

Ref.No.EML/ MOEF/23/93
Date: 28/12/2023

To
The Member Secretary,
Expert Appraisal Committee (Industry - I),
Ministry of Environment, Forests and Climate Change
Government of India Indira Paryavaran Bhawan,
Jor Bagh Road, NEW DELHI -110003

Essar Minmet Limited
Essar House,
11, K. K. Marg,
Mahalaxmi,
Mumbai -400 034.

Corporate Identity Number:
U27100MH2016PLC355097

Subject: Submission of Updated EIA Report for grant of Environmental Clearance for
setting up of 2 x 7 MTPA Pellet Plant at Paradeep, Jagatsinghpur District, Odisha

T: +91 22 6660 1100
E: CS@essarminmet.co.in
www.essar.com

Reference:

1. EIA Notification No. SO 1533 dated September 14, 2006 and SO 3067(E) dt. 01/12/2009.
2. Proposal No IA/OR/IND/ 198977/2018 dated 19/02/2021
3. ToR for EIA vide F.No. IA-J-11011/38/2021-IA-II(I)] dt. 04/03/2021
4. EC Recommendation
5. ADS of Nov-2022
6. Our ADS reply on 17/10/2023
7. MOEF&CC ADS dated 02/11/2023
8. Our updated EIA report submitted on 20/11/2023
9. ADS raised at 50th EAC meeting held on 15/12/2023

Dear Sir

This has reference to the captioned subject and cited references; we intend to set up 2 x 7 MTPA Pellet Plant at Paradeep, Jagatsinghpur district, Odisha.

ToR for carrying out EIA had been accorded on 4th, March 2021 as per above mentioned reference and Public Hearing was conducted on 5th January 2022 after submission of Draft EIA to OSPCB. After incorporation of proceedings of Public Hearing & associated details in the draft EIA, we are pleased to submit our proposal for Environmental Clearance (EC) in the prescribed online form Form-2 at the MoEFCC Web Portal "PARIVESH" with other relevant enclosures as per EIA Notification 2006 and amendments thereof.

This has reference to Sl. No. 4 regarding recommendation of EC by EAC after meeting of the EAC Industry -1 sector held on 14/15th September 2022 and subsequent ADS issued in November 2022 regarding submission EC application for the integrated Iron Ore Beneficiation plant of 14.3 MTPA at Tikarpada -Keonjhar District of linked project.

With reference to sl.no. 8, we had submitted the updated EIA report considering interim period of operation of Pellet plant till Beneficiation plant and Slurry pipeline become operational. Subsequently the proposal was considered at the 50th EAC Meeting held on 15th December 2023 (ref no.9) and some additional details were sought along with revised EIA report. We are submitting the revised EIA report along with replies to the ADS raised.

We request you to kindly consider our application in the Expert Appraisal Committee meeting at the earliest to grant us the Environmental Clearance.

Thanking you

Yours faithfully
For Essar Minmet Limited


P C Mohapatra
(Director- Projects)



REPLIES TO ADS BY EAC (IND-1) AT 50th EAC MEETING HELD ON 15th DECEMBER 2023

1. The EAC discussed the modifications in the current proposal and believes that, for a clearer comprehensive of the project's facets, it is essential to compare all significant aspects outlined in the initial EIA/EMP Report with the alterations made in the revised EIA/EMP Report. The current documents lack clarity at this moment. Given that the proposal was previously endorsed after through deliberations, it is essential to comprehend the changes made with careful scrutiny.

Reply: The EIA report has been revised taking into account the revised requirements for the interim operation of 7 MTPA using imported iron ore concentrate. The summary of changes made against the original EIA report for 14 MTPA is elaborated in the Table below:

Sl. No.	Description	As per EIA Report (August 2022) for 14 MTPA Pellet Plant (Recommended for EC by EAC - Industry 1)	Modified for operation during interim period (7 MTPA pellet production)	Remarks
1.	Plant Configuration	2 x 7 MTPA	2 x 7 MTPA	Both units construction will start simultaneously.
2.	Plant operation	2 x 7 MTPA	1 x 7 MTPA	Any one 7 MTPA module will operate during the interim period till July 2027
3.	Raw Material	1. Iron Ore Concentrate - 14,294,000 TPA 2. Bentonite - 80000 TPA 3. Limestone - 320,000 TPA 4. Dolomite - 156,000 TPA 5. Anthracite coal - 202,000 TPA	1. Iron Ore Concentrate - 7,000,000 TPA 2. Bentonite - 40000 TPA 3. Limestone 160,000 TPA 4. Anthracite coal - 101,000 TPA	During interim operation, the total consumption will reduce by 50% and impact due to road transportation of raw materials from port will also get reduced. Iron Ore concentrate will be transferred from Paradeep Port to plant through the same pipe conveyor envisaged for product pellet transport in return direction.
4.	Land Area	40.47 ha	40.47 ha	No change in total land area. The project site is Industrial land under ownership of Paradeep Port Authority taken on lease for 60 years vide Certificate of possession valid from 17.04.2023 to 16.04.2083. (Annexure 1). Thus there is no change with respect to distance from nearest village, railway station, port, wildlife sanctuary and industries operating within the study area. Therefore, there would be no change in impact.

Sl. No.	Description	As per EIA Report (August 2022) for 14 MTPA Pellet Plant (Recommended for EC by EAC - Industry 1)	Modified for operation during interim period (7 MTPA pellet production)	Remarks
5.	Surface water resource	No impact on surface water resource as water recovered from dewatering of slurry would be used as plant makeup water	During interim period, about 214 m ³ /hr (2.1 cusecs) of water would be withdrawn from Taladanda canal.	Recommendation for withdrawal of 2.1 cusec water from Taladanda canal is given by State Level Single Window Clearance Authority (SLSWCA) through IPICOL vide memo no. 3066 dated 16.12.2023.(Annexure 2). The location of the water intake point and pipeline route through the industrial area under PPA is near Paradeep Port Toll Gate. There are no downstream users and the pipeline will be laid in the land owned by PPA, there will be insignificant impact on surface water resource and land use
6.	Ground water resource & quality	No impact	No Impact	No change
7.	Pollution Load	Total flue gas volume from all stacks - 23,80,000 Nm ³ /hr <ul style="list-style-type: none"> PM - 47.6 kg/hr SO₂ - 100 kg/hr NOx - 200 kg/hr 	Total flue gas volume from all stacks - 11,90,000 Nm ³ /hr <ul style="list-style-type: none"> PM - 23.8 kg/hr SO₂ - 50 kg/hr NOx - 100 kg/hr 	Only 1 module will be in operation during interim period. Therefore, the stack emissions during the interim period would be 50% of the emissions anticipated at 14 MTPA stage
8.	Traffic Load	629 PCU per day	315 PCU per day	The vehicular load due to raw material transportation will be half of the vehicular load projected at 14 MTPA since any one module will be in operation.
9.	Ground level concentration	Max glc PM ₁₀ - 2.92 µg/m ³ PM _{2.5} - 1.46 µg/m ³ SO ₂ - 2.2 µg/m ³ NOx - 4.3 µg/m ³ CO - 28.45 µg/m ³ (8 hr avg)	Max glc PM ₁₀ - 1.45 µg/m ³ PM _{2.5} - 0.73 µg/m ³ SO ₂ - 1.07 µg/m ³ NOx - 2.15 µg/m ³ CO - 12.3 µg/m ³ (8 hr avg)	Impact on air environment will get reduced during interim operation period
10.	Noise	No impact on ambient noise levels	No impact on ambient noise levels	No change
11.	Process solid waste generation	Pellet Fines generation from APCD -70,000 TPA	Pellet Fines generation from APCD -35,000 TPA	Fines generation during interim period shall be 50% of the generation projected at 14 MTPA since any one module will be in operation.
12.	Waste water generation	150 cubic mtr clarifloculator will be installed. Additional rain water during rainy season can be returned through return water pipeline to Beneficiation plant.	150 cubic mtr clarifloculator will be installed. Water to tune of 150 cubic mtr can be utilized for process.	Since the return water pipeline will not be in operation during this intermittent period, the extent of use of rain water will be 150 cub mtr per hour maximum.
13.	Zero discharge concept	Adopted	Adopted	No change
14.	STP	STP sludge 110 ton/annum (used as manure for greenery development) Water recovery - 6 m ³ /hr	STP sludge 66 ton/annum (used as manure for greenery development) Water recovery - 3.5 m ³ /hr	The installed capacity of STP will be utilized 100% during the construction period and during interim operation 60% capacity will be utilized due to reduced manpower.
15.	Used Oil	30 KL per annum	15 KL per annum	Used oil generation during interim period shall be 50% of the generation projected at 14 MTPA since any one module will be in operation.

Sl. No.	Description	As per EIA Report (August 2022) for 14 MTPA Pellet Plant (Recommended for EC by EAC - Industry 1)	Modified for operation during interim period (7 MTPA pellet production)	Remarks
16.	Manpower	Construction phase Direct (50), Indirect (700) Operation phase- Direct (149), Indirect (450)	Construction phase Direct (50), Indirect (700) Operation phase- Direct (110), Indirect (250)	No change in manpower requirement for construction phase. Reduced manpower requirement during interim operation of one module of 7 MTPA. During the interim period there would be marginal loss of job opportunities
17.	Socio economic upliftment activities	Budget - INR 37.05 crore Period of implementation - 2 years	Budget - INR 37.05 crore Period of implementation - 2 years	There would be no reduction in budget for socio economic development during the interim period
18.	Greenery development	Area covered - 16.19 ha (40% of project land) No. of trees - 40,475	Area covered - 16.19 ha (40% of project land) No. of trees - 40,475	No reduction in area under greenery and there would be positive impact on the local environment
19.	SPA requirement	Stack emission - PM - 20 mg/Nm ³ Zero Liquid discharge Greenbelt - 40% Socio economic development budget – 1.5 times of non-SPA area Fugitive dust emission control through dust suppression, water sprinkling, tyre washing system, avenue plantation & social forestry and maintenance of service road	Stack emission - PM - 20 mg/Nm ³ Zero Liquid discharge Greenbelt - 40% Socio economic development budget - 1.5 times of non-SPA area Fugitive dust emission control through dust suppression, water sprinkling, tyre washing system, avenue plantation & social forestry and maintenance of service road	During interim period all requirements of SPA will be complied

The cost benefit analysis was also carried out and is presented below:

Cost Benefit Analysis/Financial Impact

Sl. No.	Particulars	Impact
1	Minimum Guarantee Tonnage (MGT) to Paradip Port by EML	MGT committed by EML to Paradip port as per Tender conditions - 8.5 MTPA from Mar 2026. Rs. 170 Cr / year EML has to pay as penalty beyond Mar 2026.
2	GST	One year delay in project execution leads to delayed receipt of Rs. 150 Cr to Govt.
3	Forex earnings	One year delay in commissioning of plant with original process route, EBITDA generated Rs. 8850 Cr. By Importing concentrate for 7 MTPA , EBITDA generated will be Rs. 2010 Cr.

Socio- Economic Impact

Sl. No.	Particulars	Impact
1	Tree Plantation for Green Belt	40,475 trees plantation gets delayed by one year.
2	Socio-economic upliftment activities	Commitment of Rs. 21.85 Cr in the first year gets delayed by one year.
3	Employment	Employment generation delay for one year.
4	Local economic activities	With the plant delayed coming up by one year, opening of additional shops, vehicles including transportation, etc. gets delayed.

2. The EAC discussed the transportation study provided by the project proponent and observed that the current Level of Service (LOS) is C. However, there is a need for greater clarity regarding the LOS in the post-proposed project scenario.

