biota and habitat Removal of habitat for site access or material or equipment staging	If terrestrial habitat is altered during construction to provide storage room or site access, habitats should be rehabilitated before the contractor leaves the site. Planting and stabilization of the environment, including replacement of any native plant species, to be undertaken.	PMU Contractor
		Social, economic, and cultural		
		Safety and human health Reduced safety of beach users	Public consultation to identify locations, times, and types of potential safety risks, and develop site-specific advisories and safety measures	PMU Contractor

			All equipment, waste, and construction material debris must be inspected and removed daily from site.	
		Tourism Beach amenity and recreational use	Public consultation to identify locations, times, and types of potential safety risks, and develop site-specific advisories and safety measures	PMU Contractor
		disturbed	All equipment, waste, and construction material debris must be removed daily from the site.	
		Fishing activity Disturb traditional fishing activity	Public consultation to identify locations, times, and types of potential conflict, and develop site-specific measures to minimize disruption of boat launching and fishing activity	PMU Contractor

CHAPTER 12
CONCLUSIONS

A. Gains That Justify Project Implementation

The project designs are intended to prevent further degradation of the coastline, while providing a situation whereby the beach can regain stability through natural processes. The benefits of the proposed interventions on the beaches will accrue from preventing erosion by correcting the sediment cycle. The economy will benefit from preventing loss of property and saving on the recurring cost of coastal protection. The enhanced beach will help regain traditional fisheries operations, help the tourist sector to recover losses and prevent further losses, and create new opportunities for beach tourism. Additional benefits could include the possible enhancement offisheries.

Erosion-related problems cause significant loss of opportunities to society as well as irrevocable loss of beachfront properties. Substantial amounts of resources may be needed to recover loss at a future date if the current trend is allowed to continue.

B. Minimization of Adverse Effects

1. Potential adverse effects during the construction phase, which will take place over several non-monsoon seasons, can be mitigated and significant residual effects are not anticipated.

2. Potential adverse effects on current and wave conditions and erosion of beaches were considered, and detailed numerical modeling was used to aid the selection of designs and locations to avoid those effects. The risks of unexpected or undesirable impact on coastal erosion, and possible risk management measures, were considered.

3. Environmental management plans (EMPs) will address the possible effects during construction and operation phases. Additional information to be obtained during an early stage of implementation to support the development of the EMPs includes
(i) details on planned sediment dredging and extraction activities;

(ii) characterization of fish and invertebrate communities in all subproject areas using existing published and unpublished information to aid the identification of possible refinements in activities and schedules; and
(iii) details on planned sand-scraping and transportation activities and supplementary assessment of potential effects.

4. The present national environmental capacity to analyze the impact of development projects on the coastal dynamics and supervise mitigation and monitoring programs is quite limited. One of

the project objectives is to upgrade the capacity of the government and private sector consultants to support the preparation of professional environmental impact reports.

C. Use of Irreplaceable Resources

The project will use very small amount of hydrocarbons as fuel and oil to operate vehicles, and equipment.

EXHIBIT-C
& 27/6/23

158 th meeting of SEIAA

SEIAA Meeting number: 158 **Meeting Date** February 27, 2019

Subject: CRZ Clearance for CONSTRUCTION OF ANTI SEA EROSION MEASUERS AT AKSA BEACH, MADH, MUMBAI SUBURBAN

Is a Violation Case: No

1.Name of Project	CONSTRUCTION OF ANTI SEA EROSION MEASUERS AT AKSA BEACH, MADH, MUMBAI SUBURBAN
2.Type of institution	Government
3.Name of Project Proponent	Chief Executive Officer, Maharashtra Maritime Board,
4.Name of Consultant	Aryama engineers and consultants
5.Type of project	Others
6.New project/expansion in existing project/modernization/diversification in existing project	NEW PROJECT
7.If expansion/diversification, whether CRZ Clearance has been obtained for existing project	Recommended by the MCZMA in its 127th meeting dated 2nd November, 2018
8.Location of the project	Aksa beach, Madh, Mumbai
9.Taluka	Malad
10.Village	Madh
Correspondence Name:	Maharashtra Maritime Board
Room Number:	--
Floor:	3rd Floor,
Building Name:	Indian Mercantile Chambers
Road/Street Name:	Ramjibhai Kamani Marg
Locality:	Ballard Estate
City:	Mumbai
11.Whether in Corporation / Municipal / other area	Mumbai suburban
12.IOD/IOA/Concession/Plan Approval Number	Not Applicable
	IOD/IOA/Concession/Plan Approval Number: Not Applicable
	Approved Built-up Area: 0.0
13.Note on the initiated work (If applicable)	Not Applicable
14.LOI / NOC / IOD from MHADA/ Other approvals (If applicable)	Not Applicable
15.Total Plot Area (sq. m.)	Not applicable
16.Deductions	Not applicable
17.Net Plot area	Not applicable
18 (a).Proposed Built-up Area (FSI & Non-FSI)	**FSI area (sq. m.):** Not applicable
	Non FSI area (sq. m.): Not applicable
	Total BUA area (sq. m.):
18 (b).Approved Built up area as per DCR	**Approved FSI area (sq. m.):** Not Applicable
	Approved Non FSI area (sq. m.): Not Applicable
	Date of Approval: 01-01-1900
19.Total ground coverage (m2)	Not applicable
20.Ground-coverage Percentage (%) (Note: Percentage of plot not open to sky)	Not applicable
21.Estimated cost of the project	29000000

22.Number of buildings & its configuration

Serial number	Building Name & number	Number of floors	Height of the building (Mtrs)
1	Not applicable	Not applicable	Not applicable
2	Not applicable	Not applicable	Not applicable

23.Number of tenants and shops	NOT APPLICABLE
24.Number of expected residents / users	Not applicable
25.Tenant density per hectare	Not applicable
26.Height of the building(s)	
27.Right of way (Width of the road from the nearest fire station to the proposed building(s)	Not applicable
28.Turning radius for easy access of fire tender movement from all around the building excluding the width for the plantation	Not applicable
29.Existing structure (s) if any	Not applicable
30.Details of the demolition with disposal (If applicable)	Not applicable

31.Production Details

Serial Number	Product	Existing (MT/M)	Proposed (MT/M)	Total (MT/M)
1	Not Applicable	Not applicable	Not applicable	Not applicable

32.Total Water Requirement

Dry season:	Source of water	Not applicable
	Fresh water (CMD):	Not applicable
	Recycled water - Flushing (CMD):	Not applicable
	Recycled water - Gardening (CMD):	Not applicable
	Swimming pool make up (Cum):	Not applicable
	Total Water Requirement (CMD) :	Not applicable
	Fire fighting - Underground water tank(CMD):	Not applicable
	Fire fighting - Overhead water tank(CMD):	Not applicable
	Excess treated water	Not applicable
Wet season:	Source of water	Not applicable
	Fresh water (CMD):	Not applicable
	Recycled water - Flushing (CMD):	Not applicable
	Recycled water - Gardening (CMD):	Not applicable
	Swimming pool make up (Cum):	Not applicable
	Total Water Requirement (CMD) :	Not applicable
	Fire fighting - Underground water tank(CMD):	Not applicable
	Fire fighting - Overhead water tank(CMD):	Not applicable
	Excess treated water	Not applicable
Details of Swimming pool (If any)	Not applicable	

33.Details of Total water consumed									
Particulars	Consumption (CMD)			Loss (CMD)			Effluent (CMD)		
Water Requirement	Existing	Proposed	Total	Existing	Proposed	Total	Existing	Proposed	Total
Domestic	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

34.Rain Water Harvesting (RWH)	Level of the Ground water table:	Not applicable
	Size and no of RWH tank(s) and Quantity:	Not applicable
	Location of the RWH tank(s):	Not applicable
	Quantity of recharge pits:	Not applicable
	Size of recharge pits :	Not applicable
	Budgetary allocation (Capital cost) :	Not applicable
	Budgetary allocation (O & M cost) :	0.0
	Details of UGT tanks if any :	Not Applicable
35.Storm water drainage	Natural water drainage pattern:	Not applicable
	Quantity of storm water:	Not applicable
	Size of SWD:	Not applicable
36.Sewage and Waste water	Sewage generation in KLD:	Not applicable
	STP technology:	Not applicable
	Capacity of STP (CMD):	Not Applicable
	Location & area of the STP:	Not Applicable
	Budgetary allocation (Capital cost):	Not applicable
	Budgetary allocation (O & M cost):	Not applicable

37.Solid waste Management

Waste generation in the Pre Construction and Construction phase:	**Waste generation:**	Not applicable
	Disposal of the construction waste debris:	Not applicable
Waste generation in the operation Phase:	**Dry waste:**	Not applicable
	Wet waste:	Not applicable
	Hazardous waste:	Not applicable
	Biomedical waste (If applicable):	Not applicable
	STP Sludge (Dry sludge):	Not applicable
	Others if any:	Not applicable
Mode of Disposal of waste:	**Dry waste:**	Not applicable
	Wet waste:	Not applicable
	Hazardous waste:	Not applicable
	Biomedical waste (If applicable):	Not applicable
	STP Sludge (Dry sludge):	Not applicable
	Others if any:	Not applicable
Area requirement:	**Location(s):**	Not Applicable
	Area for the storage of waste & other material:	Not applicable
	Area for machinery:	Not Applicable
Budgetary allocation (Capital cost and O&M cost):	**Capital cost:**	Not Applicable
	O & M cost:	Not Applicable

38.Effluent Charecterestics

Serial Number	Parameters	Unit	Inlet Effluent Charecterestics	Outlet Effluent Charecterestics	Effluent discharge standards (MPCB)
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Amount of effluent generation (CMD):	Not Applicable
Capacity of the ETP:	Not Applicable
Amount of treated effluent recycled :	Not Applicable
Amount of water send to the CETP:	Not Applicable
Membership of CETP (if require):	Not Applicable
Note on ETP technology to be used	Not Applicable
Disposal of the ETP sludge	Not Applicable

39.Hazardous Waste Details

Serial Number	Description	Cat	UOM	Existing	Proposed	Total	Method of Disposal
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

40.Stacks emission Details

Serial Number	Section & units	Fuel Used with Quantity	Stack No.	Height from ground level (m)	Internal diameter (m)	Temp. of Exhaust Gases
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

41.Details of Fuel to be used

Serial Number	Type of Fuel	Existing	Proposed	Total
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable
42.Source of Fuel		Not Applicable		
43.Mode of Transportation of fuel to site		Not Applicable		

44.Green Belt Development	**Total RG area :**	Not Applicable
	No of trees to be cut :	Not Applicable
	Number of trees to be planted :	Not Applicable
	List of proposed native trees :	Not Applicable
	Timeline for completion of plantation :	Not Applicable

45.Number and list of trees species to be planted in the ground

Serial Number	Name of the plant	Common Name	Quantity	Characteristics & ecological importance
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable
46.Total quantity of plants on ground				

47.Number and list of shrubs and bushes species to be planted in the podium RG:

Serial Number	Name	C/C Distance	Area m2
1	Not Applicable	Not Applicable	Not Applicable

48.Energy

Power requirement:	**Source of power supply :**	Not Applicable
	During Construction Phase: (Demand Load)	Not Applicable
	DG set as Power back-up during construction phase	Not Applicable
	During Operation phase (Connected load):	Not Applicable
	During Operation phase (Demand load):	Not Applicable
	Transformer:	Not Applicable
	DG set as Power back-up during operation phase:	Not Applicable
	Fuel used:	Not Applicable
	Details of high tension line passing through the plot if any:	Not Applicable

49.Energy saving by non-conventional method:

Not Applicable

50.Detail calculations & % of saving:

Serial Number	Energy Conservation Measures	Saving %
1	Not Applicable	Not applicable

51.Details of pollution control Systems

Source	Existing pollution control system	Proposed to be installed
Not Applicable	Not Applicable	Not Applicable

Budgetary allocation (Capital cost and O&M cost):	**Capital cost:**	Not Applicable
	O & M cost:	Not Applicable

52.Environmental Management plan Budgetary Allocation

a) Construction phase (with Break-up):

Serial Number	Attributes	Parameter	Total Cost per annum (Rs. In Lacs)
1	Not Applicable	Not Applicable	Not Applicable
2	Not Applicable	Not Applicable	Not Applicable

b) Operation Phase (with Break-up):				
Serial Number	Component	Description	Capital cost Rs. In Lacs	Operational and Maintenance cost (Rs. in Lacs/yr)
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable

52. Storage of chemicals (inflamable/explosive/hazardous/toxic substances)

Description	Status	Location	Storage Capacity in MT	Maximum Quantity of Storage at any point of time in MT	Consumption / Month in MT	Source of Supply	Means of transportation
Not Applicable	Not Applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

53. Any Other Information

No Information Available

54. Traffic Management

	Nos. of the junction to the main road & design of confluence:	Not Applicable
Parking details:	**Number and area of basement:**	Not Applicable
	Number and area of podia:	Not Applicable
	Total Parking area:	Not Applicable
	Area per car:	Not Applicable
	Area per car:	Not Applicable
	Number of 2-Wheelers as approved by competent authority:	Not Applicable
	Number of 4-Wheelers as approved by competent authority:	Not Applicable
	Public Transport:	Not Applicable
	Width of all Internal roads (m):	Not applicable

	CRZ/ RRZ clearance obtain, if any:	Recommended by the MCZMA in its 127th meeting held on 2nd November, 2018
	Distance from Protected Areas / Critically Polluted areas / Eco-sensitive areas/ inter-State boundaries	Not applicable
	Category as per schedule of EIA Notification sheet	The project comes under CRZ Notification, 2011
	Court cases pending if any	Not applicable
	Other Relevant Informations	Due to erosion protection measures existing beach will be protected.
	Have you previously submitted Application online on MOEF Website	Yes
	Date of online submission	26-12-2018

Brief information of the project by SEAC/MCZMA

Proposed beautification of Aksa Beach at Madh, Mumbai Subarban by MMB

(127th Meeting of MCZMA dated 2.11.2018)

The MMB officials presented that the proposal is for construction of Anti Sea Erosion Measure at Aksa Beach. The project involves repairs of old bund, construction of pathway, construction of parapet wall, providing solar street light, length 300 m. The proposed project is situated in CRZ I area. As per the EIA report submitted, clearing, stripping and levelling of sites, construction of anti-sea erosion measures, earth filling and excavation for foundation, will lead to some disturbances to the habitat. The MCZMA in its 115th meeting held on 17th & 18th January, 2017 observed that solid construction on beach may erode the beach and discouraged the proposal. However, the MMB officials presented that considering the erosion problem of the Aksa Beach, Solid construction in the form of anti-sea erosion bund is required. The MMB further assured that Solid construction will be restricted to landward side of the High Tide Line and beach area will not be used for construction and no construction debris will be dumped on beach.

DECISION OF SEAC/MCZMA

After deliberations, the Authority decided to recommend the proposals of anti-sea erosion bund to SEIAA with subject to following conditions:

1. MMB to ensure that no construction is allowed in intertidal or beach area i.e. CRZ area. Solid construction should be restricted to landward side of the High Tide Line.

2. MMB to ensure that construction debris is not dumped in the beach and CRZ area.

3. Mangroves, if any should not be destroyed/ cut.

4. All other required permission from different statutory authorities should be obtained.

5. In case of present of mangrove, no construction should be undertaken in mangroves & its 50 m buffer zone.

Specific Conditions by SEAC/MCZMA:

SEIAA DECISION

Proposal was recommended in 127th meeting of MCZMA.

SEIAA decided to grant CRZ clearance subject to following conditions-

1. MMB to ensure that no construction is allowed in intertidal or beach area i.e. CRZ area. Solid construction should be restricted to landward side of the High Tide Line.

2. MMB to ensure that construction debris is not dumped in the beach and CRZ area.

3. Mangroves, if any should not be destroyed/ cut.

4. All other required permission from different statutory authorities should be obtained.

5. In case of present of mangrove, no construction should be undertaken in mangroves & its 50 m buffer zone.

6. This is only CRZ Clearance.

Specific Conditions by SEIAA:

1) MMB to ensure that no construction is allowed in intertidal or beach area i.e. CRZ area. Solid construction should be restricted to landward side of the High Tide Line.
2) MMB to ensure that construction debris is not dumped in the beach and CRZ area.
3) Mangroves, if any should not be destroyed/ cut.
4) All other required permission from different statutory authorities should be obtained.
5) In case of present of mangrove, no construction should be undertaken in mangroves & its 50 m buffer zone.
6) This is only CRZ Clearance.

FINAL RECOMMENDATION

SEIAA have decided to grant the proposal for CRZ Clearance subject to above conditions

EXHIBIT-D
+ 2716/23

सत्यमेव जयते

STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY

Environment department,
Room No. 217, 2nd floor,
Mantralaya, Annexe,
Mumbai- 400 032.
Date:March 5, 2019

To,
Chief Executive Officer, Maharashtra Maritime Board,
at Aksa beach, Madh, Mumbai

Subject: CRZ Clearance for CONSTRUCTION OF ANTI SEA EROSION MEASUERS AT AKSA BEACH, MADH, MUMBAI SUBURBAN

Sir,

This has reference to your communication on the above mentioned subject. The proposal was considered , by the Maharashtra Coastal Zone Management Authority, Maharashtra in its th meeting and recommend the project for CRZ Clearance to SEIAA. Information submitted by you has been considered by State Level Environment Impact Assessment Authority in its 158th meetings.

2. It is noted that the proposal is considered by Maharashtra Coastal Zone Management Authority as per CRZ Notification 2011.

Brief Information of the project submitted by you is as below :-

1.Name of Project	CONSTRUCTION OF ANTI SEA EROSION MEASUERS AT AKSA BEACH, MADH, MUMBAI SUBURBAN
2.Type of institution	Government
3.Name of Project Proponent	Chief Executive Officer, Maharashtra Maritime Board,
4.Name of Consultant	Aryama engineers and consultants
5.Type of project	Others
6.New project/expansion in existing project/modernization/diversification in existing project	NEW PROJECT
7.If expansion/diversification, whether CRZ Clearance has been obtained for existing project	Recommended by the MCZMA in its 127th meeting dated 2nd November, 2018
8.Location of the project	Aksa beach, Madh, Mumbai
9.Taluka	Malad
10.Village	Madh
Correspondence Name:	Maharashtra Maritime Board
Room Number:	--
Floor:	3rd Floor,
Building Name:	Indian Mercantile Chambers
Road/Street Name:	Ramjibhai Kamani Marg
Locality:	Ballard Estate
City:	Mumbai
11.Area of the project	Mumbai suburban
12.IOD/IOA/Concession/Plan Approval Number	Not Applicable **IOD/IOA/Concession/Plan Approval Number:** Not Applicable **Approved Built-up Area:** 0.0

13.Note on the initiated work (If applicable)	Not Applicable
14.LOI / NOC / IOD from MHADA/ Other approvals (If applicable)	Not Applicable
15.Total Plot Area (sq. m.)	Not applicable
16.Deductions	Not applicable
17.Net Plot area	Not applicable
18 (a).Proposed Built-up Area (FSI & Non-FSI)	FSI area (sq. m.): Not applicable
	Non FSI area (sq. m.): Not applicable
	Total BUA area (sq. m.):
18 (b).Approved Built up area as per DCR	Approved FSI area (sq. m.): Not Applicable
	Approved Non FSI area (sq. m.): Not Applicable
	Date of Approval: 01-01-1900
19.Total ground coverage (m2)	Not applicable
20.Ground-coverage Percentage (%) (Note: Percentage of plot not open to sky)	Not applicable
21.Estimated cost of the project	29000000

22.Production Details

Serial Number	Product	Existing (MT/M)	Proposed (MT/M)	Total (MT/M)
1	Not Applicable	Not applicable	Not applicable	Not applicable

23.Total Water Requirement

Dry season:	Source of water	Not applicable
	Fresh water (CMD):	Not applicable
	Recycled water - Flushing (CMD):	Not applicable
	Recycled water - Gardening (CMD):	Not applicable
	Swimming pool make up (Cum):	Not applicable
	Total Water Requirement (CMD) :	Not applicable
	Fire fighting - Underground water tank(CMD):	Not applicable
	Fire fighting - Overhead water tank(CMD):	Not applicable
	Excess treated water	Not applicable
Wet season:	Source of water	Not applicable
	Fresh water (CMD):	Not applicable
	Recycled water - Flushing (CMD):	Not applicable
	Recycled water - Gardening (CMD):	Not applicable
	Swimming pool make up (Cum):	Not applicable
	Total Water Requirement (CMD) :	Not applicable
	Fire fighting - Underground water tank(CMD):	Not applicable
	Fire fighting - Overhead water tank(CMD):	Not applicable
	Excess treated water	Not applicable
Details of Swimming pool (If any)	Not applicable	

24.Details of Total water consumed									
Particulars	Consumption (CMD)			Loss (CMD)			Effluent (CMD)		
Water Requirement	Existing	Proposed	Total	Existing	Proposed	Total	Existing	Proposed	Total
Domestic	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

25.Rain Water Harvesting (RWH)	Level of the Ground water table:	Not applicable
	Size and no of RWH tank(s) and Quantity:	Not applicable
	Location of the RWH tank(s):	Not applicable
	Quantity of recharge pits:	Not applicable
	Size of recharge pits :	Not applicable
	Budgetary allocation (Capital cost) :	Not applicable
	Budgetary allocation (O & M cost) :	0.0
	Details of UGT tanks if any :	Not Applicable
26.Storm water drainage	Natural water drainage pattern:	Not applicable
	Quantity of storm water:	Not applicable
	Size of SWD:	Not applicable
27.Sewage and Waste water	Sewage generation in KLD:	Not applicable
	STP technology:	Not applicable
	Capacity of STP (CMD):	Not Applicable
	Location & area of the STP:	Not Applicable
	Budgetary allocation (Capital cost):	Not applicable
	Budgetary allocation (O & M cost):	Not applicable

28.Solid waste Management		
Waste generation in the Pre Construction and Construction phase:	Waste generation:	Not applicable
	Disposal of the construction waste debris:	Not applicable
Waste generation in the operation Phase:	Dry waste:	Not applicable
	Wet waste:	Not applicable
	Hazardous waste:	Not applicable
	Biomedical waste (If applicable):	Not applicable
	STP Sludge (Dry sludge):	Not applicable
	Others if any:	Not applicable
Mode of Disposal of waste:	Dry waste:	Not applicable
	Wet waste:	Not applicable
	Hazardous waste:	Not applicable
	Biomedical waste (If applicable):	Not applicable
	STP Sludge (Dry sludge):	Not applicable
	Others if any:	Not applicable
Area requirement:	Location(s):	Not Applicable
	Area for the storage of waste & other material:	Not applicable
	Area for machinery:	Not Applicable
Budgetary allocation (Capital cost and O&M cost):	Capital cost:	Not Applicable
	O & M cost:	Not Applicable

29.Effluent Charecterestics					
Serial Number	Parameters	Unit	Inlet Effluent Charecterestics	Outlet Effluent Charecterestics	Effluent discharge standards (MPCB)
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Amount of effluent generation (CMD):		Not Applicable			
Capacity of the ETP:		Not Applicable			
Amount of treated effluent recycled :		Not Applicable			
Amount of water send to the CETP:		Not Applicable			
Membership of CETP (if require):		Not Applicable			
Note on ETP technology to be used		Not Applicable			
Disposal of the ETP sludge		Not Applicable			

30.Hazardous Waste Details

Serial Number	Description	Cat	UOM	Existing	Proposed	Total	Method of Disposal
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

31.Stacks emission Details

Serial Number	Section & units	Fuel Used with Quantity	Stack No.	Height from ground level (m)	Internal diameter (m)	Temp. of Exhaust Gases
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

32.Details of Fuel to be used

Serial Number	Type of Fuel	Existing	Proposed	Total
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable
33.Source of Fuel		Not Applicable		
34.Mode of Transportation of fuel to site		Not Applicable		

35.Energy

Power requirement:	Source of power supply :	Not Applicable
	During Construction Phase: (Demand Load)	Not Applicable
	DG set as Power back-up during construction phase	Not Applicable
	During Operation phase (Connected load):	Not Applicable
	During Operation phase (Demand load):	Not Applicable
	Transformer:	Not Applicable
	DG set as Power back-up during operation phase:	Not Applicable
	Fuel used:	Not Applicable
	Details of high tension line passing through the plot if any:	Not Applicable

Energy saving by non-conventional method:

Not Applicable

36.Detail calculations & % of saving:

Serial Number	Energy Conservation Measures	Saving %
1	Not Applicable	Not applicable

37.Details of pollution control Systems

Source	Existing pollution control system	Proposed to be installed
Not Applicable	Not Applicable	Not Applicable

Budgetary allocation (Capital cost and O&M cost):	Capital cost:	Not Applicable
	O & M cost:	Not Applicable

38.Environmental Management plan Budgetary Allocation

a) Construction phase (with Break-up):

Serial Number	Attributes	Parameter	Total Cost per annum (Rs. In Lacs)
1	Not Applicable	Not Applicable	Not Applicable
2	Not Applicable	Not Applicable	Not Applicable

b) Operation Phase (with Break-up):

Serial Number	Component	Description	Capital cost Rs. In Lacs	Operational and Maintenance cost (Rs. in Lacs/yr)
1	Not Applicable	Not Applicable	Not Applicable	Not Applicable

39.Storage of chemicals (inflamable/explosive/hazardous/toxic substances)

Description	Status	Location	Storage Capacity in MT	Maximum Quantity of Storage at any point of time in MT	Consumption / Month in MT	Source of Supply	Means of transportation
Not Applicable	Not Applicable	Not applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

40.Any Other Information

No Information Available

	CRZ/ RRZ clearance obtain, if any:	Recommended by the MCZMA in its 127th meeting held on 2nd November, 2018
	Distance from Protected Areas / Critically Polluted areas / Eco-sensitive areas/ inter-State boundaries	Not applicable
	Category as per schedule of EIA Notification sheet	The project comes under CRZ Notification, 2011
	Court cases pending if any	Not applicable
	Other Relevant Informations	Due to erosion protection measures existing beach will be protected.
	Have you previously submitted Application online on MOEF Website.	Yes
	Date of online submission	26-12-2018

3. The proposal has been considered by SEIAA in its 158th meeting & decided to accord CRZ Clearance to project proponent under the provisions of Environment Impact Assessment Notification, 2006 & CRZ Notification 2011 subject to implementation of the following terms and conditions:

Specific Conditions:

I	MMB to ensure that no construction is allowed in intertidal or beach area i.e. CRZ area. Solid construction should be restricted to landward side of the High Tide Line.
II	MMB to ensure that construction debris is not dumped in the beach and CRZ area.
III	Mangroves, if any should not be destroyed/ cut.
IV	All other required permission from different statutory authorities should be obtained.
V	In case of present of mangrove, no construction should be undertaken in mangroves & its 50 m buffer zone.
VI	This is only CRZ Clearance.

General Conditions:

I	The SEIAA reserves the right to revoke this recommendation, if the conditions stipulated are not complied with to the satisfaction of the MCZMA or Environment Department.
II	The SEIAA or any other competent authority, may stipulate any additional conditions subsequently, if deemed necessary, for environmental protection, which shall be complied with
III	A copy of the recommendation letter shall be marked to the concerned local body/ local NGO, if any, from whom any suggestion/ representation has been received while processing the proposal
IV	The environmental safeguard measures should be implemented in letter and spirit
V	The Clearance from CRZ point of view is being issued without prejudice to the action initiated under EP Act or any court case pending in the court of law and it does not mean that project proponent has not violated any environmental laws in the past and whatever decision under EP Act or of the Hon'ble court will be binding on the project proponent. Hence this clearance does not give immunity to the project proponent in the case filed against him, if any or action initiated under EP Act

4. The CRZ Clearance is being issued without prejudice to the action initiated under EP Act or any court case pending in the court of law and it does not mean that project proponent has not violated any environmental laws in the past and whatever decision under EP Act or of the Hon'ble court will be binding on the project proponent. Hence this clearance does not give immunity to the project proponent in the case filed against him, if any or action initiated under EP Act.

5. In case of submission of false document and non-compliance of stipulated conditions, Authority/ Environment Department will revoke or suspend the CRZ Clearance without any intimation and initiate appropriate legal action under Environmental Protection Act, 1986.

6. The Environment department reserves the right to add any stringent condition or to revoke the clearance if conditions stipulated are not implemented to the satisfaction of the department or for that matter, for any other administrative reason.

7. This Clearance will be valid for 5 years from the date of issue of recommendation for commencement of construction & operation.

8. In case of any deviation or alteration in the project proposed from those submitted to this department for clearance, a fresh reference should be made to the department to assess the adequacy of the condition(s) imposed and to incorporate additional environmental protection measures required, if any.

9. The above stipulations would be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and rules there under, Hazardous Wastes (Management and Handling) Rules, 1989 and its amendments, the public Liability Insurance Act, 1991 and its amendments.

10. Any appeal against this CRZ Clearance shall lie with the National Green Tribunal (Western Zone Bench, Pune),New Administrative Building, 1stFloor, D-, Wing, Opposite Council Hall, Pune, if preferred, within 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

Shri. Anil Diggikar (Member Secretary SEIAA)

Copy to:

1. SHRI JOHNY JOSEPH, CHAIRMAN-SEIAA
2. SHRI UMAKANT DANGAT, CHAIRMAN-SEAC-I
3. SHRI M.M.ADTANI, CHAIRMAN-SEAC-II
4. SHRI ANIL .D. KALE, CHAIRMAN SEAC-III
5. SECRETARY MOEF & CC
6. IA- DIVISION MOEF & CC
7. MEMBER SECRETARY MAHARASHTRA POLLUTION CONTROL BOARD MUMBAI
8. REGIONAL OFFICE MOEF & CC NAGPUR
9. MUNICIPAL COMMISSIONER MUMBAI
10. MUNICIPAL COMMISSIONER NAVI MUMBAI
11. REGIONAL OFFICE MPCB MUMBAI
12. REGIONAL OFFICE MPCB NAVI MUMBAI
13. REGIONAL OFFICE MIDC ANDHERI
14. REGIONAL OFFICE MIDC KOPER KHAIRANE NAVI MUMBAI
15. MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
16. COLLECTOR OFFICE MUMBAI
17. COLLECTOR OFFICE MUMBAI SUB-URBAN

EXHIBIT-E

NOTARY Mrs. SNEH... SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA

27/6/23

HOME DEPARTMENT (PORTS & TRANSPORT)
MAHARASHTRA MARITIME BOARD
Indian Mercantile Chambers, 3rd Floor,
14 Ramjibhai Kamani Marg, Ballard Estate, Mumbai - 400 001.
Tel.: 022-22658375. Fax : 022-22614331

गृह विभाग (बंदरे व परिवहन)
महाराष्ट्र मेरीटाईम बोर्ड
इंडियन मर्केन्टाईल चेंबर्स, ३रा मजला, १४ रामजीभाई कमानी मार्ग,
बेलार्ड इस्टेट, मुंबई - ४०० ००१.
दूरध्वनी क्र.: ०२२-२२६५८३७५, फॅक्स क्र.: ०२२-२२६१४३३१

Website : https://mahammb.maharashtra.gov.in Email : ceommb@gmail.com

MMB/CEO/ENGG/ Axa/ 296

Date: 27 AUG 2020

To,
Member Secretary,
Maharashtra Coastal Zone Management Authority (MCZMA)
Environment Department, Room No. 217,
2nd Floor, Annex Building,
Mantralaya, Madam Cama Marg,
Mumbai – 32

Subject: Application for amendment in CRZ clearance obtained for Anti Sea Erosion Measures to Sea Front Development and beautifications at Axa beach, Madh, Mumbai suburban by Maharashtra Maritime Board.

Reference: CRZ clearance vide letter dated 05.03.2019

Respected Sir,

Maharashtra Maritime Board has received CRZ clearance vide reference above for Anti Sea Erosion Measures at Axa beach from your good office; but due to additional scope, this project has been modified as a Sea Front Development; The scope of project has some changes; therefore new CRZ or amendment in earlier CRZ clearance is required; therefore modified scope is herewith submitting along with application for amendment in CRZ clearance with duly filled form and all required documents.

Thus, we would request you to accept our application to accord the amended permission.

Enclosed:
1. Form
2. Annexure 1: Project layout superimposed on CZMP Map.
3. Annexure 2: Google Map showing Project site.
4. Environmental Impact Assessment (EIA) Report.

Thanking You,

Chief Engineer
(Maharashtra Maritime Board)

NOTARY Mrs. SNEHAL C. SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA

f 2716/23

FORM 1

1. **Basic Information**

Name of the Project: Sea Front Development and Beautification at Aksa Beach.

Location / site alternatives under consideration: 19°10'33.46"N and 72°47'43.26"E. at Aksa Beach, Madh Dist. MUMBAI SUBURBAN.

Size of the Project:

Expected cost of the project: Rs. 15 Cr.

Contact Information: MAHARASHTRA MARITIME BOARD, MUMBAI

2. **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, etc.)**

Sr No	Information/Checklist confirmation	Yes / No	Details there of approximate quantities 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	Clearance of existing land, vegetation and buildings?	**No**	
1.3	Creation of new land uses?	**No**	
1.4	Pre-construction investigations e.g. bore Houses, soil testing?	**Yes**	
1.5	Construction works?	**Yes**	Construction of anti-sea erosion bund and project components include parking area, bamboo shacks, sanitary facilities, seating area, open gym, children play area and volleyball court. Gardens will

			be developed for beautification of the beach front
1.6	Demolition Works?	**NO**	
1.7	Temporary sites used for construction works or housing of construction workers?	**Yes**	
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	**Yes**	
1.9	Underground works including mining or Tunneling?	**No**	
1.10	Reclamation Works?	**No**	
1.11	Dredging?	**No**	
1.12	Offshore Structures?	**Yes**	
1.13	Production and manufacturing processes?	**No**	
1.14	Facilities for storage of goods or materials?	**No**	
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	**Yes**	Organic waste like paper, wooden piece and inorganic waste like lubrication oil, construction waste like debris, . Approximately 50 Kg/day Waste will be disposed in authorized waste disposal site and secured landfill site.
1.16	Facilities for long term housing of Operational workers?	**No**	
1.17	New road, rail or sea traffic during Construction or operation?	**No**	
1.18	New road, rail, air waterborne or other Transport infrastructure including new or altered routes and stations, ports, airports etc?	**No**	
1.19	Closure or diversion of existing transport routes or infrastructure	**No**	

	leading to changes in traffic movements?		
1.20	New or diverted transmission lines or pipelines?	**No**	
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	**No**	
1.22	Stream crossings?	**No**	
1.23	Abstraction or transfers of water form ground or surface waters?	**No**	
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	**No**	
1.25	Transport of personnel or materials for construction, operation or decommissioning?	**Yes**	
1.26	Long-term dismantling or decommissioning or restoration works?	**No**	
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	**No**	
1.28	Influx of people to an area in either temporarily or permanently?	**No**	
1.29	Introduction of alien species?	**No**	
1.30	Loss of native species or genetic diversity?	**No**	
1.31	Any other actions?	**No**	

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):

Sr. No	**Information/Checklist confirmation**	**Yes / No**	**Detailsthereof approximate quantities wherever possible) with source of information data**

2.1	Land especially undeveloped or agricultural land (ha)	-	
2.2	Water (expected source & competing users) unit: KLD	**40KLD**	**MCGM**
2.3	Minerals (MT)	-	
2.4	Construction material – stone, aggregates, and / soil (expected source – MT)	**Yes**	
2.5	Forests and timber (source – MT)	**No**	
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	**1MW**	**Adani electricity**
2.7	Any other natural resources (use appropriate standard units)	-	

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.

Sr No	**Information/Checklist confirmation**	**Yes / No**	**Details there of approximate quantities 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**	
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	**No**	
3.3	Affect the welfare of people e.g. by changing living conditions?	**Yes**	The Employment will increase, the earning capacity of people will increase
3.4	Vulnerable groups of people who	**No**	

	could be affected by the project e.g. hospital patients, children, the elderly etc.,		
3.5	Any other causes?	**No**	

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

Sr No	**Information/Checklist confirmation**	**Yes / No**	**Detailsthereof approximate quantities wherever possible) with source of information data**
4.1	Spoil, overburden or mine wastes	**No**	
4.2	Municipal waste (domestic and or commercial wastes)	**No**	
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	**No**	
4.4	Other Industrial Process Wastes	**No**	
4.5	Surplus product	**No**	
4.6	Sewage sludge or other sludge from effluent treatment	**No**	
4.7	Construction or demolition wastes	**No**	
4.8	Redundant machinery or equipment	**No**	
4.9	Contaminated soils or other materials	**No**	
4.10	Agricultural wastes	**No**	
4.11	Other solid wastes	**Yes**	

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

Sr No	**Information/Checklist confirmation**	**Yes / No**	**Detailsthereof approximate quantities wherever possible)**

			with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	**No**	
5.2	Emissions from production processes	**No**	
5.3	Emissions from materials handling including storage or transport	**No**	
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	No	
5.6	Emissions from incineration of waste	**No**	
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	**No**	
5.8	Emissions from any other sources	**No**	

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

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	**No**	
6.2	From industrial or similar processes	**No**	
6.3	From construction or demolition	**No**	
6.4	From blasting or piling	**Yes**	
6.5	From construction or operational traffic	**Yes**	
6.6	From lighting or cooling systems	**No**	
6.7	From any other sources	**No**	

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:

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	No	
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	
7.3	By deposition of pollutants emitted to air into the land or into water	No	
7.4	From any other resources	No	
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	

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

Sr No	Information/Checklist confirmation	Yes / No	Details thereof approximate quantities wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	No	
8.2	From any other resources	No	
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	No	

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

Sr No	Information/Checklist confirmation	Yes / No	Detailsthereof approximate quantities wherever possible) with source of information data
9.1	Lead to development of supporting. lities, 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**	Aksa beach is one of the famous beach in Mumbai; people from all over Mumbai visit this beach during weekends and festive seasons. As a result to cater these tourists there is a need to develop the coastal infrastructure or coastal beautification.
9.2	Lead to after-use of the site, which could have an impact on the environment	**No**	
9.3	Set a precedent for later developments	**No**	
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	**No**	

3. Environmental Sensitivity

Sr No	Information/Checklist confirmation	Yes / No	Detailsthereof approximate quantities wherever possible) with source of information data
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 -	**No**	

	Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests		
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	**Yes**	
5	State, National boundaries	**No**	
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	**Yes**	
7	Defence installations	**No**	
8	Densely populated or built-up area	**No**	
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	**No**	
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	**No**	
11	Areas already subjected to pollution nor environmental damage. (those where existing legal environmental standards are exceeded)	**No**	
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**	

Environmental Impact Assessment Report

& 27/6/23 For

Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai

Submitted to

Maharashtra Coastal Zone Management Authority (MCZMA)

Environmental Consultant

buildingenvironment

Building Environment (India) Pvt. Ltd

Dakshina Building, Office No-401,4th Floor,
Beside Raigad Bhavan, Sakal Bhavan Rd,
Sector 11, CBD Belapur, Navi Mumbai,
Maharashtra 400614
Telefax: 022 4123 7073/2757 8554
Web: www.beipl.co.in
Accreditation No. NABET/EIA/1821/RA0133

Submitted by

Maharashtra Maritime Board

2nd Floor, Indian Mercantile Chambers, Ramji
Kamani Marg, Ballard Estate, Mumbai 400001.
Tel: 22-69041701
Web: www.mmb.mahaonline.gov.in

Monitoring Laboratory

Horizon Services

Lab Approved by MoEF&CC/NABL 17025:2017

Shree K 3/4, S. No. 10, Erandawane Housing Society,
Opposite Deenanath Mangeshkar Hospital, Pune - 411 004

Undertaking

TO WHOMSOEVER IT MAY CONCERN

Maharashtra Maritime Board has conducted an Environmental Impact Assessment through Building Environment (India) Pvt Ltd, (a NABET accrediated agency) for *Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai* per the MOEF&CC office memorandum No. J-11013/41/2006-IA.II(I) dated 5th October 2011, we herewith declare ownership of the contents (information and date) provided in this EIA report.