Reply: During the interim operation the details of post project traffic load and impact on the LOS is shown below:

1. Traffic study has been conducted on **Athar Banki on NH-53** which is approximately 250 m from the plant site.
2. Raw material (additives) and fuel (LDO) from Paradip port and IOCL to plant will come by road which is **5%** of total raw material requirement for the plant. The finished product (pellet) would be transported to Paradip Port by pipe conveyor. Iron ore concentrate from Port to plant during Interim period will be transported by pipe conveyor in the return side.
3. Existing PCU is **1145.79 PCU/hr at Athar Banki on NH 53** and existing level of service (LOS) is: **C**

Road	Location	V (Vol in PCU/hr)	C (Capacity in PCU/hr)	Existing V/C Ratio	LOS
NH53	Athar Banki	1145.79	3600*	0.32	C

4. PCU load after proposed project will be **1145.79 (Existing) + 13.1 (Additional during interim period)** PCU/hr and level of service (LOS) will be: **C**

* **Note:** Capacity as per **IRC-106-1990** Guide line for capacity for roads.

Conclusion: The level of service will remain **C** after including additional traffic due to proposed project during interim period.

3. Since PP has proposed this alternate plan with external iron ore concentrate through pipe Conveyor from Paradip Port, till Beneficiation plant and slurry pipeline become operational, PP is required to submit a NOC from the Paradip Port.

Reply: NOC and RoW has been issued by Paradip Port Authority vide letter no. AD/EST/LAND-I-30/2020/3705 dated 19.12.2023 (Annexure 3)

4. The EAC observed that the Project Proponent (PP) had proposed a greenbelt covering 16.19 hectares, approximately 40% of the total project area. However, upon reviewing the drone survey of the project site, the EAC noted a significantly inadequate greenbelt status.

The committee believes that the PP should have initiated greenbelt development during this timeframe. The EAC suggests that the PP shall commence greenbelt development at the beginning of the upcoming monsoons and submit an undertaking to complete the greenbelt within a one-year period.

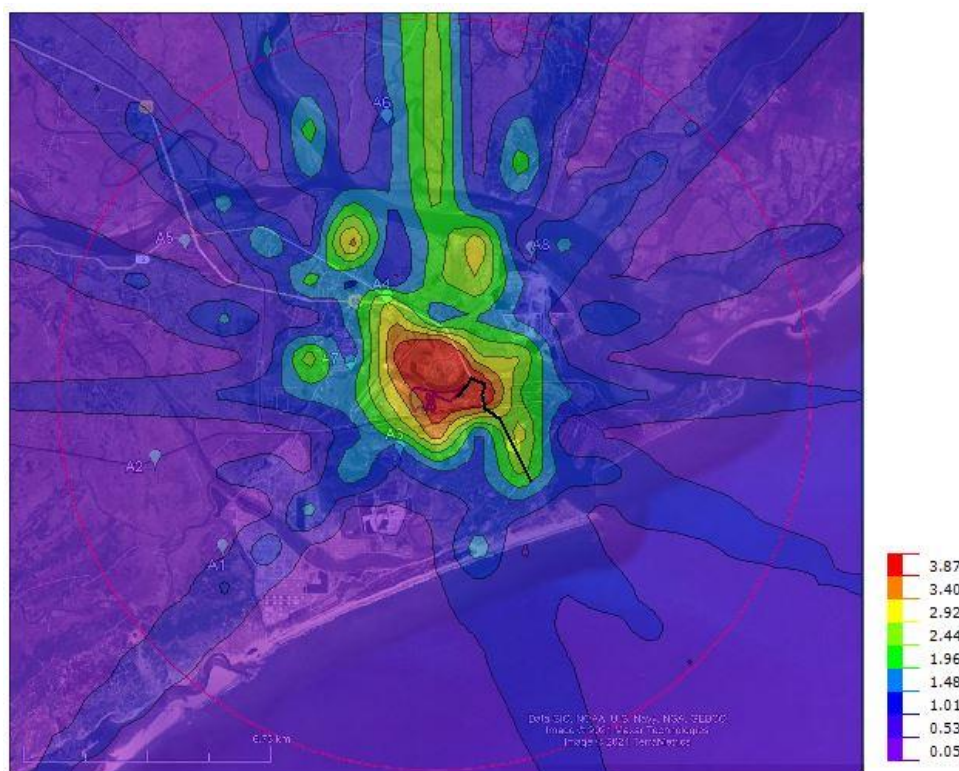
5. The Committee deliberated on the baseline data and incremental GLC due to the proposed project and is of the opinion that PP shall re-evaluate the modeling for the probable changes during this time period. PP shall also make a comparison with the secondary data from reliable sources.

AAQ data was collected from Odisha State Pollution Control Board for the Paradeep Area and the comparison with respect to data collected for the proposed project (March 2021 – May 2021) is presented below:

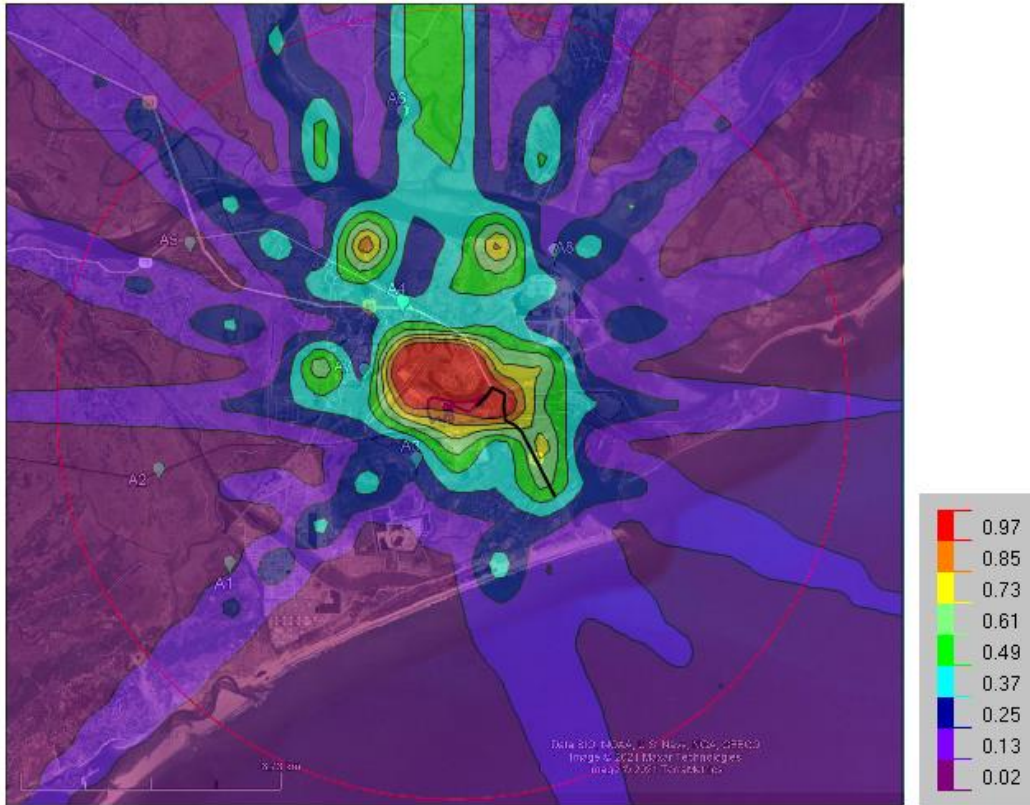
Parameter	March 2021 - May 2021, average value in $\mu\text{g}/\text{m}^3$	October 2023, average value in $\mu\text{g}/\text{m}^3$
PM ₁₀	94.6	93
PM _{2.5}	51.8	41
SO ₂	10.8	13.2
NO _x	26.2	10.6

As observed, the monitored values have generally reduced except for SO₂.

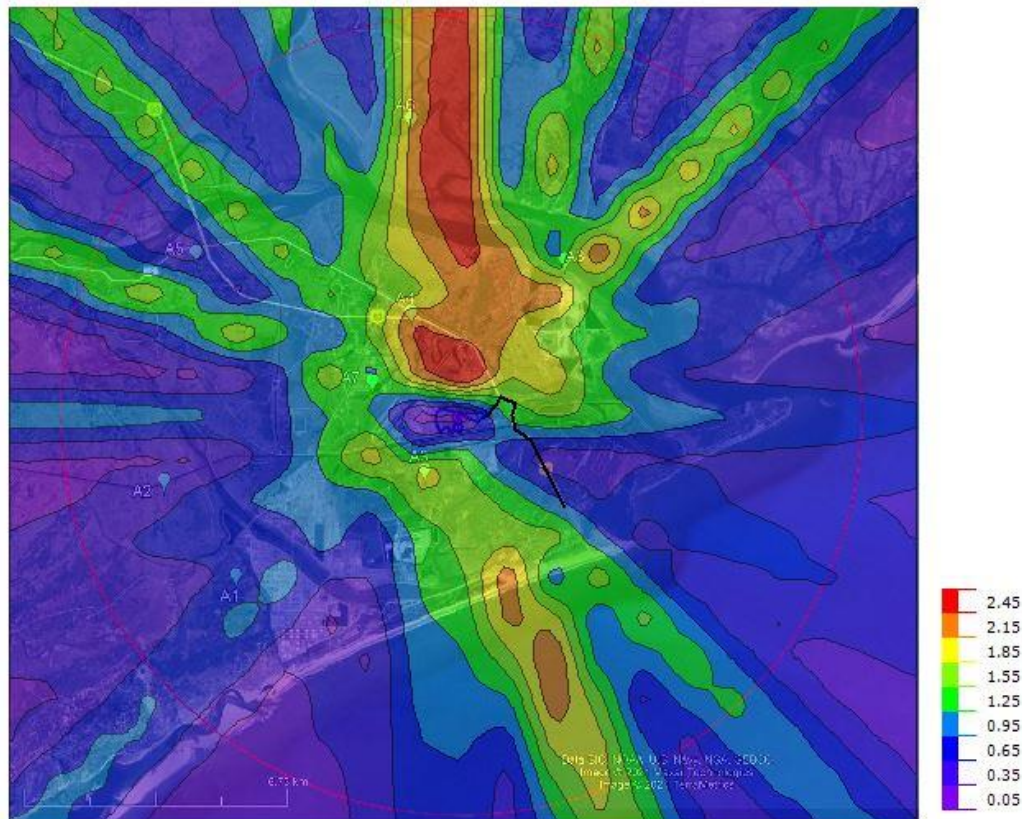
The predicted glcs for 14 MTPA vis-a-vis 7 MTPA is given below.