Authorized Representative

Maharashtra Maritime Board

Environmental Impact Assessment Report

For

Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai

Project Proponent: Maharashtra Maritime Board

For and on behalf of	:	Building Environment (India) Pvt. Ltd.
Approved by	:	Mr. Vivek Kulkarni
Position	:	EIA Coordinator
Date	:	November 2020

DECLARATION BY EXPERTS

Declaration by Experts contributing to the EIA of CRZ Clearance for *Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai.*

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA coordinator	:	Mr. Vivek Kulkarni

Functional Area Experts

Sr. No	Functional Areas		Name of the Functional experts	Name of the Team Member	Involvement (Period & Task**)	Signature
1	Land Use		Mr. Hrushikesh Kolatkar	--	July 2020 till date	
2	Air	AP	Mr. Ashok Bandgar	--	July 2020 till date	
		AQ	Mr. Ashok Bandgar	Ms. Nishu Singh	July 2020 till date	
3	Noise		Ms. Nishu Singh	Ms. Nishu Singh	July 2020 till date	
4	Water		Mr. Sanjay Shevkar	Ms. Akanksha Kanade	July 2020 till date	
5	Geology		Mr. Bhushan Kachawe	Mr. Anand Kirpekar	July 2020 till date	
6	Hydrogeology		Mr. Bhushan Kachawe	Mr. Anand Kirpekar	July 2020 till date	
7	Soil Conservation		Ms. Shraddha Gathe	--	July 2020 till date	
8	Ecology & Biodiversity		Mr. Sunil Belvekar	Ms. Preeti Dalvi	July 2020 till date	
9	Risk & Hazard Assessment		Mr. Nilesh Potdar	Ms. Saumya Raj	July 2020 till date	
10	Solid & Hazardous Waste (MSW)		Mr. Nilesh Potdar	Ms. Saumya Raj	July 2020 till date	
11	Socioeconomic		Mr. Hrushikesh Kolatkar	--	July 2020 till date	

**Involvement and task of the Functional Area Experts

S. No.	Functional Areas		Name of the experts	Task
1	Land Use		Mr. Hrushikesh Kolatkar	Analysis of topography Analysis of data related to Land use pattern and Land use map using GIS tools and its classifications.
2	Air	AP	Mr. Ashok Bandgar	Air pollution monitoring. Meteorological parameter measurement. Identification & assessment of quantum of emission and its Mitigation measures.
		AQ	Mr. Ashok Bandgar	Analysis of micrometeorological data, Assessment of air quality, prediction of impacts due to proposed project.
3	Noise		Ms. Nishu Singh	Monitoring of noise levels of the project site and surrounding area. Assessment of noise level and vibration potential due to proposed project and its mitigation measures.
4	Water		Ms. Sanjay Shevkar	Water Quality monitoring (Marine surface water and sediment) Identification & assessment of water pollution and its Mitigation measures.
5	Geology		Mr. Bhushan Kachawe	Geology & Geomorphologic analysis and preparation of maps.
6	Hydrogeology		Mr. Bhushan Kachawe	Hydrological studies & analysis preparation of drainage patterns of the study area Analysis and description of aquifer characteristics
7	Soil Conservation		Ms. Shraddha Gathe	Sampling analysis & characterization of soil quality. Soil pollution & contamination of soil, probability and its mitigation measures
8	Ecology & Biodiversity		Mr. Sunil Belvekar	Conducting Ecological survey for ground truthing. Secondary data collection & validation. Identification & assessment of ecological impact due to proposed project and its Mitigation measures.
9	Risk & Hazard Assessment		Mr. Nilesh Potdar	Identification of hazards due to proposed project. Preparation of risk assessment report and onsite & offsite disaster management plan.
10	Solid & Hazardous Waste		Mr. Nilesh Potdar	Identification of hazardous and non-hazardous wastes Identification & assessment of impact due to proposed project and its Mitigation measures.
11	Socio-economic		Mr. Hrushikesh Kolatkar	Evaluation of Socio-economic development status of the area Secondary data collection. Identification & assessment of impact due to proposed project and its Mitigation measures.

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

Building Environment India Pvt. Ltd.

4th Floor, Plot No.2, Dakshina Building,
Sector 11, C.B.D Belapur, Navi Mumbai – 400614, Maharashtra

Accredited as **Category - A** organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors.

Sl. No.	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Onshore oil and gas exploration, development & production	2	1 (b)	A
2	Thermal power plants	4	1 (d)	A
3	Petroleum refining industry	10	4 (a)	A
4	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
5	Distilleries	22	5 (g)	A
6	Pulp & paper industry excluding manufacturing	24	5(i)	A
7	Sugar Industry	25	5(j)	B
8	Industrial estates/ parks/ complexes/ Areas, export processing Zones (EPZs), Special economic zones (SEZs), Biotech Parks, leather Complexes	31	7 (c)	A
9	Ports, harbours, break waters and dredging	33	7(e)	A
10	Highways	34	7 (f)	A
11	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
12	Building and construction projects	38	8 (a)	B
13	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RA AC minutes dated December 07, 2018 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/19/1019 dated July 30, 2019. The accreditation needs to be renewed before the expiry date by Building Environment India Pvt. Ltd., Navi Mumbai, following due process of assessment.

Sr. Director, NABET
Dated: July 30, 2019

Certificate No.
NABET/ EIA/1821/ RA 0133

Valid till
28.11.2021

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

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LIST OF ABBREVIATIONS

ACO	Accredited Consultant Organization
AP	Air Pollution
AQ	Air Quality
BOD	Biological Oxygen Demand
BGL	Below Ground Level
CGWB	Central Ground Water Board
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CRZ	Coastal Regulation Zone
CTO	Consent to Operate
CFU	Colony Forming Unit
CZMP	Coastal Zone Management Plan
CUM	Cubic Meter
DG	Diesel Generator
DPR	Detailed Project Report
dB	Decibel
DO	Dissolved Oxygen
DRT	Disaster Response Team
EIA	Environmental Impact Assessment
EHS	Environment Health & Safety
EMP	Environment Management Plan
EMC	Environment Management Cell
EPA	Environment Protection Act
ERT	Emergency Response Team
FAE	Functional Area Expert
FC	Faecal Coliforms
FAA	Functional Area Associate
GPS	Global Positioning System
HTL	High Tide Line
Hz	Hertz
Ha	Hectare
IMD	India Meteorological Department
ISCST	Industrial Source Complex Short Term
ISO	International Organisation for Standardization
IS	Indian Standards
KLD	Kilo Litres Per Day
Km	Kilo Meters
Kg	Kilo Grams
kVA	Kilovolt-Ampere
LTL	Low Tide Line
LULC	Land Use Land Cover
Leq	Logarithmic Equivalent
MCZMA	Maharashtra Coastal Zone Management Authority
MoEF & CC	Ministry of Environment, Forest and Climate Change
MPCB	Maharashtra Pollution Control Board
mm	Millimetres
MW	Mega Watt
NABET	National Accreditation Board for Education and Training
NABL	National Accreditation Board for Testing and Calibration Laboratories
NBWL	National Board of Wildlife
NAAQs	National Ambient Air Quality Standards
NOC	No Objection Certificate

NH	National Highway
OSHA	Occupational Safety and Health Administration
PP	Project Proponent
ppm	Parts per million
PM	Particulate Matter
PUC	Pollution Under Control
PPE	Personal Protective Equipment's
RSPM	Respirable Suspended Particulate Matter
SEAC	State Level Expert Appraisal Committee
SEIAA	State Environment Impact Assessment Authority
SOI	Survey of India
SPCB	State Pollution Control Board
STP	Sewage Treatment Plant
SWM	Solid Waste Management
Sqm	Square Meters
TPA	Tonnes Per Annum
TSS	Total Suspended Solids
TDS	Total Dissolved Solids
TC	Total Coliform

1. Introduction

1.1 Preamble and Project Background

The state of Maharashtra has about 720 km long indented coastline marked by the presence of major estuaries and narrow creeks. There are 48 intermediate & non-major ports and 35 creeks on this coastline. The creeks have shallow water jetties for use of the fishermen and local boats. Maharashtra Maritime Board (MMB) is the nodal agency that takes care of the regulatory and developmental framework of the state's maritime activities. Over the years, MMB has taken number of initiatives to harness the potential of its coastline. These include development of the marine front including setting up of several cargo jetties, ferry wharfs, larger port terminals, inland water transport system, shipyards etc.

Aksa beach is one of the scenic location along west coast of suburban Mumbai which is regularly visited by tourists especially on weakends. The beach experiences strong currents which is erods the sand and causes quicksand. In this context MMB has identified need of constructing the anti sea erosion bund and development of sea front considering tourism value of the beach.

1.2 Purpose of the Report

The purpose of this report is to assess the baseline environmental status of the project area and identify the environmental impacts due to construction of anti sea erosion bund and sea front development. The report also addresses the mitigation measures to minimize the adverse environmental impacts and provides the environmental management plan for construction as well as operation phase of the project.

1.3 Importance of the Project

Aksa beach is a less crowded beach located away from mainland of Mumbai city. Many visitors visits the beach due to its scenic value. The beach is also ill-famed for strong currents and quicksand which poses risk of drowning. Also due to strong currents the beach is subjected to sand erosion. Therefore to avoid sand erosion it is important to implement suitable anti-erosion measure. Also sea front development at this beach would enhance the tourism value of the beach. Considering need of protecting beach from sand erosion and to enhance it from tourism point of view it becomes important to construct the anti sea erosion bund and develop sea front for visitors.

1.4 Identification of the Project Proponent

The Maharashtra Maritime Board was established in the year 1996 and has played a pivotal role in encouraging and facilitating maritime activities in the state of Maharashtra. The administration of MMB comes under the Maharashtra Act No. XV of 1997 which provides MMB the rights to oversee the development and maintenance of the non-major ports.

The role of MMB is to facilitate development of the non-major ports. The MMB has under its wing 48 port limits and is continuously working to further develop the Maharashtra's coastal belt. Amongst their recent undertakings is development of an Inland Transport System besides initiatives in coastal shipping, ship construction and repair. Details of the project proponent are provided in **Table 1.1**.

Table 1.1: Contact Details of the Project Proponent

Sr. No.	Item	Description

1	Name of the project proponent	Mr. Manish Sudhakar Metkar Sub Engineer Maharashta Maritime Board
2	Registered Office Address	2nd Floor, Indian Mercantile Chambers, Ramji Kamani Marg, Ballard Estate, Mumbai 400001. Tel: 22-69041701
3	Correspondence address	2nd Floor, Indian Mercantile Chambers, Ramji Kamani Marg, Ballard Estate, Mumbai 400001. Tel: 22-69041701

1.5 Identification of Environment Consultant

The consultant details are given below in Table 1.2.

Table 1.2: Details of Environment Consultant

Sr.No.	Item	Description
1	EnvironmentalConsultant	Building Environment India Pvt. Ltd (NABET/EIA/1821/RA0133& Valid Till 28.11.2021). Dakshina Building, Office No-401, 4th Floor, Sector 11, CBD Belapur, Navi Mumbai, Maharashtra 400614
2	Monitoring Lab	**Horizon Services (Lab NABL 17025:2017)** NABL/MoEFCC Approved lab Shree K 3/4, S. No. 10, Erandawane Housing Society, Opposite Deenanath Mangeshkar Hospital, Pune - 411 004

1.6 Brief Description of the Project

1.6.1 Nature, Size, Location of the Project

The project involves construction of anti sea erosion bund and sea front development with beautification of beach. Proposed anti sea erosion bund will be 950 m long and 10.7 m wide at base and 3 m wide on top. Sea front development involves development of parking area, gardens, bamboo shacks, sanitary facilities, seating area, open gym, children play area and volleyball court.

The proposed project is located at Aksa beach at Madh in Mumbai suburban district. Geographic coordinates of the project location are 19°10'32.44"N 72°47'42.82"E. Location of the project is shown below in **Figure 1.1** and the project layout superimposed on Google imagery is shown in Figure 1.2.

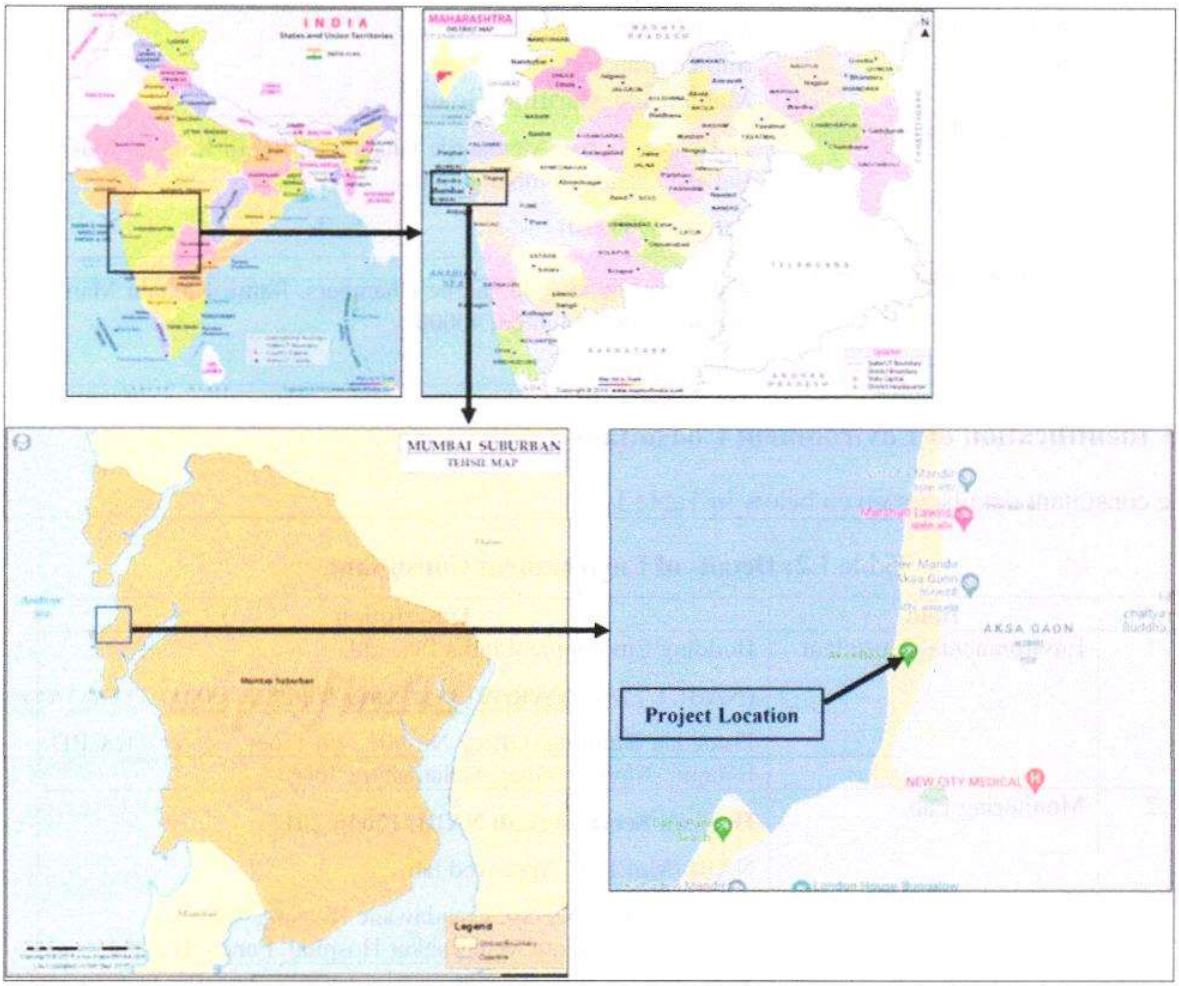


Figure 1.1: Index Map Showing Project Location.

Figure 1.2: Google Image Showing Proposed Project Location

1.7 Applicability of the CRZ Notification With Reference to Project Activities

MoEFCC had declared coastal stretches as Coastal Regulation Zone and imposed restrictions on industries, operations and processes in the CRZ through a Notification in 2011 and outlined the procedure for obtaining the CRZ clearance for the developmental activities in the CRZ. As per the Coastal Regulation Zone Notification 2011 and its amendments thereafter; for regulating development activities along the coast open to the sea, the coastal stretches within 500 m of High Tide Line (HTL) on the landward side are classified into four categories, namely: CRZ (I), (II), (III) and (IV).

1. CRZ-I: (A): The areas that are ecologically sensitive and the geomorphological features which play a role in the maintaining the integrity of the coast,- (i) mangroves; (ii) coral reefs; (iii) sand beaches and sand dunes; (iv) mudflats; (v) protected areas under the Wild Life (Protection) Act, 1972 (53 of 1972), the Forest (Conservation) Act, 1980 (69 of 1980) or Environment (Protection) Act, 1986 (29 of 1986); (vi) salt marshes; (vii) turtle nesting grounds; (viii) horse shoe crabs habitats; (ix) sea grass beds; (x) sea weed beds; (xi) nesting grounds of birds; (xii) fishing villages and areas of traditional rights.

   (B) - The area between Low Tide Line and High Tide Line.

2. CRZ-II - CRZ-II shall constitute the developed land areas up to or close to the shoreline, within the existing municipal limits or in other existing legally designated urban areas, which are substantially built-up with a ratio of built-up plots to that of total plots being more than 50 per cent and have been provided with drainage and approach roads and other infrastructural facilities, such as water supply, sewerage mains, etc.
3. CRZ-III - Areas that are relatively undisturbed and those do not belong to either CRZ-II shall constitute CRZ-III.
4. CRZ-IV: CRZ IV shall constitute the water area and is further classified as follows:
   A. The water area from the Low Tide Line to twelve nautical miles on the seaward side; and
   B. The water area of the tidal influenced water body from the mouth of the water body at the sea up to the influence of tide which is measured as five parts per thousand during the driest season of the year.

1.7.1 Details of CRZ Classification as per Approved CZMP

As per the letter vide F.No.19-36/2017-IA.III dated 26.02.2019 by MoEF&CC, regarding clarification on implementation of the project falling in CRZ area in Maharashtra, it is stated that "*Until the CZMPs of Maharashtra prepared under the provision of CRZ notification 2011 are updated/revised under provision of the CRZ notification 2019 issued vide GSR 37 (E) dated 18.01.2019 the provision of CRZ notification 2011 shall continue to be followed for appraisal and CRZ clearance of project in CRZ area*".

Out of total 50099.42 sq.m about 10165 sq.m area of anti sea erosion bund falls in CRZ I(B) and 39934.42 sq.m area of recreational facilities falls in CRZ II as per the CZMP 2011.

1.7.2 Validity of CRZ Clearance

The clearance accorded to the projects under this notification shall be valid for a period of five years from the date of issue of clearance, as per CRZ Notification 2011, provided that the construction activities are completed, and the operations commence within five years from the date of issue of such clearance. However, as per the notification dated ***6th March, 2018 by Ministry of Environment Forest and Climate Change***, the validity of the clearance accorded to the projects under CRZ notification 2011 has been amended to period of seven years from the date of issue of clearance, provided that the construction activities shall commence within a period of five years from the date of the issue of clearance and the construction be completed and the operations be

commenced within seven years from the date of issue of the clearance. Further the period of validity may be extended for a maximum period of three years by making an application by applicant to the concerned authority within the validity period, along with recommendation for extension of validity of the clearance by the concerned State / Union Territory Coastal Zone Management Authority.

1.7.3 Post CRZ Clearance Monitoring

As per CRZ notification 2011 and EIA Notification 2006 it is mandatory to submit the half-yearly compliance reports of the conditions imposed by MCZMA on 1st June and 1st December of each calendar year to the concerned regulatory authority.

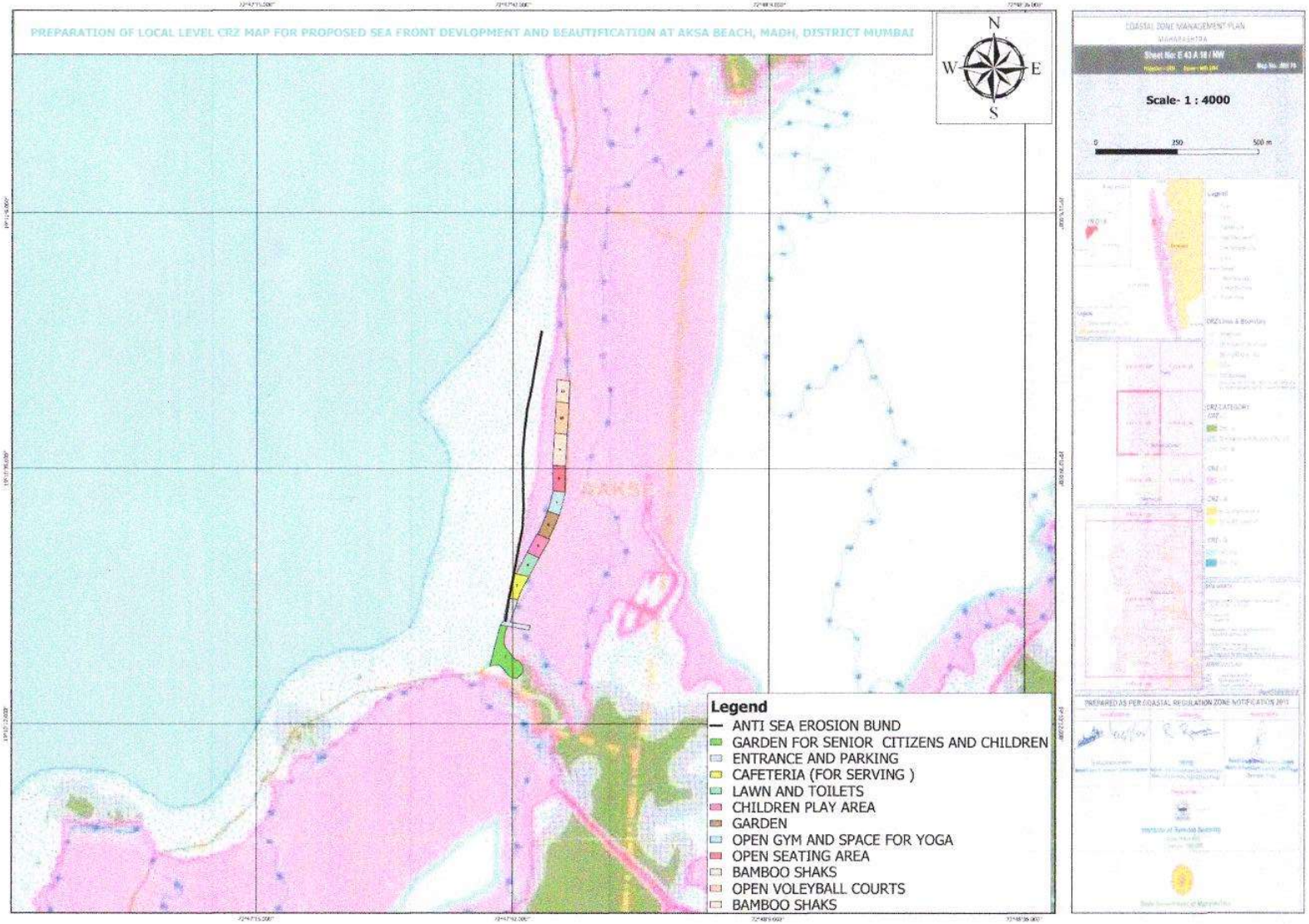


Figure 1.3: Project Layout Superimposed on Approved CZMP (1:4000) (Source: https://mczma.gov.in)

1.8 Litigation(S)/ Orders Passed by Any Court of Law/ Any Statutory Authority against the Project

At present, there are no litigations / court cases against the project that may hinder the process of obtaining CRZ Clearance.

1.9 Applicable Legal and Policy Framework

The project location falls under CRZ I(B), II area as per CZMP 2011 and requires to obtain the CRZ clearance from Maharashtra Coastal Zone Management Authority (MCZMA) as per *paragraph 4.2(i)(b)* of CRZ notification 2011. The project doesn not require to obtain the environmental clearance as per EIA notification 2006 as it does not involve cargo handling nor fish landing. The illustrative list of other applicable laws and regulations are presented in **Table 1.3.**

Table 1.3: Applicable Laws and Regulations

Applicable Legislation/ Policy	Agency Responsible	Applicable Permits and Requirement	Status
Prevention and Control of Air Pollution			
The Air (Prevention and Control of Pollution) Act, 1981, amended in 1987 and the Air (Prevention and Control of Pollution) Rules 1982, as amended up to 18th Feb 1992.	MPCB	Consent for Establishment Consent to Operate Compliance under the Act	The CTE shall be taken prior to the construction and CTO shall be taken prior to commissioning of the project
Prevention and Control of Water Pollution			
The Water (Prevention and Control of Pollution) Act, 1974, amended in 1988	MPCB	Consent for Establishment Consent to Operate Compliance under the Act	The CTE shall be taken prior to the construction and CTO shall be taken prior to commissioning of the project
Noise Emissions			
The Noise (Regulation & Control) Rules, 2000 as amended in January 2010	MPCB	Compliance under the rules to maintain stipulated standards	Will be complied during construction and operation phase of the project
Coastal Regulation Zone Clearance			
Coastal Regulation Zone notification 2011 & amendments	Maharashtra Coastal zone management Authority	Requirement of CRZ clearance	In process
Environment Protection			
The Environment (Protection) Act 1986, as amended in April 2003;	MoEF&CC	Compliance of conditions stipulated under CRZ Clearance.	Will be complied during construction and operation phase of the project.
Waste Management Rules			
Hazardous Wastes (Management Handling and Transboundary Movement) Rules, 2016 and subsequent amendments.	MPCB	Compliance under the rules to maintain stipulated standards.	Shall ensure compliance under these rules.
Solid Waste Management Rules 2016			
C&D waste Management Rules 2016			

1.10 Scope of EIA Study

- To identify all the project activities and the environmental aspects likely to be affected by the proposed development.
- To anticipate environmental impacts and evaluate its significance during the construction and operation phase of the project in relation to the sensitive receptors;
- To recommend project specific appropriate preventive and mitigative measures to minimize pollution, environmental disturbances during construction phase and operation phase of the project;
- To adopt suitable environmental action plans and management systems, so as to implement and monitor the appropriate mitigate measures.

1.11 Method for the EIA Study

EIA study has been carried out as per EIA notification 2006. Various steps involved in EIA studies are as follows.

- Procurement of project details from project proponent and collection of secondary data and applicability of the same in context of the proposed project.
- The study of physical, geological, hydrological and biological settings of the study areas.
- Generation of environmental baseline data for air, noise, water and ecology and biodiversity as well as data on physical, geological, hydrological settings of the study area.
- Identification of environmental aspects likely to be affected by the project and/or likely to cause adverse impacts to the Project, including both the natural and man-made environment.
- Provide information on the consideration of alternatives/options for site selection and layouts of the project to avoid and minimize potential environmental impacts to environmentally sensitive areas and other sensitive uses.
- Identification and assessment of impacts on air quality, noise quality, water quality, waste management implications, creek ecology, fisheries, cultural heritage and landscape and aesthetics of the area.
- Recommendation/Suggestion of mitigation measures to minimize pollution, environmental disturbance and nuisance during construction and operation of the project;
- Design and specify the environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.
- Preparation of Environmental Management Plan and Post-project Environmental Monitoring Programme.

1.12 Structure of EIA Report

The content of the report is as follows.

Chapter -1	Introduction	This chapter provides the purpose of the report, background information of the project, brief description of nature, size and location of project,

		objectives of the project, scope and organization of the study. The applicable environmental legislation to the project and the methodology adopted in preparation of this report has also been described in this chapter
Chapter -2	Project Description	This chapter presents project details, the need of the project, location, connectivity and surrounding features of the project, details of resources used, project schedule and cost.
Chapter -3	Description of Environment	The chapter presents the methodology and analysis of environmental baseline conditions with respect to all the environmental components supplemented by the secondary data.
Chapter -4	Anticipated Environmental Impacts & Mitigation Measures	This chapter details the inferences drawn from the environmental impact assessment of the project during construction and operation phase of the project through modeling studies and available expertise and suggestion/recommendation of mitigation measures for minimizing or offsetting of identified impacts.
Chapter -5	Analysis of alternatives	This chapter justifies as to why alternative study was not carried for this project.
Chapter -6	Environmental Monitoring Plan	Environmental monitoring plan to check the effective implementation of mitigation measures during construction and operational phase have been delineated in this chapter.
Chapter -7	Additional Studies	The chapter describes risk assessment and disaster management plan to minimize the risks or to combat the associated risks.
Chapter -8	Project Benefits	This chapter describes benefits of the project to the local people and tourists.
Chapter -9	Cost Benefit Analysis	Environmental cost benefit analysis will be carried out on recommendation of apprasing authority and will be included in this report.
Chapter -10	Environmental Management Plan (EMP)	It provides recommendations / Environment Management Plan (EMP) including mitigation measures for minimizing the negative environmental impacts of the project and budgetary provisions for the implementation.
Chapter -11	Summary and Conclusion	This Chapter highlights the overall summary of the complete EIA report.
Chapter -12	Disclosure of the Consultants Engaged	The list of experts involved in preparation of the present EIA report is given along with brief profile of the consultancy organization involved.

2. Project Description

This chapter gives brief description about project location, need of the project, site connectivity, environmental and social setting of the project site, project components, construction method, activity impacts and control measures, implementation schedules and project cost.

2.1 Type of the project

The proposed project involves sea front development and beautification of Aksa beach. Sea front development will include construction of anti sea erosion bund with pathway for walking. Also other facilities proposed in sea front development include parking area, bamboo shacks, sanitary facilities, seating area, open gym, children play area and volleyball court. Gardens will be developed for beautification of the beach front.

2.2 Need of the Project.

Aksa beach is a well known scenic and touring place located away from mainland of Mumbai city. The beach is frequently visited by many visitors from surrounding city regions. The beach is also ill-famed for having strong currents which poses risk of drowning due to quicksand occurring at beach. Also due to strong currents the beach is subjected to sand erosion. Uncontrolled sand erosion would affect the tourism value of the beach. Therefore to avoid sand erosion and enhance

tourism at the beach the MMB has identified need of anti sea erosion bund along with provision of recreational facilities to visitors.

2.3 Project Location

The proposed project is located at Aksa beach at Madh in Mumbai suburban district of Maharahstra. The project location indicated on google earth imagery shown below in Figure 2.1 and site photograph is shown in Figure 2.2.

Figure 2.1: Proposed Project Location Marked on Google Earth

Figure 2.2: Project Site Photograph

2.4 Project Components/Activities

The proposed project involves sea front development and beautification of Aksa beach. Sea front development involves construction of anti sea erosion bund. Also other project components include parking area, bamboo shacks, sanitary facilities, seating area, open gym, children play area and volleyball court. Gardens will be developed for beautification of the beach front. Area details of the various project components are given below in Table 2.1.

Table 2.1: Project Area Details

S. No.	Description	Area (sq.m)
1.	Garden for senior citizen and children	7503.46
2.	Entrance and parking	3305.46
3.	Cafeteria (For serving)	3215.70
4.	Lawn and Toilets	2833.76
5.	Children play area	2635.52
6.	Garden	3295.56
7.	Open gym and space for Yoga	2892.82
8.	Open seating area	3348.80
9.	Bamboo shacks 1	4157.55
10.	Open volley ball court	3903.41
11.	Bamboo shacks 1	2842.38
12.	Anti sea erosion bund	10165.00
	Total project area	**50099.42**

2.4.1 Project Layout

Proposed anti sea erosion bund will be 950 m long and 10.73 m wide at base. The bund will be provided with 3 m wide pathway for walking. The proposed project layout superimposed on google earth imagery and cross section of proposed bund is given below in Figure 2.3 and Figure 2.4.

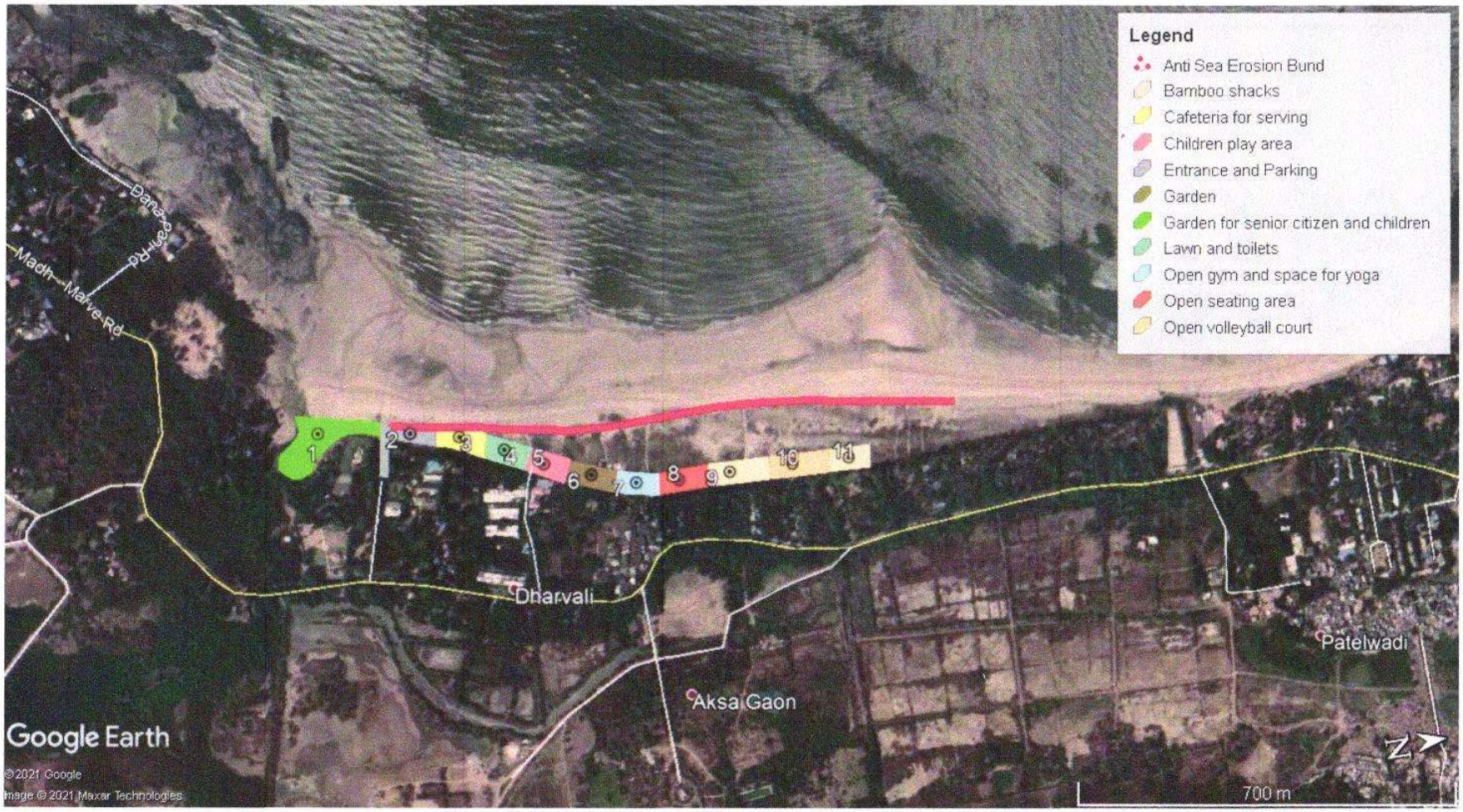


Figure 2.3: Project Layout Superimposed on Google Earth

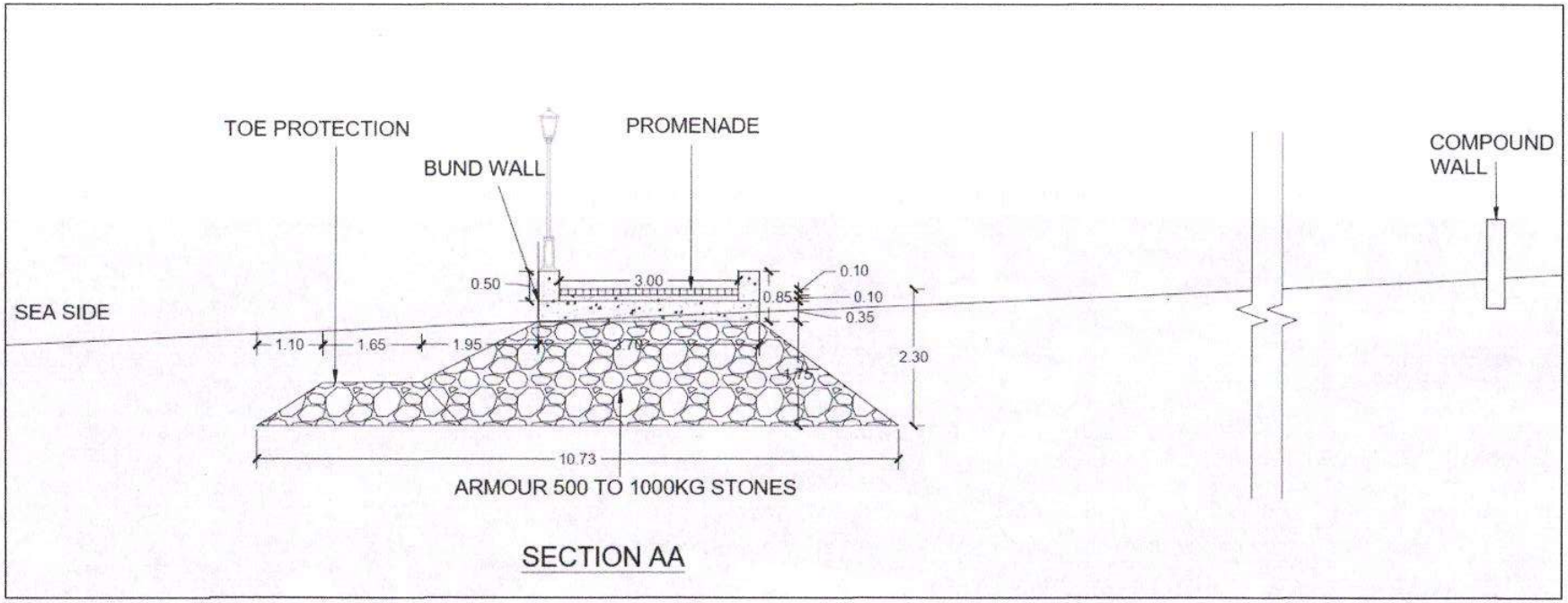


Figure 2.4: Cross-section of bund

2.4.2 Construction Method

Construction method to be used for the proposed sea fron development is given below in Figure 2.5.

Figure 2.5: Construction Method

2.5 Identification of Aspects and Impacts of the Project

Various project activities during construction and operation phase have been identified and their aspects, impacts are given below in Table 2.2

Table 2.2: Aspect Impact Matrix

S. No.	Activity	Work Process	Aspect	Environment Impacts
Construction phase				
1.	Transportation, storage, and handling of raw material	Movement of heavy vehicles carrying raw material and heavy machineries like cranes, forklifts etc.	• Vehicular gaseous emissions • Noise emission from equipment and vehicles • Dust emissions • Accidental spillage of fuels or oil	• Impact on ambient air quality • Increase in noise levels from equipment and vehicle operation. • Beach sediment contamination due to accidental spillage of fuels or oil • Impact on benthic fauna from contamination of beach sediment from accidental fuel or oil spillage • Inconvenience to visitors from unaesthetic visual and noisy activities
2.	Excavation and foundation	Excavating bund area using excavators, Filling of boulders and rubbles to prepare base for bund	• Gaseous emissions from equipment • Noise emissions from equipment • Generation of excavated waste	• Impact on ambient air quality • Increase in noise levels from equipment operation. • Inconvenience to visitors from unaesthetic visual from excavated waste and noisy activities
3.	Construction of anti-sea erosion bund	Laying of armor stones using cranes, Laying of pathway on bund	• Gaseous emissions from equipment • Noise emissions from equipment • Site runoff	• Impact on ambient air quality • Increase in noise levels from equipment operation • Contamination of sediment from site runoff and labour generated waste • Impact on benthic fauna due to contamination of sediment • Inconvenience to visitors from unaesthetic visual and noisy activities
4.	Sea front development	Constructing recreational facilities for tourists such as cafeteria, parking area, sanitary facility, sitting areas and gardens	• Gaseous emissions from equipment • Noise emissions from equipment • Generation of construction waste	• Impact on ambient air quality • Increase in noise levels from equipment operation • Employment opportunity to labor • Inconvenience to visitors from unaesthetic visual and noisy activities
Operation phase				

S. No.	Activity	Work Process	Aspect	Environment Impacts
1	Recreational activity	Usage of recreational facilities by tourists	• Waste generation on beach from visitors • Drowning of visitors • Recreational activity • Tourist vehicular activity	• Visitor generated waste may enter sea if not managed properly and lead to floating garbage and unaesthetic and unhygienic conditions • Contamination of marine water and sediment by waste disposal in beach area • Impact on marine flora and fauna due to contamination of water from waste entering sea • Increase in traffic along Madh –Marve road causing traffic congestion and parking issue • Drowning of visitors due to crossing bund and entering sea • Disturbance to local residents from Aksa village due to noise levels • Tourism business opportunities to locals
2	Anti sea erosion bund	Protection from strong currents	• Prevention of sand erosion	• Anti sea erosion bund will protect Aksa beach from sand erosion

2.6 Site Connectivity

The proposed project location is accessible from NH 8 via Madh-Marve road. The details of the site connectivity have been provided in **Table 2.3.**

Table 2.3: Site connectivity

Sr. No.	Particulars	Details	Approximate aerial Distance
1	Nearest Railway Station	Malad Railway Station	5.69 km
		Goregaon Railway Station	6.04 km
		Kandivali Railway Station	6.53 km
2	Roads & highways	Madh-Marve Road	0.25 km
		NH 8	6.7 km
		SV Road	4.5 km
3	Ferry	Marve ferry point	2.5 km
		Madh ferry wharf	4.00 km
		Versova jetty	4.13 km
4	Airport	Chhatrapati Shivaji Maharaj international Airport	12.10 km

2.7 Site Surrounding Features

Details of the site surrounding features within 15 km from project location are provided in Table 2.4.

Table 2.4: Detail of Site Surrounding Features

S. no.	Features	Distance and direction from Project location (Km)
1	Sanjay Gandhi National Park	10.5 km NE
2	Dana Pani Beach	1.2 km SW
3	Malad creek	2.5 km E
4	Gorai creek	2.8 km N
5	Arabian Sea	0.2 km W
6	Tulsi lake	12.3 km ENE
7	Vihar lake	11.2 km ESE
8	Powai lake	12.2 km SE
9	Meethi river	10.8 km SE
10	Dahisar river	9.9 km NNE
11	Poisar river	7.0 km N
12	Mangrove vegetation	0.5 km SE
13	Mudflats of Gorai creek	3.1 km N
14	Mudflats of Malad creek	2.5 km E
15	Kanheri caves	12.2 km ENE
16	Global Vipassana pagoda	6 km NNE
17	INS Hamla	1.8 km N

2.8 Details of Equipments, Materials and Resources Required

2.8.1 Vehicle and Equipment

Details of vehicles and equipment required during construction period are given below in **Table 2.5.**

Table 2.5: Details of Vehicles and Equipments

S. no.	Particulars	Quantity
1.	Trucks	2
2.	Cranes	2
3.	Excavator	2
4.	Hydraulic pumps	2
5.	Concrete mixer	1
6.	Rebar bender	2
7.	Rebar tweezer	2
8.	Vibrator	2
9.	Welding machine	1
10.	Steel cutter	1

2.8.2 Raw Materials

Details of raw materials to be used during proposed sea front development are given below in **Table 2.6.**

Table 2.6: Details of Raw Materials

S. no.	Raw Material	UOM	Quantity
1.	Ready Mixed Concrete	Cum	1000
2.	Structural steel	MT	100
3.	Cement	MT	1000
4.	Armour rock	MT	25000
5.	Core roack	MT	10000

2.8.3 Water Supply

Water required for construction activities will be obtained through tankers. During construction phase water will be required for curing purpose and drinking purpose. For curing of the recreational structures about 2 m^3/day water is required. Considering 30 workers deployed on site drinking water quantity required is estimated to be 750 lit/day.

2.8.4 Power Supply

During construction phase LSD D.G set of 25 KV shall be used as a source of power supply at construction sites.

2.8.5 Manpower Requirement

It is estimated that around 30 workers during construction will be engaged on site. The construction phase will include hiring of local labourers.

2.9 Quantification and Characteristics of Waste

2.9.1 Construction Phase

During the construction phase waste like municipal garbage, plastic, metal, debris, leftover cement will be generated from the construction activities which can be categorized in following.

- Construction waste
- Municipal solid waste
- Hazardous waste
- Biomedical waste

Construction Waste

Construction waste is complex due to the different types of materials being used. Construction waste for this project may be composed of cement and concrete waste; remains of welding sticks, reinforcement steel rod cuttings etc.

Municipal Solid Waste

Municipal solid waste consists of daily use items which are either degradable or non-degradable. The proposed project is likely to generate garbage, rubbish, unpacked materials, plastic waste, discarded waste, and food waste from labour deployed on construction site. The total municipal waste generated will be 7.5 kg/day out of which, 3 kg/day will be biodegradable, and 4.5 kg/day will be non-biodegradable waste which will be collected and separated by providing separate bins on site and will be sent for further processing via authorized vendor. The details of the quantity of waste generated during construction phase is given in the **Table 2.7.**

Table 2.7: Waste generation during construction phase

S.No.	Component	Quantity (Kg/day)
1.	Biodegradable	3
2.	Non-Biodegradable	4.5
	Total	7.5

Hazardous Waste

The construction activities will entail generation of hazardous wastes like paint, tarpaulin, spent oil, lubricants, varnish, adhesives etc. Proponent, through contractual obligations, will specify disposal of hazardous waste by the contractor to authorized recyclers/agencies within 90 days.

2.10 Requirements for Management of Waste

Control measures for waste management at construction site are given below in Table 2.8.

Table 2.8: General requirements for waste management

Waste Type	Control Measures
General Requirements	• Minimization of waste generation for disposal (via reduction/recycling/re-use) • Segregating waste materials according to type to facilitate re-use and recycling. • Separation of inert construction and demolition materials for either re-use on-site or use as material fill. • During demolition works, segregating materials at source as far as practical. • Co-ordinate material deliveries to site to minimize storage times on site and the likelihood of causing damage. • Training site staff in waste minimization practices • Transport of wastes off site as soon as possible • Maintenance of accurate waste records • Use of re-useable metal hoardings / signboards. • No on-site burning will be permitted
Construction waste	• Segregation of materials to facilitate recycling/reuse (within designated area and in appropriate containers/stockpiles) • Appropriate stockpile management • Planning and design considerations to reduce over ordering and waste generation. • Recycling and re-use of materials where possible • For material which cannot be re-used/recycled, collection will be carried out by an approved waste contractor for landfill disposal
Construction Chemical waste material	• Storage within locked, covered and bunded area. • Storage area will not be located adjacent to sensitive receivers e.g., drains. • Minimize waste production and recycle oils/solvents where possible. • A spill response procedure will be in place and absorption material available for minor spillages. • Use appropriate and labelled containers. • Educate onsite workers on site cleanliness/waste management procedures. • Collection by a licensed chemical waste collector

Waste Type	Control Measures
Municipal waste	• Waste will be stored within a temporary refuse collection facility, in appropriate containers prior to collection and disposal • Regular, daily collections are required by an approved waste collector and recycler

Table 2.9: Regulatory requirements for waste management

S.No.	Category of Waste	Applicable Rule
1.	C&D waste	Construction and Demolition waste Management Rule 2016
2.	Municipal Solid Waste	Solid Waste Management Rules 2016
3.	Hazardous Waste	Hazardous and Other Waste (Management & Transboundary Movement) Rules, 2016

2.11 Project Implementation Schedule

Proposed project will be implemented within approximately 12 months after obtaining necessary approvals.

2.12 Project Cost

Total cost of the project is 15.0 crores.

3. Description of the Environment

3.1 Introduction

This chapter outlines the present environmental setting of the project area. Following environmental attributes were considered for the baseline study:

- Physical: Ambient air quality, marine water and sediment, ambient noise and vibrations, topography, land use-land cover, geology, hydrogeology etc.
- Biological: Terrestrial flora including mangrove and non mangrove vegetation, aquatic flora including phytoplankton, terrestrial fauna including avifauna, mammals, reptiles, insects, arthropods and aquatic fauna including fishes, zooplankton and benthos.
- Social: Economy, social infrastructures, security and safety, health and culture.

3.2 Study Area

The baseline monitoring was carried out considering nature and magnitude of project activity. Also, the environmental setting and potential receptors of the impact were considered for determining monitoring locations. The study area for secondary data collection is set within 10 km radius from proposed project location. The study area for primary data collection is set within 2 km radius from proposed project location. Study area maps represented on topo sheet and google earth are shown below in Figure 3.1 and Figure 3.2 respectively.

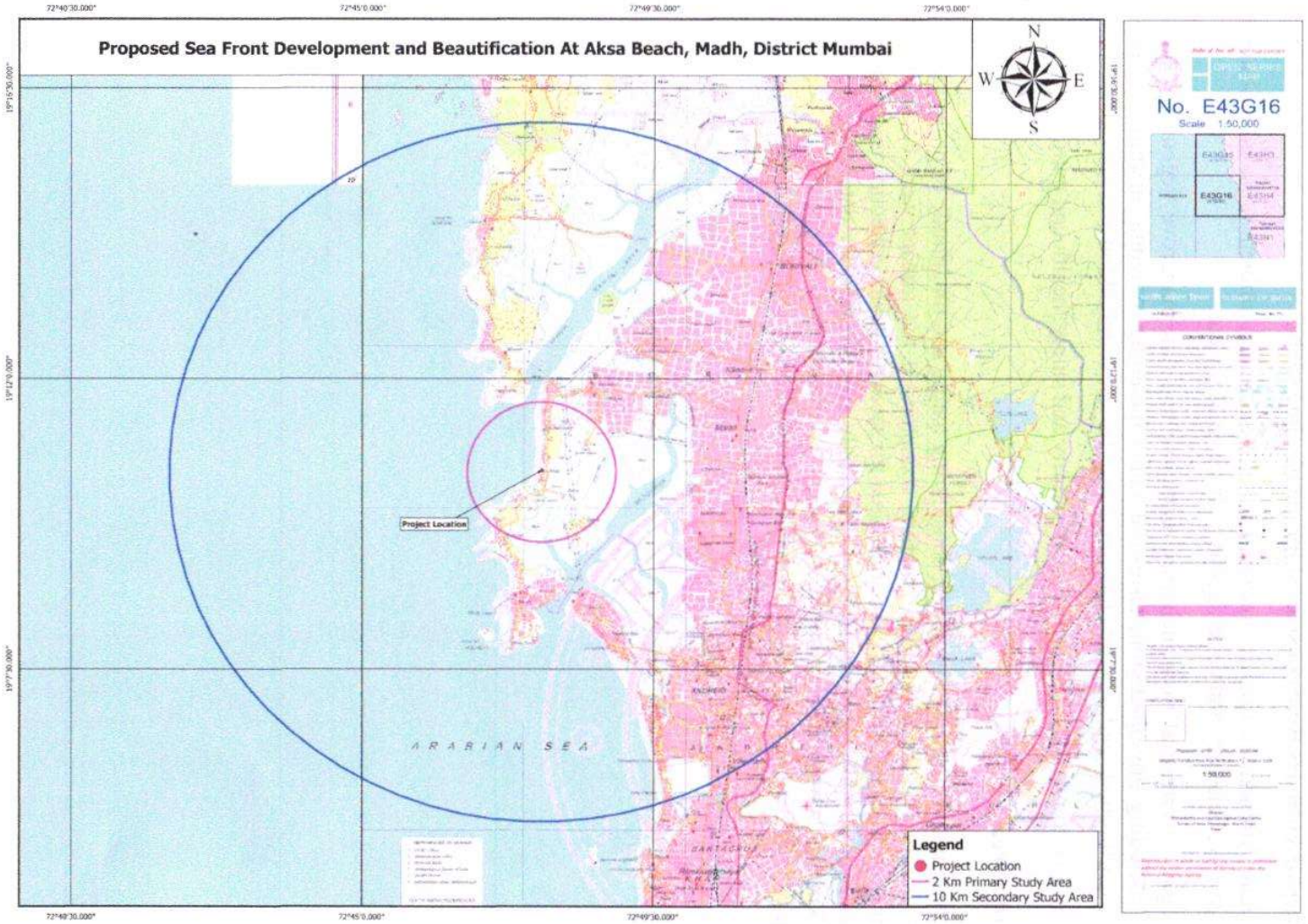


Figure 3.1: SOI Toposheet Showing Baseline Study Area

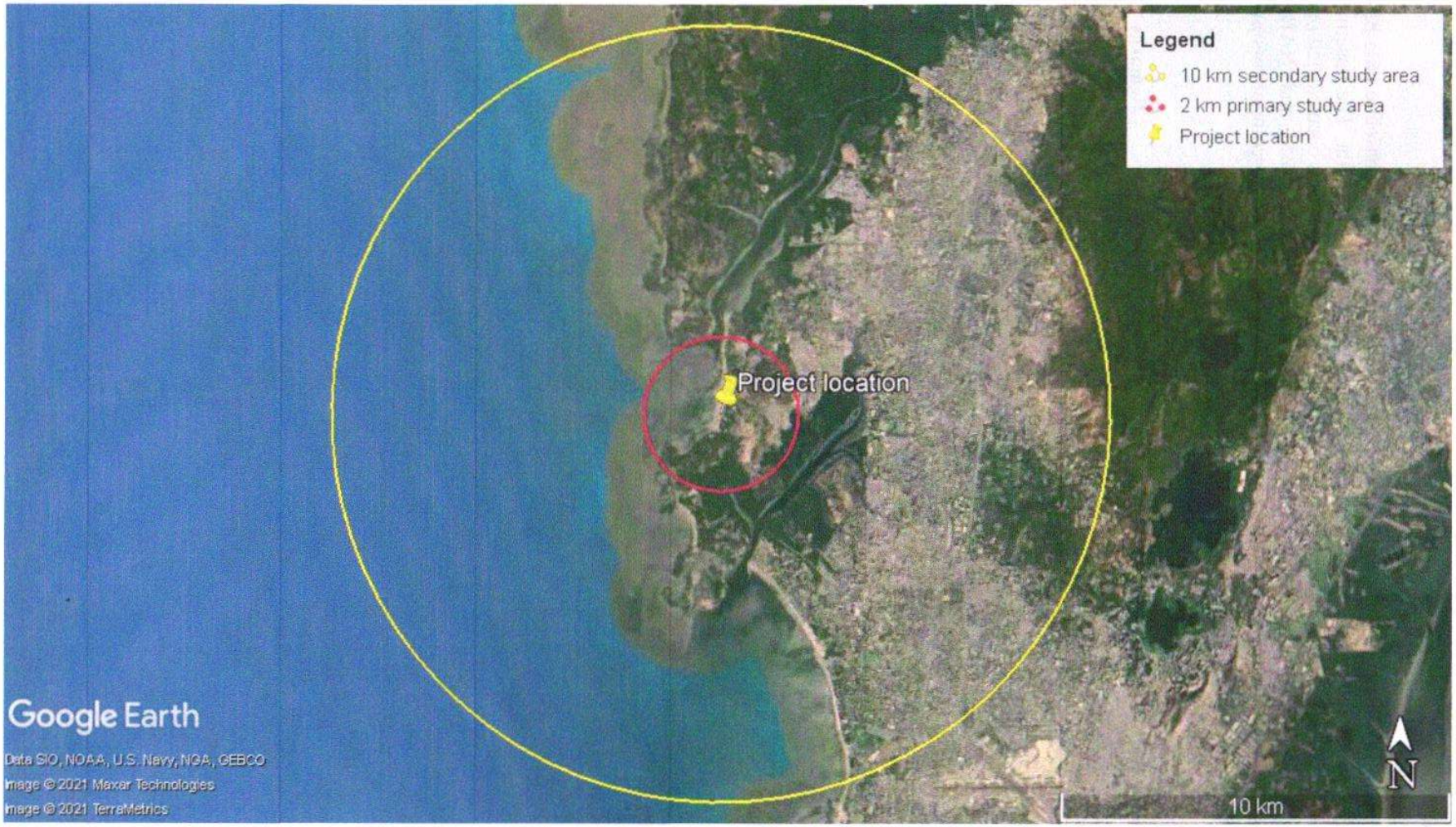


Figure 3.2: Google Earth Imagery Showing Baseline Study Area

3.3 Approach

The environmental baseline study has been carried out in October 2020. The baseline data has been collected through primary sampling and surveys as well as secondary data. The baseline monitoring for air quality, noise, marine water and sediment, marine biology has been carried out by Horizon Environmental Services Private Limited (MoEF&CC recognized and NABL Accredited Lab). Sampling and analytical methods for various environmental components are given below in **Table 3.1.**

Table 3.1: Baseline Monitoring Approach

Component	Sampling		Method	Remarks
	Network	Frequency		
Ambient Air Quality				
Particulate Matter (size less than 10 µm) or PM10µg/m^3	Sample collection from 3 different locations within study area	24 hours (twice a week) for one non-monsoon season	• Gravimetric • TOEM • Beta attenuation	As per CPCB standards for NAAQS, 2009
Particulate Matter (size less than 2.5 µm) or PM2.5µg/m^3			• Gravimetric • TOEM • Beta attenuation	
Sulphur Dioxide (SO2), µg/m^3			• Improved West and Geake • Ultraviolet fluorescence	
Nitrogen Dioxide (NO_2), µg/m^3			• Modified Jacob &Hochheiser (Na-Arsenite) • Chemiluminescence	
Ambient Noise Level				
Noise Level Readings; Noise Level Results consisting Lmax, Lmin, Leq Day, Leq Night & Ldn	Sample collection from 3 different locations within study area	Hourly, for one day in a season (day includes working or non-working)	Noise Monitoring with Noise Level Meter	The Noise Pollution (Regulation and Control) Rules, 2000
Marine Water Quality				
Temperature, pH, Salinity,DO, BOD, Ammonical Nitrigen, Phosphate, Total Phosphorus, Total Nitrogen, Zinc, Cadmium, Lead, Mercury, Copper, Nickel, Oil & Grease, Electrical conductivity, PHc	Sample collection from 3 different locations within study area	Once during sampling period	IS 3025	As per CPCB Standards.
Marine Sediment Quality				

Component	Sampling		Method	Remarks
	Network	Frequency		
Ambient Air Quality				
Particulate Matter (size less than 10 µm) or PM10µg/m^3	Sample collection from 3 different locations within study area	24 hours (twice a week) for one non-monsoon season	• Gravimetric • TOEM • Beta attenuation	As per CPCB standards for NAAQS, 2009
Particulate Matter (size less than 2.5 µm) or PM2.5µg/m^3			• Gravimetric • TOEM • Beta attenuation	
Sulphur Dioxide (SO2), µg/m^3			• Improved West and Geake • Ultraviolet fluorescence	
Nitrogen Dioxide (NO_2), µg/m^3			• Modified Jacob &Hochheiser (Na-Arsenite) • Chemiluminescence	
Texture, pH, Aluminum, Chromium, Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium, Mercury, Lead, C_{org}, Phosphorus, PHc	Sample collection from 3 different locations within study area	Once during sampling period	Marine sediment sampling by using van-Veen grab	As per CPCB Standards.
Ecology and Biodiversity				
Terrestrial flora and fauna **Marine flora** **Phytoplankton** • Total cell count (no. of cell×10^3/L) • Total Genera (nos.) • Percentage composition **Marine fauna** **Zooplankton** • Population (nox10^3/100m^3) • Biomass (ml/100m^3) • Total Groups (nos.) **Macro & Meio-Benthos** • Population (no./m^2) • Biomass (g/m^2) • Benthic groups (nos.) • Percentage composition **Microbiology** • Microbial count in water (CFU/ml)/ • Microbial count in sediment (CFU/g)	Field survey Sample collection from 3 different locations within study area	Once during survey period	Marine water sampling using clean bucket and Heron Tranter plankton net of 300 µm mesh size. Subtidal Sediment sampling by using van-Veen grab. Intertidal sediment sampling by using quadrates of 0.25m^2 area.	

3.4 Physical Environment

3.4.1 Physiography and Topography

Physiographic feature of the Mumbai sub urban district is broad and flat terrain flanked by north – south trending hill ranges. The hill ranges form almost parallel ridges in the eastern and western part of the area. The Powai – Kanheri hill ranges are the other hills extending in the eastern and central part running NNE – SSW. The maximum elevation of the area is 450 m above mean sea level (m amsl) at some of the peaks of hill ranges. Trombay island has north – south running hills with maximum elevation of 300 m above man sea level. Malbar, Colaba, Worli and Pali hills are the isolated small ridges trending north – south in the western part of the district. The Powai – Kanheri hills form the largest hilly terrain in the central part of the Salsette island and are the feeder zone for the three lakes viz., Powai, Vihar and Tulsi. There are a number of creeks, dissecting the area. Among them, Thane is the longest creek. The Vasai Creek to the north and Thane Creek to the east separates Salsette Island from the mainland. Within the city the Malad (or Marve) Creek and the Gorai (or Manori) Creek inundate the suburban region. The Mahim Creek forms the border between the two districts. The Manori, Malad and Mahim creeks which protrudes in the main land and give rise to mud flangs and swamps[1].

3.4.2 Geology

The entire district is underlain by basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow Alluvium formation of recent age also occurs as narrow stretch along the major rivers flowing in the area. The geology of the district can be classified as hard rock of Deccan trap basalt areas and loose formations of alluvium.

Hard Rock Areas

Deccan Trap Basalt

The 'Pahoehoe' flows in the district consist of highly vesicular layer having closely spaced horizontal joints but the thickness is generally less. The vesicles are generally filled with secondary minerals and green earths. In such cases, they do not serve as aquifer. However, such vesicular zones are weathered in most part of the area, thus, making them moderately permeable. But if, vesicles are not filled, they act as highly permeable aquifers.

Loose Formation

Alluvium

River Alluvium patches along the course of rivers and Marine Alluvium in the coastal area, form highly potential aquifer but with limited areal extent. The ground water occurs under water table conditions in sandy / gritty layers. The alluvial fill of low-lying areas underlain by weathered basalt has relatively better ground water potential.

3.4.3 Geomorphology

According to the various geomorphic features, the district has been divided into three geomorphic land units and categorized as: (1) denudational, (2) fluvial and (3) coastal landform. Residual Hills are formed due to the process of peneplanation that reduces original mountain masses into a series of scattered knolls standing on the peneplain. These hills are found in north of Gorai. Mudflats (also known as tidal flats), are covered by permanent and/or temporary salt water, and occur in the lowland area. Mudflats are mainly seen around Thane,

[1] Ground Water Information Report Greater Mumbai, CGWB 2013

Manori and Malad. Beaches are loose unconsolidated deposits made by marine action near the shore. Sandy beaches are seen along the western shore of Mumbai, the most noticeable ones being the Worli-Bandra, Juhu, Aksa, Gorai and Utan. At Madh, large patches of rocky exposures are seen[2].

3.4.4 Hydrogeology

The rivers Vaitarna, the Ulhas, which originate in Konkan region, and other rivers are the Patalganga and the Amba. Even though these rivers do not flow through Greater Mumbai but their basins form the major source of surface water for Greater Mumbai as a whole for its domestic and industrial consumption. The Mumbai Hydrometric Area (MHA) under Department of Irrigation, Government of Maharashtra, comprises these four river basins.

They have a total catchment area of 5756 Sq. Km. The total surface water potential of MHA is estimated to be 10439 million Cubic Meter (MCM) at 75% dependability and 7869 MCM at 90% dependability. Water supply to Mumbai city is dependent on six lakes viz Tulsi, Vihar, Tansa, Upper Vaiterna, Bhatsa and Mumbai III.

The occurrence and circulation of ground water is controlled by vesicular unit of lava flows and through secondary porosity and permeability developed due to weathering, jointing, fracturing etc., of Basalt. The ground water occurs under phreatic, semi confined and confined conditions. Generally, the phreatic aquifer range down to depth of 10 m bgl.

There are mainly two types of ground water structures i.e., dug wells and borewells in the area. The yields of the dug wells vary from 10 to 1000 m 3 /day, whereas that of borewells ranges between 50 and 1000 m 3 /day tapping the promising aquifer in the depth range of 40 to 60 m bgl.

To meet the shortfall in water supply, ground water supply as a supplementary source has been used for all purposes than domestic as it is not suitable for drinking. Total 3950 dug wells and 2514 bore wells (BMC records) are under operation for water supply purpose in the city.[3]

Water Level Trend (2001 – 2011)

Analysis of long-term water level trend data indicates rise of water levels in the range of 0.02 to 0.04 m/year during pre-monsoon and rise in the range of 0.02 to 0.05 m/year during post monsoon.

3.4.5 Drainage Pattern

Mumbai sub urban region is drained by Mahim, Mithi, Dahisar and Polsar rivers. These small rivers near the coast, form small rivulets which inter mingle with each other resulting in swamps and mud flats in the low-lying areas.[4] Major rivers flowing through the district are as follows.

Mithi River:

Mithi river is the main river in the Mumbai Suburban District. Mithi River originates in the Vihar Lake area, flows southwards and through the Bandra-Kurla Complex, and finally meets Arabian Sea at Mahim bay. For a large part of its southern course is influenced by tidal action. It has a total aerial length of 13.5 km and catchments area of 7295 hectares that covers parts of eastern and western suburbs. A 3.5 km stretch passes through the Bandra-Kurla Complex which

[2] Geomorphology and its implication in urban groundwater environment: case study from Mumbai, India 2014.

[3] Ground Water Information Report Greater Mumbai, CGWB 2013

[4] mumbaisuburban.gov.in

is planned and developed by the Mumbai Metropolitan Region Development Authority (MMRDA).

Dahisar River (Mandpeshwar):

Dahisar river is second main river in Mumbai suburban district. It originates from Tulsi Lake (Gundogan) which is in Sanjay Gandhi National Park, flows through Magathane, Kanheri, Dahisar, Mandpeshwar before meeting the Arabian sea via the Bhayandar creek.

Poisar River:

Poisar River originates in Sanjay Gandhi National Park and flows through Akurli, Poisar, Kandivali, Valanee, Malad and meets to Arabian Sea via Malad creek.

Oshiwara River:

Oshiwara river originates in Film City (Goregaon). Before meeting the Arabian Sea via the Malad Creek, two rivulets join the river, one rivulet flows from Santhosh Nagar and another from Oshiwara and meets the river near Araey Colony bridge.

3.4.6 Seismology[5]

Bureau of Indian Standards [IS-1893 – part – 1: 2002], based on various scientific inputs from a number of agencies including earthquake data supplied by IMD, has grouped the country into four seismic zones viz., Zone-II, -III, -IV and -V. Of these, zone V is rated as the most seismically prone region, while zone II is the least. The Modified Mercalli (MM) intensity, which measures the impact of the earthquakes on the surface of the earth, broadly associated with various zones, is shown in the **Table 3.2.**

Table 3.2: Seismic Zones and Intensity

Seismic Zone	Intensity on MMI scale	% of total area
II (Low intensity zone)	VI (or less)	43%
III (Moderate intensity zone)	VII	27%
IV (Severe intensity zone)	VIII	18%
V (Very severe intensity zone)	IX (and above)	12%

[5] BMTPC Vulnearability Atlas

The study area fall in Zone IV as per earthquake hazard map by building material and technology promotion council (BMTPC), this is moderate damage risk zone III. Seismic zone map is shown below in Figure 3.3.

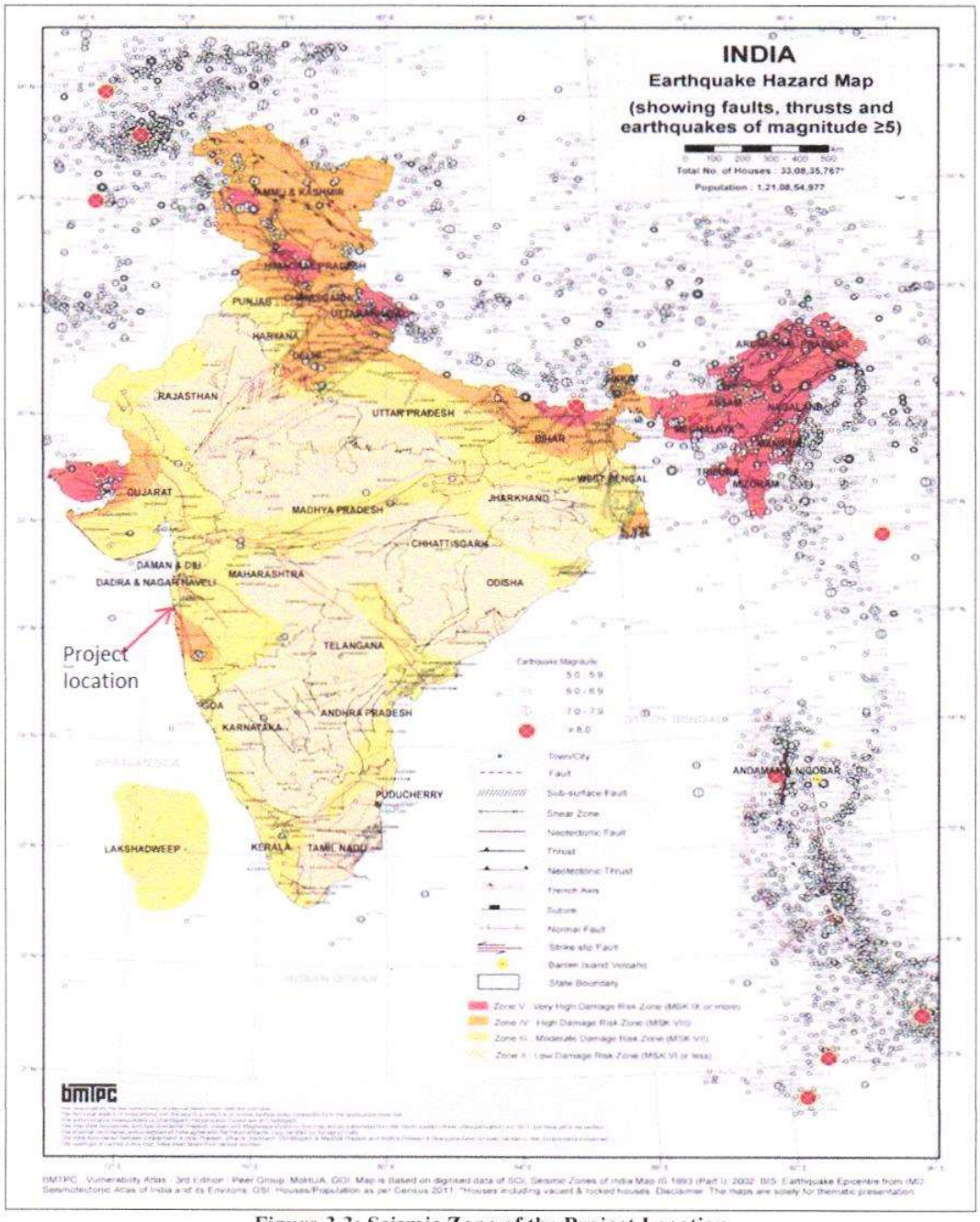


Figure 3.3: Seismic Zone of the Project Location

3.5 Land Use/ Land Cover

Land use/ land cover study was carried out using secondary data sourced from land reclamation studies carried out by NIO during 2015. According to this study about 39.41% of the land area

of Mumbai district is builtup land. Land use land cover distribution of Mumbai district is given in Table 3.3 and Figure 3.4.