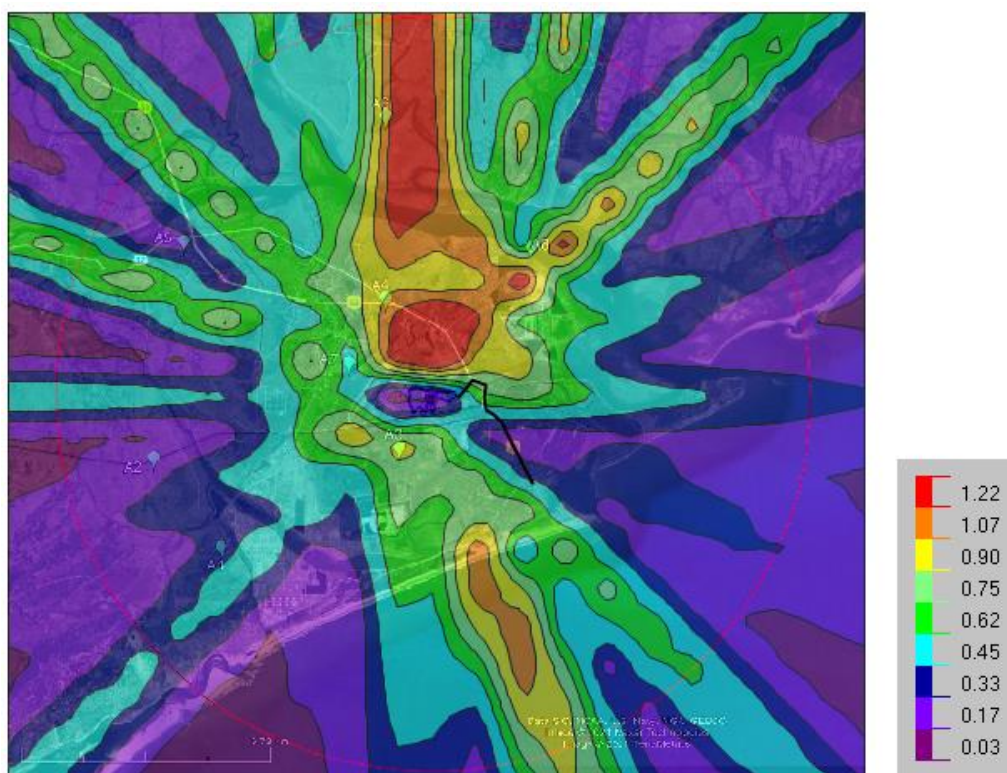
PREDICTED 24-HOURLY AVERAGE GLC OF PM₁₀ AT 14 MTPA IN µG/CUM



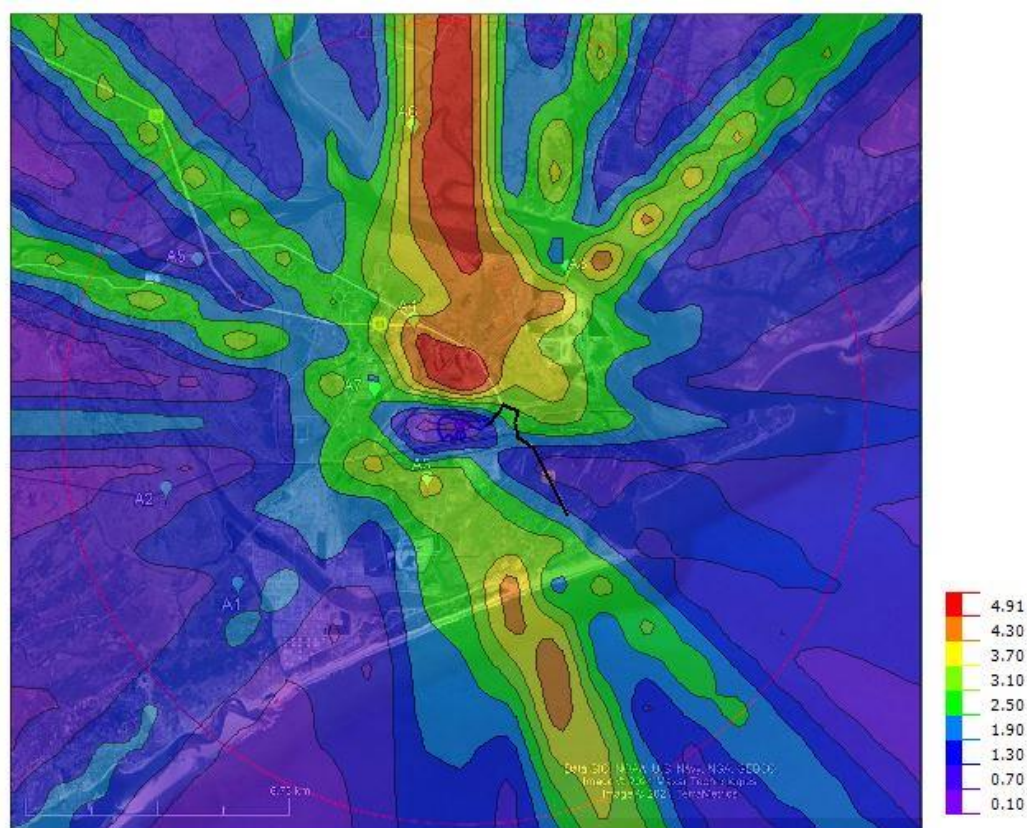
PREDICTED 24-HOURLY AVERAGE GLC OF PM_{2.5} AT 7 MTPA IN µG/CUM



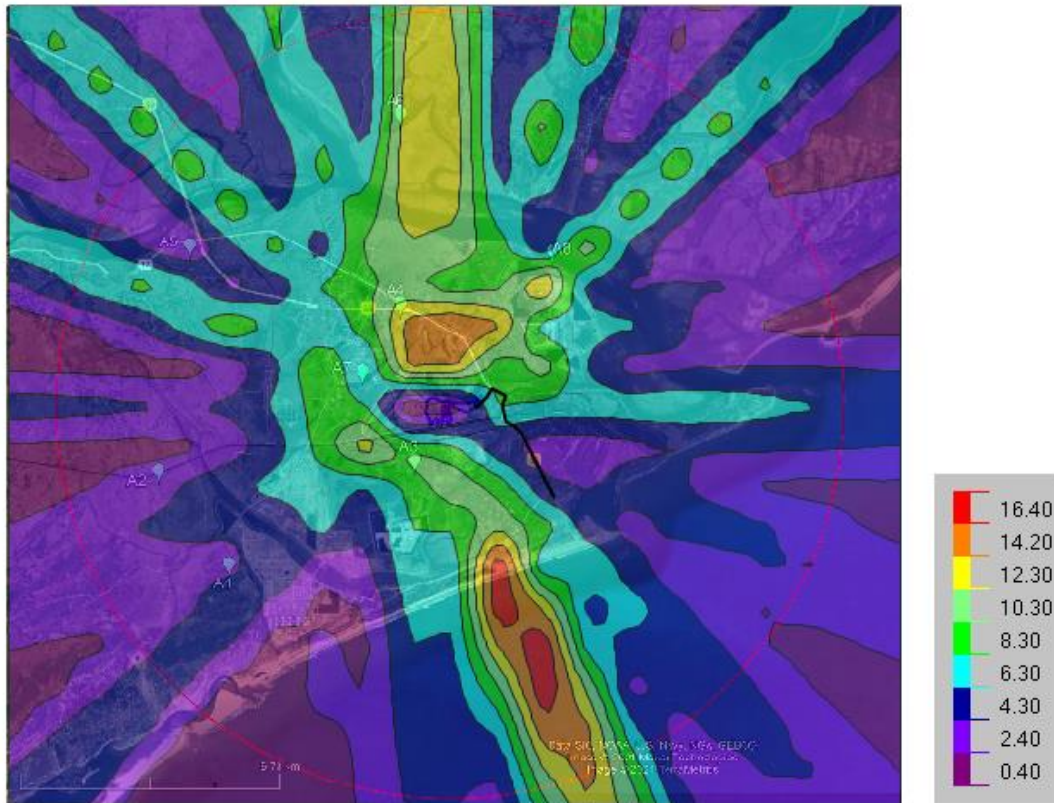
PREDICTED 24-HOURLY AVERAGE GLC OF SO₂ AT 14 MTPA IN µG/CUM



PREDICTED 24-HOURLY AVERAGE GLC OF SO2 AT 7 MTPA IN µG/CUM



PREDICTED 24-HOURLY AVERAGE GLC OF NO_x AT 14 MTPA IN μG/CUM



PREDICTED 24-HOURLY AVERAGE GLC OF CO AT 7 MTPA IN µG/CUM

6. The EAC also discussed the socio-environmental changes and believes that the Project Proponent should quantify these changes. Subsequently, the PP needs to formulate a plan to address the identified issues.

Reply: The changes with regard to socioeconomic parameters are as follows:

- i) The project area of 40.47 ha and location remains unchanged.
- ii) The allocated budget for socio-economic development activities is unchanged at INR 37.05 crores.
- iii) The commitments made towards issues raised in Public Hearing remain unchanged.
- iv) The manpower requirement during construction period remains unaltered
- v) During interim operational period, there would be a reduction in the manpower requirement of 200 indirect and 39 direct employment opportunities for a period of 1 year.
- vi) As committed during the last appraisal for EC the terms pertaining to adoption of 2 nos. villages remain unchanged

7. The EAC noted that the Project is close to the Estuary ecosystem, the PP shall submit a plan to conserve and protect the Estuary ecosystem.

Reply: The following measures have been taken to protect the estuarine ecosystem:

- i) The project has been designed based on Zero Liquid Discharge.

- ii) Only the excess stormwater would be discharged to the drainage system leading to the sea during high monsoon after treatment through Clarifloculator.
 - iii) Additionally, as committed earlier, soil conservation scheme and erosion control measures would be carried out for Santra river located about 600 meters from the plant boundary and Taladanda canal located about 300 meters from the plant boundary. A 1 km stretch starting about 100 m upstream of the point nearest to the plant boundary and extending downstream would be taken up at each water body for conservation. The following measures are proposed for conservation of the water bodies:
 - a) Protection of embankment on the right bank of Taladanda canal and left bank of Santra river with installation of geomembrane and plantation of creepers.
 - b) Installation of wire mesh with geomembrane for slope protection at the embankments for both water bodies.
 - c) Plantation of tree species with deep roots along the banks for prevention of soil erosion. The spaces in between the tree plantations would be augmented with shrubs to further prevent erosion.
8. As reported total land is 40.49 ha which is under the possession of Paradip Port Trust Authority and PP had undertaken that they would take this land on long term lease basis for sixty (60) years. The PP shall submit the status of acquisition of the land with credible documents.
- Reply:** Certificate of Possession has been issued by Paradip Port Authority for a period of 60 years w.e.f. 17.04.23 to 16.04.2083 (Annexure 1)
9. The EAC advised PP/Consultant to represent the case again with revised proposal presentation. In view of the same, the EAC opined that PP needs to update the EIA/EMP Report with all the desired details and shall submit the revised EIA/EMP Report for consideration of the proposal.
- Reply:** The EIA/EMP report has been revised and uploaded.
10. The EAC advised PP/Consultant to gather all the facts and figures related to the instant proposal for clear understanding and further consideration of the Committee.
- Reply:** The EIA/EMP report has been revised and uploaded.
11. The PP/Consultant agreed to the suggestions of EAC and requested EAC to all reappear after revision of the application with the desired information.
- Reply:** Noted



PARADIP PORT AUTHORITY
PARADIP PORT-754142, ODISHA(INDIA)

CERTIFICATE OF POSSESSION OF LAND
MADE OVER BY THE PARTIES

Certified that the possession of Ac.100 (One Hundred Acres) of Port land (as per sketch / drawing enclosed) located over the following Plot nos. under Khata No. 01 in revenue village Bhitargarh, Tahasil-Kujang, Thana-Paradip, Dist-Jagatsinghpur is delivered w.e.f. 17.04.2023 at the hands of Sri Sanjay Kumar Pattnaik, Director(Project Affairs & Business Development)(Authorized Signatory), M/s Essar Minmet Limited (Authorized representative of Consortium headed by M/s Essar Investments Holdings Mauritius Limited), Essar House, 11 K.K.Marg, Mahalaxmi, Mumbai-400034 for the purpose of setting up of 14 MMTPA Iron Ore Pellet Plant at Paradip.

Plot No. 268, 272(P), 273(P), 274(P), 275(P), 279(P), 280(P), 296(P), 304(P), 305(P), 309, 310, 311, 312, 228(P)

This possession is valid for a period of 60 (sixty) years w.e.f. 17.04.2023 to 16.04.2083.

Biswajit Mishra

(Biswajit Mishra)
Sr. Assistant Estate Manager
Paradip Port Authority
Sr. Asst. Estate Manager
Paradip Port Authority

Babaji Ch. Nayak

(Babaji Nayak)
Sr. Revenue Inspector
Estate Wing
Paradip Port Authority

Witness

1. *(A.C. Mohapatra)*
Dir. Projects Essar Minmet Ltd.
2. *Ranjana Rashmi Beura*
Head Asst. Estate wing.
Paradip Port.