Table 3.3: Distribution of Land use/ Landcover for Mumbai district (2015)[6]

S. No.	Class	Area of Class in sq. km for year 2015.	Percentage
1.	Aquatic Vegetation	0.68	0.08
2.	Barren land	76.45	9.42
3.	Built up land	319.75	39.41
4.	Cropland/Grassland	3.18	0.39
5.	Fallow Land	8.56	1.06
6.	Forest	65.29	8.05
7.	Mangrove	65.90	8.12
8.	Marshy Area	8.47	1.04
9.	Mudflats	13.74	1.69
10.	Other (Salt pans)	18.82	1.70
11.	Sandy area	1.31	2.32
12.	Vegetation	54.02	6.66
13.	Water Bodies	175.21	21.59
Total		**811.38**	**100**

[6] Study of Land Reclamation and its Influence on Mumbai's Coastline and Implications for Proposed Projects by NIO, Final report January 2016

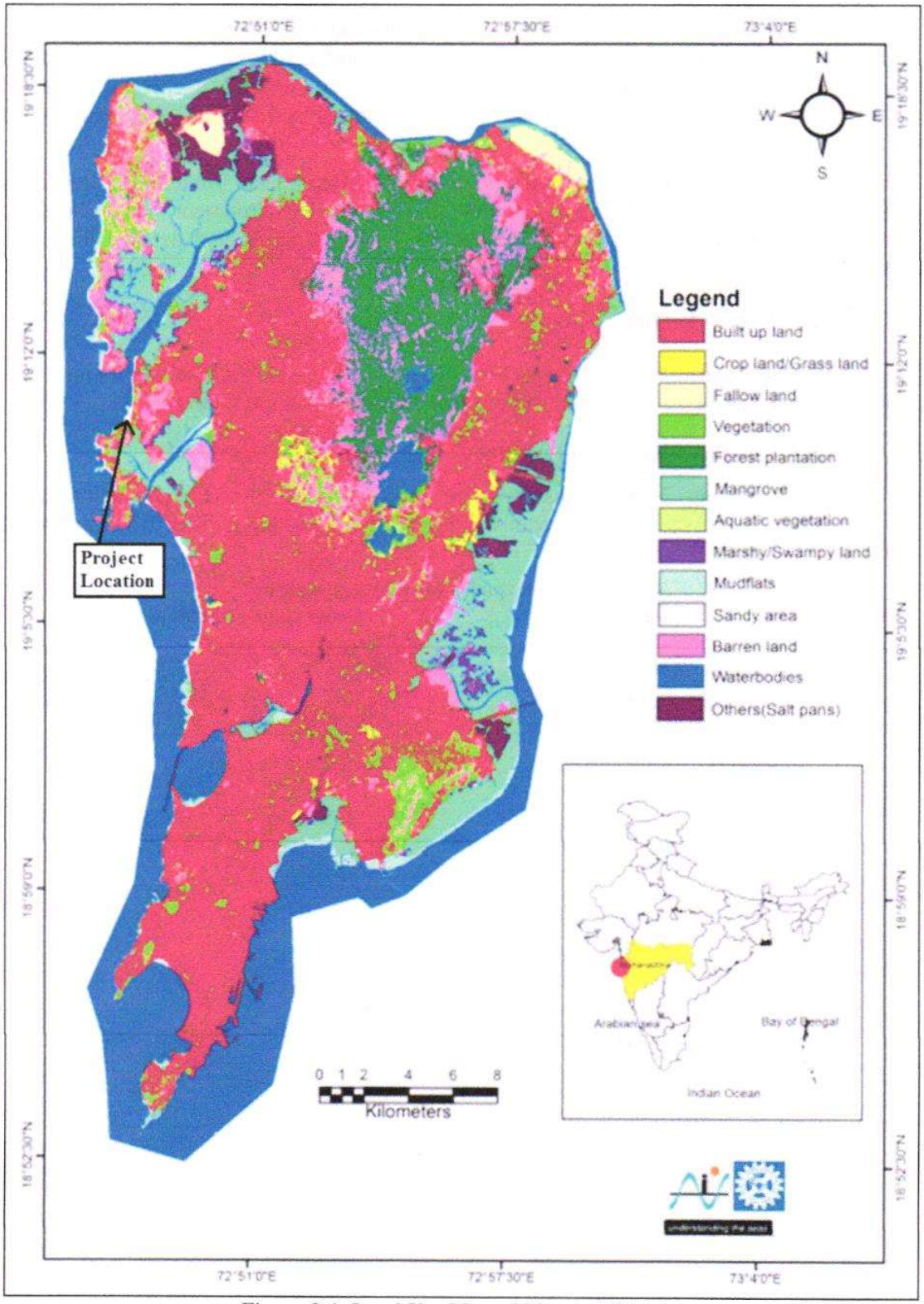


Figure 3.4: Land Use Map of Mumbai District

From the above figure it can be seen that project location lies in sandy area. Other land use classes falling within study area include barren land, waterbody, built up land and mangrove.

3.6 Soil Environment

Two types of soils have been observed in Mumbai district viz., medium to deep black and reddish soil. It is observed that at a depth of 2.6m loose brown silty sand along with gravel is found. At 4.25 m brown plastic clay along with sand is found. Further in deeper layers the soil is dense brown and silty sand. At a dept of more than 5m the soil is brown, medium grained and party decomposed volcanic breccia[7].

The proposed project involves sea front development at Aksa beach. Therefore no impact is anticipated on terrestrial soil. Hence baseline study for soil environment is not conduted. However, baseline study for marine sediment has been carried out and detailed in further section.

3.7 Marine Water Quality

The marine water quality monitoring has been carried out to assess the existing marine water quality and evaluate significance of the impact from proposed sea front development.

3.7.1 Water Quality Monitoring Locations

Three locations within 2 km radius from the project location have been identified for monitoring the marine water quality. Details of the monitoring locations given in **Table 3.4** and represented in **Figure 3.5.**

Table 3.4: Water Quality Monitoring Locations

Location Code	Sampling Location	Geographic Coordinates	
MW1	Near Dana Pani Beach	19°10'13.07"N	72°47'7.67"E
MW2	Near project location	19°10'38.79"N	72°47'18.91"E
MW3	Near INS Hamla	19°11'18.38"N	72°47'35.09"E

[7] Seismic Liquefaction Hazard and Site Response for Design of Piles in Mumbai City 2014.

Figure 3.5: Marine Water Monitoring Location Map

3.7.2 Water Quality Results

Marine water quality samples were analysed for various quality parameters. Result of analysis is given in **Table 3.5.**

Table 3.5: Marine Water Quality Result

S. No.	Description	Unit	Result			CPCB Standard for Class SW-V(Navigation and Controlled Waste Disposal)
			MW1	MW2	MW3	
1.	Temperature	°C	29.0	29.3	28.9s	-
2.	pH	--	7.43	7.5	7.38	6.0-9.0
3.	Salinity	ppt	31.3	30.9	31.4	-
4.	Dissolved Oxygen	mg/lit	5.2	5.1	5.4	3.0
5.	BOD	mg/lit	48	42	44	-
6.	Ammonical Nitrogen	µmol/l	0.3	0.5	0.4	-
7.	Phosphate	µg/l	1.2	0.9	1.3	-
8.	Total Phosphorous	µg/l	0.5	0.42	0.54	-
9.	Total Nitrogen	µmol/l	9.8	8.7	8.5	-
10.	Zinc	µg/l	4.22	3.46	3.21	-
11.	Cadmium	µg/l	0.14	0.08	0.07	-
12.	Lead	µg/l	0.06	0.10	0.09	-
13.	Mercury	µg/l	0.1	0.09	0.84	-
14.	Copper	µg/l	< 0.01	< 0.01	< 0.01	-
15.	Nickel	µg/l	0.5	0.42	0.6	-
16.	Oil and Grease	µg/l	2.2	1.6	2.1	-
17.	Electrical conductivity	µS/cm	24.5	24.6	25.4	-
18.	PHc	µg/g	1.8	2.1	1.9	-

Inference

Marine water sampled from project location and open sea indicates slightly basic pH. Phosphate and nitrogen levels in water samples can be attributed to waste streams draining into Gorai creek from surrounding residential areas which further drains into Arabian sea off Aksa beach. Traces of heavy metal and oil & grease in water samples can be attributed to pollution load from Gorai creek.

3.8 Marine Sediment Quality

Sediment quality plays an important role in aquatic environment as its physicochemical and biological state represents health of the ecosystem as a whole. Proposed project activity may have impact on sediment quality during its construction as well as operation phase. Baseline study is carried out to assess the existing marine sediment quality near project and its surrounding region and to evaluate siginificance of the impact on sediment quality.

3.8.1 Marine Sediment Quality Monitoring Locations

Three locations have been identified within 2 km radius from the project site for monitoring the marine sediment quality. Details of the sediment quality monitoring locations are given in **Table 3.6** and represented in **Figure 3.6.**

Table 3.6: Marine Sediment Quality Monitoirng Location

Location Code	Sampling Location	Location GPS Coordinates	
MS1	Near Dana Pani Beach	19°10'13.07"N	72°47'7.67"E
MS2	Near project location	19°10'38.79"N	72°47'18.91"E
MS3	Near INS Hamla	19°11'18.38"N	72°47'35.09"E

Figure 3.6: Marine Sediment Quality Monitoring Location

3.8.2 Sediment Quality Results

Marine sediment quality samples were analysed for various qualitative parameters. Result of analysis is given in **Table 3.7.**

Table 3.7: Marine Sediment Analysis Result

S. No.	Parameters	Unit	Result		
			MS1	MS2	MS3
1.	Particle Size distribution	-			
	Sand	%	74.1	79.5	81.6
	Silt	%	15.7	12.5	8.1
	Clay	%	10.2	8.0	10.3
2.	Texture	-	Sandy loam	Sandy loam	Sandy loam
3.	pH	-	7.5	7.6	7.48
4.	Aluminum (Al)	%	5.69	6.21	6.25
5.	Chromium (Cr)	µg/g	189	201	187
6.	Manganese (Mn)	µg/g	1105	1156	1099
7.	Iron (Fe)	%	9.8	9.7	8.9
8.	Cobalt (Co)	µg/g	35	31	23
9.	Nickel (Ni)	µg/g	65	57	54
10.	Copper (Cu)	µg/g	92	65	81
11.	Zinc (Zn)	µg/g	169	148	175
12.	Cadmium (Cd)	µg/g	0.17	0.19	0.11
13.	Mercury (Hg)	µg/g	0.12	0.08	0.15
14.	Lead (Pb)	µg/g	10.8	11.07	10.5
15.	C_{org}	%	1.9	1.3	1.3
16.	Phosphorous (P)	µg/g	312	349	331
17.	PHc	µg/g	1.8	1.9	1.84

Inference

The project location being a sandy beach the sediment sample indicated sandy loam texture. Traces of heavy metals in sediment can be attributed to pollution load draining into Arabian sea from Gorai creek. Presence of petroleum hydrocarbon in traces may be due to fuel or oil leakages from ferry boats near mouth of Gorai creek.

3.9 Ambient Noise

3.9.1 Equivalent Continuous Sound Levels

Though there are a huge number of indices in use worldwide, use of equivalent continuous level (Leq) is the best noise index. The Leq is an 'A' weighted average measure of sound pressure levels over a given period. It is a logarithmic variable and, therefore, not linearly additive. Moreover, all noise prediction models give Leq value. This is because; Leq is independent of the statistics of the source contribution. The Leq can be calculated based on equation as given below;

$$L_{eq} = 10 \log\left(\sum_{i=1}^{n} fi\sqrt{10^{LpAi\ /10}}\right)^2$$

Where LpAi is the dBA level and fi is the ith fraction of time that LpAi is in progress. Hourly Leq values for study period during daytime and night-time were computed from combination

of data from similar land-use in and around the project site. Leq values recorded for various stations in study area during daytime (0600 Hrs and 2200 Hrs) and night-time (2200 Hrs and 0600 Hrs) at differing land-use in and around project site.

3.9.2 Noise level Monitoring Locations

Three locations within 2 km radius of the project site have been identified for monitoring the noise levels. Details of the noise level monitoring locations given below in **Table 3.8** and represented in **Figure 3.7.**

Table 3.8: Noise Level Monitoring Locations

Sr No.	Location code	Monitoring location	Latitude	Longitude
1	NQ1	Project location	19°10'32.45"N	72°47'44.79"E
2	NQ2	Near beach resort	19°10'29.34"N	72°47'45.54"E
3	NQ3	Near Sai Vidya mandir	19°10'35.38"N	72°47'55.10"E

Figure 3.7: Noise Level Monitoring Location Map

3.9.3 Noise Level Monitoring Results

Noise level monitoring results for various location in the project surrounding region are given below in **Table 3.9.**

Table 3.9: Noise level monitoring results

Station Code	Location	Leq in dB(A)	
		Day	Night
NQ1	Project location	58.2	49.8
NQ2	Near beach resort	61.4	52.7
NQ3	Near Sai Vidya mandir	49.2	38.4

The noise monitoring results are compared to the Ambient Noise Level Standards for commercial area for NQ1 and NQ2 locations and silence zone for NQ3 location as specified by CPCB in their Noise Rules 2000. Details of the Ambient Noise Level Standards by CPCB are mentioned below in **Table 3.10.**

Table 3.10: CPCB Standards for Ambient Noise Levels

Category of Area	Limits in dB (A) Leq	
	Day Time (6 am – 10 pm)	Night Time (10 pm – 6 am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

Inference

Noise level monitoring results indicated higher noise levels near beach areas as compared to near school. Higher values of noise could be due to noisy activities on beach, nearby road traffic etc. However at all the locations monitored noise levels were found to be within CPCB specified standards.

3.10 Air Quality

Ambient air quality monitoring is carried out for the proposed sea front development at Aksa beach. It involves construction of anti sea erosion bund and other recreational facilities. These activities may have impact on ambient air quality of the project surrounding area. Hence baseline status of the ambient air quality is monitored.

3.10.1 Meteorology

Secondary annual meteorological data of Mumbai region was acquired from met data processing consultancy, Envitrans Pvt Ltd. for April 2019-March 2020. The meteorological records include hourly data for wind speed, wind direction, temperature, relative humidity, rainfall and cloud cover.

3.10.1.1 Rainfall

The annual maximum rainfall was observed as 22.57 mm/hr at Geographical location Mumbai.

3.10.1.2 Temperature

The annual average temperature at Mumbai for April 2019- March 2020 was found to be 25.19°C. The maximum annual temperature is found to be 35.9°C in the month of May whereas, minimum temperature recorded as 9.1°C.

3.10.1.3 Humidity

The minimum, Maximum & Average annual relative humidity for Mumbai geographical location was observed as 13%, 100% & 68.88% respectively. It is observed that the air is humid throughout the year in the study region excluding few months of winter.

3.10.1.4 Cloud Cover

The study area has recorded the cloud cover to be 0 to 10 Oktas, which represents clear sky to overcast for annual period. (0 Oktas - Clear Sky; 1-2 Oktas - Fine Sky; 3-5 Oktas- Partly Cloudy Sky; 6-7 Oktas- Cloudy Sky; 8 Oktas – Overcast).

3.10.1.5 Wind Direction and Wind Speed

Wind direction and wind speed study was carried out based on earlier studies carried out for Mumbai region during April 2019 to March 2020. The annual maximum wind speed was observed to be 14.27 m/s. The predominant wind direction is from WSW. The annual windrose diagram is shown below in Figure 3.8.

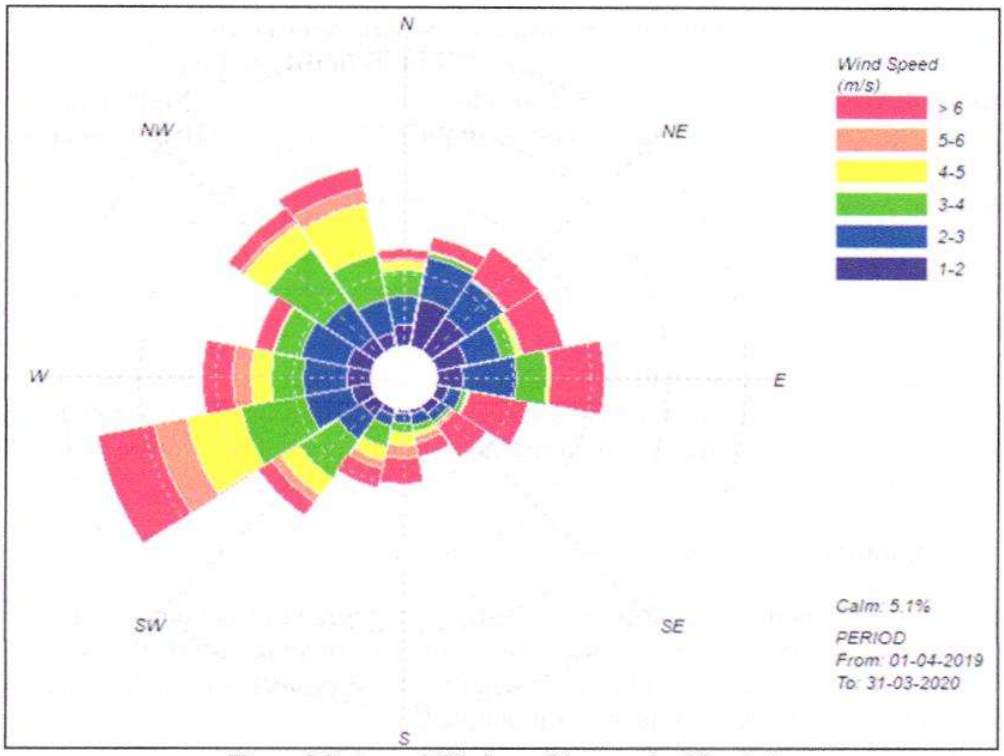


Figure 3.8: Annual Windrose Diagram for Mumbai

3.10.2 Ambient Air Quality Monitoring Locations

Three locations have been identified for monitoring the ambient air quality within 2 km radius from the project location. Details of the ambient air quality monitoring locations are given below in **Table 3.11** and location map is shown in **Figure 3.9.**

Table 3.11: Ambient Air Quality Monitoring Locations

Sr No	Location Code	Location Name	Geographic Coordinates		Direction
			Latitude	Longitude	
1	AQ1	Near Madh Marve Road	19°10'7.93"N	72°47'32.76"E	Upwind
2	AQ2	Project location	19°10'32.75"N	72°47'45.67"E	Cross wind

Sr No	Location Code	Location Name	Geographic Coordinates		Direction
			Latitude	Longitude	
3	AQ3	Ambojwadi	19°10'33.78"N	72°48'40.23"E	Down wind

Figure 3.9: Air Quality Monitoring Location Map

3.10.3 Ambient Air Quality Result

Ambient air quality analysis carried out at three location within study area are given below in Table 3.12.

Table 3.12: Ambient Air Quality Results

Location Code		Ambient Air Quality				
		$PM_{2.5}$	PM_{10}	SO_2	NO_2	CO
NAAQM standards		60 (µg/m³)	100 (µg/m³)	80 (µg/m³)	80 (µg/m³)	2 (mg/m³)
AQ1	Minimum	16.2	20.1	7.2	10.4	0.02
	Maximum	25.5	32.7	17.4	18.3	0.4
	Average	20.96	26.98	12.27	14.39	0.18
	98%tile	25.5	32.64	17.04	18.24	0.4
AQ2	Minimum	17.4	23.2	9	11.1	0.01
	Maximum	27.4	35.3	19.7	20	0.5
	Average	23.59	30.15	13.25	15.24	0.23
	98%tile	27.22	35.24	18.92	19.82	0.5
AQ3	Minimum	22.2	30	11.8	15.7	0.1
	Maximum	40	50.8	18.6	23.7	0.4
	Average	32.36	38.92	14.61	19.05	0.23
	98%tile	39.952	50.56	18.3	23.1	0.4

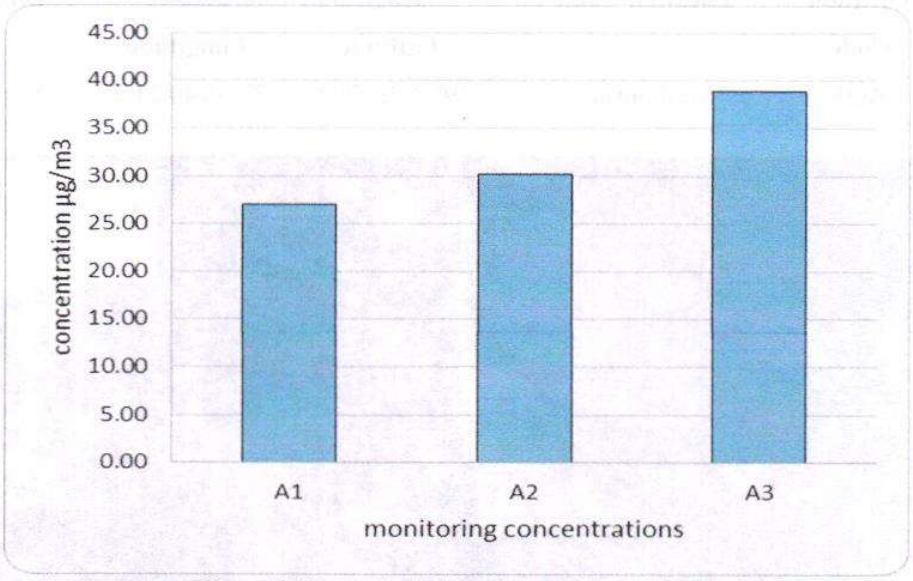


Figure 3.10: Average Concentration of PM10

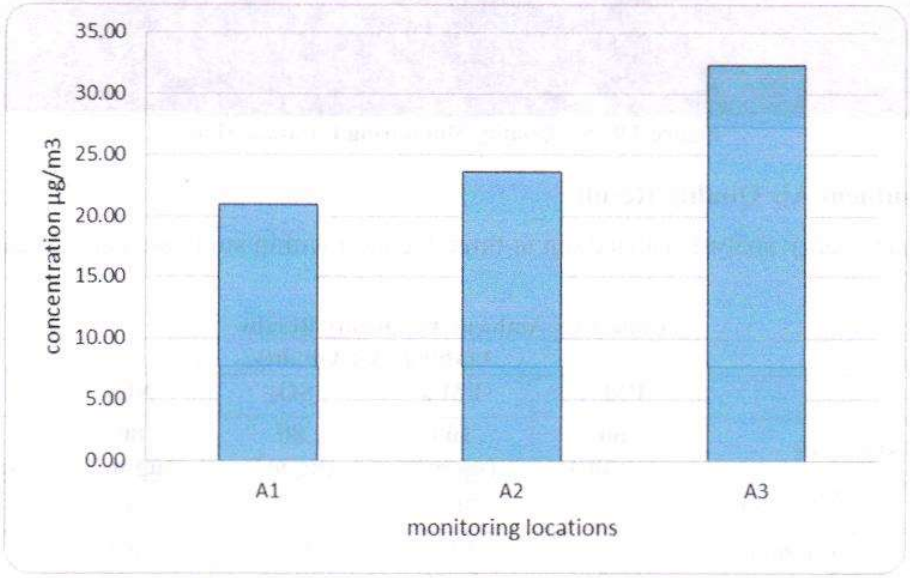


Figure 3.11: Average Concentration of PM2.5

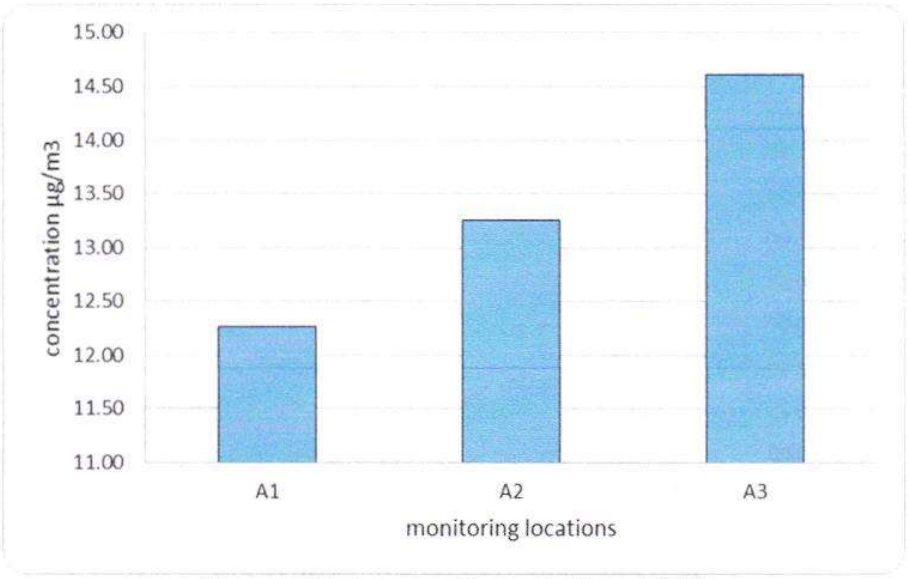


Figure 3.12: Average Concentration of SO2

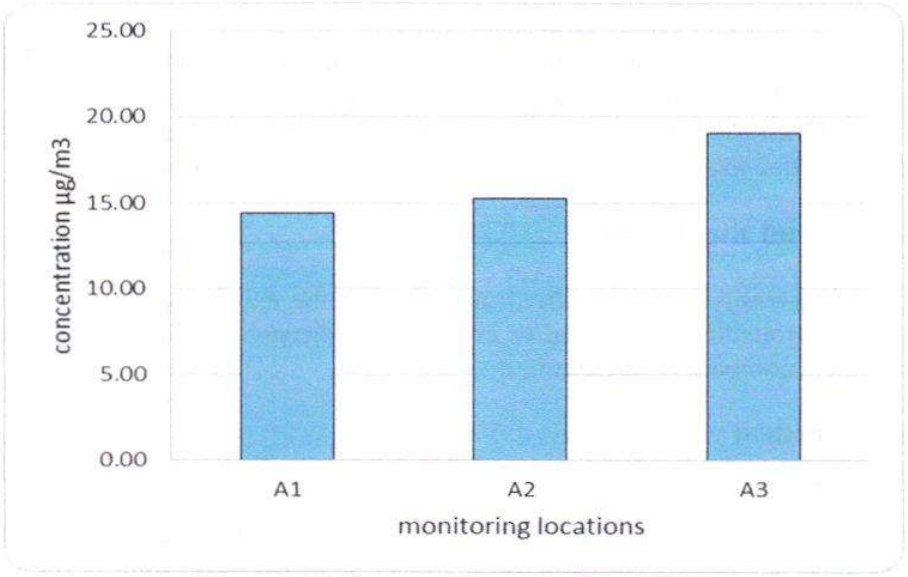


Figure 3.13: Average Concentration of NO2

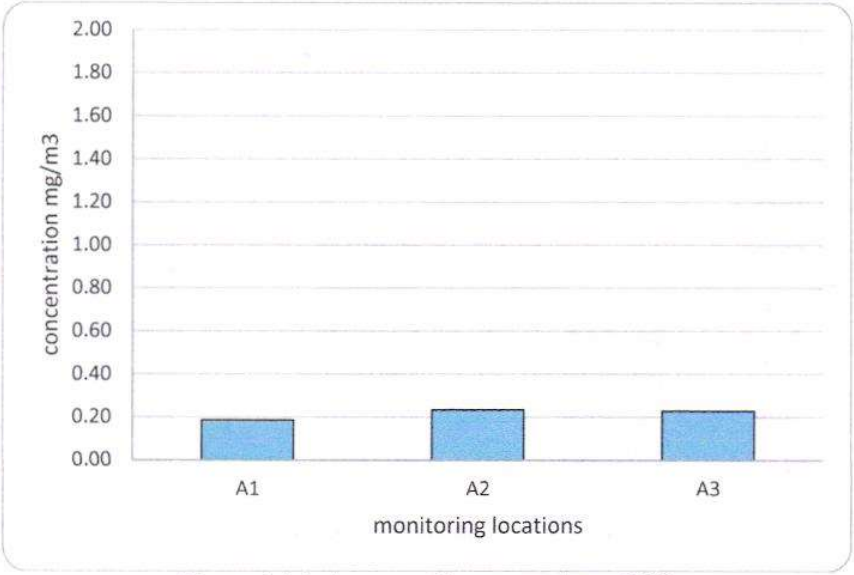


Figure 3.14: Average Concentration of CO

Inference

Based on ambient air quality monitoring carried out within study area it is observed that average concentrations of all air quality parameters were within national ambient air quality standards specified by CPCB. Low concentrations of pollutants are observed near project site which is beach. It could be due to absence of or less activities leading to gaseous emissions.

3.11 Ecology and Biodiversity

Ecology and biodiversity study is carried out to assess the existing ecological status of the project and its surrounding region and to evaluate significance of the impacts perceived by various ecological components present in it.

3.11.1 Survey method

3.11.1.1 Desk study

Desk study involved superimposition of the project layout on google earth imagery and demarcation of study area. The proposed project involves sea front development and beautification at Aksa beach. Considering nature, duration and extent of project activities the primary study area was defined within 2 km radius and secondary study area was defined within 10 km radius distance from project location. Google earth imagery for the study area was examined for various physiographical features such as waterbodies, vegetation patches, as well as villages, agricultural lands, low lying areas etc. About 40% of primary study area was composed of water body (sea), other areas were covered by beach, vegetation, residential settlements, barren land etc.

3.11.1.2 Field survey

3.11.1.2.1 Floral survey

Both terrestrial and aquatic survey was carried out to study flora within study area. Terrestrial floral observations were made near mangrove vegetation, along beach and other vegetation patched within study area. Sparse mangrove vegetation was observed on South wets of the project where a small branch of Malad creek drains into sea at south of the project. Observed

floral species were recorded as a checklist during survey. Aquatic flora was studied by collecting marine water samples followed by analysis in lab.

3.11.1.2.2 Faunal survey

Faunal survey included both terrestrial and aquatic fauna observations. Survey was conducted near proposed project location, vegetation along beach, plantations near villages and barren lands. Terrestrial faunal survey included reptiles, amphibians, mammals, birds, insects and arachnids. Aquatic faunal study included monitoring of microbial fauna, zooplankton, benthic fauna and fish species.

Amphibians and Reptiles: Spotting of amphibian fauna is done in specific habitats such as under the tree logs and stones, observing short bushes and tree hollows, water logged areas and under fallen barks. Reptile species were recorded by visual encounter.

Insects: Insects were identified by direct spotting and unidentified insects were photographed and identified using insect guide. Ponds and shallow water accumulated regions were observed for insects such as dragonflies. Butterfly food plants were closely observed for presence of eggs or larvae.

Mammals: The study covered vegetation near villages and barren lands. The study area does not show any dense forest area. Therefore sighting of common mammals was anticipated. Hence mammal species were recorded by opportunistic sighting method during survey.

Avifauna: Birds were surveyed by point count method and also opportunistic sightings during survey. Various secondary sources of information were used to study occurrence of avifauna within study area.

Marine water and sediment samples were collected from three locations for monitoring aquatic flora including phytoplankton and fauna including zooplankton, benthic invertebrates. Details of monitoring locations are given below in **Table 3.13** and shown in Figure 3.15.

Table 3.13: Marine Biology Monitoring Locations

Location code	Location	Geographic Coordinates	
MW1	Near Dana Pani Beach	19°10'13.07"N	72°47'7.67"E
MW2	Near project location	19°10'38.79"N	72°47'18.91"E
MW3	Near INS Hamla	19°11'18.38"N	72°47'35.09"E

Figure 3.15: Marine Biology Sampling Locations

3.11.2 Survey Observations

3.11.2.1 Flora

3.11.2.1.1 Terrestrial flora

Vegetation within study area was observed along Aksa and Dana Pani beach, near residential settelments and marshy lands near Malad creek channel. Vegetation near Aksa beach was mainly composed of coconut and Toddy palms. Other vegetation within study area included commonly occurring trees such as casurina, copper pod, rain tree etc.

As per the status of Forest Report, Forest Survey of India, mangroves of Maharashtra are spread for about 304 sq.km in the 6 coastal districts namely Mumbai City and Sub-urban, Raigad, Ratnagiri, Sindhudurg, Thane and Palghar. The total mangrove cover of the Mumbai Sub urban districts is reported to be 14.5%[8].

Mangrove vegetation within study area was observed on Southwest of the project at marshy lands which was represented by *Avicennia marina, Avicennia officinalis, Excoecaria agallocha* and *Sonneratia apetala*. Checklist of tree species, mangrove and mangrove associate species observed within study area are given below in **Table 3.14** and **Table 3.15.**

Table 3.14: Checklist of Trees Observed Within Study Area

Sr. No	Common Name	Botanical Name	Family	Habit
1.	Bamboo	Bambusa sp.	Poaceae	Grass
2.	Banyan tree	Ficus benghalensis	Moraceae	Tree
3.	Blackboard tree	Alstonia scholoris	Apocynaceae	Tree
4.	casurina	casurina equisetifolia	Casuarinaceae	Tree
5.	Coconut tree	Cocos nucifera	Arecaceae	Tree

[8] Annual Report of the project 'monitoring the health of mangroves of maharashtra state using near real time satellite remote sensing data' by indian institute of space science and technology, Thiruvananthapuram

Sr. No	Common Name	Botanical Name	Family	Habit
6.	Copper pod	Peltophorum pterocarpum	Caesalpiniaceae	Tree
7.	Coral tree	Erythrena stricta	Fabaceae	Tree
8.	Jambhul	Syzygium cumini	Myrtaceae	Tree
9.	Mango	Mangifera indica	Anacardiaceae	Tree
10.	Neem	Azadirachta indica	Meliaceae	Tree
11.	Rain tree	Albizia saman	Mimosaceae	Tree
12.	Red silk cotton	Bombex Ceiba	Malvaceae	Tree
13.	Sacred fig	Ficus religiosa	Moraceae	Tree
14.	Shirish tree	Albizia lebbeck	Fabaceae	Tree
15.	Toddy palm	Borassus flabellifer	Arecaceae	Tree

Table 3.15: Mangrove and Mangrove Associate Species

S. No.	Common Name	Scientific Name
True Mangroves		
1.	Gray Mangrove	*Avicennia marina*
2.	Chipee	*Sonneratia apetala*
3.	Milk Mangrove	*Excoecaria agallocha*
4.	Indian Mangrove	*Avicennia officinalis*
Mangrove Associates		
1.	Meswak	*Salvadora persica*
2.	Sesban	*Sesbania grandiflora*
3.	Subabul	*Leucaena leucocephala*

3.11.2.1.2 Phytoplankton

Phytoplankton species were observed from water samples collected near Aksa beach. Total 18 genera of phytoplankton were identified during study. Higher percentage compositon was represented by *Skeletonema, Nitzschia, Navicula* and *Thalassiosira*. Cell count and major genera observed are given below in **Table 3.16.** Percentage composition of the species at each sampled location is given in **Table 3.17.**

Table 3.16: Phytoplankton Cell Count

Station	Cell Count (nos× 10^3cells/l)	Total Genera	Major Genera
MB1	3.6	14	*Biddulphia, Coscinodiscus, Nitzschia, Pleurosigma, Navicula, Navicula Cyclotella, Odontella, Skeletonema, Rhizosolenia, Diploneis, Fragilaria, Thalassiosira, Ceratium*
MB2	4.2	10	*Chaetoceros, Coscinodiscus, Cylindrotheca, Navicula, Ceratium, Cyclotella, Odontella, Pleurosigma, Thalassiosira, Gymnodium*
MB3	4.5	11	*Navicula, Thalassiosira, Ceratium, Nitzschia, Chaetoceros, Diploneis, Fragilaria, Rhizosolenia, Gymnodium Peridinium, Oscillatoria*

Table 3.17: Percentage Composition of Phytoplankton Population

S. No.	Name of the genera	MB1	MB2	MB3	Avg
1.	*Biddulphia*	0.5	1.1	0.6	0.73
2.	*Ceratium*	0.6	-	-	0.60
3.	*Chaetoceros*	1.3	-	-	1.30
4.	*Coscinodiscus*	-	-	1.8	1.80
5.	*Cyclotella*	3.2	10.3	1.9	5.13
6.	*Cylindrotheca*	2.6	-	-	2.60
7.	*Diploneis*	0.6	12.4	1.1	4.70
8.	*Fragilaria*	0.7	3.1	-	1.90
9.	*Gymnodium*	-	-	1.9	1.90
10.	*Navicula*	12.6	22.4	23.4	19.47
11.	*Nitzschia*	18.9	16.2	15.9	17.00
12.	*Odontella*	6.4	3.1	-	4.75
13.	*Oscillatoria*	-	-	1.1	1.10
14.	*Peridinium*	-	-	0.8	0.80
15.	*Pleurosigma*	7.1	4.7	-	5.90
16.	*Rhizosolenia*	5.2	-	-	5.20
17.	*Skeletonema*	21.6	10.3	28.6	20.17
18.	*Thalassiosira*	18.7	16.4	22.9	19.33
	Total	**100**	**100**	**100**	**100**

3.11.2.2 Fauna

3.11.2.2.1 Avifauna

Avifauna observed near proposed project location represented commonly occurring marine bird species. Some of the terrestrial birds also were observed during survey near barren lands and vegetation near residential places. Checklist of bird species observed during survey is given below in **Table 3.18.**

Table 3.18: Avifauna Species Observed During Survey

Sr. No.	Common Name	Scientific Name	Order	Family	WP Schedule	IUCN
1	Asian Koel	*Eudynamys scolopaceus*	Cuculiformes	Cuculidae	IV	LC
2	Asian Pied Starling	*Gracupica contra*	Passeriformes	Sturnidae	IV	LC
3	Black Drongo	*Dicrurus macrocercus*	Passeriformes	Dicruridae	IV	LC
4	Black-headed Gull	*Chroicocephalus ridibundus*	Charadriiformes	Laridae	IV	LC
5	Brahminy Starling	*Sturnia pagodarum*	Passeriformes	Sturnidae	-	LC
6	Cattle Egret	*Bubulcus ibis*	Pelecaniformes	Ardeidae	IV	LC
7	Common Myna	*Acridotheres tristis*	Passeriformes	Sturnidae	IV	LC
8	Common sandpiper	*Actitis hypoleucos*	Charadriiformes	Scolopacidae	IV	LC
9	Grey Heron	*Ardea cinerea*	Pelecaniformes	Ardeidae	IV	LC
10	Great Egret	*Ardea alba*	Pelecaniformes	Ardeidae	IV	LC
11	House Sparrow	*Passer domesticus*	Passeriformes	Passeridae	IV	LC
12	Indian Pond-Heron	*Ardeola grayii*	Pelecaniformes	Ardeidae	IV	LC
13	Indian Robin	*Copsychus fulicatus*	Passeriformes	Muscicapidae	IV	LC
14	Laughing Dove	*Streptopelia senegalensis*	Columbiformes	Columbidae	IV	LC
15	Little Cormorant	*Microcarbo niger*	Suliformes	Phalacrocoracidae	IV	LC
16	Little Egret	*Egretta garzetta*	Pelecaniformes	Ardeidae	IV	LC
17	Little stint	*Calidris minuta*	Charadriiformes	Scolopacidae	IV	LC
18	Marsh Sandpiper	*Tringa stagnatilis*	Charadriiformes	Scolopacidae	IV	LC
19	Oriental Magpie-Robin	*Copsychus saularis*	Passeriformes	Muscicapidae	IV	LC
20	Pied Kingfisher	*Ceryle rudis*	Coraciiformes	Alcedinidae	-	LC
21	Plain Prinia	*Prinia inornata*	Passeriformes	Cisticolidae	-	LC
22	Purple Heron	*Ardea purpurea*	Pelecaniformes	Ardeidae	IV	LC
23	Red-vented Bulbul	*Pycnonotus cafer*	Passeriformes	Pycnonotidae	IV	LC
24	Red-wattled Lapwing	*Vanellus indicus*	Charadriiformes	Charadriidae	-	LC
25	Red-whiskered Bulbul	*Pycnonotus jocosus*	Passeriformes	Pycnonotidae	IV	LC

Sr. No.	Common Name	Scientific Name	Order	Family	WP Schedule	IUCN
26	Shikra	*Accipiter badius*	Accipitriformes	Accipitridae	-	LC
27	Western reef egret	*Egretta gularis*	Pelecaniformes	Ardeidae	IV	LC
28	Whiskered tern	*Chlidonias hybridus*	Charadriiformes	Laridae	-	LC

3.11.2.2.2 Mammals

The project being located near beach and there is no forest area present in the surrounding no large mammal species were observed within study area. In the project surrounding areas including barren lands and vegetation around residential areas mammal such as Indian flying fox and three stripped palm squirrel were commonly observed.

3.11.2.2.3 Reptiles and Amphibians

The project being located near beach and there is no forest area present in the surrounding commonly occurring species of reptiles were observed. During survey garden lizard, common skink and common rat snake were the only species of reptiles observed. No amphibian species were observed during survey.

3.11.2.2.4 Arthropoda and Insects

Arthopods and insects observed within study area are given below in **Table 3.19.**

Table 3.19: Arthropods and Insects

Sr No.	Common Name	Scientific Name	Order	Family
Butterflies				
1.	Common castor	*Ariadne merione*	Lepidoptera	Nymphalidae
2.	Common Crow	*Euploea core*	Lepidoptera	Nymphalidae
3.	Common emigrant	*Catopsilia pomona*	Lepidoptera	Pieridae
4.	Common mormon	*Papilio polytes*	Lepidoptera	Nymphalidae
5.	Peacock Pansy	*Junonia almana*	Lepidoptera	Nymphalidae
6.	Plain Tiger	*Danaus chrysippus*	Lepidoptera	Nymphalidae
7.	Psych	*Leptosia nina*	Lepidoptera	Nymphalidae
8.	Small Salmon Arab	*Colotis amata*	Lepidoptera	Pieridae
Odonata				
1.	Ground Skimmer	*Diplacodes trivialis*	Odonata	Libellulidae
2.	Wandering glider	*Pantala flavescens*	Odonata	Libellulidae
Arthropods				
1	Signature spider	*Argiope pulchella*	Araneae	Araneidae
2	Jumping spider	*Icius sp*	Araneae	Salticidae
Other Insect				
1.	Carpenter bee	*Xylocopa sp.*	Hymenopterans	Apidae
2.	Paper Wasp	*Vespidae*	Hymenoptera	Vespidae
3.	Red cotton bug	*Dysdercus cingulatus*	Hemiptera	Pyrrhocoridae

3.11.2.2.5 Microbiology

Microbiology study was conducted from marine water and sediment samples. Microbial count was analysed for bacteria such as Total coliform(TC), Faecal coliform(FC), *Escherichia coli* like organism (ECLO), *Proteus klebsiella* like organism(PKLO), *Vibrio* like organism(VLO), *Vibrio parahaemolyticus* like organism(VPLO) and *Vibrio cholerae* like organism (VCLO). High viable count was observed from samples collected near INS Hamla. Microbial presence in water can be attributed to tourist activity associated pollution near beach as well pollution load draining into Gorai creek from surrounding residential areas. Microbial count anlysed from marine water samples and marine sediment samples is given in below Table 3.20 and Table 3.21 respectively.

Table 3.20: Microbial Count in Marine Water (CFU/ml)

Type of Bacteria	MB1	MB2	MB3
TVC	102×10^3	110×10^3	189×10^3
TC	20	40	40
FC	20	10	30
ECLO	50	ND	20
PKLO	140	140	180
VPLO	120	130	210
VLO	100	50	110
VCLO	110	80	130

Table 3.21: Microbial Count in Marine Sediment (CFU/g)

Type of Bacteria	MB1	MB2	MB3
TVC	140×10^3	130×10^3	170×10^3
TC	20	20	10
FC	20	10	40
ECLO	10	40	30
VPLO	150	160	160
VLO	20	20	ND
VCLO	270	150	180

3.11.2.2.6 Zooplankton

Zooplankton groups identified from marine water samples showed copepods and decapod larvae to be common at all sampling locations. Zooplankton species were identified from marine water samples collected within study area. Details of zooplankton groups are given below in **Table 3.22.**

Table 3.22: Biomass, population and groups of zooplankton

Sr. No.	Location code	Biomass ($ml/100m^3$)	Population ($nox10^3/100m^3$)	Total groups (Nos.)	Groups
1	MB1	1.5	6.4	10	Copepods Decapod larvae Fish larvae Chaetognaths Ctenophores Amphipods Polychaetes Isopods Sergestids Fish eggs

Sr. No.	Location code	Biomass (ml/100m^3)	Population (nox10^3/100m^3)	Total groups (Nos.)	Groups
2	MB2	2.2	4.9	13	Copepod Amphipods Cladocerans Decapod larvae Fish larvae Foraminiferans Gastropods bivalves Ostracods Cnidaria Lucifer larvae Medusae Polychaetes
3	MB3	1.7	7.4	11	Copepods Decapod larvae Fish larvae Chaetognaths Medusae Gastropods Lamellibranchs Amphipods Isopods Fish eggs Appendicularians

3.11.2.2.7 Subtidal Macro- Benthos

Macrobenthos study shows higher biomass and population of benthic fauna near INS Hamla which could be due to more nutrient flushing from Gorai creek where it drains into sea. Higher percentage composition was represented by polychaetes followed by amphipods. Macrobenthic species identified from sediment and its percentage composition are given below in **Table 3.23** and **Table 3.24.**

Table 3.23: Biomass, Population and Groups of Subtidal Macrobenthos

Sr. No.	Location code	Biomass (g/m^2; wet weight)	Population (Ind./m^2)	Total groups (Nos.)
1	MB1	120.08	354	8
2	MB2	72.6	306	11
3	MB3	21.4	521	12

Table 3.24: Percentage Composition of Macrobenthos

Sr. No.	Groups	Location			Average
		MB1	MB2	MB3	
1.	Polychaeta	39.7	46.8	72.6	53.03
2.	Amphipoda	32.6	22.4	13.4	22.80
3.	Cumacea	13.4	6.1	2.1	7.20
4.	Tanaidacea	2.6	3.6	3.4	3.20

5.	Isopoda	3.5	11.2	2	5.57
6.	Copepoda	-	1.3	0.8	1.05
7.	Brachyura	4.8	6.7	1.8	4.43
8.	Decapoda Larvae	0.4	0.6	1.2	0.73
9.	Anomura	-	0.2	0.5	0.35
10.	Cladocera	-	-	0.2	0.20
11.	Anthozoa	3	0.4	1.2	1.53
12.	Holothuroidea	-	0.7	0.8	0.75
	Total	**100**	**100**	**100**	**100**

3.11.2.2.8 Subtidal Meio-benthos

Meio-benthos study shows higher percentage composition represented by nematodes followed by foraminiferans and hydrozoans. Meio-benthic species identified from sediment and its percentage composition is given below in **Table 3.25** and **Table 3.26** respectively.

Table 3.25: Biomass, Population and Groups of Meiobenthos

Sr. No.	Location code	Biomass ($\mu g/10cm^2$)	Population ($Ind./10cm^2$)	Total groups (Nos.)
1	MB1	131.3	260	6
2	MB2	95.2	226	9
3	MB3	192.4	318	9

Table 3.26: Percentage Composition of Meiofauna

Sr. no	Groups	Location			Average
		MB1	MB2	MB3	
1.	Amphipods	1.2	0.6	1.9	1.23
2.	Bivalves	0.8	0.2	0.4	0.47
3.	Foraminiferans	13.2	38.9	36.2	29.43
4.	Harpacticoids	-	1.3	0.2	0.75
5.	Hydrozoans	12.1	3.4	2.4	5.97
6.	Nauplius	-	0.1	0.3	0.20
7.	Nematodes	71.6	55.2	57.8	61.53
8.	Ostracods	-	0.2	0.1	0.15
9.	Polychaetes	1.1	0.1	0.7	0.63
	Total	**100**	**100**	**100**	**100**

3.11.2.2.9 Intertidal Macro-Benthos

Intertidal macrobenthos study indicated higher biomass and population of benthic invertebrates near low tide area than high tide area. Higher percentage composition was represented by polychaetes followed by pelecypods. Macrobenthic species identified from intertidal region and their species composition is given below in Table 3.27 and Table 3.28.

Table 3.27: Biomass, Population and Groups of Macrobenthos

Sr. No.	Station code	Biomass (g/m^2; wet weight)	Population ($Ind./m^2$)	Total groups (Nos.)

1	HT	2.8	16	5
2	LT	4.6	21	6

Table 3.28: Percentage Composition of Macrobenthos

Sr. No.	Groups	Station		Average
		HT	LT	
1	Pelecypoda	25.4	28.9	27.15
2	Tanaidacea	0	0.6	0.3
3	Oligochaeta	6.1	8.2	7.15
4	Amphipoda	1.2	2.4	1.8
5	Polychaeta	61.4	52.7	57.05
6	Isopoda	5.9	7.2	6.55
	Total	**100**	**100**	**100**

3.11.2.2.10 Intertidal Meio-Benthos

Intertidal meio-benthos study showed higher biomass and population in low tide area. Higher percentage composition was represented by nematodes followed by polychaetes. Meio-benthic species identified from intertidal region and their species composition is given below in Table 3.29 and Table 3.30.

Table 3.29: Biomass, Population and Groups of Meiobenthos

Sr. No.	Station code	Biomass ($\mu g/10cm^2$)	Population ($Ind./10cm^2$)	Total groups (Nos.)
1	HT	266.5	110	6
2	LT	496.2	193	8

Table 3.30: Percentage Composition of Meio-Benthos

Sr. No.	Groups	Station		Average
		HT	LT	
1.	Nematodes	85.4	77.2	81.3
2.	Nemerteans	2.5	3.1	2.8
3.	Oligochaetes	0.4	1.2	0.8
4.	Polychaetes	10.1	16.1	13.1
5.	Turbellarians	0.4	0.3	0.35
6.	Nauplius	1.2	0.8	1
7.	Ostracods	0	1.1	0.55
8.	Zoea	0	0.2	0.1
	Total	**100**	**100**	**100**

3.11.2.2.11 Pisces

Proposed project location lies at Aksa beach. Gorai creek drains into Arabian sea at north of the Aksa beach. The fish species from gorai creek and coastal waters off Mumbai were studied based on secondary data. Mudflats of Gorai creek have been reported with abundant presence of mudskipper species such as *Boleophthalmus boddaerti* and *Boleophthalmus viridis*[9]. Majority of the

[9] K. Balasaheb et al. – Present status of intertidal biodiversity in and around Mumbai, (2017), Transylv. Rev. Syst. Ecol. Res. 19.1 (61-70)

trawlers fishing in coastal waters of Mumbai land their catches at Sassoon Dock, Ferry Wharf and Versova fishing harbor. About 112 species of fishes have been reported from the catch of multi-day and single-day trawlers from Mumbai coast. Dominant species from the catch belonged to the order Perciformes. Species such as *Otolithus cuvieri* contributed maximum followed by *Arius maculatus*, *Lepturacanthus savala* and *Megalaspis cordylla* in terms of catch percentage[10].

3.11.2.3 Inference

Vegetation near Aksa was mainly composed of coconut and Toddy palms. Other vegetation within study area included commonly occurring trees such as casurina, copper pod, rain tree etc. Mangrove vegetation within study area was observed on Southwest of the project at marshy lands which was represented by *Avicennia marina, Avicennia officinalis, Excoecaria agallocha* and *Sonneratia apetala.* Total 18 genera of phytoplankton were identified during study. Higher percentage compositon was represented by *Skeletonema, Nitzschia, Navicula* and *Thalassiosira.* Avifauna observed near proposed project location represented commonly occurring marine bird species. Some of the terrestrial birds also were observed during survey near barren lands and vegetation near residential places. In the project surrounding areas including barren lands and vegetation around residential areas mammal such as Indian flying fox and three stripped palm squirrel were commonly observed. During survey garden lizard, common skink and common rat snake were the only species of reptiles observed. No amphibian species were observed during survey. Among insects and arthropods common species of butterfly, dragonfly and spiders were observed during survey. High viable count was observed from samples collected near INS Hamla. Microbial presence in water can be attributed to tourist activity associated pollution near beach as well pollution load draining into Gorai creek from surrounding residential areas. Zooplankton groups indicated copepods and decapod larvae to be most common groups. Higher percentage composition was represented by polychaetes followed by amphipods in subtidal sediments. Whereas, meio-benthic fauna was represented mainly by nematodes. Higher percentage composition of intertidal Macrobenthos was represented by polychaetes followed by pelecypods. Higher percentage composition of meio-benthic fauna was represented by nematodes followed by polychaetes. Mudflats of Gorai creek have been reported with abundant presence of mudskipper species such as *Boleophthalmus boddaerti* and *Boleophthalmus viridis.* About 112 species of fishes have been reported from the catch of multi-day and single-day trawlers from Mumbai coast. Dominant species from the catch belonged to the order Perciformes.

3.12 Socio-Economics

This section discusses the baseline scenario of the socio-economic environment in the study area. The social aspect study includes demographic pattern, economic activity, education and literacy profile, etc.

3.12.1 Socio-Economic Profile of the State and District

Maharashtra State

Maharashtra is the third largest state in India with an area of 3,07,713 sq. km and a population of 11.2 crore. It is one of the wealthiest and most developed states in the country, which constitutes approximately 5.8 crore of male and 5.4 crore of female population. The density of the state overall

[10] Fishing characteristics of trawling off Mumbai coast of Maharashtra, India by Kharatmol BR, Shenoy L, Singh VV, Landge AT and Mohite AS.

is 365/km^2. The literacy rate is of the state is 82.34 percent. The sex ratio is 929 females per 1000 males. Demography of the Maharashtra State are covered in

Table 3.31.

Table 3.31: Demography of the Maharashtra[11]

S. No.	Particulars	Details
1	Geographical location	Geographical Coordinates of Maharashtra are 19.7515° N, 75.7139° E
2	Area	3,07,713 Sq. Km.
3	Population	11,23,74,333
4	Population (Male)	5,82,43,056
5	Population (Female)	5,41.31,277
6	Population density	365 per Sq. Km.
7	Sex ratio	929 females per 1000 males
8	Literacy rate	82.34 percent
9	Decadal Growth percentage	15.99 percent

Mumbai Suburban

Mumbai Suburban District is a coastal District, located on the West coast of India. It lies between 18° 58' and 19° 17' North latitudes and 72° 46' and 72° 60' East longitudes. The district is surrounded by Arabian sea at the West, Thane District at the East and North and Mumbai District at the South. The district is Northern part of Greater Mumbai Municipal Corporation which, spreads over an area of 446.0 sq. kms as per Surveyor General of India and has a population of 93,56,962 as per 2011 Census. The District shares 0.14 per cent of area of the State and 8.33 per cent of the total population of the State. This District alone accounts for 18.41 per cent of the total urban population of Maharashtra, which has a total of 534 urban centres. The density of population is 20,980 persons per sq.km.

Table 3-32: Demographic Pattern of Mumbai Suburban District

Area	386.56 Sq Km
Revenue Divisions	2
Talukas	3
Revenue Mandal	9
Municipal Corporations	1
Villages	87
Total Population	93,56,962
Population (Males)	50,31,323
Population (Females)	43,25,639
Literacy Rate	80.96%
Literates (Males)	4,223,029
Literates (Females)	3,352,456

3.12.2 Socio-Economic Profile of the Aksa Village

[11] Census 2011

The proposed project is located at Aksa beach, Madh, Mumbai Suburban, Maharashtra. The demographic profile of the Aksa village is shown in **Table 3-33.**

Table 3-33: Demography of the Aksa Village[12]

Area	1.47 km²
Population (2020)	3399
Population Density	2313 people per km²
Male Population	1770
Female Population	1629

Aksa beach is a popular beach and a vacation spot in Aksa village in Malad in Mumbai. It is situated close to Marvé beach. It is a popular weekend destination. It is dotted with many private cottages and hotels, some of which are rented out to tourists and visitors. Aksa beach also happens to be one of the cleanest beaches in the city. The proposed project will be providing facilities of garden for senior citizen and children, entrance and parking facilities, lawn and toilets, children play area, open gym and space for yoga, bamboo shacks, cafeteria and open volley ball courts. This project will give a positive impact on tourism business as well as the daily livelihood of local people. The project will lead to generation of employment and business opportunities. Fishermen in the region will also be benefited due to sale of fish catch to the cafeterias. The project will also provide the recreational space to the nearby population. The proposed anti sea erosion measures will protect the beach from erosion.

[12] https://geoiq.io

4. Anticipated Environment Impacts and Mitigation Measures

This chapter presents environmental impacts associated with activities during construction and operation phase of the project and mitigation measures to minimize the environmental impacts.

4.1 Method

Impact assessment is the process of identifying the future consequences of a current or proposed action. It is used to ensure that projects, programs and policies are economically viable, socially equitable and environmentally sustainable. This chapter endeavors to identify various environmental impacts associated with construction and operation phases of the proposed project

Based on all possible causes of pollution, environmental impacts and considering the baseline environmental status around the project; the environmental factors that are likely to be affected are identified and assessed. Both positive and negative impacts are accounted for this purpose. The prediction of impacts will help in the preparation of a sound environmental management plan which has to be executed during the on-going activities for the project to minimize the adverse impacts on the environmental quality.

The impact analysis covers all the project activities whose impacts are significant enough to exceed environmental standards. Mitigation measures are proposed in order to minimize and control adverse environmental impact to acceptable levels and to achieve the expected outcomes of the project being implemented with minimal loss to the environment.

The first step of the impact assessment is identification of the potential impacts on air quality, noise quality, land-use/landcover, marine water quality, marine sediment, biodiversity, socio-economics from various activities involved in the proposed project. The steps involved in impact assessment are given in

Figure 4.1 and the identified impacts during construction and operations phase of the project as presented in Table 4.1.

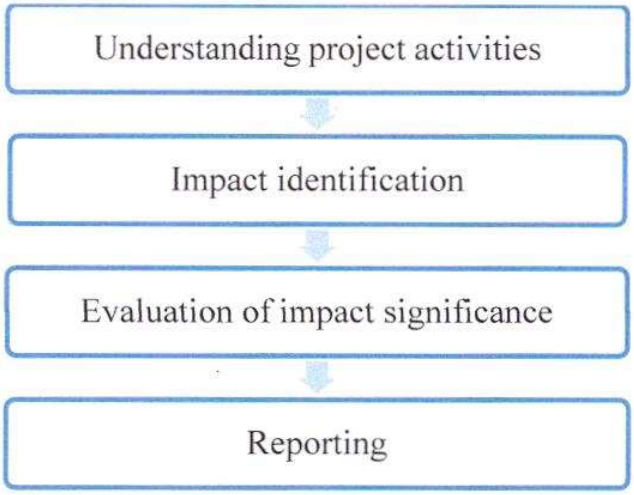


Figure 4.1: Steps Involved in Impact Assessment

Table 4.1: Impact Identification Matrix

S. No.	Activities	Anticipated Impacts	Physical Environment						Biological Environment		Socio-Economic Environment			
			Land use/ Land cover	Soil Quality	Marine water Quality	Marine Sediment Quality	Air Quality	Noise Level	Aquatic biology	Terrestrial biology	Aesthetic and Visual Impact	Social Inconvenience	Social Health and Safety	Employment/ business opportunity
Construction phase														
1	Transportation, storage, and handling of raw material	• Impact on ambient air quality • Increase in noise levels from equipment and vehicle operation. • Beach sediment contamination due to accidental spillage of fuels or oil • Impact on benthic fauna from contamination of beach sediment from accidental fuel or oil spillage • Inconvenience to visitors from unaesthetic visual and noisy activities				√	√	√	√		√	√		
2	Excavation and foundation	• Impact on ambient air quality • Increase in noise levels from equipment operation. • Inconvenience to visitors from unaesthetic visual from excavated waste and noisy activities					√	√			√	√		
3	Construction of anti- sea erosion bund	• Impact on ambient air quality • Increase in noise levels from equipment operation • Contamination of sediment from site runoff and labour generated waste • Impact on benthic fauna due to contamination of sediment • Inconvenience to visitors from unaesthetic visual and noisy activities				√	√	√	√		√	√		
4	Sea front development	• Impact on ambient air quality • Increase in noise levels from equipment operation • Employment opportunity to labor • Inconvenience to visitors from unaesthetic visual and noisy activities					√	√			√			√
Operation phase														
1	Recreational activity	• Visitor generated waste may enter sea if not managed properly and lead to floating garbage and unaesthetic and unhygienic conditions			√	√			√		√	√	√	√

S. No.	Activities	Anticipated Impacts	Physical Environment						Biological Environment		Socio-Economic Environment			
			Land use/ Land cover	Soil Quality	Marine water Quality	Marine Sediment Quality	Air Quality	Noise Level	Aquatic biology	Terrestrial biology	Aesthetic and Visual Impact	Social Inconvenience	Social Health and Safety	Employment/ business opportunity
		• Contamination of marine water and sediment by waste disposal in beach area • Impact on marine flora and fauna due to contamination of water from waste entering sea • Increase in traffic along Madh – Marve road causing traffic congestion and parking issue • Drowning of visitors due to crossing bund and entering sea • Disturbance to local residents from Aksa village due to noise levels • Tourism business opportunities to locals												
2	Anti sea erosion bund	• Anti sea erosion bund will protect Aksa beach from sand erosion				√					√			

4.1.1 Impact Evaluation Criteria

The impact evaluation is done based on Severity, Extent, Duration and Probability of the impact. The resultant of the impact evaluation is represented by the Significance of the impact which is basically the multiplication of these four parameters.

4.1.2 Severity of Impact

It indicates the degree of damage that may be caused to the environmental components concerned. This will be decided by the standards available for the parameter. Severity for the measurable parameters is based on scale. This scale is assumed to be percentage value of the parameter with respect to the existing standard. The 0 reading would be considered as 0 % and the standard value will be considered as 100%. For example, permissible limit for 24-hourly monitored SO2 concentration as per NAAQ standards is 80 $\mu g/m^3$. In this case if a project depicts baseline or prediction value as 80 $\mu g/m^3$ then the value in terms of scale is considered as 100%. If a project depicts baseline or predicted value as 72 $\mu g/m^3$ then the value is 90%. Based on this scale three levels of severity are considered which are defined in **Table 4.2**.

Table 4.2: Severity of Impact

Severity 1 (Low)	The baseline and / or predicted value is less than 90%
Severity 2 (Moderate)	The baseline and / or predicted value is between 90% to 100%
Severity 3 (High)	The baseline and / or predicted value is more than 100%

4.1.3 Extent of Impact

The geographical spread of the impact around project location and corridors of activities is considered to define the extent of impact. Scale of extent of impact is defined in **Table 4.3.**

Table 4.3: Extent of the Impact

Extent 1 (Low)	The extent of the impact is within the project boundary.
Extent 2 (Moderate)	The extent of the impact is within 500m from the project boundary.
Extent 3 (High)	The extent of the impact is beyond 500m from the project boundary.

4.1.4 Duration of Impact

The time for which the impact lasts taking into account the project lifecycle. For construction phase the criteria used to determine duration of the impact is presented in **Table 4.4**.

Table 4.4: Duration of the Impact (Construction Phase)

Cont. Duration 1 (Low)	Impacts those are instantaneous.
Cont. Duration 2 (Moderate)	Impacts those last during the entire construction phase.
Cont. Duration 3 (High)	Impacts those last after the construction phase.

Any impact resulting from operation of the project may continue throughout the life of the project or occur intermittently. Hence these impacts are categorized based on their likely occurrence or frequency. For operation phase the criteria used to determine duration of the impact is presented in **Table 4.5.**

Table 4.5: Duration of the Impact (Operation Phase)

Ope. Duration 1 (Low)	Rare
Ope. Duration 2 (Moderate)	Periodic

Ope. Duration 3 (High)	Regular (e.g. regular boat operations)

4.1.5 Probability

Criteria for evaluating probability of impacts that may cross threshold are given in **Table 4.6**.

Table 4.6: Probability of Impact

Probability 1 (Low)	Almost nil
Probability 2 (Moderate)	May occur
Probability 3 (High)	Definitely occur

A positive or beneficial impact that may result from this project is not ranked and is depicted in the form of ++

4.1.6 Impact Significance

The significance of the impact is adjudged based on a multiplicative factor of the four element rankings mentioned above. The **Table 4.7** below assigns impact significance in the scale of Low-Medium-High and will be used for delineation of preventive actions, if any, and management plans for mitigation of the impacts.

The impact significance is determined taking into account the measures which are factored in at the construction and operation phase of the project. Legal issues are taken into account in the criteria set, wherever appropriate, to aid in effort to comply with all relevant legislations. Additionally, the results of quantitative impact prediction exercise, wherever undertaken, are also considered.

Table 4.7: Criteria Based Significance of Impact

Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability (D)	Impact Significance (A X B X C X D)	
1	1	1	1	1	LOW
1	1	1	2	2	
1	1	1	3	3	
1	1	2	2	4	
1	2	2	1	4	
2	3	1	1	6	
1	2	2	2	8	
3	3	1	1	9	
2	3	2	1	12	
2	2	2	2	16	
2	3	3	1	18	
3	2	3	1	18	
2	2	2	3	24	
3	2	2	2	24	
3	3	3	1	27	MODERATE
3	1	3	3	27	
3	3	2	2	36	
3	3	3	2	54	
3	3	3	3	81	HIGH

Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability (D)	Impact Significance (A X B X C X D)	
- Impact is Beneficial -				++	POSITIVE

To assist in determining and presenting the significance of an impact, an impact evaluation matrix was developed. The significance of the impact is depicted using color codes for easy understanding. In the case that an environmental component might be impacted by more than one project activity the higher impact significance ranking is taken as the significance ranking for the subject receptor. Impacts that are determined to have high significance ranking of ">24" are considered to be significant and hence require examination in terms of preventive actions and/or required additional mitigation to reduce the level of the potential impact.

4.2 Evaluation of Impacts

4.2.1 Landuse/Land Cover

The proposed project is for sea front development and beautification of Aksa beach. There is no change in current recreational activities on beach as the prject will only improve the recreational activities. Therefore the project would not lead to any impact on the landuse and landcover of the beach.

4.2.2 Soil Quality

The proposed project will be developed in coastal environment. Further the project does not involve any construction activity on main land area and also it is a small scale project involving sea front development. Hence no impact on soil quality is anticipated from the proposed project during construction and operation phase.

4.2.3 Marine Water & Sediment

4.2.3.1 Construction Phase

Anticipated Impacts

- Contamination of the beach sediment is anticipated due to accidental spillage of fuel or oil from equipment's and machineries plying at construction site on beach.
- Labour generated waste may contaminate beach sediment if not stored and disposed properly.
- Site runoff during construction phase if not contained may contaminate beach sediment.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Storage and handling of raw material	1	2	2	2	8 (Low)
Construction activity	2	2	2	2	16 (Low)

As the project is small scale and location has adequate space on beach for storage of raw material chances of contamination of beach sediment are very less. Also project does not involve storage of large amount of hazardous material and chemicals. Hence spillage of raw material may be in very less quantity. Therefore severity of impact is low. Extent of the impact may be limited to the project surrounding within 500m hence ranked moderate. Construction work is temporary activity

and the impact may persist during construction phase only. Hence duration of impact is ranked moderate. Spillage of raw material may or may not occur at construction site hence probability is ranked moderate. Overall significance of impact is estimated to be low.

Severity of impact due to construction activity is ranked moderate as site runoff is not anticipated to be significant. Extent of the impact may be limited to the project surrounding within 500m hence ranked moderate. Proposed sea front development is a temporary activity and the impact may persist during construction phase only. Hence duration of impact is ranked moderate. Impact from construction activities on marine water and sediment may or may not occur hence probability is ranked moderate. Overall significance of impact is estimated to be low.

Mitigation Measures

- Storage of the raw materials beyond the intertidal region. Excess storage of material especially the hazardous material such as fuels lubricants and paints should be avoided.
- Proper handling of the raw materials should be done to avoid spillage.
- Collection and storage of the labour generated waste and disposal to authorized agency.
- Containment of site runoff in case runoff is generated during construction activity to avoid it draining into sea.
- Deployment of trained workers can minimize chances of material spillage in work area.

4.2.3.2 Operation Phase

Anticipated Impacts

- Waste disposal by visitors such as plastic bottles, food wrappers and other wastes arising from recreational activities may contaminate the marine water and sediment if not managed properly. This may result result into the floating garbage in sea water near beach causing unpleasant visual and unhiegenic condition at beach.
- Anti sea erosion bund will have positive impact as it will provide the protection to the beach from sand erosion.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Recreational activity	2	1	3	2	12(Low)

Disposal of waste by visitors at beach is not anticipated to have higher impact as visitor activity will be prohibited beyond bund area. Also provision of dust bins will reduce waste disposal by visitors on beach. Hence the severity of the impact has been ranked moderate. Extent of the impact has been ranked low considering the localized impact. The duration of the impact has been ranked high considering long term visitor activity. Impact from visitor activity on marine water and sediment may or may not occur hence probability is ranked moderate. Overall significance of the impacts from boat operations has been ranked low.

Mitigation Measures

- Disposal of waste on beach should be prohibited and indicated through sign boards for visitors.
- Adequate waste storage bins should be maintained on beach for collecting waste generated visitors.
- Regular waste collection and disposal should be implemented through local regulatory body. The waste generated to be handed over to authorized vendors for treatment and disposal.

4.2.4 Ambient Noise

4.2.4.1 Construction Phase

Anticipated Impacts

- Increase in noise level during transport and handling of raw material due to vehicular activity is anticipated.
- Operation of heavy equipment such as cranes and excavators may elevate noise levels during construction phase.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Noise from construction activity and equipment operations	2	1	2	3	12(Low)

Severity of the impact is ranked moderate as the increase in noise level will be intermittent and may not be very high. Extent of the impact is local hence ranked low. Duration of the impact is ranked moderate as the construction activity will be short term. Noise levels will definitely increase during operation of cranes during bund construction. Hence probability of impact is ranked high. Overall impact significance is estimated to be low.

Mitigation Measures

- Construction machinery and vehicles should be maintained in good working condition to reduce high noise levels.
- Construction activity to be restricted to day time only from 6 AM to 10 PM as per CPCB guidelines.
- Construction site should be barricaded with galvanized sheets to avoid noise propogation to longer distance.
- High noise making equipment such as DG sets should be acoustically covered to reduce noise levels.

4.2.4.2 Operation Phase

Anticipated Impacts

- During operation phase of the project noise levels are anticipated to increase due to recreational activities by visitors.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Recreational activity	1	2	2	2	8(Low)

Severity of the impact is low as noise levels generated from recreational activities are not anticipated to be very high. Noise may be restricted to beach area and may not have impact beyond 500 m hence extent of impact is ranked moderate. Duration of impact is ranked moderate as the recreational activities may not be continuous throughout day and may be at peak only on

weekends and evenings. The impact from recreational activity on noise levels may or may not occur hence ranked moderate. Overall impact significance is estimated to be low.

Mitigation measures

- High noise levels from sound systems of functions should be prohibited and regulated as per CPCB guidelines.
- High noise generating activities should be restricted at night time beyond 10 PM.

4.2.5 Ecology and Biodiversity

4.2.5.1 Construction Phase

- Contamination of sediment due to accidental spillage of fuels or oil during construction activities may affect benthic fauna.
- Marine bird species may be affected due to visual disturbance and noise by machinery operations, vehicular movements in beach area during construction period.
- Construction site runoff and labour generated waste may contaminate beach sediment which may in turn affect benthic fauna.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Storage and handling of raw material	1	2	2	2	8 (low)
Construction activity	1	2	2	2	8 (low)

As the project location has adequate space near beach for storage of raw material and also project does not involve large amount of storage of hazardous material and chemicals. Hence chances of contamination of sea water and sediment are very less. Hence accidental spillage of raw material may not be significant. Hence severity of impact is ranked low. Extent of the impact may be limited to the project surrounding within 500m hence ranked moderate. Construction work is temporary activity and the impact may persist during construction phase only. Hence duration of impact on marine flora and fauna is ranked moderate. Spillage of raw material may or may not occur at construction site hence probability is ranked moderate. Overall significance of impact is estimated to be low.

Severity of the impact from construction activity is anticipated to be low as the labour generated waste will be stored at site appropriately. Also the project being small scale the runoff from the construction activity is not anticipated to be significant. Extent of impact may be limited to project surrounding within 500m hence ranked moderate. Construction work is temporary activity and the impact may persist during construction phase only. Hence duration of impact is ranked moderate. The construction activity may or may not have impact on marine flora and fauna. Hence probability is ranked moderate. Overall significance of impact is estimated to be low.

Mitigation Measures

- Containment of site runoff in case runoff is generated during construction activity to avoid it draining into sea.

- Regular servicing and maintenance of construction equipment should be carried out. Also acoustic enclosures should be provided wherever applicable to the high noise generating equipment.
- Spillage of fuels or oil on beach should be strictly avoided to avoid contamination of beach sediment. Skilled manpower should be deployed on site and construction should be carried out under supervision of site supervisor.
- Storage of fuel and construction material should be done away from intertidal area to avoid beach sediment contaminations from accidental spillages. Excess storage of material should be avoided.

4.2.5.2 Operation Phase

Anticipated Impacts

- Waste disposal by visitors such as plastic bottles, food wrappers and other wastes arising from recreational activities may contaminate the marine water and sediment if not managed properly. This may result result into the floating garbage in sea water near beach which may affect marine flora and fauna.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Recreational activity	1	1	3	2	6 (Low)

Severity of the impact on marine flora and fauna from recreational activities is anticipated to be low as the waste disposal on beach will be reduced due to provision of dust bins. Also visitors will be restricted beyond bund which will minimize direct contact with sea water. Therefore extent of impact will be local hence ranked low. The recreational activities will be regular once sea front is developed. Hence duration of the impact is ranked high. Impact from recreational activity may or may not occur hence probability is ranked moderate. Overall significance of impacts is estimated to be low.

Mitigation Measures

- Adequate waste storage bins should be provided on beach for visitors for disposal of waste.
- Regular waste collection and disposal should be implemented through local regulatory body.
- Disposal of waste on beach as well as bund crossing and waste disposal into sea should be prohibited and indicated through sign boards.

4.2.6 Ambient Air Quality

4.2.6.1 Construction Phase

Anticipated Impacts

- Impact on air quality is anticipated due to vehicles carrying raw materials and heavy equipment operation will generate gaseous emissions.
- Dust emissions are expected during bund construction due to loading and unloading of material and crane operations and dispersion of particulate matter from excavated waste.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Transportation of raw material	1	2	2	2	8 (Low)
Construction activity	1	2	2	3	12 (Low)

Transportation activity will be short term and will not lead to excessive emissions and will be localised. Hence the severity of the impact is ranked low. Extent of the impact is anticipated tobe not beyond 500 m from project location hence ranked moderate. The duration of the impact is ranked moderate as the impact of the activity will last till the construction phase. The probability of impact is ranked moderate as the impact from transportation may or may not occur. Overall significance of impact from transportation of material is estimated to be low.

Severity of the impact from gaseous and dust emissions is anticipated to be low considering small scale of the project which may not lead to excessive emission. Emissions from vehicles and equipment may reach upto 500m from source hence extrent of impact is ranked moderate. Duration of impact is ranked moderate as the impact will be temporary limited to construction period. Definite emission from various construction equipment and machinery are anticipated hence probability of impact is considered high. Overall significance of impact is estimated to be low.

Mitigation Measures

- Material transportation vehicles should be covered with tarpaulin sheets to minimize dust.
- Idling of the delivery trucks during unloading or other inactive periods to be prevented.
- Cleaner fuel such as low sulphur diesel, to be used to run the transportation vehicles.
- DG sets having acoustic enclosure along with sufficient stack height of 3m to be used at construction site complying with emissions norms notified by CPCB.
- The vehicles should be maintained with a valid Pollution Under Control (PUC) Certificate in accordance with the Motor Vehicles Act, 1988 in order to reduce excessive emissions. The construction equipment used in the construction activities to be routinely serviced.
- As far as practicable, construction activity to be halted during the periods of sustained strong winds.

4.2.6.2 Operation Phase

During operation phase recreational activities will take place at beach. Recreational activities involve volleyball, gardens, childrens playing, walking on pathway etc. which will not lead to gaseous emissions. Therefore no impact on air quality is anticipated during operation phase.

4.2.7 Socio-Economic Environment

4.2.7.1 Construction Phase

Anticipated Impacts

- During construction phase barricading portion of beach, excavated waste stockpiles may create unaestheic visual for visitors and also divert them to other area of no construction activity on beach.
- Operation of heavy equipments such as excavator and cranes and construction activities would affect aesthetics of the beach which will cause inconvenience to visitors.
- Increase in noise levels during construction period may disturb the visitors and divert them to other areas where there is no construction activity.
- Increase in noise levels will also have impact on local residents of Aksa village located within 100m from proposed project activities.
- Labour may get employment opportunity at project site during construction phase.

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Construction activity	2	1	2	3	12 (low)
Generation of the employment opportunities	++				Positive

Severity of impact on social environment is moderate as the site will be barricaded and construction will be carried out as per applicable regulatory norms. Extent of the impact will be localised hence ranked low. Impact from construction activities will be restricted to construction period only hence duration of the impact is ranked moderate. Definite impact on visitors is anticipated from noise and unaesthetic visual. Hence probability of impact is ranked high. Overall significance of impact is estimated to be low.

Labor may get temporary employment opportunities during construction phase of the project which is a positive impact.

Mitigation measures

- Prior indication of commencement of construction work should be displayed near beach with detail schedule.
- Barricading of construction site should be done to minimize noise levels propogation beyond construction site.
- Construction should be carried out complying applicable regulatory norms.
- Construction activity should be restricted to day time i.e. 6 Am to 10 PM as per CPCB guidelines.
- Excavated waste stock piles should be covered and disposed to designated sites regularly.

4.2.7.2 Operation Phase

Anticipated Impacts

- During operation phase large amount of waste generation can be anticipated from visitors on beach. Disposal of waste on beach may create unaesthetic visual. Also waste disposed by visitors may enter sea water and result into floating garbage in sea contaminating it.