PARADIP PORT AUTHORITY
PARADIP PORT-754142, ODISHA(INDIA)

CERTIFICATE OF POSSESSION OF LAND
TAKEN OVER BY THE PARTIES

Certified that I, Sri Sanjay Kumar Pattnaik, Director(Project Affairs & Business Development)(Authorized Signatory), M/s Essar Minmet Limited (Authorized representative of Consortium headed by M/s Essar Investments Holdings Mauritius Limited), Essar House, 11 K.K.Marg, Mahalaxmi, Mumbai-400034 have taken possession of Ac.100(One Hundred Acres) of Port land (as per sketch/ drawing enclosed) w.e.f. 17.04.2023 on behalf of Consortium having M/s Essar Investments Holdings Mauritius Limited erstwhile M/s. Essar Ports & Shipping Limited, Mauritius as lead member and Sri Jagannath Steels & Power Limited & M/s Essar Minmet Limited as members from the hands of the Sr. Revenue Inspector, Estate Wing, Paradip Port Authority located over the following Plot nos. under Khata No. 01 in revenue village Bhitagarh, Tahasil-Kujang, Thana-Paradip, Dist-Jagatsinghpur for the purpose of setting up of 14 MMTPA Iron Ore Pellet Plant at Paradip.

Plot No. 268, 272(P), 273(P), 274(P), 275(P), 279(P), 280(P), 296(P), 304(P), 305(P), 309, 310, 311, 312, 228(P)

This possession is valid for a period of 60 (sixty) years w.e.f. 17.04.2023 to 16.04.2083.

Sanjay Kumar Pattnaik
M/s Essar Minmet Limited 17/04/2023
(Authorized representative of Consortium headed by M/s Essar Investments Holdings Mauritius Limited)

Witness

1. *P.C. Mohapatra*
Dir. Projects, Essar Minmet Ltd.
2. *Rajen Rashmi Beura*
Head Asst.
Estate wing, Paradip Port



ANNEXURE 2


ODISHA
NEW OPPORTUNITIES

CGM/SLNA/EML-185/19/

Date: 16.12.2023

To,

Additional Secretary to Government
Department of Water Resources
Rajiv Bhawan
Bhubaneswar

Sub: Proceedings of 125th SLSWCA meeting held on 07.12.2023: Phase Wise Water Allocation- M/s. Essar Minmet Ltd- To set up 14 MTPA Beneficiation at Keonjhar, 14 MTPA Pellet Plant at Paradip and 14 MTPA Slurry pipe line connecting Beneficiation plant and pellet plant.

Sir,

In inviting reference to the above subject, I am directed to inform that the State Level Single Window Clearance Authority (SLSWCA) in its 125th meeting held on 07.12.2023 discussed the Phasing Proposal of M/s Essar Minmet Ltd and noted the following:

"After detailed discussion, SLSWCA approved the request from M/s Essar Minmet Ltd to draw water as per the following Schedule":

Source of water	Quantity (cusec)	Duration		Remarks
		From	To	
Taldanda Canal	0.1	01-02-2024	31-07-2026	For Construction Purpose
Taldanda Canal	2.1	01-08-2026	31-07-2027	For Pellet Plant Operation
Baitarani River	7.16	01-08-2027	Onwards	For Beneficiation, Slurry Pipeline & Pellet Plant Operation

The above Phasing may be considered as per prevailing guidelines/ rules of DoWR. This for your kind information and necessary action please.

Yours faithfully,

Sd/-
(K.C. Mohanty)

Executive Director

Date: 16.12.2023

Memo no. _____

Office of Engineer in Chief, Water Resource, Secha Sadan Bhawan, Bhubaneswar/ Chief Engineer, Water Services, Secha Sadan Bhawan, Bhubaneswar / SE, Planning DoWR & Member (SLFC), IPICOL for kind information and necessary action.

Sd/-
Executive Director

Date: 16.12.2023

Memo no. 3066

Copy to CEO & MD, M/s. Essar Minmet Ltd, 3rd Floor, UCCI Building, Plot No-1/1C, N6- IRC Village, Bhubaneswar-751015 for information and necessary action.

Sd/-
Executive Director



PARADIP PORT AUTHORITY
ADMINISTRATIVE DEPARTMENT
(ESTATE WING)

No. AD/EST/LAND-I-30/2020/3705

Date: 19.12.2023

To

**The CEO & MD,
ESSAR Minmet Limited,
3rd Floor UCCI Building, Plot No.1/1C,N-6-IRC Village, Nayapalli,
Bhubaneswar-751015(Odisha)**

Sub: Route for RoW for Pellet Conveyor and import of 7 MTPA Iron Ore Concentrate through Paradip Port to your Pellet Plant-reg

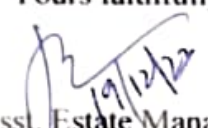
Ref: Letter of ESSAR Minmet Limited vide No.EML/General/23/78 dtd:31.10.2023

Sir,

With reference to your letter cited above, it is to inform you that the Chairperson, PPA has been pleased to give the in-principal approval towards RoW permission for Pellet Conveyor and import of 7 MTPA Iron Ore Concentrate through Paradip Port to your Pellet Plant. However, the final clearance shall be provided subject to fulfillment of following conditions by Essar Minmet Limited: -

- i) Submission of detail engineering drawing from the designated berth to plant area by Essar Minmet Limited.
- ii) After submission of the said Drawing, the same shall be examined in detail by Engineering Department, E& M Department and Traffic Department, PPA for giving clearance.
- iii) After which the matter will be placed before the LAC and after recommendation of LAC, the matter will be placed before Board of PPA for approval.

Yours faithfully,


Sr. Asst. Estate Manager,
Paradip Port Authority

Copy to :-

1. The Secretary, PPA for kind information.
2. PS to Chairperson, PPA for kind information of the Chairperson, PPA
3. PA to Dy. Chairperson, PPA for kind information of the Dy. Chairperson, PPA.

Essar Minmet Limited

Essar House,
11, K. K. Marg,
Mahalaxmi,
Mumbai -400 034.

Corporate Identity Number:

U27100MH2016PLC355097

T: +91 22 6660 1100

E: CS@essarminmet.co.in

www.essar.com

Undertaking

We hereby give undertaking that on receipt of EC, EML will commence construction of boundary wall to prevent trespassing on the leased land. Greenery development shall be commenced from June 2024 and will be completed by June 2025.

FOR ESSAR MINMET LIMITED



Name: P. C. Mohapatra
Designation: Director Projects



REVISED ENVIRONMENTAL IMPACT ASSESSMENT REPORT

ON

**INSTALLATION OF 2 X 7 MTPA GREENFIELD
PELLET PLANT AT PARADIP**

FOR

ESSAR MINMET LIMITED

Document No.	:	11572/EIA/2021/001 Rev. 2
Sector	:	8 (NABET)
Category	:	A – Sl. No. 3a
Lab Engaged	:	Envirocheck
NABL Certificate No.	:	TC-6014 Valid till 12.01.25
Monitoring Period	:	March 2021 to May 2021

REVISED DECEMBER 2023



**M. N. DASTUR & COMPANY (P) LTD
CONSULTING ENGINEERS**

NABET CERTIFICATE NO. NABET/EIA/2225/RA 0289

Undertaking

I hereby give undertaking that the data and information provided in the report and enclosures are true to my best of knowledge and belief and I am aware that if any part of the data and information are found to be false and misleading at any stage, the project will be rejected and clearance given, if any to the project will be revoked at our risk and cost. In addition to this, I hereby give undertaking that no expansion/construction activity has been taken up.

FOR ESSAR MINMET LIMITED



Name: P. C. Mohapatra

Designation: Director





UNDERTAKING

We do hereby confirm that the data and information given in the EIA Report are true to the best of our knowledge and all Terms of Reference prescribed for EIA have been complied with.

For M. N. Dastur & Company (P) Ltd

S. K. Mukhopadhyay
Technical Director & HOD (Environment)



Declaration by Experts contributing to the revised EIA for setting up of 2 x 7 MTPA greenfield pellet plant at Paradeep, Jagatsinghpur district, Odisha for Essar Minmet Limited

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

EIA coordinator:



Name: Sandip Kumar Mukhopadhyay
 Prabal Kumar Samanta (Team Member for Sector 8)
 Sandarpan Mukherjee (Team Member for Sector 8)

Signature & Date: 

Period of involvement: March 2021 onwards

Contact information: Ph: (033)2225-5420/-0500
 Fax: (033)2225-1422

Functional area experts:

Sl. No.	Functional areas	Name of the expert/s	Involvement (period and task**)	Signature and date
1	AP	Sandarpan Mukherjee	a) Identifying the sources of emissions and mitigation measures b) Inventorisation of point source stack emissions details c) Ambient Air Quality (AAQ) monitoring impact predictions and mitigations	
2	WP	Sandip Kumar Mukhopadhyay	a) Surface water and ground water quality monitoring and assessment, impacts on water environment and mitigations b) Water balance and conservation measures	



Sl. No.	Functional areas	Name of the expert/s	Involvement (period and task**)	Signature and date
3	SHW	Sandarpan Mukherjee	a) Non-hazardous solid wastes generation, recycling and disposal b) Storage and management of hazardous solid wastes	<i>S Mukherjee</i>
4	SC	Prabal Kr Samanta	a) Monitoring, analysis & characterisation of soil b) Assessment of impact on soil quality and mitigation measures	<i>Prabal Kr Samanta</i>
5	AQ	Sandip Kumar Mukhopadhyay	a) Air dispersion modelling for prediction of glcs due to PM ₁₀ , SO ₂ and NO _x	<i>S Mukherjee</i>



**Declaration by the Head of the accredited consultant organization/
authorized person**

I, Sandip Kumar Mukhopadhyay, hereby, confirm that the above mentioned experts prepared the revised EIA for setting up of 2 x 7 MTPA greenfield pellet plant at Paradeep, Jagatsinghpur district, Odisha for Essar Minmet Limited. I also confirm that the consultant organization shall be fully accountable for any misleading information mentioned in this statement.

Signature:

Name: Sandip Kumar Mukhopadhyay

Designation: Head Environment and Technical Director

Name of the EIA Consultant Organization: M.N. Dastur & Company (P)
Ltd

NABET Certificate No. & Issue Date: NABET/EIA/2225/RA 0289
issued on 6th July 2023, valid up
to November 17, 2025



Sl. No.	Functional Area Code	Complete name of the Functional Areas
1	AP	Air Pollution Prevention, Monitoring & Control
2	WP	Water Pollution Prevention, Control & Prediction of Impacts
3	SHW	Solid Waste & Hazardous Waste Management
4	SC	Soil Conservation
5	AQ	Meteorology, Air Quality Modelling & Prediction

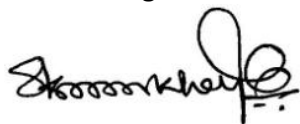
Certificate of Plagiarism check

Title of EIA Report:	REVISED EIA FOR INSTALLATION OF 2 X 7 MTPA GREENFIELD PELLET PLANT AT PARADIP FOR ESSAR MINMET LIMITED
Name of Accredited Organization:	M N Dastur & Company (P) Ltd.
Unique Identification Number:	NABET/EIA/2225/RA 0289
Name of EIA Co-ordinator (EC):	Sandip Kumar Mukhopadhyay
Name of the Software:	Online Plagiarism Check – www.duplichecker.com
Date of Check:	28.12.2023
Time of Check:	05.22 PM

Declaration by the Head of the accredited consultant organization/ authorized person:

I hereby certify that this EIA Report has been evaluated using online/~~in-house~~ software viz., **duplichecker.com website**. The report produced has been analyzed by the system and based on it; I certify that the EIA report produced in accordance with good scientific practice.

Date and Sign of EIA Coordinator:



Name: Sandip Kumar Mukhopadhyay

Designation: Technical Director and HOD – Environment

Date and Sign of Head of Accredited Organization:  28.12.2023

Name of the EIA consultant organization: M. N. Dastur & Co. (P) Ltd.

NABET Certificate No. & Issue Date: NABET/EIA/2225/RA 0289 issued on 6th July 2023

Brief Note on Reconsideration of EC for 14 MTPA Pellet Plant at Paradip

Background:

EAC recommended for EC for 14 MTPA Pellet plant at Paradip by EAC after meeting of the EAC Industry -1 sector held on 14/15th September 2022. Subsequently an ADS was raised on 9th Nov-2022 to expedite the process of EC application for the integrated Iron Ore Beneficiation plant of 14.3 MTPA at Tikarpada -Keonjhar District being a linked project.

EML pursued the matter of announcement of date for Public Hearing for Beneficiation plant with all concerned officials/departments of Govt. of Odisha. Subsequent the issue was taken up with Ministry of Steel and MOEF&CC Govt. of India. They have also conveyed to Govt. of Odisha and State Pollution Control Board for Public Hearing date.

However, the Public Hearing date for Beneficiation plant is yet to be announced.

In the meantime, EML was informing MOEFCC time to time on the various efforts taken on the Public Hearing date through ADS replies.

Present Proposal:

On 17th Oct-2023, EML proposed through ADS reply an alternate scheme for importing iron ore concentrate from overseas and transferring the same to the Pellet plant through return pipe conveyor envisaged for the project from port for interim period till Beneficiation plant and Slurry pipeline becomes operational.

As the Public Hearing and subsequent EIA report submission for Beneficiation plant is getting delayed and Pellet plant site preparation and construction needs more time in comparison to Beneficiation plant, the interim period proposal is submitted with respect to ADS raised on 2nd Nov-2023. It is pertinent to note that the delay in execution of the Pellet plant is causing substantial time and cost overrun. Each day delay in operation of the plant, production loss will be 42,400 tons/day. With present selling price of pellet, the delay of 1 year will result in loss of earning of foreign exchange in tune of 2 Billion USD.

The following sections are covered in this updated EIA report for interim operation in addition to normal operation.

- A. Summary of Updated EIA – Interim Operations with respect to ToR
- B. Summary of Impact on Environment
- C. Compliance to Terms of Reference (ToR) points Specific ToR
- D. Standard Terms of Reference
- E. Updated EIA Report



COMPLIANCE TO TERMS OF REFERENCE (ToR) POINTS

SPECIFIC ToR

1	Action plan to achieve particulate matter from stacks emissions less than 30 mg/Nm ³ shall be furnished.	For induration furnace waste gas, ESPs are proposed to keep stack emission to less than 30 mg/Nm ³ . All dedusting stacks from raw material and product handling would be equipped with PTFE dipped pulse jet bag filters to achieve PM emission less than 30 mg/Nm ³	Please refer to Chapter-2, Section 2.9.1., Page 2-26
2	PP will provide detailed action plan for greenbelt development un 33% project area with a tree density of 2500 per hectare.	40% of the plant area has been reserved for greenery including 10-100 m greenbelt of at last 3 tiers @ 2500 trees per ha.	Please refer to Chapter-10, Section 10.4., Page 10-16
3	Plan for use LDO/LSHS as fuel for pellet plant shall be submitted. Producer Gas Plant is not permitted.	Furnace oil would be used as fuel initially. However, term sheet has been signed with IOCL/GAIL for supply of natural gas in the near future which would then replace Furnace oil	Please refer to Chapter-2, Section 2.8.5., Page 2-14
4	Plan for use of water from iron ore slurry dewatering plant and Taladanda Canal shall be furnished. No ground water shall be used for industrial purpose.	No ground water usage is envisaged. Recovered water from slurry dewatering system would be utilized as plant make up water after treatment For interim Period till Beneficiation plant and Slurry pipeline becomes operational, 2.1 cusecs of water will be drawn from Taldanda canal for 7 MTPA Pellet plant operation.	Please refer to Chapter-2, Section 2.8.7., Page 2-16
5	Action plan for 100% solid waste utilization shall be furnished.	Main source of solid waste would be pellet fines which would be reused in the process	Please refer to Chapter-2, Section 2.9.4., Page 2-28
6	Control measures for fugitive emission from raw material storage, packaging section, transfer points, movement of trucks, loading and unloading shall be submitted.	Covered truck transportation would be employed for the collected dusts from the dust catchers of various units. Installation of tyre washing system at exit side of the material gate (Gate#2) to reduce the fugitive dust due to movement of heavy vehicles.	Please refer to page 4-14 Refer section 4.6.6 page 4-19



		<p>Plant roads would be black topped & kept dust free by using industrial vacuum cleaners and water sprinkling at regular intervals.</p> <p>PTFE dipped bag filters would be utilized for all Dedusting stacks to keep PM emission below 30 mg/Nm³</p> <p>Development of 3 tier greenbelt along plant periphery and wind curtain of 8-10 m to minimize fugitive dust emission</p> <p>During interim period iron ore concentrate of 7 MTPA will be transferred from Paradip Port to Pellet plant through pipe conveyor envisaged for pellet loading to vessels. The same conveyor on the return side will be used for transferring concentrate.</p> <p>Pipe conveyor is proposed to avoid transfer points and ensuring nil fugitive emission during conveying.</p>	
7	Proposed control measures for fugitive emission and run-off from stockyards shall be submitted.	<p>Covered truck transportation would be employed for the collected dusts from the dust catchers of various units.</p> <p>Installation of tyre washing system at exit side of the material gate (Gate#2) to reduce the fugitive dust due to movement of heavy vehicles.</p> <p>Plant roads would be black topped & kept dust free by using industrial vacuum cleaners and water sprinkling at regular intervals.</p> <p>PTFE dipped bag filters would be utilized for additive grinding building dedusting stacks to keep PM emission below 30 mg/Nm³</p> <p>Development of 3 tier greenbelt along plant periphery and wind curtain of 8-10 m to minimize fugitive dust emission.</p>	Please refer to Table 10-6, page 10-19



		Water sprinkling at product stockpile and roads to arrest fugitive dust emission. All plant run off would be routed through settling pits and reused to the extent possible. Only excess storm water would be discharged after settling.	
8	Since the plant is located near the coast, the air quality modeling shall include both the scenarios i.e. of water and air boundary shall be considered.	Complied To predict the post project ground level concentrations (glcs) of PM, SO ₂ and NO _x respectively, BREEZE AERMOD ISC, US-EPA approved software was used.	Please refer to Chapter-4, Section 4.6.6., Page 4-8

STANDARD TERMS OF REFERENCE

1.	Executive Summary	Complied	Please refer to chapter 11
2.	Introduction		
i.	Details of the EIA Consultant including NABET accreditation	EIA Consultant: M. N. Dastur & Co. (P) Ltd. NABET Extension Letter No. QCI/NABET/ENV/ACO/22/2417. Valid till 10th October 2022	Please refer to Chapter -12 and Appendix 1-3
ii.	Information about the project proponent	Essar Minmet Limited (EML) is Essar Company under Metals & Mining vertical of Essar Global Fund Limited (EGFL). EML is wholly owned by Essar Investment Holdings Mauritius Limited (EIHML).	Please refer to Section 1.2 on page 1-2
iii.	Importance and benefits of the project	Production of pellets is essential to the goal of achieving 300 MT crude steel production in India by 2030 and will generate considerable foreign exchange as Pellet demand from overseas will also be met through the project. The project would contribute to the socio-economic development of the region including generation of employment and contribute to the national economy through generation of revenue and taxes.	Please refer to Section 1.4. on page 1-10
3.	Project Description		
i.	Cost of project and time of completion.	Cost of the project: INR 3,347 crore Time of completion: 30 months	Please refer to Section 2.5. on page 2-2 and Section 2.6 on



			page 2-3
ii.	Products with capacities for the proposed project.	14 MTPA Pellets	Please refer to Section 2.8.3. on page 2-11
iii.	If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.	The proposed project is a greenfield project	NA
iv.	List of raw materials required and their source along with mode of transportation.	<p>The major raw material would be iron ore concentrate (14,294,000 TPA) which would be transported in slurry form through pipeline from proposed beneficiation plant in Keonjhar district 250 km away.</p> <p>Other raw materials (total 758,000 TPA) would be sourced from open market and transported by sea. From Paradeep port the raw materials would be brought to the plant site in covered trucks.</p> <p>During interim period 7,000,000 TPA would be transported from Paradip port to pellet plant through pipe conveyor.</p> <p>Other chemicals (fuel) required during the interim period Furnace oil (105,000 kl/year) and LDO (220 kl/year).</p>	Please refer to Section 2.8.4. on page 2-13 to 2-15
v.	Other chemicals and materials required with quantities and storage capacities.	<p>Other chemicals (fuel) required would be Furnace oil (210,000 kl/year) and LDO (440 kl/year).</p> <p>EML has already signed Term Sheet with GAIL & IOCL, the two major PSUs who are going to supply piped natural gas in Paradeep. The conversion from Furnace oil to Natural gas would reduce the carbon footprint significantly.</p>	Please refer to Section 2.8.5 & 2.8.6 on page 2-13
vi.	Details of emission, effluents, hazardous waste generation and their management.	<p>There would be a total of 8 stacks (4 stacks per module) with a total emission load of PM - 71.4 kg/hr, SO₂ 100 kg/hr and NO_x - 200 kg/hr.</p> <p>Used oil - 30 kl/annum (To be handed over to authorized used oil recyclers)</p> <p>STP sludge 110 ton/annum (used as manure for greenery development)</p>	Please refer to Section 2.9. on page 2-22 Section 4.9 & appendix. 4-1 Give reference no for STP Refer Table 2-15



		<p>Wastewater - 73 m³/hr (Recycled for dust suppression, greenbelt development, process use, etc.)</p> <p>During interim period : There would be a total of 4 stacks (4 stacks per module) with a total emission load of PM – 23.8 kg/hr, SO₂ 50 kg/hr and NO_x</p> <p>Used oil –15 kl/annum (Handed over to authorized hazardous waste disposal agency) STP sludge 110 ton/annum (used as manure for greenery development)</p> <p>Wastewater – 82 m³/hr (Recycled for dust suppression, greenbelt development,</p>	–
vii.	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	<p>Water - 385 m³/hr Power - 69 MW Manpower - Construction phase - Direct (50), Indirect (700) Operation phase - Direct (149), Indirect (450)</p> <p>During – Interim Period Water – 214 m³/hr Power 38 MW Manpower Construction phase Direct (50), Indirect (700) Operation phase – Direct (110), Indirect (250)</p>	Please refer to Section 2.8.7. on page 2-14, 2-16, Fig 2-3; Section 2.8.10. on page 2-25
viii.	The project proponent shall furnish the requisite documents from the competent authority in support of drawl of ground water and surface water and supply of electricity.	<p>Source of water would be recovered water from dewatering of iron ore slurry. In principle approval obtained from department of water resources, Govt. of Odisha vide letter No. 9276/WR dated 13/4/2022</p> <p>During Interim Period Source of water would be from Taldanda canal Requirement is about 2.1 cusec. Request Letter for water drawl submitted to IDCO.</p>	Please refer to Section 2.8.7.
ix.	Process description along with major equipment and machineries, process flow sheet (quantitative) from raw material to products to be provided.	<p>Following processes would be implemented for the proposed Pellet Plant.</p> <p>a) Disc pelletizer for production of green balls b) Travelling grate process for heat hardening of Pellets</p>	Please refer section 2.7 on page 2-4 to 2-11