- Risk of drowning of visitors is anticipated due to strong currents if they enter sea in this region.
- Increased number of visitors and vehicular movements near Aksa beach will have impact on locals from Aksa village due to increased noise levels.
- Increased traffic due to increased visitor activity may cause traffic congestion due to parking space unavailability.
- During operation phase the project will provide visitors with walkable pathway on bund. Also other recreational facilities will enhance aesthetics of the beach.
- Also small scale vendors and food stalls will be benefitted from increased availability of consumers due to proposed sea front development

Impact Evaluation Matrix

Activity	Severity of Impact (A)	Extent of Impact (B)	Duration of Impact (C)	Probability of Impact (D)	Impact Significance (AxBxCxD)
Recreational activity	3	1	3	2	18(low)
Tourism business opportunities	++				Positive

Incidence of visitor drowning can be severe due to loss of life hence severity is ranked high. Yet probability of this incidences can be moderate as visitors will be made aware of the drwoning risk at the entrance hence ranked moderate. Extent of the impact will be local hence ranked low. The recreational activities will be going on in the long run hence duration of the impact is ranked high. Overall impact is estimated to be low.

Proposed sea front development will provide tourism business opportunity to local vendors due to increased availability of consumers which is a positive impact on socio-economic environment.

Mitigation measures

- Adequate waste storage bins should be provided on beach for collection of visitor generated waste. Disposal of collected waste should be done effectively through authorized waste disposal agency.
- Strict prohibition of entering sea ward side of anti sea erosion bund should be made aware to visitors through notice boards at the entrance.
- Adequate parking facility should be provided for visitors to avoid road congestions.
- Recreational activity time should be followed as per CPCB guidelines i.e. between 6 AM to 10 PM.

5. Analysis of Alternatives

The project involves sea front development at Aksa beach which includes construction of anti sea erosion bund and provision of recreational facilities for visitors. The beach is known for its aesthetics as well as frequent quick sand scenarios. Also the strong currents at this beach are causing rapid sand erosion. In order to protect the beach from sand erosion and enhance tourism value of the beach it is necessary to implement the sand erosion measure at Aksa beach. Hence no alternate site is analysed for proposed development.

6. Environment Monitoring Program

An Environmental Monitoring Program (EMoP) is an integral part of Environment Management plan which provides a mechanism to monitor the adverse environmental impacts arising from project activities. This EMoP defines frequencies and responsibilities to be followed for the monitoring program. With the knowledge of baseline conditions, the monitoring program will serve as an indicator for any deterioration in environmental conditions due to construction & operation phase of the project, to enable taking up suitable mitigation steps in time to safeguard the environment. Implementation of monitoring program is as important as that of control of pollution since the efficiency of pollution control measures can be determined from environmental monitoring.

6.1 Objectives of Environmental Monitoring Plan

- To ensure the compliance to environmental norms stipulated by regulatory bodies.
- To verify predictions made in the impact assessment by obtaining real time measurements;
- Evaluate the performance and effectiveness of mitigation measures proposed in the Environment Management Plan (EMP) and suggest improvements in management plan, if required.
- Provide early warning of potential environmental impacts and contribute to continuous improvement in the management of environmental issues related to the project.

The project proponent should have a comprehensive approach towards the construction activities at site and the ensuing operations. The project proponent should retain overall responsibility for the execution of the Monitoring Plan.

The project proponent should confirm that the contractor(s) during the construction phase would undertake the implementation and adherence to plan that would address impacts and mitigation measures. Adequate budgetary provisions should be made for fulfilling the obligations arising from the implementation of this EMoP.

The sampling and analysis proposed in the monitoring plan shall be carried out by the NABL and MoEF&CC accredited lab under the supervision of the project proponent. Details of Environmental Monitoring Program during project construction and operation phase of the project is represented in **Table 6.1.**

Table 6.1: Environment Monitoring Program

Sr. No.	Type	Locations	Parameters	Period and Frequency	Institutional Responsibility	
					Implementation	Supervision
Construction Phase						
1	Ambient Air Quality	Three locations As per baseline monitoring plan	PM10, PM2.5, SO2, CO, NOx,	Quarterly till end of construction	Contractor through NABL/MoEF&CC approved Lab	MMB
2	Noise levels	Three locations As per baseline monitoring plan	Noise level in dB(A) Day & Night, Leq	Quarterly till end of construction	Contractor through NABL/MoEF&CC approved Lab	MMB
3	Marine Water Quality	one location near project site	Temperature, pH, Salinity, DO, BOD, Ammonical Nitrogen, Phosphate, Total Phosphorus, Total Nitrogen, Zinc, Cadmium, Lead, Mercury, Copper, Nickel, Oil & Grease, PHc	Quarterly till end of construction	Contractor through NABL/MoEF&CC approved Lab	MMB
4	Sediment Quality	one location near project site	Texture, pH, Aluminum, Chromium, Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium, Mercury, Lead, C_{org}, Phosphorus, PHc	Quarterly till end of construction	Contractor through NABL/MoEF&CC approved Lab	MMB
5	Marine Biology	one location near project site	• Phytoplankton cell count, Total Genera, Percentage composition • Zooplankton Population, Biomass, Total Groups • Macro & Meio-Benthos Population, Biomass, Benthic groups, Percentage composition • Microbial count in water and sediment	Quarterly till end of construction	Contractor through NABL/MoEF&CC approved Lab	MMB
Operation Phase						

Sr. No.	Type	Locations	Parameters	Period and Frequency	Institutional Responsibility	
					Implementation	Supervision
1	Ambient Air Quality	1 location near Aksa beach	PM10, PM2.5, SO2, CO, NO2	Half yearly	Contractor through NABL/MoEF&CC approved Lab	MMB
2	Noise level	1 location near Aksa beach	Noise level in dB(A) Day & Night, Leq	Half yearly	Contractor through NABL/MoEF&CC approved Lab	MMB
3	Marine water quality	1 location near Aksa beach	Temperature, pH, Salinity, DO, BOD, Ammonical Nitrogen, Phosphate, Total Phosphorus, Total Nitrogen, Zinc, Cadmium, Lead, Mercury, Copper, Nickel, Oil & Grease, PHc	Half yearly	Contractor through NABL/MoEF&CC approved Lab	MMB
4	Sediment Quality	1 location near Aksa beach	Texture, pH, Aluminum, Chromium, Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium, Mercury, Lead, C_{org}, Phosphorus, PHc	Half yearly	Contractor through NABL/MoEF&CC approved Lab	MMB
5	Marine Biology	1 location near Aksa beach	• Phytoplankton cell count, Total Genera, Percentage composition • Zooplankton Population, Biomass, Total Groups • Macro & Meio-Benthos Population, Biomass, Benthic groups, Percentage composition	Half yearly	Contractor through NABL/MoEF&CC approved Lab	MMB

6.2 Regulatory Compliance Reporting

Half yearly compliance report in respect of the stipulated terms and conditions of CRZ Clerance should be submitted by project proponent to the concerned regulatory authorities on 1st June and 1st December of each calendar year.

6.3 Environmental Monitoirng Cost

The budget for one time environment monitoring during construction and operation phase is estimated to be 0.8 lacs and 0.5 lacs respectively. Details of environment monitoring budget to be allocated for the project is given below in **Table 6.2.**

Table 6.2: Budget for Environmental Monitoring

Component	Quantity	Unit Rate/sample (Rs.)	Total Cost (Rs.)
Construction phase			
Ambient Air Quality	3	7000	21000
Marine Water Quality	3	7000	21000
Marine Sediment Quality	1	7000	7000
Marine Biology	1	14000	14000
Noise level monitoring	1	1400	1400
Miscellaneous costs			15600
		TOTAL	**80,000**
Operation phase			
Ambient Air Quality	1	7000	7000
Marine Water Quality	1	7000	7000
Marine Sediment Quality	1	7000	7000
Marine Biology	1	14000	14000
Noise level monitoring	1	1400	1400
Miscellaneous costs			13600
		TOTAL	**50,000**

7. Additional Studies –Risk Assessment and Disaster Management Plan

7.1 Hazard Identification and Risk Assessment

7.1.1 Approach of the study

The risk assessment study is conducted considering construction activities and the tourism activity post construction. The approach for proposed study is presented in the form of a flowchart in **Figure 7-1**. It illustrates the steps undertaken to carry out Risk Assessment for the proposed project.

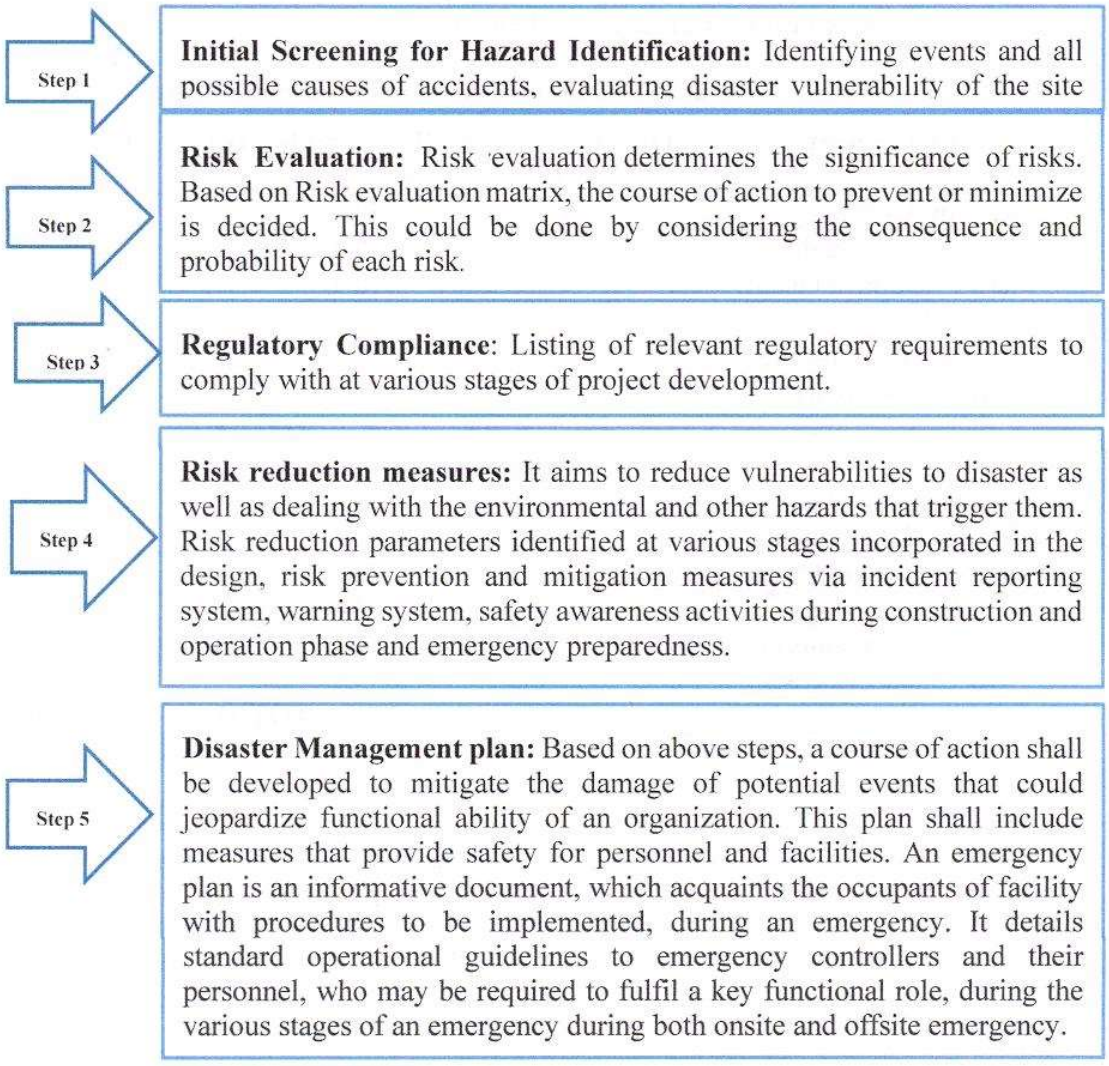


Figure 7-1: Flowchart-Approach of Study

7.2 Screening Checklist

The following hazard identification checklist is used for identification of various hazards in the proposed project.

7.2.2 Construction Phase/Operation Phase

Consideration of hazards in terms of their probability of occurrence and severity of consequence provides the general rationale for performing all safety risk assessments. **Table 7-1** is the screening checklist for construction phase and operation phase.

Table 7-1: Screening Checklist

Activities/Events	Potential Hazard	Construction phase	Operation phase (and Maintenance)
Construction			
Spills of liquid or solid material	Slip/Fall	√	
Wind-driven rain			
Use of unsuitable footwear, with wet, muddy, greasy or oily soles			
Inadequately designed/ constructed/ maintained bund	Drowning	√	
Getting in water for swimming and other recreational activities		√	√
Injuries caused by sharp edges or broken parts on work equipment	Machinery accident	√	
Injuries sustained while using work equipment without proper protection			
Work accidents and injuries caused by lack of proper training			
Welding or abrasive cutting	Fire/ Explosion	√	√
Fuel leakage			
Electric sparks/malfunction			
Use of heavy construction machinery operation- Excavator, concrete equipment	Noise & Vibration	√	
Use of DG set		√	√

7.2.3 Natural Hazard

District Disaster Management Plan (2019) for the Mumbai Suburb was referred for the study of natural hazard. The probabilities associated with various natural hazards are given in **Table 7-2**

Table 7-2: Probability of Natural Hazard

Hazard	Probability of occurrence	Remarks	Reference source
Flood	Yes	The floods affect most of the Mumbai Suburb	District Disaster Management Plan (2019) for the Mumbai Suburb

Hazard	Probability of occurrence	Remarks	Reference source
Earthquake	Yes	The Mumbai Suburb district is located in seismic zone III - Moderate Damage Risk Zone	District Disaster Management Plan (2019) for the Mumbai Suburb.
Cyclones	Yes	Coastal areas of Mumbai Suburbs are prone to cyclone	District Disaster Management Plan (2019) for the Mumbai Suburb.

7.3 Risk Evaluation Matrix

The risk evaluation matrix used for this report is based on the impact on people and/or property and the nature of beach as the currents are strong and the sands of the beach keep shifting because of the waves due to rapidly changing tides, and merging to two tide currents.The ranking of risk is multiplication of probability and consequence. There are 4 levels definedfor each as given in **Table 7-3**.

Table 7-3: Probability Table

Probability	Criteria
Almost Certain	Certainly, occurs in most circumstances
Likely	probable in most circumstances
Possible	Possibility of occurrence cannot be ignored/ Occurred elsewhere
Unlikely	Not likely in normal conditions

7.3.1 Consequence Analysis

Table 7-4: Consequence Analysis

Consequence	Impact on People	Impact on Property	Extent
Severe	Permanent disability or death – one or more person	Catastrophic in nature – require off-site support	Off-site
Major	Major injuries - Hospitalization required	Serious impact on property – require off-site support	Off-site
Moderate	Moderate injuries - medical treatment required	Moderate impact on property – can be controlled with in- house emergency response	On-site
Minor	Minor injuries - can be controlled with first aidmeasures	Minor event- minor impact on property – can be controlled on the spot	On-site

7.3.3 Risk Matrix

		Consequence			
		Minor	Moderate	Major	Severe
Probability	Almost Certain	High	High	Very High	Very High
	Likely	Medium	High	High	Very High
	Possible	Medium	High	High	Very High
	Unlikely	Low	Medium	Medium	High

7.3.4 Risk Mitigation Criteria

Risk Rank	Emergency Level	Mitigation/ management measures
VeryHigh	3	Require off-site emergency management support
High		Require off-site emergency management support
Medium	2	Can be managed with routine procedures as well as interventionof building management
Low	1	Can be managed with routine procedures

Major events related to construction phase and operation phase are presented below.

7.3.5 Risk Evaluation Matrix for Construction Phase

Sr. No.	Event	Probability	Consequence	Resultant Risk Ranking	Emergency level
1	Drowning	Possible	Moderate	High	3
2	Noise and vibration	Possible	Minor	Medium	2
3	Fire	Unlikely	Moderate	Medium	2
4	Slips	Unlikely	Moderate	Medium	2
5	Machinery accident	Unlikely	Moderate	Medium	2

7.3.6 Risk evaluation matrix for Operation phase

Sr. No.	Event	Probability	Consequence	Resultant Risk Ranking	Emergency level
1	Drowning	Possible	Moderate	High	3
2	Noise and vibration	Unlikely	Minor	Low	1
3	Fire	Unlikely	Minor	Low	1
4	Slips	Possible	Moderate	High	3

7.3.7 Risk Evaluation Matrix for Natural Hazard

Sr. No.	Event	Probability	Consequence	Resultant Risk Ranking	Emergency level
1.	Flood	Possible	Moderate	High	3
2.	Earthquake	Unlikely	Moderate	Medium	2
3.	Cyclones	Possible	Moderate	High	3

7.3.7.1 Regulatory Compliance

The proposed project is for the development of the sea front at Aksa beach in Mumbai. It is mandatory to get the clearance under the provision of the CRZ Notification 2011 for the proposed project. Along with the CRZ clearance, project is required to comply following additional rules and regulations:

- Disaster Management Act, 2005
- The Electricity Act 2003.
- Indian Electricity Rules, 1956 till Central Electricity Authority (Measures relating to Safety and Electricity Supply), Regulations are notified by the Authority.
- The Petroleum Act, 1934
- The Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981
- The Environment Protection Act, 1986
- The Public Liability Insurance Act 1991 and Rules 1991.
- Minimum Wages Act, 1948 and Rules 1950.
- Contract Labor Act, 1970 and Rules 1971.
- Child Labor (Prohibitions & Regulations) Act, 1986 and Rules 1950.
- The Noise Pollution (Regulation & Control) Rules, 2000.
- Notification on Control of Noise from Diesel Generator (DG) sets, 2002.
- Manufacture, Storage & Import of Hazardous Chemicals Rules, 1989.
- Solid Waste Management Rules, 2016
- Hazardous Wastes (Management Handling and Transboundary Movement) Rules, 2016 and subsequent amendments.
- ISO 45001:2018 - OHS Management Systems.
- ISO 14001-2004: Environmental Management Systems.

7.4 Risk Reduction Measures

7.4.1 Communication System

7.4.1.1 Incident Reporting System

The incident reporting system to be installed and implemented on site. This can be used to analyses, track and document accidents and incidents that take place on the site. This includes

- To identify principal causes of accidents or near misses,
- To identify deficiencies in the operation,
- To find out and critically evaluate unsafe practices requiring correction and
- To find out and finalize needs for engineering revision. Based on data gathered,

mitigation strategies are developed to improve safety.

- Documentation, investigation of every dangerous occurrence and required notificationsshall be reported to the appropriate authorities.

7.4.1.2 Warning System

- **Communication system - Early Warning**

Generation of disaster warning is a multi-institutional endeavor. The early warning system is useful to forecast and issue alert when the disaster occurs. Different institutions are responsiblefor early warning for cyclones, flood, earthquakes etc. IMD is mandated to monitor the tropical cyclones and earthquakes in the country and provide necessary information/warnings to Government officials and public. Various nodal agencies issuing alerts fordifferent disasters are mentioned **Table 7-5**.

Table 7-5: Agencies issuing alerts for different disasters

Disasters	Agencies
Earthquakes	IMD, MERI (Marine Engineering and Research Institute)
Floods	Meteorology Department, Irrigation Department CentralWater Commission
Cyclones	IMD (Indian Meteorological Department)
Epidemics	Public Health Department
Road accidents	Police
Industrial & Chemical Accidents	Factory, Police, MARG
Fires	Fire Brigade Squad, Police

7.4.1.3 Safety Awareness Activities

- Conducting safety awareness campaigns to get the message transferred among the employees from different backgrounds at project site.
- Provide information in language understood by the employees to avoid communication barrier among safety officer and employees
- Notices in English and regional language should be posted in prominent positions stating rescue equipment available and their locations, personal protective equipment to be used.
- A list of resources for emergency response, address and telephone numbers shall be made available at strategic locations

7.4.1.4 Preventive Measures and Mitigation Measures

7.4.1.4.1 Preventive and Safety Measures

After identifying the range of hazards, the general preventive measures are mentioned below and preventive and safety measures for specific hazards are mentioned in **Table 7-6**. The sea front will be designed considering the location, meteorological conditions, natural phenomenon, and geology.

- Appointment of certified/authorized contactor;

- Periodical maintenance of safety construction machinery, equipment by certified person atregular intervals;
- Providing First aid facility;
- Provide adequate signs and signage to avoid accidents;
- Locate and identify utilities before starting work;
- Using appropriate protective equipment.
- Electrical systems are maintained and operable, in compliance with fire safety design.
- Fueling equipment should be inspected prior to fueling activities to ensure all componentsare in satisfactory condition.

Table 7-6: Preventive and Safety Measures

Sr No.	Hazard	Preventive and safety measures
1	Noise and vibration	• Works will be restricted during daytime.
2	Drowning	• To provide guard-rails at the edges over water where practical • Where it is impracticable, workman shall be provided a lifejacket or use a buoyancy aid. • Rescue equipment should be provided to protect against drowning. • Spotlights shall be installed at strategic locations such that any person fallen into water can be spotted easily.
4	Fire	• Hazardous substances including fuel, paints, lubricants etc. will be stored in designated areas and chemicals shall comply with standard procedures for ensuring general environmental safety. • Vehicles and equipment will be inspected daily for fuel and oil leaks. Records will be kept for inspections. • A sand-filled drip tray should be placed underneath the machinery which has a risk of oil leakage to retain the oil • Ensure fire extinguishers are regularly refilled • All products appropriately segregated • Flame proof wiring to be used in hazardous goods storage areas
6	Slips/Falls	• To reduce tripping hazards, tools, ropes and other materials not in use should be stored away. • Wires and ropes should be coiled and secured so as to prevent any obstruction.

7	Spills/Chemical hazard due to storage and handling	• First aid, firefighting and spill response kits will be available carrying dangerous goods; • All hazardous goods will be stored in accordance with the requirements outlined in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. • Hazardous goods stored area will be monitored to ensure spillages and incidents are observed, cleaned up and recorded. • Storage area will be adequately covered where required
8	Flood	• The stock area and fuel storage will be located at above maximum probable flood level
9	Cyclones	• Weather monitoring during construction. • Standard Operating Procedures (SOP) for maintenance, cleaning and repairs, including: guarding, lock-out mechanisms, training should be prepared and implemented. • Control cables used should be long enough to allow visual contact with the danger zone. • Housekeeping schedule should be planned and implemented. • Seafront development and recreational activity to be planned inline with warnings for cyclones.

Table 7-7: Personal Protective Equipment (PPE)

Sr. No.	PPE	Use
1.	Safety Shoes	• Properly fitting safety shoes should be worn while at work
2.	Safety helmet	• Safety helmet with chin strap should be worn at work.
3.	Lifejacket and buoyancy aid	• A lifejacket or buoyancy aid should fit the wearer, and shouldallow the wearer freedom in action and movement without restricting vision, hearing or breathing. • The lifejacket or buoyancy aid should have distinctive and easily visible colour and preferably be provided with a whistle which can aid in locating the wearer. • The lifejacket or buoyancy aid should be properly maintained.
4.	Goggles	Protective glass or goggles and welding goggles for eye protection
5.	Ear Muff/plug	To dampens the noise to a bearable decibel value.

7.4.2 Monitoring System

The monitoring system should include provisions of two-to-three tier safety, early-warning system, power back-up system for safety of equipment/provision, start-up and shutdown procedures, following and updating SOP's time to time, conducting mock-drills, and regular trials of the standby systems, review and monitoring of the plan including safety audit, availability of emergency equipment and materials.

7.4.2.1 Workplace Inspection

- **Construction phase**

a) Inspection checklist should include information regarding workers (individual characteristics), materials, site condition (slippery surfaces, insufficient illumination), meteorological conditions and management on site.

b) Conducting daily worksite equipment maintenance, personal protective equipment (PPE) inspections and rescue equipment by an authorized competent person.

- **Operation phase**

A. General

The following inspections/safety audits should be routinely carried out or following in-clement weather conditions along with the integrity of the seafront development:

a) The rescue equipment, medical equipment and communication equipment;
b) Medical health checkup of employees at regular intervals;
c) Surveillance cameras for inspection of malicious act/accident vulnerable areas for constant monitoring and record.
d) Structural assessment (to be done by a Structural Engineer).
e) Electric safety audit-checking of the electrical system by an electrician.
f) Fire safety audit-checking for possible sources of fire and identifying inflammableitems in the project site.
g) Communication of the Procedures and training
h) Emergency response procedures should be communicated to all employees along with training to tackle emergency situation.

7.4.3 Mitigation Measures

- **Providing appropriate PPE**
  - The management will ensure that all workers/employees are provided with basic Personnel Protective Equipment (PPEs) like ear plug/muff, safety helmet, safety goggles, safety shoes, etc.
  - The management will also ensure that the quality of these PPEs is properly checked beforeproviding to the workers. It will also be ensured that all the safety equipment are placed properly and are available instantaneously when required
- **First Aid Support**
  - Emergency response procedures should be available at the site for the workers/ employees engaged in the working of the site in order to provide them with necessary treatments in case of accidental mishaps or their health breakdown.

7.5 Emergency Preparedness

After detailing the prevention measures, preparedness measures to handle an emergency. To evaluate the thoroughness and effectiveness of an onsite management plan, it is necessary to conduct Mock drills.

Emergency Communication system will be available at all times to report such instances. Contact details of Police Commissioner, police department, fire brigade and other important bodies will be kept handy.

7.5.1 Supplies and Rescue Team

Construction site will be equipped with DMP plan along with Emergency Response Kit as mentioned in onsite disaster management plan.

- **Rescue Team**

A rescue team should be organized and trained to deal with emergency situations. Every member of the team should be trained in rescue and emergency procedures, and should have completed a course in first aid. MCGM has already made the provisions of beach safety equipment at Aksa beach as mentioned in **Table 7-8.**

Table 7-8: Provision of Beach Safety Equipment at Aksa Beach by MCGM

Name of equipment's	Quantity
Jet Ski	1
Semi Inflatable Boat	1
PFD	3
Ring Buoy	4
Surf Rescue Boat	1
Spine Boat	1
Rescue Tube	3
Rechargeable Battery	1
Ropes	3

7.5.2 Training

- **General**

- Training on emergency response procedures should be conducted for all employees. They should be provided with the necessary information to enable them to act effectively and efficiently in an emergency situation.
- Training may include general induction and more specific training. It should embrace safetypractices, constituents of a safe workplace and information on the particular site conditions.
- They should also know where to get the emergency equipment and how to use the equipment.
- Training should include first aid and rescue equipment training.

7.5.3 Emergency Procedures

The emergency procedures should be posted in prominent positions. It should include the following:

- A list of resources for emergency response, address, telephone numbers should be available at strategic locations;
- Individual workmen action required;
- Procedure for raising the alarm for emergency calling the police informing, public andemergency response agencies when required;
- The emergency procedures in case of spillage, reporting and triggering remedial actions immediately.
- Procedures for using rescue equipment and first aid;

Stating routes for rescue operation if necessary and sending rescued persons to hospital for medical treatment due to immersion in water or injury and accidents.

7.6 Disaster Management

In general, the key causes for disasters are lack of safety management systems, human errors or negligence and natural calamities or sabotage. It is required to inform the plan to workers and occupants in operation phase. Disaster Management plan is intended to provide guidance to all emergency respondents within the project site.

Emergency Response Plan is prepared to effectively deal with all kinds of hazards and also is in a state of preparedness to respond to such events and their adverse effects to the on-site as well as off-site population. It includes worst disaster scenario with reference to specific cases like fire, explosion, oil/chemical spills, including floods, cyclones, terrorist attacks etc. The plan includes early detection of emergencies (natural calamities like cyclones, earthquakes etc.) command and co-ordination of response organization along with trained personnel, availability of appropriate resources for handling emergencies, emergency response actions, effective notification and communication facilities and effective training for personnel. On-site emergency is confined to project area and can be combated within its capability and if necessary, then summoning external help to keep control over the activities whereas off-site emergency affects area beyond project site, affecting neighboring population and environment. The governmental authorities are involved in offsite emergencies when Site Incident Controller activates ECC and declares it as an off-site emergency.

On-site Disaster Management Plan

If an accident/incident takes place within the site, its effects are confined to the site premises, involving only the persons within the project site it is called as On-site Emergency. This plan should include system of warnings, communication protocols within and outside the project site, identification of evacuation routes, access by emergency vehicles to people with disability. The Disaster Management Plan should also location and number of emergency equipment and materials, regular maintenance of emergency equipment, arrangements.

7.6.1.1 Potential Emergency Scenario

Following types of hazards (most of which are incidental due to construction activities) have the potential to occur at the Project site (but not limited to):

- Drowning
- Noise and vibration
- Fire
- Slips
- Machinery accident

7.6.1.2 Potential Disaster Scenario

The following types of disasters have the potential to occur at the Project site (but not limited to):

- Earthquakes
- Fire
- Floods
- Slips
- Drowning

7.6.2 Institutional Mechanism

For the effective safety management, implementation of preventive measures, preparedness for emergency response and implementation of disaster management plan, it is required that the beach has the adequate institutional mechanism in place. The effective collaboration among all levels along with the clearly defines roles, responsibilities and objectives results in to an effective safety management at the site.

7.6.3 Disaster Control

7.6.3.1 Control Room

It is necessary that the emergency is controlled from one specific point so that all the inputs are available at the Control Centers. Control Centers will be equipped with the latest Communication facilities and will be manned 24 x 7 during both the construction and operations phase. At existing substations, the adequacy of size of control room shall be ascertained and the same shall be augmented, if required.

A suitable location/ room shall be identified as Emergency Control Room. It is necessary that the emergency is controlled from one specific point so that all the inputs are available at the ECC. **ECC should be equipped with following items:**

- Copy of "DMP" and Technical Manuals on operating, maintenance procedures.
- Telephone (Internal and External).
- Networked Computer Systems, Note pads, pencil etc.
- Personal Protective Equipment's (PPE). Safety helmets, Safety shoes, Safety goggles, Reflective jackets, Full Body Harness, Rescue boat
- First aid box, stretcher, Search light/ torch, Spare, Portable fire extinguishers
- Uninterruptible Power Supplies with Generators
- The emergency control room shall be equipped with items that may be suitable for use in the emergency situation. The list of such equipment is given below:
- List of telephone Nos. of key personal & other external agencies
- List of safety Equipment as applicable to the site & their storage locations
- Site plans showing assembly points & exists routes, facility description, various drawings and maps of the facility describing the electrical fittings, availability of the firefighting equipment etc. and road maps leading to the site
- Torch with battery
- Hand Operated alarm/siren
- Public announcement system
- Log Books & Stationery Items

➢ **Communications**

A standard emergency communication procedure in case of emergency is developed & communicated to all concerned in the site. The procedure shall give clear guidelines on how to communicate in the following area:

- To alert workers/staff/visitors in case of emergency
- To evacuate or take other action
- To report emergencies

The emergency communication system shall be through siren, public address system or any other system suitable to the site condition. The alarm shall be distinctive & recognized by all personnel working in the site as a signal to evacuate the work area or perform actions identified in the site emergency response and rescue procedure.

➢ **Alert**:

- In case of emergencies the siren to be rang.
- ERT team shall disseminate information based on early warning alerts issued by various agencies. Various nodal agencies issuing alerts for different disasters are mentioned in **Table 7-9**.

Table 7-9: Agencies issuing alerts for different disasters

Disasters	Agencies
Earthquakes	Indian Meteorological Department (IMD)
Floods	Irrigation Department Central Water Commission (CWC)
Cyclones	Indian Meteorological Department (IMD)
Epidemics	Ministry of Health and Family Welfare (MoHFW), Municipal Corporation
Landslides	Geological Survey of India (GSI)
Industrial & Chemical Accidents Industry	Police, BARC (Baba Atomic Research Centre), DISH (Director, Industrial Safety and Health)
Road Accidents	Police
Fires	Fire Brigade, Police

(Source: National Disaster Management Plan, 2016. A publication of the National Disaster Management Authority, Government of India. May 2016, New Delhi).

7.6.4 Emergency Response Plan

Municipal Corporation of Greater Mumbai as a Nodal agency for disaster management is the focal point for the preparation of Response Plan at the District level as it is the point of public service delivery and responsible for directing, supervising and monitoring relief measures for disasters. Plans are periodically reviewed and updated in the light of lessons learnt in dealing with calamities from time to time and the technological advancements.

7.6.5 Emergency Response Kit

The contractor should provide suitable and sufficient rescue equipment for use in emergency rescue operations. Rescue lines should be provided and one rescue boat should be kept ready for immediate use adjacent to turbulent water. Competent boatmen trained in rescue and emergency procedures should handle the rescue boat. First aid facilities along with stretcher and a portable resuscitation equipment should be provided, properly maintained and readily accessible for emergency use. Emergency Response Kit should include the following recommended items:

- Torch with battery,
- Whistles,
- Ropes-Nylon,
- Ladder
- Search light
- Manual Siren
- Metal Cutting set
- Hand tools (Axe, shovel)
- Barricade tape
- Flags
- First Aid Box

7.6.6 Existing SOP for Flood Rescue and Beach Safety by MCGM

SOP Activation Code	(SOP) for flood rescue and beach safety
Level One	In normal routine, the life guards posted at Aksa beach are deployed on duty. The Brigade Flood Rescue Team remains standby at fire station.
Level Two	Level two is activated during High-tide (MORE THEN 4.5 m) days & on Sundays as well as Holidays during Monsoon or heavy shower message received from the Disaster Control Room or Observatory, Level Two will be operated along with Level One staff at the beach & additional arrangements will be made along with one Asst. Station Officer, 3 flood rescue firemen with necessary rescue equipment's along with NDRF & Civil Defence.
Level Three	In case of heavy shower, Level one staff and level two staff will be on site along with additional arrangement. Station Officer, 4 flood rescue firemen along with Assistant Divisional Fire Officer will be deployed. Ward level manpower & resources will be asked for through Asst. Commissioner of the concerned Ward. The Private Institutions i.e., Juhu Beach Safety Association, H2O organization & Local fishermen's assistance will be taken for beach safety.
Level Four	In case of major flood and major shower, Level one staff, level two staff and level three staff along with Divisional Fire Officer & Dy. C.F.O. of their respective jurisdiction and if required additional arrangements at the site of beaches will be as follows: Total staff of Flood Rescue Team i.e., 160 officers & men including 120 regular and 40 fresh/newly trained and men along with Ward Resources, local fishermen, local volunteer organizations, Private Institutions, Juhu Beach Safety Association, NDRF, Navy etc. will tackle the emergency situation

In case of exigencies and during high tide coincide with heavy rain, Level 3 & 4 SOP activation overall arrangements will be in coordination with D.F.O. (M) MFB control room, Chief Officer DMP/ CCRS by D.F.O. under the supervision of C.F.O.

7.6.7 Dovetailing of On-site Emergency Plans with off-site disaster Plan

Off-site Emergency is necessary if the accident at the site is uncontrollable and it may spread outside the premises. It is necessary that the actions enlisted in the on-site plan are consistent with the plan of action in this Off-site Emergency Plan[13]. The dovetailing to this effect needs to be ensured in the following areas among others:

- Communication to the District Authorities/Agencies
- Line of command

[13](Source: Guidelines for preparation of Off-site Emergency plans, Hazardous Substance Management Division.Ministry of Environment and Forests, Government of India)

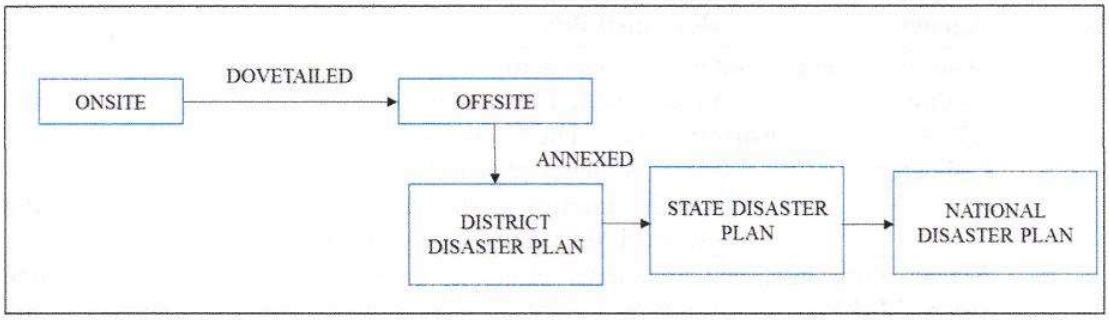


Figure 7-2: **Dovetailing Mechanism**

7.7 Off-site Disaster Management Plan

The objective of the off-site disaster management plan is to facilitate effective incident management by improving preparedness of the locality for off-site releases. The plan is collaborative activity of the facility, local emergency response agencies, and external supporting facilities.

7.7.1 Responsibilities

The Off-site Emergency Plan shall be prepared by the District Magistrate and Govt. agencies.The plan contains up-to-date details of outside emergency services and resources such as Fire Services, Hospitals, and Police etc. with telephone number. The district authorities are to be included in the plan area. Police Department, Revenue Department, Fire Brigade, Medical Department, Municipality, Gram Panchayat, Railway Department, Telephone Department, Factory Department, Electricity Department, Pollution Control Department, Explosive Department., Press and Media.

Functions of Disaster Management cell are listed below:

1. Issue alert to all concerned agencies.
2. Provide early warning to citizens whenever possible.
3. Deploy first responders through Fire Brigade, Hospitals and Search and Rescue Teams.
4. Arrange for emergency supplies of water and food.
5. Arrange for transfer of stranded & marooned persons.
6. Arrange for emergency transport for the seriously injured.
7. Coordinate for setting up temporary shelters.
8. Coordinate with NGOs

The general responsibilities of the various authorities and agencies involved in mitigation of off-site emergency are listed below. In addition, the authorities and agencies should perform all such tasks as per the demands of emergency situation at hand.