		<p>The pellet plant would comprise the following facilities:</p> <ul style="list-style-type: none"> a) Storage, handling and preparation including dry grinding of binder and additive. b) Receipt of iron ore concentrate (iron ore fines in initial years) and additives/binder. c) Iron ore fines wet grinding d) Proportioning and mixing. e) Green balling. f) Induration-drying, pre-heating, firing, after firing and cooling. g) Product screening. h) Finished product handling and storage. <p>During Interim period the concentrate will be imported through Paradip port and transferred to Pellet</p>	
x.	Hazard identification and details of proposed safety systems.	<p>Main potential hazards are fire in Furnace oil and LDO storage and fire in Natural gas pipeline (in future).</p> <p>Mitigation measures would include foam-based fire fighting system and pressure/temperature monitor in Natural gas pipeline.</p>	Please refer section 2.10 on page 2-25 & Mitigation Plan in section 7.2 page 7-7
xi.	Expansion/modernization proposals:		
	a. Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MoEF&CC/ SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment, Forest and Climate Change as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including	Not applicable since the proposed project is greenfield in nature	NA



	Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing/ existing operation of the project from SPCB/PCC shall be attached with the EIA-EMP Report.		
	b. In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.	Not applicable for the present proposal	NA
4.	Site Details		
i.	Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	<p>The proposed project is located in Paradeep in Kujang Tehsil of Jagatsinghpur district of Odisha.</p> <p>Two land parcels were identified:</p> <p>a. 70 Acres in Balidia & 30 Acres at Paradipgarh</p> <p>b. 100 Acres in Paradip Port Area</p>	Please refer section 5.2 on page 5-4



ii.	A toposheet of the study area of radius of 10 km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places).	Complied		Please refer Drg. 11572-97A-000-ENV-0001										
iii.	Co-ordinates (lat-long) of all four corners of the site	<table><tr><th>Sl. No.</th><th>Coordinate</th></tr><tr><td>1.</td><td>20.289 N, 86.633 E</td></tr><tr><td>2.</td><td>20.290 N, 86.645 E</td></tr><tr><td>3.</td><td>20.286 N, 86.642 E</td></tr><tr><td>4.</td><td>20.283 N, 86.632 E</td></tr></table>	Sl. No.	Coordinate	1.	20.289 N, 86.633 E	2.	20.290 N, 86.645 E	3.	20.286 N, 86.642 E	4.	20.283 N, 86.632 E		Please refer Section 1.3.3 on page 1-6 and Drg. 11572-97A-000-ENV-0002
Sl. No.	Coordinate													
1.	20.289 N, 86.633 E													
2.	20.290 N, 86.645 E													
3.	20.286 N, 86.642 E													
4.	20.283 N, 86.632 E													
iv.	Google map-Earth downloaded of the project site.	Complied		Please refer to Fig 1-2 on page 1-9										
v.	Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating location of unit within the Industrial area/Estate.	Complied		Please refer to Drg. 11572-97A-000-ENV-0002										
vi.	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	Complied		Please refer Section 2.8.2 on page 2-11										
vii.	Landuse break-up of total land of the project site (identified and acquired), government/ private - agricultural, forest, wasteland, water bodies, settlements, etc. shall be included (not required for industrial area)	The total project site area is acquired on 60 years lease from Paradip Port Authority and its land use is Industrial Land		Please refer section 2.8.2. on page 2-11										

9



		The water table in the study area is high.	
x.	Details of Drainage of the project upto 5 km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood level of the project site and maximum flood level of the river shall also be provided. (mega Greenfield projects)	<p>The study area is drained by Mahanadi river. Nuna nadi and Kharinasi nadi joins Mahanadi from the north western side and north Eastern side respectively in the study area. The distributary of Mahanadi known as Santra nadi flows and Mahanga nadi flows through the western side of the study area. Many small river/stream are present in the study area. Taldanda canal flows through the northern side of the study area.</p> <p>The Highest Flood Level of Mahanadi (nearest river) was +5.5 m CD during super cyclone. The project site would be raised to a height of 5.1 m amsl.</p>	Please refer to section 3.3.3 on page 3-4
xi.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	The land has been allotted to EML by Paradip Port Authority on a 60 year lease.	Please refer to Section 2.8.2 on page 2-11 and Appendix 2-1
xii.	R&R details in respect of land in line with state Government policy.	R&R is not applicable for the proposed project	Please refer to Section 7.10 page 7-20
5.	Forest and wildlife related issues (if applicable)		
i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department (if applicable).	Forest land is not required for the proposed project	NA
ii.	Land use map based on high resolution satellite imagery (GPS) of the proposed site delineating the forest land (in case of projects involving forest land more than 40 ha).	Land use map has been prepared for study area	Refer section 3.3.5 on page 3-5
iii.	Status of Application submitted for obtaining the stage I forestry clearance	Not applicable	NA



	along with latest status shall be submitted.		
iv.	The projects to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.	Bhitarkanika Wildlife Sanctuary falls within the study area at a distance of 7.8 km NE The Site Specific Wild Life Management plan and vicinity map showing project site vis-à-vis location of WLS is duly approved by PCCF and Chief Wildlife Warden, Odisha .	Please refer Appendix. 4.2
v.	Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna, if any exists in the study area.	Site specific wildlife conservation plan authenticated by PCCF, Odisha has been prepared and INR 357.781 lakh has been earmarked for the conservation of Schedule 1 species	Pl refer Appendix. 4.2
vi.	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.	Not applicable	NA
6.	Environmental Status		
i.	Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	The average dry bulb temperature was recorded at 29.9 °C with relative humidity of 77.9 %, predominant wind direction was SW and S and average wind speed of 8.6 km/hr. The total monitored rainfall was 209.5 mm.	Please refer to section 3.4.1. on page 3-20



ii.	AAQ data (except monsoon) at 8 locations for PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the predominant wind direction, population zone and sensitive receptors including reserved forests.	AAQ data was recorded at 8 locations covering sensitive receptors like hospitals, human habitation (industrial townships and other densely populated regions) as well as covering upwind, downwind and crosswind of predominant and second predominant wind directions.	Please refer to section 3.4.3. on page 3-22
iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQPM Notification of November 2009 along with – min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.	PM ₁₀ : Max: 132.8 Min 51.8 P98 - 130.3 micro gram/m ³ PM _{2.5} : Max: 71.5 Min 23.2 P98 - 68.5 micro gram/m ³ SO ₂ : Max: 25 Min <4.0 P98 -24.4 micro gram/m ³ NO _x : Max: 36.8 Min 10.5 P98 - 36.5 micro gram/m ³ All AAQ data was monitored twice weekly for 12 weeks	Please refer to Appendix Field Report
iv.	Surface water quality of nearby River (60 m upstream and downstream) and other surface drains at eight locations as per CPCB/ MoEF&CC guidelines.	Surface water was monitored at 8 locations. DO: 5.2 - 6.8 mg/l COD: 20.81 - 52.24 mg/l Chromium: bdl - 0.1 mg/l BOD: 5.33 - 20.67 mg/l	Please refer to section 3.4.5. on page 3-30
v.	Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC.	No	NA
vi.	Ground water monitoring at minimum at 8 locations shall be included.	Ground water was monitored at 8 locations. TSS : 10 - 14.97 mg/l TDS : 1230 - 2154 mg/l Chromium: bdl - 0.02 mg/l Total hardness: 505 - 605 mg/l Chlorides: 289 - 503 mg/l	Please refer to section 3.4.4. on page 3-27
vii.	Noise levels monitoring at 8 locations within the study area.	Noise level was monitored at 8 locations Leq (Day): 60.67 - 67.87 dB(A) Leq (Night): 57.33 - 65.43 dB(A)	Please refer to section 3.6 on page 3-38



viii.	Soil Characteristic as per CPCB guidelines.	Soil quality was monitored at 5 locations: N: 720 - 1480 mg/kg P: 650 - 850 mg/kg K: 920 - 1520 mg/kg EC: 1.3 - 1.8 ds/m	Please refer to section 3.5 on page 3-33
ix.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.	Traffic study carried out at two locations: Location 1 (Adani Gate): ADT - 10460 PCU Location 2 (Atharbanki): ADT - 27499 PCU	Please refer to section 3.7. on page 3-39
x.	Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If Schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	Since Bhitarkanika Wildlife Sanctuary falls in the study area, there is presence of Schedule 1 species like Olive Ridley Turtle, Dolphins, Indian Python, Crocodiles etc. A wildlife conservation plan approved by PCCF, Odisha has been prepared and INR 357.781 lakhs has been allocated for the said plan	Please refer to section 3.8 on page 3-41 And Appendix 4-2
xi.	Socio-economic status of the study area.	Socio-economic survey was conducted in 16 villages and one town within the study area located in all directions with reference to the project site.	Please refer to section 3.14 on page 3-62
7.	Impact Assessment and Environment Management Plan		
i.	Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modeling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project in the AAQ Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be well assessed.	The model used for the point source and line source modeling is US EPA approved BREEZE AERMOD. The cumulative impact of point source and fugitive emission from transportation are (in terms of incremental concentration): PM ₁₀ - 5.7 microgram/m ³ PM _{2.5} - 3 microgram/m ³ SO ₂ - 2.2 microgram/m ³ NO _x - 4.3 microgram/m ³	Please refer Section 4.6.6 from page 4-8 to page 4-14



	Details of the model used and the input data used for modeling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.		
ii.	Water Quality modeling - in case, if the effluent is proposed to be discharged into the local drain, then Water Quality Modeling study should be conducted for the drain water taking into consideration the upstream and downstream quality of water of the drain.	No effluent is proposed to be discharged outside the plant premises.	Please refer to section 4.5.3 on page 4-3
iii.	Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport or conveyor-cum-rail transport shall be examined.	<p>The major raw material i.e. iron ore concentrate would be transported from the proposed beneficiation plant of EML at Tikarapada, Keonjhar district, Odisha in the form of slurry through slurry pipeline. Thus, the major impact due to transportation of raw materials would be avoided. Other raw materials like anthracite coal, bentonite, limestone and dolomite would be sourced by sea to Paradeep port and then to plant by road (4 km away). All transportation by road would be through tarpaulin covered trucks. The line source modeling of truck movement has been carried out and included in the calculation of glcs</p> <p>During Interim Period : The major raw material i.e iron ore Concentrate would be imported from external sources through Paradip Port and transferred from port to plant through a pipe conveyor. Thus, the environment impact due to transportation of raw materials would be avoided.</p>	Please refer to section 2.8.9. on page 2-24



iv.	A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.	Waste water streams from various plant operations would mainly be cooling tower blowdown, compressor cooling, treated water from STP etc. This water would be recycled for use in dust suppression, equipment washing and greenbelt development after treatment in CETP. The plant would be 100% zero effluent discharge.	Please refer to Section 2.9.3 on page 2-24
v.	Details of stack emission and action plan for control of emissions to meet standards.	<p>There would be a total of 8 stacks (4 stacks per module) with a total emission load of PM - 71.4 kg/hr, SO₂ 100 kg/hr and NO_x - 200 kg/hr. Pellet plant waste gas system would be equipped with ESP to maintain PM at 30 mg/Nm³ and all DE stacks would be equipped with pulse jet bag filter of adequate capacity to maintain 30 mg/Nm³ PM emissions.</p> <p>During interim period : There would be a total of 4 stacks (4 stacks per module) with a total emission load of PM – 23.8 kg/hr, SO₂ 50 kg/hr and NO_x 100 kg/hr. Pellet plant waste gas system would be equipped with ESP to maintain PM at 20 mg/Nm³ and all DE stacks would be equipped with pulse jet bag filter of adequate capacity to maintain 20 mg/Nm³ PM emissions.</p>	<p>Please refer to Section 2.9.1 on page 2-25</p> <p>–</p>
vi.	Measures for fugitive emission control.	<p>Pneumatic or covered truck transportation would be employed for the collected dusts from the dust catchers of various units.</p> <p>Installation of tyre washing system at the strategic locations of the plant to reduce the fugitive dust due to movement of heavy vehicles.</p> <p>Plant roads would be black topped & kept dust free by using industrial vacuum cleaners and water sprinkling at regular intervals.</p> <p>PTFE dipped bag filters would be utilized for all Dedusting stacks to keep PM emission below 30 mg/Nm³</p> <p>Development of 3 tier greenbelt along plant periphery and wind curtain of</p>	Refer section 4.6.6 page 4-15