Table 7-10: Responsibility of various Agencies

Sr. No	Agency	Responsibility
1.	Occupier/Project Proponent	Overall responsibility to combat onsite emergency, and coordination with District Collector Mumbai Suburban district, Disaster Management and other responders to help combat Offsite emergency. Supporting district authorities in mitigation, rescue and rehabilitation, with resources identified and agreed with theauthorities in advance.

Sr. No	Agency	Responsibility
2.	District emergenc Authority (DEA – Distri Collector)	Overall management and mitigation of off-site emergency. Ensure that all responding agencies work harmoniously and efficiently. The district authority is responsible for the Off-Site emergency plan and it shall be equipped with up-to-date website, control room etc., with provisions for monitoring the level of preparedness at all times.
3.	Maharashtra Maritime Board(MMB)	It maintains effective co-ordination with Area Cyclone Warning Centre to gather port warning messages and circulating the same to the ports expected to get affected.
4.	Police	Cordoning and crowd control, evacuation of people if necessary.
5.	Fire Service Department	Fire-fighting and rescue. The fire services need to be updated interms of equipment and trained manpower. The infrastructure and capacity building of the NFSC and the fire brigades shall be augmented on a priority basis.
6.	Health Department	To assure that all victims get immediate medical attention on thesite as well as at the hospitals/ health-care facility where they areshifted. In addition, the department needs to network all the health-care facilities available in the vicinity for effective management and also take effective measures to prevent the occurrence of any epidemic.
7.	Technical Experts	Render expert technical advice for combating Emergency
8.	Mutual AID Groups	Mobilize resources to mitigate emergency
9.	Pollution Control Board	Assess and control pollution damage. Need to ascertain the developing severity of the emergency in accordance with responsive measures by constant monitoring of the environment.If and when an area is fit for entry will depend upon the results of the monitoring. A decontamination operation would be required to be carried out with the help of other agencies and industries.
10.	Media	Dissemination of vital information to public, avoid spread of rumors
11.	Electricity Board	Ensure uninterrupted power supply, also supply at temporary shelters
12.	Telecommunication Department	Ensure efficient working of communication lines
13.	National Disaster Response Force and State Disaster Response Force	Mitigation of the emergency/disaster as required. The NDRF and SDRF are the specialized forces to manage these disasters in a longer run according to the severity and nature of the disaster. Their specialized training is an effective measure that needs to be built up and maintained with time for achieving a higher standard of preparedness. They need to coordinate with other local agencies such as the Central Industrial Security Force that may be responsible for security at the industrial site.
14.	Local Government Bodies	Mobilize resources for combating emergency and also makeshelters available for evacuees
15.	NGOs	Aid and assist the responding agencies

Sr. No	Agency	Responsibility
16.	Other Members of DCG	Assist and act as per directions of the District Collector

7.7.2 Emergency Communication

Site Incident controller will manage the activities for off-site emergency plan who will be contact with emergency co-ordination officer of the area.

7.7.3 Emergency Contacts

Table 7-11: Off-site Emergency Contacts

Sr. No.	Emergency Facility	Contact Number
Police Control Room		
1	Malvani Divisional ACP	28820497
2	DCP	28903899
3	Additional CP	28854643
4	Dindoshi Police Station ACP	28752181
5	Goregaon Police Station	28724376
6	National Disaster Response Force	02114 231509
7	Disaster Management Unit, MCGM	22694727/25
8	Brihanmumbai Electricity Supply & Transport	22873961, 22840601
9	Indian Coast Guard	24301393, 24301564
10	Central Reserve Police Force	24360971
Fire Control Room		
1	Malad Marve Road, Malvani, Malad(W)	28071010
2	Chinchli, Link Road, Malad(W,)	9819751759
3	Dindoshi Arun Kumar Vaidya Marg, Goregoan E	9869331391
4	Goregoan Best Colony Road, Goregoan(W)	28712869
Government Hospitals		
1	Siddharth Nagar, Goregaon (West), Mumbai - 400 104	2876 6885, 2876 6886
2	Daftary Road, Malad (East), Mumbai - 400097	2889 4381, 2889 9447
3	Govindnagar Hospital, Govindnagar, Haji Badu Road, Malad (East), Mumbai - 400 097	2877 4215, 2877 0007
4	Malawani 1, NCC plot no-28, Maulana Azad Mat Home, Malvani, Hathi Garden	022-28813850
5	Choksy, Choksy Maternity Home, Marve Road	022-28821932
6	Valnai, Valnai Surana Hosp, Marve Road, Front of Orlem Church	022-28088012
7	Director Medical Education & Major Hospitals	23082714, 23097078
8	Director of Health Services (GoM)	22620292, 22621006
Blood Bank		
1	Suburban Hitech Blood Bank	022-28714070
2	Malad Blood Bank	022-28445678
3	Meenatai Thackeray Blood Bank - Siddharth Hospital	022-28797586

7.8 Evacuation Process

Evacuation process should be adequate and easy to follow for safe and orderly emergency evacuation. The plan should include procedures for the notification and evacuation of the sur-rounding community. The planning is a joint effort of local government and facility. Protectedescape routes will be provided to allow occupants to move in relative safety to a place of safety. Based on following consideration evacuation plans shall be developed:

- Designation of off-site assembly areas.
- Designation of employees responsible for checking the evacuation area and for takingpersonnel counts at the assembly area for safe evacuation.
- Designation of emergency escape equipment.

8. Project Benefits

8.1 Social Benefits

- The proposed sea front development includes construction of bund with pathway for walking. Also it involves development of other recreational facilities such as Gardens, lawns, volleyball court, children play area, open gym, seating area, cafeteria, parking space and sanitary facilities for beach visitors.
- The Aksa beach is one of the scenic beach and less crowded like other beaches of Mumbai. Therefore it is one of the best weekend getaway places for city dwellers from nearby areas. The proposed development of sea front will provide the visitors with various facilities along with walkable pathway on bund.
- Local street food vendors will be benefitted with increased availability of consumers due to proposed sea front development.

8.2 Environmental Benefits

- The proposed sea front development involves construction of bund as a shore protection measure. As the Aksa beach experiences strong currents it results into quicksand due to suspension of sand. This is also causing erosion of sand from the beach. The proposed bund will provide protection to beach from sand erosion.

9. Cost Benefit Analysis

The Cost Benefit Analysis is recommended at the scoping stage of the project as per EIA notification 2006 and subsequent amendments. The proposed project is for sea front development and beautification at Aksa beach and does not requires ToR approval by appraising authority, hence Cost Benefit analysis is not carried out.

10. Environment Management Plan

An Environment Management Plan (EMP) includes implementation and monitoring of mitigation measures suggested for protection of environment during construction and operation phase of the project. It is a detailed implementation plan which provides mitigation & compensatory measures for the adverse environmental impacts associated during construction and operation pahse of the project. The environmental management must be integrated into the process of project planning so that ecological balance of the area is maintained and adverse effects are minimized. EMP should be viewed as a commitment on the part of the proponent to minimize environmental impacts.

10.1 Objectives of EMP

- To establish systems and procedures for protecting environment during various stages of the project.
- To ensure that the project is implemented in an environmentally sustainable manner.
- To monitor that the project is implemented in accordance with the design.
- To monitor implementation of mitigation measures and their effectiveness.

10.2 Environment Management Plan

Environment management plan for various activities involved in construction and operation phase of the project is detailed below in Table 10.1.

Table 10.1: Environmental Management Plan

S. No.	Project Activities	Impacts	Regulatory Requirements	Mitigation Measure	Institutional Responsibility		Reporting Format	Auditability
					Implementation	Supervision		
Construction Phase								
1	Transportation, storage, and handling of raw material	• Impact on ambient air quality • Increase in noise levels from equipment and vehicle operation. • Beach sediment contamination due to accidental spillage of fuels or oil • Impact on benthic fauna from contamination of beach sediment from accidental fuel or oil spillage • Inconvenience to visitors from unaesthetic visual and noisy activities	• NAAQ Standards 2009 for Air Quality • Ambient Noise Rules 2000 • Hazardous and other waste (management and trans-boundary movement rules 2016) and amendment (2018)	• Use of low sulfur fuel • PUC check for vehicles • Covered transport of material • Restricting construction to day time • Storage of raw material away from intertidal area • Deployment of trained workers	Contractor	MMB	• PUC logbook for vehicles • Material storage inventory • Work hours record	Quarterly audits of logbooks and records
2	Excavation and foundation	• Impact on ambient air quality • Increase in noise levels from equipment operation. • Inconvenience to visitors from unaesthetic visual from excavated	• NAAQ Standards 2009 for Air Quality • Ambient Noise Rules 2000 • SWM rules 2016	• Use of low sulfur fuel • Restricting construction to day time • Maintenance of equipment and vehicles	Contractor	MMB	• Waste collection record • Equipment maintenance record • Work hours record	Quarterly audits of logbooks and records

S. No.	Project Activities	Impacts	Regulatory Requirements	Mitigation Measure	Institutional Responsibility		Reporting Format	Auditability
					Implementation	Supervision		
		waste and noisy activities	• Hazardous and other waste (management and trans-boundary movement rules 2016) and amendment (2018)	• Acoustic enclosure to DG sets • Collection and disposal of waste to authorized agency • Barricading the construction site with galvanized sheets				
3	Construction of anti- sea erosion bund	• Impact on ambient air quality • Increase in noise levels from equipment operation • Contamination of sediment from site runoff and labour generated waste • Impact on benthic fauna due to contamination of sediment • Inconvenience to visitors from unaesthetic visual and noisy activities	• NAAQ Standards 2009 for Air Quality • Ambient Noise Rules 2000 • SWM rules 2016 • Hazardous and other waste (management and trans-boundary movement rules 2016) and amendment (2018)	• Use of low sulfur fuel • Restricting construction to day time • Maintenance of equipment and vehicles • Acoustic enclosure to DG sets • Deployment of trained workers • Collection and disposal of waste to authorized agency • Barricading construction site with galvanized sheets	Contractor	MMB	• Equipment maintenance record • Work hours record • Waste collection record	Quarterly audits of logbooks and records

S. No.	Project Activities	Impacts	Regulatory Requirements	Mitigation Measure	Institutional Responsibility		Reporting Format	Auditability
					Implementation	Supervision		
4	Sea front development	• Impact on ambient air quality • Increase in noise levels from equipment operation • Employment opportunity to labor • Inconvenience to visitors from unaesthetic visual and noisy activities	• NAAQ Standards 2009 for Air Quality • Ambient Noise Rules 2000	• Use of low sulfur fuel • Restricting construction to day time • Maintenance of equipment and vehicles • Acoustic enclosure to DG sets • Barricading the construction site with galvanized sheets	Contractor	MMB	• Equipment maintenance record • Work hours record	Quarterly audits of logbooks and records
Operation Phase								
1	Recreational activity	• Visitor generated waste may enter sea if not managed properly and lead to floating garbage and unaesthetic and unhygienic conditions • Contamination of marine water and sediment by waste disposal in beach area • Impact on marine flora and fauna due to contamination of water from waste entering sea	• Ambient Noise Rules 2000 • SWM rules 2016	• Provision of dust bins on beach for collection of dry and wet waste • Prohibition of waste disposal in on beach and sea water • Prohibition of entry on seaward side of bund	MMB/waste collection agency	MMB	Record of waste collection by third party agency	Quarterly audits of logbooks and records

S. No.	Project Activities	Impacts	Regulatory Requirements	Mitigation Measure	Institutional Responsibility		Reporting Format	Auditability
					Implementation	Supervision		
		• Increase in traffic along Madh – Marve road causing traffic congestion and parking issue • Drowning of visitors due to crossing bund and entering sea • Disturbance to local residents from Aksa village due to noise levels • Tourism business opportunities to locals						

10.3 Environmental Management Cell

MMB has its environement management cell in place to monitor the environmental aspects during coastal development works. The key responsibilities of environment management cell are

- Development of environmentally sustainable coastal protection measures.
- Monitoring the effectiveness of the pollution control measures in compliance to conditions stipulated by regulatory bodies such as PCB

For this project context, the EMP Cell will also be responsible for:

Training Awareness and Competence

Site staff shall be competent to perform tasks avoiding significant environmental impacts. Project specific training is required. Environmental awareness and training shall be achieved by:

Site induction, including relevant environmental issues.

- Environmental posters and site notices.
- Method statement and risk assessment briefings.
- Toolbox talks, including instruction on incident response procedures.
- Key project specific environmental issues briefings

Addressing Non-conformance and Corrective Actions

Procedures for addressing non-conformance and corrective actions are to be provided. These may include, for example:

- A Non-Conformance Report (NCR) that will be raised to record any environmental incident and work that has not been carried out in accordance with the management plan
- A Corrective Action Report (CAR) will be raised where a deficiency is identified as a result of monitoring, inspection, surveillance and valid complaints.

Any actions identified shall nominate an owner to follow through the action to be taken, along with a specified timescale for it to be closed out.

10.4 Environment Management Cost

Budget for implementing environment management plan during construction and operation phases of the project is given below in **Table 10.2**.

Table 10.2: Environment Management Budget

Sr. no.	Management aspect	Cost (in Lakhs)
Construction phase		
1.	PPE	0.75
2.	Waste management	0.30
3.	Environmental monitoring	0.80
4.	Health and Safety	0.50
	Total	**2.35**
Operation phase		
1.	Waste Management	0.50
2.	Environmental monitoring	0.50
	Total	**1.00**

11. Summary and Conclusion

11.1 Introduction

Aksa beach is a less crowded beach located away from mainland of Mumbai city. The beach is known for strong currents and quicksand which poses risk of drowning. Also due to strong currents the beach is subjected to sand erosion. Therefore to avoid sand erosion it is important to implement suitable anti-erosion measure. Also sea front development at this beach would enhance the tourism value of the beach. Considering need of protecting beach from sand erosion and to enhance it from tourism point of view it becomes important to construct the anti sea erosion bund and develop sea front for visitors.

11.2 Project Description

The proposed project involves sea front development and beautification of Aksa beach. Sea front development will include construction of anti sea erosion bund with pathway for walking. Proposed anti sea erosion bund will be 950 m long and 10.7 m wide at base. The bund will be provided with 3 m wide pathway for walking. Also other facilities proposed in sea front development include parking area, bamboo shacks, sanitary facilities, seating area, open gym, children play area and volleyball court. Gardens will be developed for beautification of the beach front.

About 30 workers will be engaged on site during construction phase. Drinking water quantity required is estimated to be 750 lit/day. The total municipal waste generated will be 7.5 kg/day out of which, 3 kg/day will be biodegradable and 4.5 kg/day will be non-biodegradable waste which will be collected and separated by providing separate bins on site and will be sent for further processing via authorized vendor. During construction phase LSD D.G set of 25 KV shall be used as a source of power supply at construction site. Proposed project will be implemented within approximately 12 months after obtaining necessary approvals. Total cost of the project is 15 crores.

11.3 Description of Environment

The baseline environmental study has been carried out in October 2020. Baseline monitoring was carried out considering nature and magnitude of project activity. Also, the environmental setting and potential receptors of the impact were considered for determining monitoring locations. The area within 2km radial distance is defined as primary study area. Whereas, area

within 10 km radial distance is defined as secondary study area. The observation on baseline environment are summarized below.

S.No.	Parameters	Observations and Inferences
1.	Physiography	Physiographic feature of the Mumbai sub urban district is broad and flat terrain flanked by north – south trending hill ranges. The hill ranges form almost parallel ridges in the eastern and western part of the area. The Powai – Kanheri hill ranges are the other hills extending in the eastern and central part running NNE – SSW. The maximum elevation of the area is 450 m above mean sea level (m amsl) at some of the peaks of hill ranges. Trombay island has north – south running hills with maximum elevation of 300 m above man sea level. Malbar, Colaba, Worli and Pali hills are the isolated small ridges trending north – south in the western part of the district. The Powai – Kanheri hills form the largest hilly terrain in the central part of the Salsette island and are the feeder zone for the three lakes viz., Powai, Vihar and Tulsi. There are a number of creeks, dissecting the area. Among them, Thane is the longest creek. The Vasai Creek to the north and Thane Creek to the east separates Salsette Island from the mainland. Within the city the Malad (or Marve) Creek and the Gorai (or Manori) Creek inundate the suburban region. The Mahim Creek forms the border between the two districts. The Manori, Malad and Mahim creeks which protrudes in the main land and give rise to mud flangs and swamps.
2.	Geology and Geomorphology	The entire district is underlain by basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow Alluvium formation of recent age also occurs as narrow stretch along the major rivers flowing in the area. The geology of the district can be classified as hard rock of Deccan trap basalt areas and loose formations of alluvium. According to the various geomorphic features, the district has been divided into three geomorphic land units and categorized as: (1) denudational, (2) fluvial and (3) coastal landform. Residual Hills are formed due to the process of peneplanation that reduces original mountain masses into a series of scattered knolls standing on the peneplain. These hills are found in north of Gorai. Mudflats (also known as tidal flats), are covered by permanent and/or temporary salt water, and occur in the lowland area. Mudflats are mainly seen around Thane, Manori and Malad. Beaches are loose unconsolidated deposits made by marine action near the shore. Sandy beaches are seen along the western shore of Mumbai, the most noticeable ones being the Worli-Bandra, Juhu, Aksa, Gorai and Utan. At Madh, large patches of rocky exposures are seen.
3.	Hydrogeology	There are mainly two types of ground water structures i.e., dug wells and borewells in the area. The yields of the dug wells vary from 10 to 1000 m 3 /day, whereas that of borewells ranges between 50 and 1000 m 3 /day tapping the promising aquifer in the depth range of 40 to 60 m bgl.
4.	Drainage pattern	Mumbai sub urban region is drained by Mahim, Mithi, Dahisar and Polsar rivers. These small rivers near the coast, form small rivulets which inter mingle with each other resulting in swamps

		and mud flats in the low-lying areas. Mithi river is the main river in the Mumbai Suburban District. Mithi River originates in the Vihar Lake area, flows southwards and through the Bandra-Kurla Complex, and finally meets Arabian Sea at Mahim bay. Dahisar river is second main river in Mumbai suburban district. It originates from Tulsi Lake (Gundogan) which is in Sanjay Gandhi National Park, flows through Magathane, Kanheri, Dahisar, Mandpeshwar before meeting the Arabian sea via the Bhayandar creek. Poisar River originates in Sanjay Gandhi National Park and flows through Akurli, Poisar, Kandivali, Valanee, Malad and meets to Arabian Sea via Malad creek. Oshiwara river originates in Film City (Goregaon). Before meeting the Arabian Sea via the Malad Creek, two rivulets join the river, one rivulet flows from Santhosh Nagar and another from Oshiwara and meets the river near Araey Colony bridge.
5.	Seismology	The study area fall in Zone IV, which is high damage risk zone as per earthquake hazard map by BMTPC.
6.	Landuse/Landcover	About 39.41% of the land area of Mumbai district is builtup land. The project location lies in sandy area. Other land use classes falling within study area include barren land, waterbody, built up land and mangrove.
7.	Ambient air	Based on ambient air quality monitoring carried out within study area it is observed that average concentrations of all air quality parameters were within national ambient air quality standards specified by CPCB. Low concentrations of pollutants are observed near project site which is beach. It could be due to absence of or less activities leading to gaseous emissions.
8.	Ambient Noise	Noise level monitoring results indicated higher noise levels near beach areas as compared to near school. Higher values of noise could be due to noisy activities on beach, nearby road traffic etc. However at all the locations monitored noise levels were found to be within CPCB specified standards.
9.	Marine Water Quality	Marine water sampled from project location and open sea indicates slightly basic pH. Phosphate and nitrogen levels in water samples can be attributed to waste streams draining into Gorai creek from surrounding residential areas which further drains into Arabian sea off Aksa beach. Traces of heavy metal and oil & grease in water samples can be attributed to pollution load from Gorai creek.
10.	Marine Sediment Quality	The project location being a sandy beach the sediment sample indicated sandy loam texture. Traces of heavy metals in sediment can be attributed to pollution load draining into Arabian sea from Gorai creek. Presence of petroleum hydrocarbon in traces may be due to fuel or oil leakages from ferry boats near mouth of Gorai creek.
11.	Ecology and Biodiversity	Vegetation near Aksa was mainly composed of coconut and Toddy palms. Other vegetation within study area included commonly occurring trees such as casurina, copper pod, rain tree etc. Mangrove vegetation within study area was observed on

		Southwest of the project at marshy lands which was represented by *Avicennia marina, Avicennia officinalis, Excoecaria agallocha* and *Sonneratia apetala.* Total 18 genera of phytoplankton were identified during study. Higher percentage compositon was represented by *Skeletonema, Nitzschia, Navicula* and *Thalassiosira.* Avifauna observed near proposed project location represented commonly occurring marine bird species. Some of the terrestrial birds also were observed during survey near barren lands and vegetation near residential places. In the project surrounding areas including barren lands and vegetation around residential areas mammal such as Indian flying fox and three stripped palm squirrel were commonly observed. During survey garden lizard, common skink and common rat snake were the only species of reptiles observed. No amphibian species were observed during survey. Among insects and arthropods common species of butterfly, dragonfly and spiders were observed during survey. High viable count was observed from samples collected near INS Hamla. Microbial presence in water can be attributed to tourist activity associated pollution near beach as well pollution load draining into Gorai creek from surrounding residential areas. Zooplankton groups indicated copepods and decapod larvae to be most common groups. Higher percentage composition was represented by polychaetes followed by amphipods in subtidal sediments. Whereas, meio-benthic fauna was represented mainly by nematodes. Higher percentage composition of intertidal Macrobenthos was represented by polychaetes followed by pelecypods. Higher percentage composition of meio-benthic fauna was represented by nematodes followed by polychaetes. Mudflats of Gorai creek have been reported with abundant presence of mudskipper species such as *Boleophthalmus boddaerti* and *Boleophthalmus viridis.* About 112 species of fishes have been reported from the catch of multi-day and single-day trawlers from Mumbai coast. Dominant species from the catch belonged to the order Perciformes.
12.	Socio-Economic Profile	Proposed project lies at aksa beach at Madh in Mumbai suburban district. The population density of the Aksa village reported to be 2313 people/km2. Total population has been recorded to be 3399 during year 2020.

11.4 Anticipated Impacts and Mitigation Measures

Various impacts anticipated due to construction and operation phase of the project are summarized below.

Project Activities	Anticipated Impacts	Mitigation Measures
Construction Phase		
Transportation, storage, and handling of raw material	• Impact on ambient air quality • Increase in noise levels from equipment and vehicle operation. • Beach sediment contamination due to accidental spillage of fuels or oil	• Use of low sulfur fuel • PUC check for vehicles • Covered transport of material • Restricting construction to day time

Project Activities	Anticipated Impacts	Mitigation Measures
	• Impact on benthic fauna from contamination of beach sediment from accidental fuel or oil spillage • Inconvenience to visitors from unaesthetic visual and noisy activities	• Storage of raw material away from intertidal area • Deployment of trained workers
Excavation and foundation	• Impact on ambient air quality • Increase in noise levels from equipment operation. • Inconvenience to visitors from unaesthetic visual from excavated waste and noisy activities	• Use of low sulfur fuel • Restricting construction to day time • Maintenance of equipment and vehicles • Acoustic enclosure to DG sets • Collection and disposal of waste to authorized agency • Barricading the construction site with galvanized sheets
Construction of anti- sea erosion bund	• Impact on ambient air quality • Increase in noise levels from equipment operation • Contamination of sediment from site runoff and labour generated waste • Impact on benthic fauna due to contamination of sediment • Inconvenience to visitors from unaesthetic visual and noisy activities	• Use of low sulfur fuel • Restricting construction to day time • Maintenance of equipment and vehicles • Acoustic enclosure to DG sets • Deployment of trained workers • Collection and disposal of waste to authorized agency • Barricading construction site with galvanized sheets
Sea front development	• Impact on ambient air quality • Increase in noise levels from equipment operation • Employment opportunity to labor • Inconvenience to visitors from unaesthetic visual and noisy activities	• Use of low sulfur fuel • Restricting construction to day time • Maintenance of equipment and vehicles • Acoustic enclosure to DG sets • Barricading the construction site with galvanized sheets
Operation Phase		
Recreational activity	• Visitor generated waste may enter sea if not managed properly and lead to floating garbage and unaesthetic and unhygienic conditions • Contamination of marine water and sediment by waste disposal in beach area • Impact on marine flora and fauna due to contamination of water from waste entering sea • Increase in traffic along Madh – Marve road causing traffic congestion and parking issue • Drowning of visitors due to crossing bund and entering sea • Disturbance to local residents from Aksa village due to noise levels	• Provision of dust bins on beach for collection of dry and wet waste • Prohibition of waste disposal in on beach and sea water • Prohibition of entry on seaward side of bund

Project Activities	Anticipated Impacts	Mitigation Measures
	• Tourism business opportunities to locals	
Anti sea erosion bund	• Anti sea erosion bund will protect Aksa beach from sand erosion	--

11.5 Analysis of Alternatives

The Aksa beach is known for its aesthetics as well as frequent quick sand scenarios. Also the strong currents at this beach are causing rapid sand erosion. In order to protect the beach from sand erosion and enhance tourism value of the beach it is necessary to implement the sand erosion measure at Aksa beach. Hence no alternate site is analysed for proposed development.

11.6 Environmental Monitoring Program

Half yearly compliance report in respect of the stipulated terms and conditions of CRZ Clerance should be submitted by project proponent to the concerned regulatory authorities on 1st June and 1st December of each calendar year. The budget for one time environment monitoring during construction phase and operation phase is estimated to be 0.8 lacs and 0.5 lacs respectively.

11.7 Additional Studies (Risk Assessment and Disaster Management Plan)

The hazard potential of activities/events of both construction phase and operation phase and estimation of consequences in case of accidents has been identified and risk assessment has been carried out to quantify the extent of damage and suggest recommendations for safety improvement. Risk of drowning, slipping and flood is anticipated near Aksa beach. Also the disaster vulnerability of the project site location is evaluated and the probabilities associated with natural hazards are provided.

Risk mitigation measures based on risk evaluation matrix and regulatory compliance are incorporated in order to improve overall system safety and mitigate the effects of major accidents.

An effective Disaster Management Plan (DMP) to mitigate the risks involved has been prepared. This plan defines the responsibilities and resources available to respond to the different types of emergencies envisaged. Training exercises will be held to ensure that all personnel are familiar with their responsibilities and that communication links are functioning effectively.

11.8 Project Benefits

The proposed development of sea front will provide the visitors with various recreational facilities along with walkable pathway on bund. Local street food vendors will be benefitted with increased availability of consumers due to proposed sea front development. The proposed bund will also provide provide protection to beach from sand erosion.

11.9 Cost Benefit Analysis

The Cost Benefit Analysis is recommended at the scoping stage of the project as per EIA notification 2006 and subsequent amendments. The proposed project is for sea front development and beautification at Aksa beach and does not requires ToR approval by appraising authority, hence Cost Benefit analysis is not carried out.

11.10 Environmental Management Plan

An Environment Management Plan (EMP) includes implementation and monitoring of mitigation measures suggested for protection of environment during construction and operation phase of the project. During construction and operation phase implementation of mitigation measures will be responsibility of the contractors and waste collection agencies respectively and supervision of the same to be done by MMB. Budget for implementing environment management plan during construction and operation phases of the project is 2.35 lacs and 1.0 lacs respectively.

11.11 Conclusion

It could be concluded based on the Environmental Impact Assessment study that the anticipated overall impact from extension of the existing jetty and its operation phase would not have large scale impact on the surrounding environment. The sea front development will improve tourism at aksa beach and also provide business opportunity to locals through tourism. The identified impacts can be minimized by implementing the mitigation measures covered in Environmental Management Plan.

12. Disclosure of Consultants

Building Environment (India) Pvt. Ltd. is a 'QCI Accredited - Environmental Consulting Organization'. The company works at the interface where infrastructure and environment interact with the aim of bridging the gap between the two and thrives to address environmental concerns holistically which is the need of the hour. We therefore help for better building's environment and in doing so build the environment through our varied services.

This report is released for the purpose of obtaining CRZ clearance for *"Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai"* under the provision of CRZ notification 2011, Information provided (unless attributed to referenced third parties) is otherwise copyrighted and shall not be used for any other purpose without the written consent of Building Environment India Pvt. Ltd.

12.1 EIA Report Details

<table>
<tr><td>Report</td><td colspan="6">Environmental Impact Assessment Report</td></tr>
<tr><td colspan="7">Project Details</td></tr>
<tr><td>Name of the Report</td><td colspan="6">Environmental Impact Assessment Report for Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai</td></tr>
<tr><td>Client</td><td colspan="6">Maharashtra Maritime Board</td></tr>
<tr><td>Prepared by</td><td colspan="6">Building Environment India Pvt Ltd.</td></tr>
<tr><td>Project Number</td><td></td><td>Version</td><td>R0</td><td>Released Date</td><td colspan="2">18.6.2021</td></tr>
<tr><td colspan="7">Contact Details</td></tr>
<tr><td colspan="7">Building Environment India Pvt Ltd,
Dakshina Building, Office No-401,4th Floor,
Beside Raigad Bhavan, Sakal Bhavan Rd,
Sector 11, CBD Belapur, Navi Mumbai, Maharashtra 400614
Tel. No. : 022-27578554/41237072</td></tr>
<tr><td colspan="7">NABET Accreditation NO. – NABET/EIA/1821/RA0133</td></tr>
<tr><td>CRZ Application Reference Document</td><td colspan="6"></td></tr>
<tr><td colspan="7">Issue Order</td></tr>
<tr><td rowspan="3">Date</td><td colspan="3">Building Environment India Pvt Ltd.</td><td colspan="3">Maharashtra Maritime Board</td></tr>
<tr><td colspan="2">Originated by</td><td colspan="2">Checked and Approved by</td><td>Checked by</td><td>Approved by</td></tr>
<tr><td>Name</td><td>Signature</td><td>Name</td><td>Signature</td><td>Name</td><td>Signature</td><td>Signature</td></tr>
<tr><td></td><td>Mr. Sunil Belvekar</td><td></td><td>Mr. Vivek Kulkarni</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Disclaimer</td></tr>
<tr><td colspan="7">Building Environment India Pvt Ltd. has taken all reasonable precaution in the preparation of this report as per its auditable quality plan. Building Environment India Pvt Ltd. also believes that the facts presented in the report are accurate as on the date it was written. However, it is impossible to dismiss absolutely, the possibility of errors or omissions. Building Environment India Pvt Ltd. therefore specifically disclaims any liability resulting from the use or application of the information contained in this report. The information is not intended to serve as legal advice related to the individual situation.</td></tr>
</table>

12.2 Declaration by Experts

Declaration by Experts contributing to the Environmental Impact Assessment Report for "Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai"

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator:

Name	Vivek Kulkarni	
Signature and Date		
Period of Involvement	October 2020 till date	
Contact Information	**Address** Building Environment India Pvt Ltd, Dakshina Building, Office No-401,4th Floor, Beside Raigad Bhavan, Sakal Bhavan Rd, Sector 11, CBD Belapur, Navi Mumbai, Maharashtra 400614	Contact Number Tel. No.: 022-27578554/41237072 hkolatkar@beipl.co.in

Environmental Impact Assessment Report for *"Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai"*					
Project Team	**EIA Coordinator: Mr. Vivek Kulkarni**				
	FUNCTIONAL AREA		**FAE**	**FAA**	**TEAM MEMBER**
	Land Use		Mr. Hrushikesh Kolatkar	--	--
	Air	AP	Mr. Ashok Bandgar	--	--
		AQ	Mr. Ashok Bandgar	--	--
	Noise		Ms. Nishu Singh	--	--
	Water		Ms. Sanjay Shevkar	--	--
	Geology		Mr. Bhushan Kachawe	--	--
	Hydrogeology		Mr. Bhushan Kachawe	--	Mr. Anand Kirpekar
	Soil Conservation		Ms. Shraddha Gathe	--	--
	Ecology & Biodiversity		Mr. Sunil Belvekar	--	
	Risk & Hazard Assessment		Mr. Nilesh Potdar	--	Ms. Saumya Raj
	Solid Waste & Hazardous Waste		Mr. Nilesh Potdar	--	Ms. Saumya Raj
	Socioeconomic		Mr. Hrushikesh Kolatkar	--	--

12.3 Declaration by Head of ACO

Declaration by the Head of the Accredited Consultant Organization:

I, Hrushikesh Kolatkar, hereby confirm that the above-mentioned experts prepared the Environmental Impact Assessment Report for Proposed Sea Front Development and Beautification at Aksa Beach, Madh, District Mumbai.

I also confirm that I shall be fully accountable for any misleading information mentioned in this statement.

Signature:

Name: Hrushikesh Kolatkar

Designation: Managing Director

Name of EIA Consultant Organization: Building Environment India Pvt Ltd.

NABET Certificate Number & Issue Date: RA 183rd AC Meeting MOM, 7th December 2018.

NABET Accreditation NO. – NABET/EIA/1821/RA0133

27/6/23

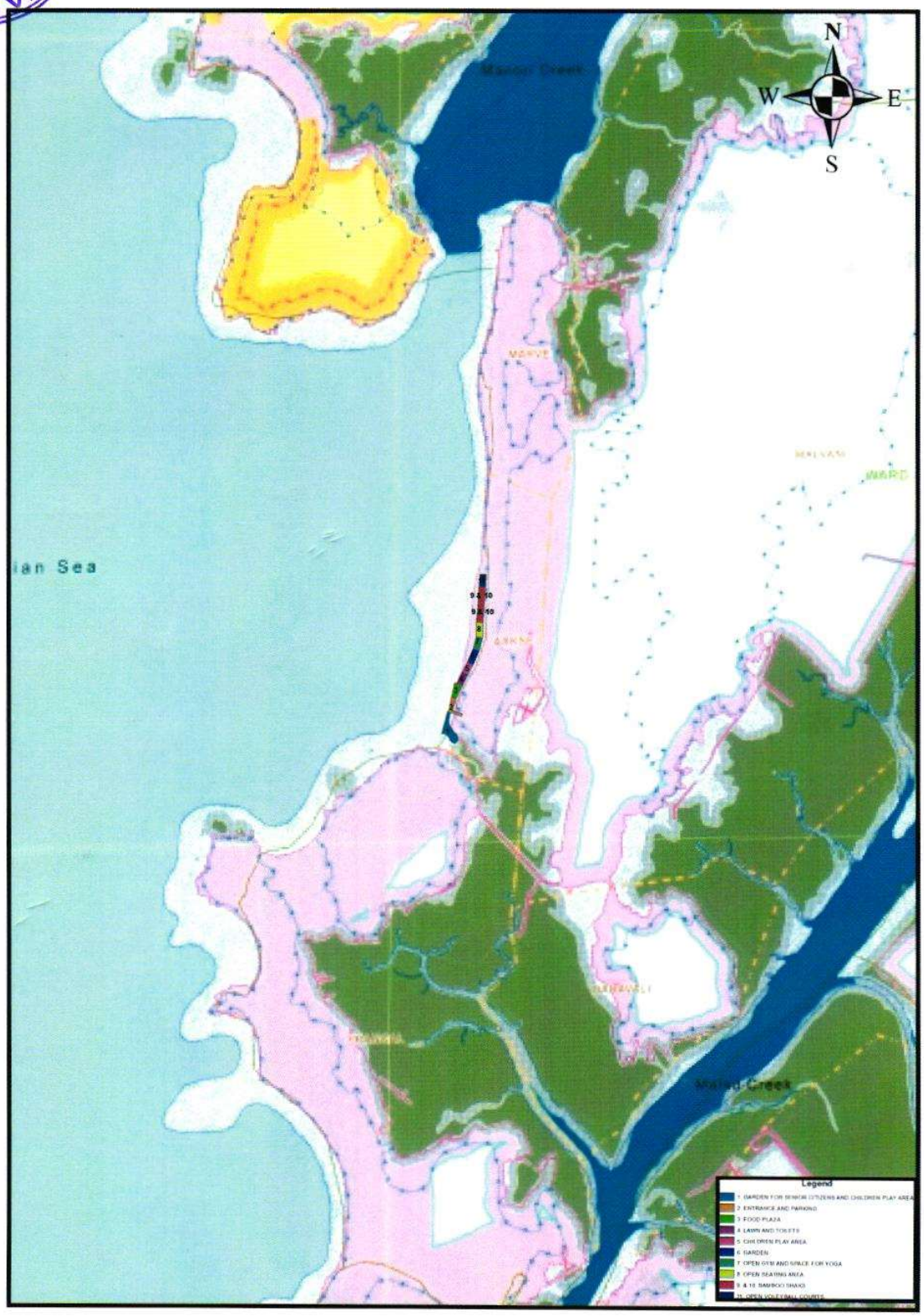


EXHIBIT - F

NOTARY Mrs. SNEHAL C. SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA

27/6/23

HOME DEPARTMENT (PORTS & TRANSPORT)
MAHARASHTRA MARITIME BOARD
Indian Mercantile Chambers, 3rd Floor,
14 Ramjibhai Kamani Marg, Ballard Estate, Mumbai - 400 001.
Tel.: 022-22658375, Fax : 022-22614331

गृह विभाग (बंदरे व परिवहन)
महाराष्ट्र मेरीटाईम बोर्ड
इंडियन मर्कन्टाईल चेंबर्स, ३रा मजला, १४ रामजीभाई कमानी मार्ग,
बेलार्ड इस्टेट, मुंबई - ४०० ००१.
दूरध्वनी क्र.: ०२२-२२६५८३७५, फॅक्स क्र.: ०२२-२२६१४३३१

Website : https://mahammb.maharashtra.gov.in Email : ceommb@gmail.com

MMB/CEO/ENGG/Aksa/ 1625

Date 30/03/2021

To,
Chairman,
Maharashtra Coastal Zone Management Authority (MCZMA)
Environment Department, Room No. 217,
2nd Floor, Annex Building,
Mantralaya, Madam Cama Marg,
Mumbai – 32

30/03/21

लिपिक, प्रधान सचिव कार्यालय, पर्यावरण व वातावरणीय बदल विभाग, मंत्रालय, मुंबई-४०० ०३२

Subject: Compliance submission of project - amendment in CRZ clearance for anti sea erosion measures to sea front development and beautification at Aksa beach, Dist. Mumbai suburban

Reference: Minutes of 148th MCZMA meeting held on 24/11/2020

Respected Madam,

With reference to minutes of 148th meeting of the Maharashtra Coastal Zone Management Authority held on 24/11/2020 we are herewith submitting the compliance as per minutes mentioned.