		8-10 m to minimize fugitive dust emission	
vii.	Details of hazardous waste generation and their storage, utilization and disposal. Copies of MOU regarding utilization of solid and hazardous waste shall also be included. EMP shall include the concept of waste-minimization. Recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.	<p>Hazardous waste generated would be used oil and STP sludge. Used Oil would be handed over to authorized waste disposal agencies and STP sludge would be reused as manure for greenery development.</p> <p>Energy conservation measures: Waste gas recirculation in induration furnace</p> <p>Power Purchase Agreement with Essar Power Limited is being considered for utilization of solar power from 95 MW Solar Power Plant.</p>	<p>Section 4.9 on page 4-16 and Appendix 4-1 for MoU on recycling of used oil</p> <p>Please refer Section 2.8.6 on page xxx</p>
viii.	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Not applicable for the proposed project	NA
ix.	Action plan for the greenbelt development plan in 33% area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The greenbelt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.	Since the proposed project would be located in Paradeep which is coming under Severely Polluted Area as per CPCB, greenery would be developed in 40% of the plant area with peripheral greenbelt width ranging from 10m – 100 m @ 2500 trees per hectare.	Please refer to Section 10.4 on page 10-10
x.	Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	Storm water would be captured in storm water drains and utilized to the extent possible by routing it to the water reservoir. The excess storm water would be drained after treating through a clarifloculator.	Please refer to Section 10.7. on page 10-16



xi.	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	CAPEX - INR 63.95 crores OPEX - INR 1 crore per annum During interim period: OPEX INR 0.5 crore per annum.	Please refer to Section 10.9 on page 10-27
xii.	Action plan for post-project environmental monitoring shall be submitted	The following attributes would be regularly monitored: i) Meteorology - Meteorological parameters ii) Air quality - Ambient air quality, work zone air quality & stack emission monitoring iii) Water quality - Ground water, surface & waste water iv) Noise levels - Ambient & work zone v) Soil quality - Characteristics & TCLP test to assess the leachability of toxic elements into ground water vi) Inventory of solid waste including hazardous waste vii) Water consumption viii) Energy consumption	Please refer to Chapter 6
xiii.	Onsite and offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.	EML would implement an On-site Emergency plan approved by Director (Factories and Boiler), Bhubaneswar. Head-Plant would designated as Works Main Controller (WMC) who assumes overall responsibility for implementation of emergency planning at the time of crisis on the site. The implementing authority of the off-site plan is the local authority and not the plant authority. Head of Plant in consultation with the Safety, Admin & other concerned department will be coordinating with the district administration/local authority for safeguarding nearby settlements during off-site emergency. The WMC would be in communication with the District Disaster management Authority (DDMA) regarding pre-disaster activities in alignment with the overall plan developed by the DDMA or the District Collector.	Please refer to sections 7.4, 7.5 and 7.6 from page 7-8 onwards
8.	Occupational Health		
i.	Details of existing Occupational & Safety Hazards. What are the exposure levels of above mentioned hazards and whether they are within Permissible Exposure	It is a Greenfield Project. The technology & equipments selection ensures the exposure levels are below PEL. All OHS parameters would be maintained below the permissible exposure limits and periodic health	Please refer Section 10.3 on page 10-6



	level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved.	checkup would be carried out to ensure the same.	
ii.	Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre-designed format, chest x-rays. Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre-placement and periodical examinations give the details of the same. Details regarding last month analysed data of above mentioned parameters as per age, sex, duration of exposure and department-wise.	Not applicable since this is a greenfield project	NA
iii.	Annual report of health status of workers with special reference to Occupational Health and Safety.	Not applicable since this is a greenfield project	NA
iv.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.	Proposed CAPEX for OHS is INR 4.5 crore and OPEX is INR 3.55 crore per annum	Please refer Section 10.3 on page 10-6, Table 10-2 on page 10-10
9.	Corporate Environment Policy		
i.	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA Report.	EML has framed HSE Policy is committed to maintain environment friendly, safe, healthy and sustainable working condition in all its operations.	Please refer to Appendix 10-1



ii.	Does the Environment Policy prescribe for standard operating process/procedures to bring into focus any infringement/deviation /violation of the environmental or forest norms/ conditions? If so, it may be detailed in the EIA.	Safety and Environment departments would be responsible for the compliance of the environmental conditions in adherence to the Environmental Laws and Regulations. Work instruction for reporting & addressing non-compliance related to EC/CTE/CTO conditions are laid down as a Standard Operating Procedure (SOP).	Pl refer 10.2.1 Page 10-5
iii.	What is the hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	In case of violation of any statutory conditions, the same is reported to In charge Environment and Safety within 2 hours of detection and appropriate corrective as well as preventive actions are taken. In charge Environment and Safety would also report the same to the CEO and MD within 12 hours. The action taken report would be communicated to all stakeholders through website notification.	Please refer to section 10.2. and Figure 10-5 on page 10-4
iv.	Does the company have system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or Shareholders or stake holders at large? This reporting mechanism shall be detailed in the EIA Report	Same as above	Please refer to section 10.2.1. on page 10-5
10.	Details regarding infrastructure facilities such as sanitation, fuel, rest room etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.	The contractual labourers during the construction phase would be provided with restrooms (separate for male/female), changing rooms and rest shelters. The same facilities would be extended to contractual labourers and truck drivers in the operation phase.	Please refer to section 10.3 on page 10-6
11.	To address the public hearing issues, provisions contained under ministry's Office Memorandum vide F. No. 22-65/2017-IA.III dated 30/09/2020 shall be complied.	Monitorable physical action plan has been prepared to cover the issues raised at Public Hearing. A budget of 1.5 times the prescribed budget (as per previous CER notification) has been allocated for the same (INR	Please refer to Table 7-2. on page 7-5



		37.05 crore)	
12.	Any litigation pending against the project and/or any direction/ order passed by any court of law against the project, if so details thereof shall be included. Has the unit received any notice under the section 5 of Environment Protection Act, 1986 or relevant sections of Air and Water Acts? If so, details thereof and compliance/ ATR to the notices and present status of the case.	No litigations pending or direction received from any court of law	NA
13.	A tabular chart with index for pointwise compliance of above TOR.	Complied	Complied
14.	The TOR's prescribed shall be valid for a period of three years for submission for the EIA-EMP reports along with Public Hearing Proceedings (wherever stipulated).	Noted	Complied

ADDITIONAL TOR FOR INTEGRATED STEEL PLANT

1.	Iron ore/coal linkage documents along with the status of environmental clearance of iron ore and coal mines.	<p>Iron ore concentrate would be transported from proposed captive beneficiation plant in Keonjhar district by slurry pipeline. EC proposal for Beneficiation plant has been submitted separately. Anthracite coal would be sourced from the international open market and brought by sea to Paradip port.</p> <p>During Interim Period : Iron ore concentrate from external sources would be imported through Paradip port and transferred to plant from</p>	Please refer Section 2.8.9 on page 2-24
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		port by pipe conveyor.	
2.	Quantum of production of coal and iron ore from coal & iron ore mines and the projects they cater to. Mode of transportation to the plant and its impact.	Iron ore concentrate will come through slurry pipeline & anthracite coal will be transported by sea route to Port & from Port to plant through covered trucks.	Please refer Table 2-7, page 2-12
3.	Recent land-use map based on satellite imagery. High-resolution satellite image data having 1 m - 5 m spatial resolution like quickbird, Ikonos, IRS P-6 pan sharpened etc. for the 10 km radius area from proposed site. The same shall be used for land used/land-cover mapping of the area.	Complied.	Please refer to Drg. 11572-97A-000-ENV-0003
4.	PM (PM ₁₀ and PM _{2.5}) present in the ambient air must be analysed for source analysis - natural dust/RSPM generated from plant operations (trace elements) of PM ₁₀ to be carried over.	Complied. The trace elements in PM (Pb, As, Ni) have been monitored as per NAAQS norms	Please refer to Table 3-8 on page 3-25
5.	All stock piles will have to be on top of a stable liner to avoid leaching of materials to ground water.	Will be complied	-
6.	Plan for the implementation of the recommendations made for the steel plants in the CREP guidelines.	As the proposed project is a standalone pellet plant, all CREP guidelines are not applicable to the project.	Please refer to EMP Matrix Table 10-6 on page 10-19
7.	Plan for slag utilization.	NA	-
8.	Plan for utilization of energy in off gases (coke oven, blast furnace)	NA	-
9.	System of coke quenching adopted with justification.	NA	-
10.	Trace metals Mercury, Arsenic and Fluoride emissions in the raw material.	The raw material are free from trace metals. Same will be analysed periodically during operation phase.	-
12.	Trace metals in waste material especially slag.	NA	-
13.	Trace metals in water	Raw water is free from trace metals. Same will be analysed periodically during operation phase.	-



SUMMARY OF UPDATED EIA - INTERIM OPERATIONS WITH RESPECT TO TOR

Sl. No.	Section Reference in EIA Report		Description as per ToR Dated 04.03.2021	As per EIA Report (August 2022) for 14 MTPA (Recommended for grant of EC by EAC - Industry 1)	Revised for Interim Period (7 MTPA)	ToR Reference No.
	Section	Page No.				
1	2.8.7	2-16	Plan for use of water from iron ore slurry dewatering plant and Taldanda Canal shall be furnished. No ground water shall be used for industrial purpose.	No ground water usage is envisaged. Recovered water from slurry dewatering system would be utilized as plant make up water after treatment.	No ground water usage is envisaged. For interim Period till Beneficiation plant and Slurry pipeline becomes operational, 2.1 cusecs of water will be drawn from Taldanda canal for 7 MTPA Pellet plant operation.	ToR Ref No. 4
2	4.6.5	4-8 to 4-9	Control measures for fugitive emission from raw material storage, packaging section, Transfer points, movement of trucks, loading and unloading shall be submitted.	<p>Installation of tyre washing system at the strategic locations of the plant to reduce the fugitive dust due to movement of heavy vehicles.</p> <p>Plant roads would be black topped & kept dust free by using industrial vacuum cleaners and water sprinkling at regular intervals. PTFE dipped bag filters would be utilized for all Dedusting stacks to keep PM emission below 20 mg/Nm³</p> <p>Development of 3 tier greenbelt along plant periphery and wind curtain of 8-10 m to minimize fugitive dust emission</p>	<p>Installation of tyre washing system at the strategic locations of the plant to reduce the fugitive dust due to movement of heavy vehicles.</p> <p>Plant roads would be black topped & kept dust free by using industrial vacuum cleaners and water sprinkling at regular intervals. PTFE dipped bag filters would be utilized for all Dedusting stacks to keep PM emission below 20 mg/Nm³</p> <p>Development of 3 tier greenbelt along plant periphery and wind curtain of 8-10 m to minimize fugitive dust emission. During interim period iron ore concentrate of 7 MTPA will be transferred from</p>	ToR Ref No. 6