The layout of proposed project superimposed on approved CZMP, 2011 in 1:4000 scale in order to ascertain the project activities.

Thanking You,

Executive Engineer

(Maharashtra Maritime Board)

Enclosed:

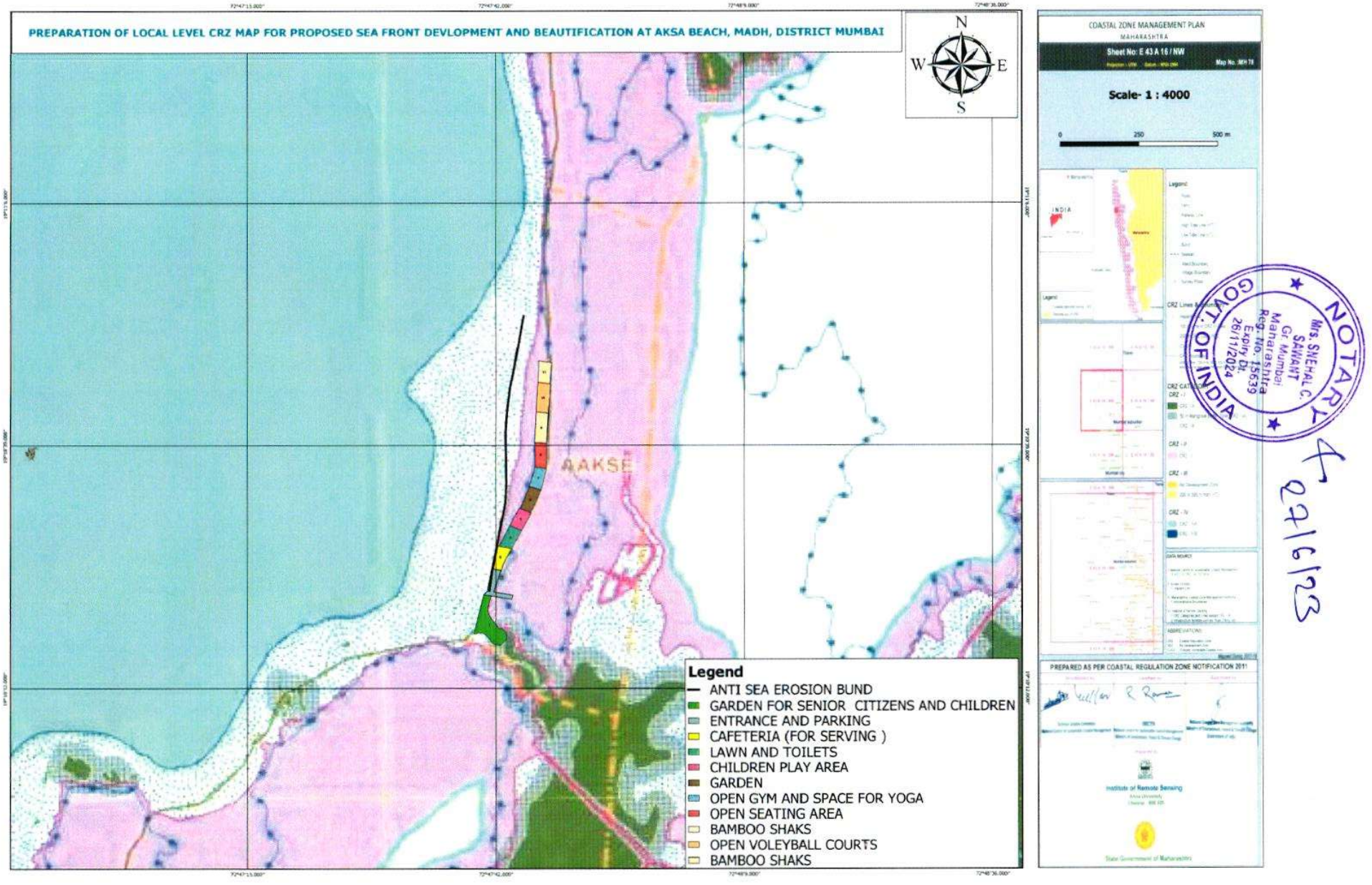
Annexure I: The layout of proposed project superimposed on approved CZMP,.2011

Copy to: Director, Environment and Climate Change Department , Maharashtra Coastal Zone Management Authority (MCZMA) Environment Department, Room No. 217, 2nd Floor, Annex Building, Mantralaya, Madam Cama Marg, Mumbai – 32

30.3.21

सहाय्यक लिपिक (कॉ.शा.)
पर्यावरण व वातावरणीय बदल विभाग
मंत्रालय, मुंबई ४०० ०३२

Project Layout Superimposed on Approved CZMP (1:4000) (Source: https://mczma.gov.in)



NOTARY GOVT. OF INDIA
Mrs. SNEHAL C. SAWANT
Gr. Mumbai
Maharashtra
Reg. No. 15639
Expiry Dt. 26/11/2024

4
2/6/23

EXHIBIT-G

27/6/23

NOTARY Mrs. SNEHAL C. SAWANT Gr. Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA

MAHARASHTRA COASTAL ZONE MANAGEMENT AUTHORITY

Tel. No. : 2202 9388
E-mail : dir1.mcv-mh@nic.in
Website: https://mczma.gov.in/

No. CRZ 2020/CR 95/TC 4
Office of the -
Maharashtra Coastal Zone Management Authority,
Environment & Climate Change Department,
15th Floor, New Administrative Building,
Mantralaya, Mumbai- 400 032
Date: 30th June, 2021

To,
Chief Executive Officer,
Maharashtra Maritime Board
Indian Mercantile Chamber,
3rd Floor, Ballard Estate, Mumbai - 01

Subject: Proposal for sea front development & beatification at Aksa beach, Madh, Mumbai Suburban by MMB

The Maharashtra Coastal Zone Management Authority in its 148th & 155th meeting held on 24th November, 2021 and 10th & 11th June, 2021 respectively deliberated the proposal of sea front development & beatification at Aksa beach, Madh, Mumbai Suburban.

2. The Authority noted that the MMB presented that earlier, the MCZMA in its 127th meeting held on 2.11.2018 granted the recommendation to the proposal of construction of Anti Sea Erosion Measure at Aksa Beach, Mumbai. The project involves repairs of old bund, construction of pathway, construction of parapet wall, providing solar street light, length 300 m. Subsequently, the said proposal has received CRZ clearance on 5.3.2019 by the SEIAA as per 158th meeting of the SEIAA.

3. Now, the MMB is seeking amendment in CRZ Clearance for Anti Sea Erosion Measures to sea front development & beatification at Aksa beach, Madh, Mumbai Suburban. The proposed activities involves a) Garden for senior citizens and children play area, b) Entrance and parking, c) Food Plaza, d) Lawns & Toilets, e) Gym and space for yoga, f) Wooden Shacks and steps, g) Bamboo Shades and steps and h) Volley ball Courts.

4. Earlier the Authority in its 148th meeting held on 24.11.2020 discussed the proposal and noted that activities are proposed along the Aksa Beach. The Authority felt that the MMB need to superimpose the layout of the project on approved CZMP, 2011 in 1:4000 scale in order to ascertain the project activities viz a viz its CRZ status. Accordingly, the Authority decided to defer the proposal for compliance by MMB as stated above. MMB vide letter dated 30.03.2021 submitted the superimposition of layout of the project on approved CZMP, 2011 in 1:4000 scale and stating that, proposed activities in CRZ-II area.

5. The Authority deliberated the proposal and observed that the project site is along the Aksa Beach and MMB has proposed certain activities like plaza/ restaurant/ Gym/ wooden shack on seaward side, which is not permissible as per the provisions of the CRZ Notification, 2011. However, the landscaping, playground/ recreational ground/garden could be allowed in CRZ II area. MMB to strictly ensure that no construction is allowed on Aksa Beach.

6. In the light of above, the Authority after deliberation decided to grant recommendation to the proposed activities of landscaping, playground/ recreational ground/garden only from CRZ point of view to planning Authority.

7. The Authority further decided that activities like plaza/ restaurant/ Gym/ wooden shack on seaward side are not permissible as per the provisions of the CRZ Notification, 2011.

8. Agenda item & minutes of the meeting is available on the website of MCZMA i.e. http://mczma.gov.in.

(Narendra Toke)
Director, Environment & MS, MCZMA

Copy for information to:

1. **PS (Environment) & Chairperson, (MCZMA),** Environment & CC Department, Room No. 217 (Annex), Mantralaya, Mumbai -32.
2. **Director (IA-III),** Coastal Zone Regulation, Government of India, Ministry of Environment, Forests & Climate Change, Indira Paryavaran bhavan, Jor Bagh Road, New Delhi - 110 003.
3. **Member Secretary, Maharashtra Pollution Control Board,** Kalpataru Point, 3rd and 4th floor, Road No. 8, Sion Cir, opp. PVR Theater, Mumbai -400022
4. **District Collector Mumbai Suburban,** 10th Floor, New Administrative Building, Near Chetna College, Bandra East, Mumbai - 51
5. **Select File-TC 4**

EXHIBIT-H

By Speed Post

भारत सरकार / Government of India
जल शक्ति मंत्रालय / Ministry of Jal Shakti
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
Department of Water Resources, River Development and Ganga Rejuvenation
केन्द्रीय जल और विद्युत अनुसंधान शाला
खडकवासला, पुणे - 411 024
CENTRAL WATER & POWER RESEARCH STATION
Khadakwasla, Pune – 411 024

आज़ादी का अमृत महोत्सव

☏:020-24103402, 24103469, ℻:020-24381004 ✉: jd@cwprs.gov.in, www.cwprs.gov.in

संख्या/No.:121/1/2021/CHS-I/ 13 दिनांक/Date: 13.01.2022

18 JAN 2022

Superintending Engineer,
Maharashtra Maritime Board,
Indian Mercantile Chamber,
3rd Floor, Ramjibhai Kamani Marg,
Ballard Estate, Mumbai - 400 001

Sub : Desk studies for design of coastal protection work at Aksa beach, Madh, Mumbai.

Ref : - Superintending Engineer letter MMB/CEO/ENG-4/Aksa Beach/2710 dated 09.07.2021

Sir,

This has reference to letter dated 09.07.2021 regarding the design of coastal protection work at Aksa beach, Madh, Mumbai. The proposed site is located about 5 km north side of Madh fort along the coast of Arabian sea. Project authorities informed that, there is a proposal to implement sea front development and beautification of the Aksa beach to enhance the recreational activities for the tourists. In this regard, project authority sought advice of the CWPRS for the design of coastal protection work at Aksa beach, Madh, Mumbai. The total length of the proposed development and coastal protection work is about 900 m.

Accordingly, the desk studies were conducted for evolving the tentative design cross-section of coastal protection work abutting to the retaining wall proposed for the proposed sea front development by project authority. A tentative cross-section is evolved based on the data such as beach profiles, tides, waves and the existing site conditions as shown in Fig.1. High Water Level (HWL) of + 5.40 m and Low Water Level (LWL) of +0.0 m are considered for the design of protection work. The maximum waves in the shallow zone are breaking and design of coastal protection work is carried out considering maximum breaking wave height of 2.6 m at HWL in front of the structure.

The design of coastal protection work abutting to the retaining wall consists of 1.5 t to 2.0 t stones in the armour placed on 1:2 slope in double layer from el. +4.5 m to el. +7.0 m. A 3.0 m wide toe-berm is provided at el. +4.5 m, consisting of 0.5 t to 1.0 t stones with a sea side slope of 1:2. Secondary layer consists of 100 Kg to 200 Kg stones below the armour in

double layer (0.8 m thick) and single layer below toe berm (0.4 m thick) as shown in Fig.1. A geo-fabric filter layer is suggested at the bed level of the protection work for separation and filtration purpose. A 0.15 m thick single layer of Gunny/Nylon bags filled with sand/stone grit (5mm) is provided for cushioning to the filter layer as shown in Figure 1.

The designs of coastal protection work evolved based on the desk studies. The design is based on empirical formulae, existing conditions at the site & previous in-house extensive wave flume studies conducted at CWPRS for hydraulic stability of marine structures. The weight of armour units were computed using Hudson's formula as shown below:

$$W = \frac{w_r . H_b^{\,3}}{K_D \times (Sr-1)^3 . \cot\theta}$$

Where,

W	= Weight of armour units (kg)
w_r	= Unit weight of armour block (kg/cum)
H_b	= Breaking wave height (m)
K_D	= Stability Coefficient for breaking wave height
W_w	= Unit weight of sea water
S_r	= Specific gravity of armour relative to water at the structure (w_r/W_w)
θ	= Angle of armour slope

The following points may please be noted during the execution of work:

1) The gradation of stones as recommended in the cross-section should be strictly adhered to.
2) Either heavier or lighter stones than the recommended should not be used in any layer of the coastal protection work.
3) The stones should be laid in double layer and the double layer thickness as mentioned in the drawing should be strictly followed.
4) The minimum density of stones should be 2.60 t/cu.m. Use of flatter stones (except in the crest) should be avoided.
5) The slope of the armour layer of the coastal protection work should be strictly followed.

Thanking You,

Yours faithfully,

(Dr. J.D. Agrawal)
Scientist "E"

Encl: Fig. 1

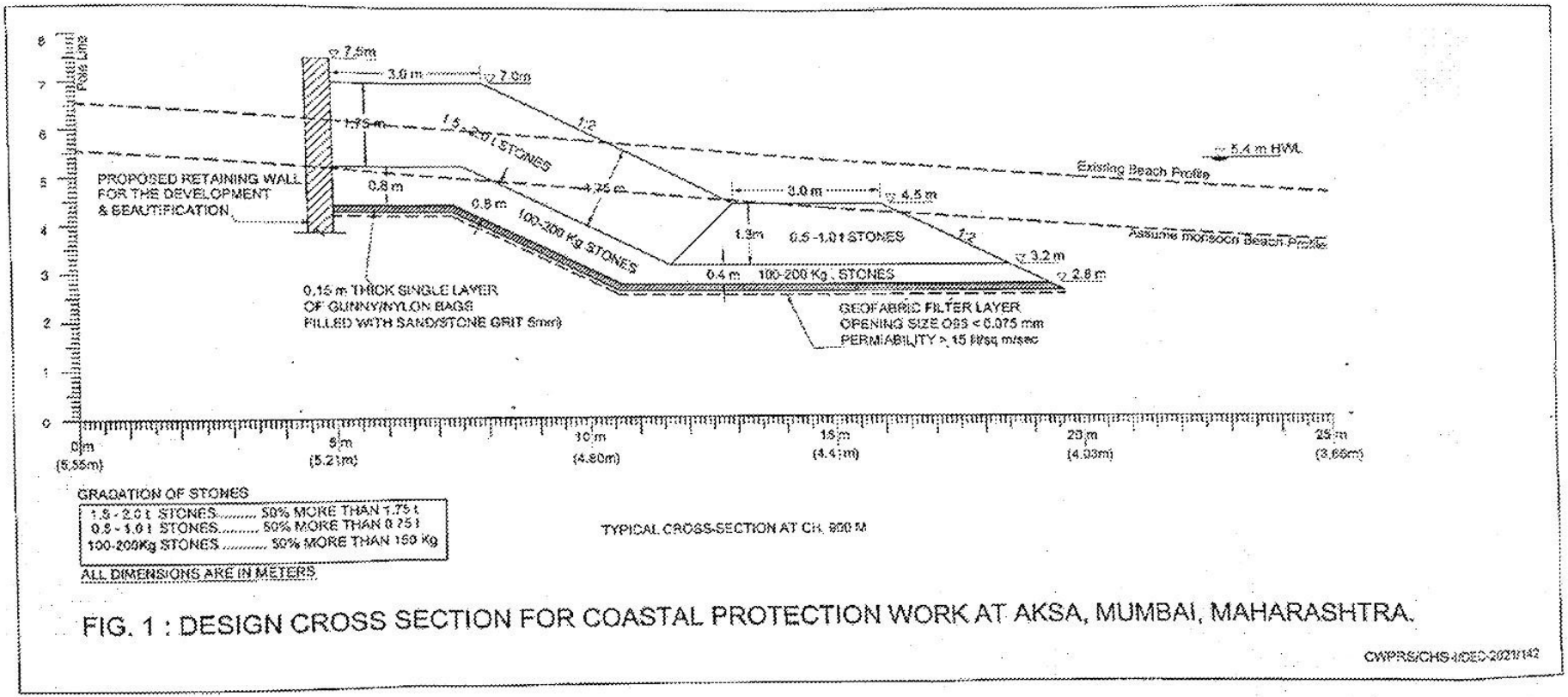


FIG. 1 : DESIGN CROSS SECTION FOR COASTAL PROTECTION WORK AT AKSA, MUMBAI, MAHARASHTRA.

CWPRS/CHS-II/CED-2021/142

EXHIBIT - I
f 27/6/23

ASSESSMENT OF LOCATION OF PLACEMENT OF ANTI-SEA EROSION BUND ALONG AKSA BEACH, MADH, MUMBAI

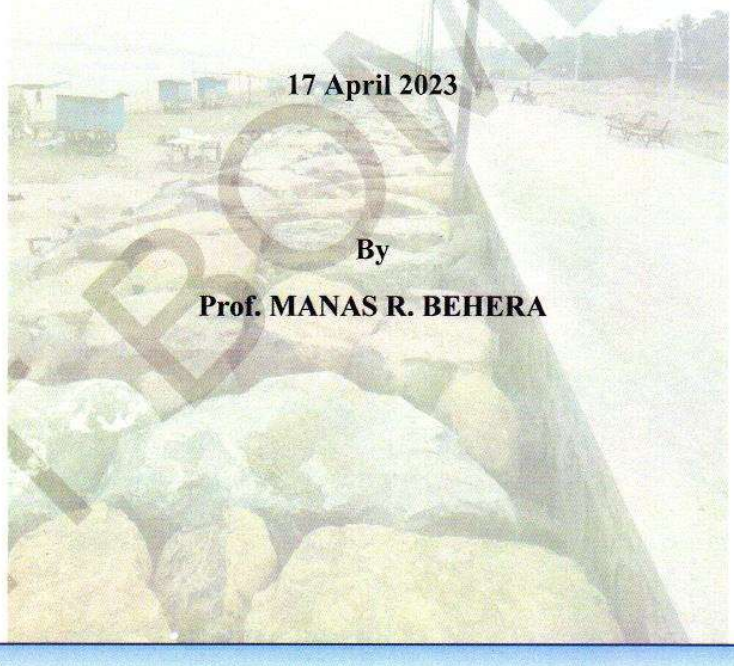
Report

(IITB/MMB/AKSA/2023-001)

Submitted to

MAHARASHTRA MARITIME BOARD

17 April 2023



By

Prof. MANAS R. BEHERA

Ocean Engineering

Department of Civil Engineering

Indian Institute of Technology Bombay

Powai, Mumbai – 400076

Introduction

Maharashtra Maritime Board (MMB), Home Department (Ports & Transport), Govt. of Maharashtra; vide letter no MMB/CEO/Engg-3/Aksa beach/1653 dated 06.04.2023; requested Prof. Manasa R. Behera, Indian Institute of Technology Bombay (IITB), Powai, Mumbai to provide expert opinion about the appropriability of location of placement of anti-sea bund along Aksa beach, as executed by MMB.

MMB informed through the above letter that the above-mentioned work of anti-sea erosion measures and tourist facilities at Aksa beach in Mumbai Suburban is being executed through District Planning Commission (DPC) Mumbai Suburban funds by MMB. CWPRS, Pune has already carried out detailed mathematical model study for protection measures for Aksa beach and submitted their report to MMB.

MMB requested Prof. Manasa R. Behera (IITB) to visit the site, verify all the reports & documents, and submit the expert opinion report to MMB.

Following documents were submitted to IIT Bombay by Maharashtra Maritime Board.

1. CWPRS study report.
2. CZMP plan
3. Various permissions of MCZMA & SEIAA
4. Pre-construction photographs of the site
5. Current post-construction photographs of the site

The scope of work for IITB expert was to provide expert opinion about the appropriability of location of placement of anti-sea bund along Aksa beach, based on the documents submitted and site visit.

In view of the above, Shri Tushar Patole (Executive Engineer, MMB) coordinated with IIT Bombay, and a visit was made to Aksa beach on 10-04-2023 @ 7:30am to assess the site condition and status of the mentioned anti-sea erosion bund.

Aksa Beach profile history

The google earth images (Figure 1) show that there is a sandy beach present from Aksa beach to Marve beach. The sediment cell is located along the mouth of the Manori creek on its right. The sediments are driven by the tide and waves present in the region. The tidal currents and wave induced currents are the major drivers for longshore and cross shore sediment transport. The loss or gain of sediments to the coast lead to erosion or accretion, respectively. The images in Figure 1 are shown from 2004 to 2022. It can be that the Aksa beach profile varies seasonally as well as annually. The beach is found to be marginally eroding over the years. The portion of beach above the high tide line is found to be very plat unlike other locations where its protected by dunes. Thus, these areas are prone to inundation and flooding during storm conditions and monsoon weather. The flooding could also lead to erosion of earth material/sand undermining the foundation of the developed facilities. Any facility developed in these areas should be protected from erosion by providing suitable erosion protection measures.

April 2004

Nov 2004

Oct 2009

Apr 2011

April 2012

March 2014

Oct 2018

Oct 2019

Figure 1: Google earth images showing Aksa to Marve beach profile from 2004 to 2022

CWPRS Report

As per the report submitted by CWPRS, the proposed site along Aksa beach is ~5km north side of Madh fort along the coast of Arabian Sea. CWPRS was mandated to design the coastal protection work for about 900m along Aksa beach. MMB had already planned a retaining wall for development of the promenade for the tourists and other recreational facilities. CWPRS carried out desk studies for evolving the tentative cross-section of coastal protection work abutting the proposed retaining wall. Cross-section of the protection work (shown in Figure 2) was evolved based on the beach profiles, tides, waves, and the pre-

execution site condition. The alignment of the proposed retaining wall was chosen along the existing electric light posts. The protection wall extended about 15 m towards the seaside from the retaining wall.

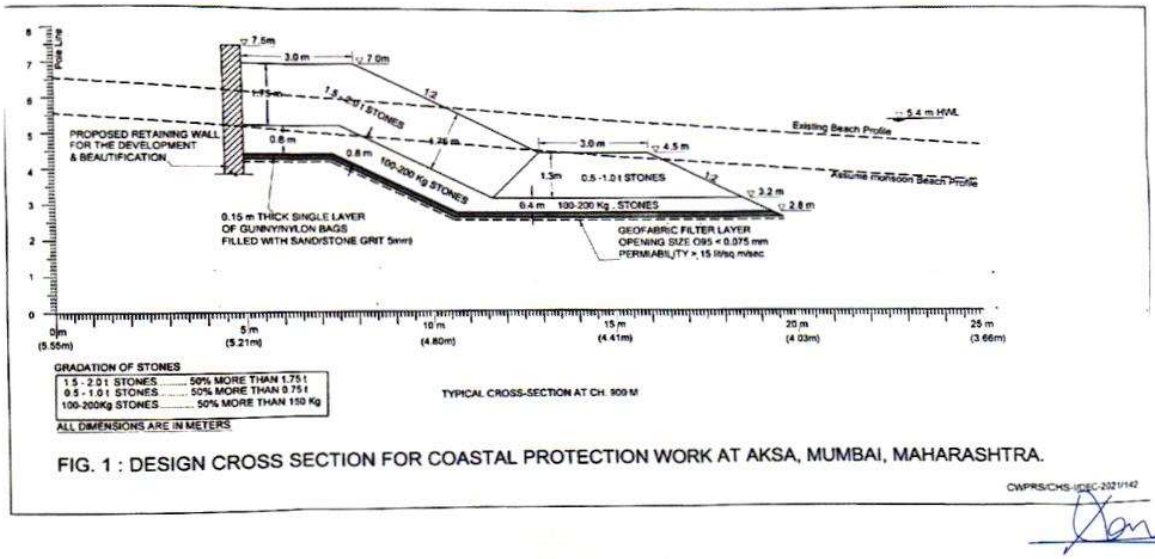


FIG. 1 : DESIGN CROSS SECTION FOR COASTAL PROTECTION WORK AT AKSA, MUMBAI, MAHARASHTRA.

CWPRS/CHS-IDEC-2021/142

Figure 2: Protection work cross-section as suggested by CWPRS.

MCZMA Recommendations

Minutes of the 127th meeting of MCZMA held on 02 Nov 2018 in its item no 29 has stated that MMB should ensure all solid constructions towards landward side of the high tide line.

Minutes of the 148th meeting of MCZMA held on 24 Nov 2020 in its item no 8 stated that MMB need to superimpose the layout of the project on approved CZMP, 2011 in 1:4000 scale.

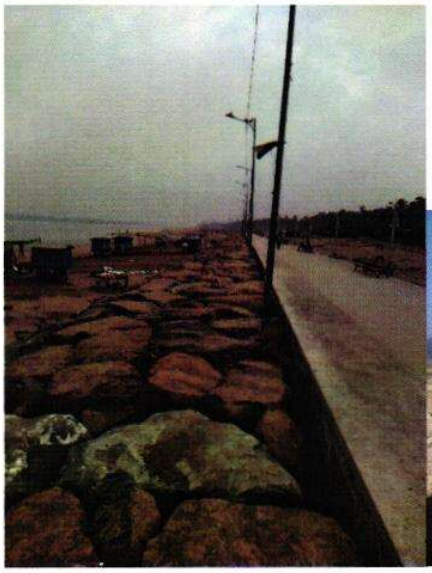
Minutes of the 155th meeting of MCZMA held on 10&11 June 2021 in its item no 6 stated the permitted and non-permitted recreational facilities.

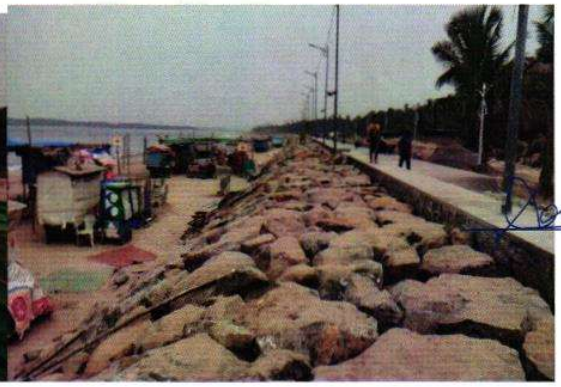
Site Condition Before Construction

The site had electric poles along the beach that was installed earlier. The foundation of the electric poles were found exposed due to erosion and at several places the severe erosion led to failure of foundation and falling of the electric poles. Thus, it is evident that any facility developed along this beach will be subjected to similar erosion. This warrants protection of the exsting infrastructure and future development of facilities.

Figure 3: Erosion at Aksa beach and falling of the electric poles due to erosion.

Site and Structures Constructed so far





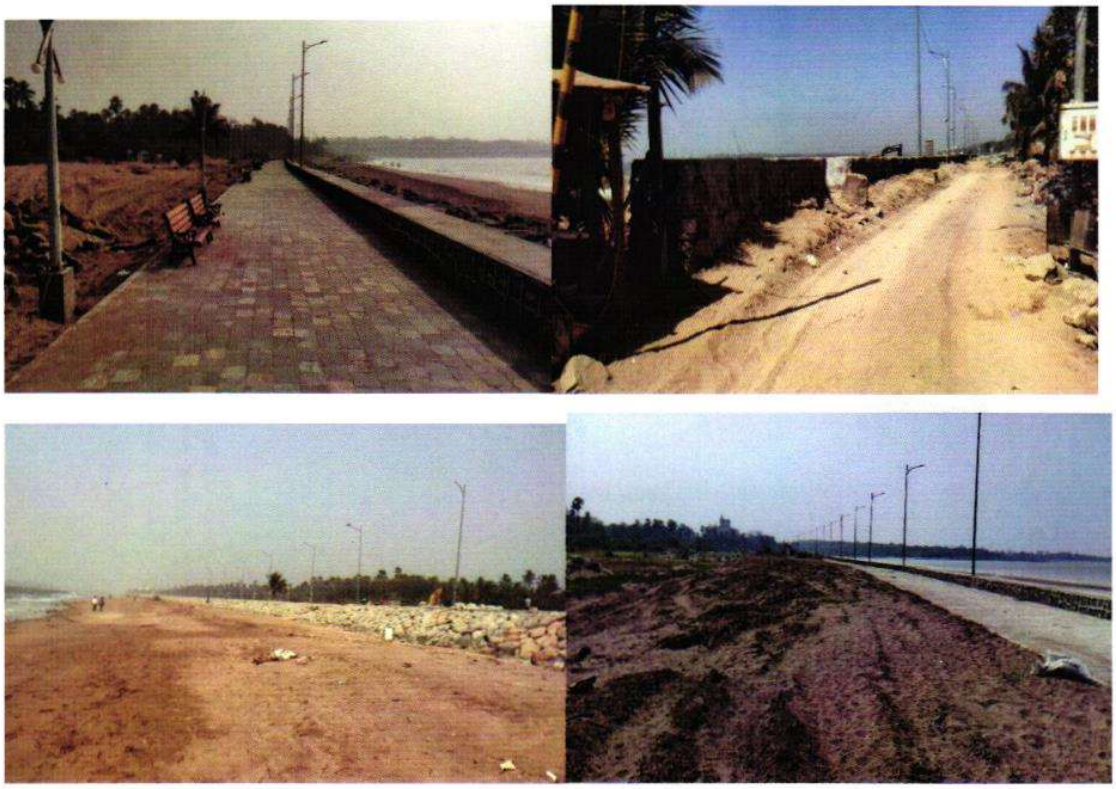


Figure 3: View of the tourist facility development and anti-sea erosion bund constructed at Aksa beach.

Concluding Remarks

Based on the site visit and information provided, it is found that Aksa beach is an eroding site and the existing structures are affected by erosion. Hence, there is need to provide anti-sea erosion bund to protect the facilities being developed. The alignment chosen to construct the anti-sea erosion measure seem appropriate as the existing electric poles were collapsing due to erosion.

26-04-2023

Prof. Manasa R. Behera
Ocean Engineering
Department of Civil Engineering
IIT Bombay

EXHIBIT-J

NOTARY Mrs. SNEHAL C. SAWANT Gr Mumbai Maharashtra Reg. No. 15639 Expiry Dt. 26/11/2024 GOVT. OF INDIA

27/6/23

By Speed Post

भारत सरकार / Government of India
जल शक्ति मंत्रालय / Ministry of Jal Shakti
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग
Department of Water Resources, River Development and Ganga Rejuvenation
केन्द्रीय जल और विद्युत अनुसंधान शाला
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CENTRAL WATER & POWER RESEARCH STATION
Khadakwasla, Pune – 411 024

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🖳:www.cwprs.gov.in

संख्या/No.:121/1/2023/CHS-I

दिनांक/Date: 12.05.2023

To,
The Executive engineer,
Maharashtra Maritime Board (MMB),
Indian Mercantile Chamber, 3rd Floor,
14, Ramjibhai Kamani Marg,
Ballard Estate, Mumbai – 400 001

Sub: Desk studies for design of coastal protection work at Aksa beach, Madh, Mumbai.

Ref: (1) CWPRS letter no. 121/1/2021/CHS-I/13 dated 13.01.2022.
(2) Executive engineer, MMB Email dated 10.04.2023.
(3) IIT Bombay report no. IITB/MMB/AKSA/2023-001 dated 17.04.2023.

Sir,

This has reference to your email dated 10.04.2023 regarding the visit of CWPRS to review and provide an expert opinion on the constructed coastal protection work at Aksa beach, Mumbai.

(1) Background : The project authorities i.e. Maharashtra Maritime Board (MMB) informed that there was a proposal to implement sea front development and beautification along with a coastal protection work (seawall) at the Aksa beach, Madh, Mumbai. In this context, the project authority sought advice of the CWPRS for the design of coastal protection work at Aksa beach. The proposed length for the development of coastal protection work was 900m.

Accordingly, the desk studies were conducted to evolve the design cross section of the coastal protection work abutting to the boundary wall of the proposed sea front development. The seawall construction was implemented by the MMB in 2022-23.

(2) Executive engineer, MMB requested CWPRS to review the constructed seawall abutting to the boundary wall of the proposed sea front development. Further, it was requested to provide the overall opinion on the constructed seawall along the Aksa beach.

(3) In this regard, MMB submitted a IIT Bombay report on the assessment of location of placement of seawall along Aksa Beach, Madh, Mumbai. Wherein, experts from IIT Bombay inferred that the Aska beach is an eroding site and the existing structures are getting affected by the erosion. Further, they indicated that there is a need to provide seawall to protect the facilities and the alignment of anti-sea erosion measures are appropriate as the existing poles are collapsing due to erosion.

(4) The MMB proposed a wall which is the boundary of the development for the beautification of the Aksa beach containing activities permitted as per the 155th meeting of MCZMA held on 10th and 11th June 2021.

(5) Accordingly, the Aksa beach site was visited by CWRPS to review the construction of coastal protection work on 28th April 2023. The opinion of CWPRS in accordance with the site visit are given below.

a. The constructed seawall is aligned with the existing electric pole. The alignment of the wall is in between High & Low water line, which is a permissible activity in CRZ-1B. The seawall /Toe-berm protection was necessary to protect boundary wall & the proposed beautification. During the visit there was a flood tide (about 3.0 m water level) and the measured distance between toe-berm of the seawall to water line was about 50 m.

b. It is recommended to provide roundhead on both sides of the seawall to reduce flanking effect on either side of seawall. However, the roundhead at the entrance (southern side of Seawall) may cause hinderance to the public visiting Aska beach. Hence, it is advised to monitor the effect of flanking on the southern side of seawall for 2-3 years and then the decision regarding the need of roundhead construction (southern side) may be taken-up. The roundhead of northern end of the seawall should be constructed immediately.

c. The constructed seawall is a flexible structure made up of rubble mound and it is essential to monitor and maintain them regularly. It is advisable to compile the beach profile data Infront of the constructed seawall upto the LWL or 80m (whichever is lower) at least for 3 years to compare the changes of the beach profiles.

d. The drainage pipes on the landward side of the seawall needs regular checking for clogging, etc. and cleaning is required in case of chocking of pipes.

e. Proper monitoring is required to check the performance of the seawall at least in 2-3 years especially during monsoon. .

Thanking You,

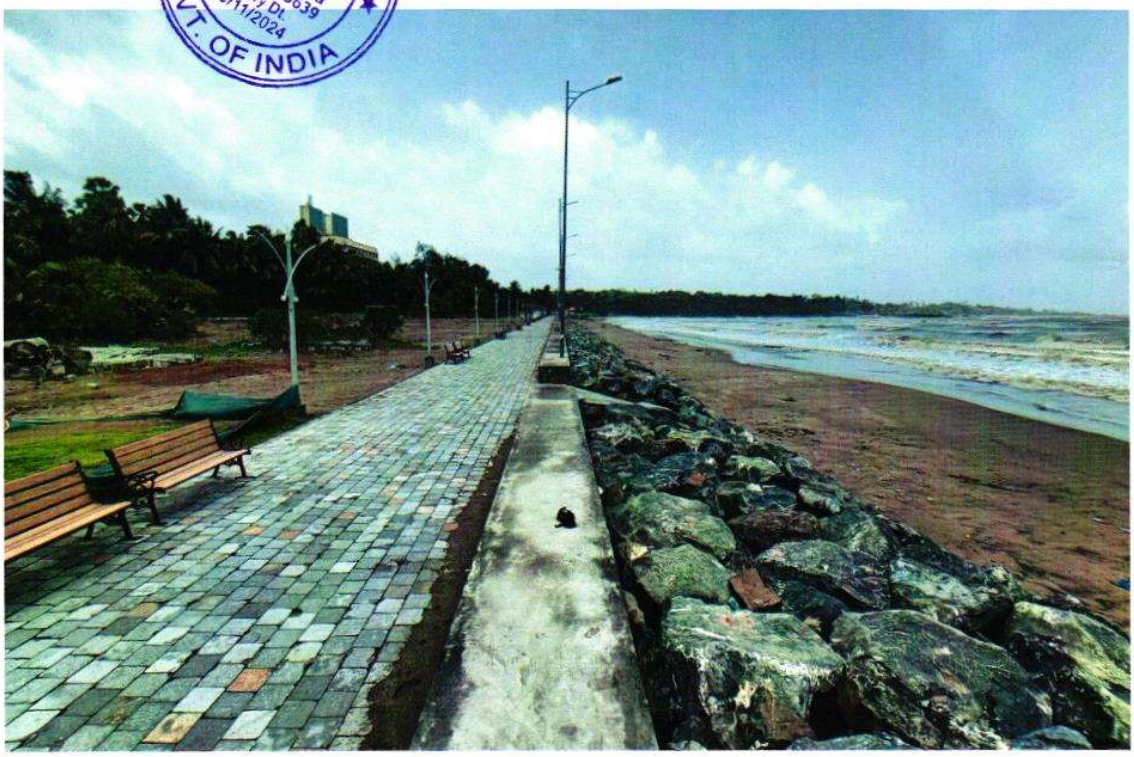
Yours faithfully,

(B. R. Tayade)
Scientist "D"

EXHIBIT-K

NOTARY
Mrs. SNEHAL C. SAWANT
Greater Mumbai
Maharashtra
Reg. No. 15639
Expiry Dt. 26/11/2024
GOVT. OF INDIA

27/6/23



NOTARY
Mrs. SNEHAL C. SAWANT
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Maharashtra
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28/11/2024
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27/6/23