Sl. No.	Section Reference in EIA Report		Description as per ToR Dated	As per EIA Report (August 2022) for	Revised for Interim Period (7 MTPA)	ToR Reference
					<p>Paradip Port to Pellet plant through pipe conveyor envisaged for pellet loading to vessels. The same conveyor on the return side will be used for transferring concentrate.</p> <p>Pipe conveyor is proposed to avoid transfer points and ensuring nil fugitive emission during conveying.</p>	
3	4.6.6	4-9 to 4-18	Since the plant is located near the coast, the air quality modeling shall include both the scenarios i.e. of water and air boundary shall be considered.	Complied	No change	ToR Ref No. 8
4	2.8.4 and 2.8.5	2-13 to 2-15	List of raw materials required and their source along with mode of transportation	The major raw material would be iron ore concentrate (14,294,000 TPA) which would be transported in slurry form through pipeline from proposed beneficiation plant in Keonjhar district 250 km away. Other raw materials (total 758,000 TPA) would be sourced from open market and transported by sea. From Paradeep port the raw materials would be brought to the plant site in covered	<p>During interim period 7,000,000 TPA would be transported from Paradip port to pellet plant through pipe conveyor.</p> <p>Other chemicals (fuel) required during the interim period Furnace oil (105,000 kl/year) and LDO (220 kl/year).</p>	3. Project Description - iv

Sl. No.	Section Reference in EIA Report		Description as per ToR Dated	As per EIA Report (August 2022) for	Revised for Interim Period (7 MTPA)	ToR Reference
				trucks.		
5	2.9	2-25 to 2-29	Details of emission, effluents, hazardous waste generation and their management.	<p>There would be a total of 8 stacks (4 stacks per module) with a total emission load of PM - 47.6 kg/hr, SO₂ 100 kg/hr and NO_x - 200 kg/hr.</p> <p>Used oil – 30 kl/annum (Handed over to authorized hazardous waste disposal agency) STP sludge 110 ton/annum (used as manure for greenery development)</p> <p>Wastewater – 82 m³/hr (Recycled for dust suppression, greenbelt development, process use, etc.)</p>	<p>During interim period : There would be a total of 4 stacks (4 stacks per module) with a total emission load of PM 23.8 kg/hr, SO₂ 50 kg/hr and NO_x - 100 kg/hr.</p> <p>Used oil ±5 kl/annum (Handed over to authorized hazardous waste disposal agency) STP sludge 110 ton/annum (used as manure for greenery development)</p> <p>Wastewater – 82 m³/hr (Recycled for dust suppression, greenbelt development, process use, etc.)</p>	3- Project Description - vi
6	2.8.7 (Utilities) 2.8.10 (Man-power)	2-16 to 2-25	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract).	<p>Water -375 m³/hr Power 69 MW– Manpower – Construction phase Direct (50), Indirect (700) Operation phase Direct (149), Indirect (450)</p>	<p>During Interim Period – Water –214 m³/hr Power 38 MW– Manpower Construction phase Direct (50), Indirect (700) Operation phase – Direct (110), Indirect (250)</p>	3. Project Description - vii
7	2.8.7	-	The project proponent shall furnish the requisite documents from the competent authority in support of drawl of ground water and	<p>Source of water would be recovered water from dewatering of iron ore slurry. In Principle approval obtained from department of water resources,</p>	<p>During Interim Period Source of water would be from Taldanda canal Requirement is about 2.1 cusec. Request Letter for water drawl submitted to IDCO.</p>	3. Project Description - viii

Sl. No.	Section Reference in EIA Report		Description as per ToR Dated	As per EIA Report (August 2022) for	Revised for Interim Period (7 MTPA)	ToR Reference
			surface water and supply of electricity.	Govt. of Odisha vide letter no. 9276/WR dated 13/4/2022		
8	2.7	2-4 to 2-11	Process description along with major equipment and machineries, process flow sheet (quantitative) from raw material to products to be provided.	<p>Following processes would be implemented for the proposed Pellet Plant.</p> <p>a) Disc pelletizer for production of green balls</p> <p>b) Travelling grate process for heat hardening of Pellets</p> <p>c) The pellet plant would comprise the following facilities:</p> <p>d) Storage, handling and preparation including dry grinding of binder and additive.</p> <p>e) Receipt of iron ore concentrate (iron ore fines in initial years) and additives/ binder.</p> <p>f) Iron ore fines wet grinding</p> <p>g) Proportioning and mixing.</p> <p>h) Green balling.</p> <p>i) Induration- drying, pre-heating, firing, after firing and cooling.</p> <p>j) Product screening.</p> <p>k) Finished product handling and storage</p> <p>l)</p>	During Interim period the concentrate will be imported through Paradip port and transferred to Pellet plant through a pipe conveyor	3. Project Description -ix
9	2.8.9 and 4.7	2-24 to 2-25 and 4-18 to 4-19	Impact of the transport of the raw materials and	The major raw material i.e iron ore concentrate would be	During Interim Period : The major raw material i.e iron	7. Impact Assessment and Environ

Sl. No.	Section Reference in EIA Report		Description as per ToR Dated	As per EIA Report (August 2022) for	Revised for Interim Period (7 MTPA)	ToR Reference
			end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum-road transport or conveyor-cum-rail transport shall be examined.	transported from the proposed beneficiation plant of EML at Tikarapada, Keonjhar district, Odisha in the form of slurry through slurry pipeline. Thus, the major impact due to transportation of raw materials would be avoided. Other raw materials like anthracite coal, bentonite, limestone and dolomite would be sourced by sea to Paradeep port and then to plant by road (4 km away). All transportation by road would be through tarpaulin covered trucks. The line source modeling of truck movement has been carried out and included in the calculation of glcs	ore Concentrate would be imported from external sources through Paradip Port and transferred from port to plant through a pipe conveyor. Thus, the environment impact due to transportation of raw materials would be avoided.	ment Management Plan -iii
10	2.9.1	2-25 to 2-27	Details of stack emission and action plan for control of emissions to meet standards	There would be a total of 8 stacks (4 stacks per module) with a total emission load of PM 47.6 kg/hr, SO ₂ 100 kg/hr and NO _x 200 kg/hr. Pellet plant waste gas system would be equipped with ESP to maintain PM at 20 mg/Nm ³ and all	During interim period : There would be a total of 4 stacks (4 stacks per module) with a total emission load of PM 23.8 kg/hr, SO ₂ 50 kg/hr and NO _x 100 kg/hr. Pellet plant waste gas system would be equipped with ESP to maintain PM at 20 mg/Nm ³ and all DE stacks	7. Impact Assessment and Environment Management Plan - v

Sl. No.	Section Reference in EIA Report		Description as per ToR Dated	As per EIA Report (August 2022) for	Revised for Interim Period (7 MTPA)	ToR Reference
				DE stacks would be equipped with pulse jet bag filter of adequate capacity to maintain 20 mg/Nm ³ PM emissions.	would be equipped with pulse jet bag filter of adequate capacity to maintain 20 mg/Nm ³ PM emissions.	
11	10.9	10-27	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included	CAPEX – INR 63.95 crores (INR 236.95 crore including technological measures for pollution mitigation) OPEX – INR 1 crore per annum	Capex – No Change During interim period: OPEX INR 0.5 crore per annum.	7. Impact Assessment and Environment Management Plan -xi
12	2.8.9	2-24 to 2-25	Iron ore/coal linkage documents along with the status of environmental clearance of iron ore and coal mines.	Iron ore would be transported from captive beneficiation plant in Keonjhar district by slurry pipeline. Anthracite coal would be sourced from the international open market and brought by sea to Paradip port.	During Interim Period : Iron ore concentrate from external sources would be imported through Paradip port and transferred to plant from port by pipe conveyor.	Additional TOR for Integrated Steel plant-1

SUMMARY OF IMPACT ON ENVIRONMENT

Sl. No.	Description	As per EIA Report (August 2022) for 14 MTPA Pellet Plant (Recommended for EC by EAC – Industry 1)	Modified for operation during interim period (7 MTPA pellet production)	Remarks
1.	Plant Configuration	2 x 7 MTPA	2 x 7 MTPA	Both units construction will start simultaneously.
2.	Plant operation	2 x 7 MTPA	1 x 7 MTPA	Any one 7 MTPA module will operate during the interim period till July 2027
3.	Raw Material	1. Iron Ore Concentrate – 14,294,000 TPA 2. Bentonite – 80000 TPA 3. Limestone 320,000 TPA 4. Dolomite – 156,000 TPA 5. Anthracite coal – 202,000 TPA	1. Iron Ore Concentrate – 7,000,000 TPA 2. Bentonite – 40000 TPA 3. Limestone 160,000 TPA 4. Anthracite coal – 101,000 TPA	During interim operation, the total consumption will reduce by 50% and impact due to road transportation of raw materials from port will also get reduced. Iron Ore concentrate will be transferred from Paradeep Port to plant through the same pipe conveyor envisaged for product pellet transport in return direction.
4.	Land Area	40.47 ha	40.47 ha	No change in total land area. The project site is Industrial land under ownership of Paradeep Port Authority taken on lease for 60 years vide Certificate of possession valid from 17.04.2023 to 16.04.2083. Thus there is no change with respect to distance from nearest village, railway station, port, wildlife sanctuary and industries operating within the study area. Therefore, there would be no change in impact.
5.	Surface water resource	No impact on surface water resource as water recovered from dewatering of slurry would be used as plant makeup water	During interim period, about 214 m ³ /hr (2.1 cusecs) of water would be withdrawn from Taladanda canal.	Recommendation for withdrawal of 2.1 cusec water from Taladanda canal is given by State Level Single Window Clearance Authority (SLSWCA) through IPICOL vide memo no. 3066 dated 16.12.2023. The location of the water intake point and pipeline route through the industrial area under PPA is near Paradeep Port Toll Gate. There are no downstream users and the pipeline will be laid in the land owned by PPA, there will be insignificant impact on surface water resource and land use
6.	Ground water resource & quality	No impact	No Impact	No change
7.	Pollution Load	Total flue gas volume from all stacks – 23,80,000 Nm ³ /hr • PM - 47.6 kg/hr SO ₂ - 100 kg/hr	Total flue gas volume from all stacks – 11,90,000 Nm ³ /hr • PM - 23.8 kg/hr SO ₂ - 50 kg/hr	Only 1 module will be in operation during interim period. Therefore, the stack emissions during the interim period would be 50% of the emissions anticipated at 14

Sl. No.	Description	As per EIA Report (August 2022) for 14 MTPA Pellet Plant (Recommended for EC by EAC – Industry 1)	Modified for operation during interim period (7 MTPA pellet production)	Remarks
		NOx - 200 kg/hr	NOx - 100 kg/hr	MTPA stage
8.	Traffic Load	629 PCU per day	315 PCU per day	The vehicular load due to raw material transportation will be half of the vehicular load projected at 14 MTPA since any one module will be in operation.
9.	Ground level concentration	Max glc PM10 – 2.92 µg/m3 PM2.5 – 1.46 µg/m3 SO2 – 2.2 µg/m3 NOx – 4.3 µg/m3 CO – 28.45 µg/m3 (8 hr avg)	Max glc PM10 – 1.45 µg/m3 PM2.5 – 0.73 µg/m3 SO2 – 1.07 µg/m3 NOx – 2.15 µg/m3 CO – 12.3 µg/m3 (8 hr avg)	Impact on air environment will get reduced during interim operation period
10.	Noise	No impact on ambient noise levels	No impact on ambient noise levels	No change
11.	Process solid waste generation	Pellet Fines generation from APCD -70,000 TPA	Pellet Fines generation from APCD -35,000 TPA	Fines generation during interim period shall be 50% of the generation projected at 14 MTPA since any one module will be in operation.
12.	Waste water generation	150 cubic mtr clarifloculator will be installed. Additional rain water during rainy season can be returned through return water pipeline to Beneficiation plant.	150 cubic mtr clarifloculator will be installed. Water to tune of 150 cubic mtr can be utilized for process.	Since the return water pipeline will not be in operation during this intermittent period, the extent of use of rain water will be 150 cub mtr per hour maximum.
13.	Zero discharge concept	Adopted	Adopted	No change
14.	STP	STP sludge 110 ton/annum (used as manure for greenery development) Water recovery – 6m3/hr	STP sludge 66 ton/annum (used as manure for greenery development) Water recovery – 3.5m3/hr	The installed capacity of STP will be utilized 100% during the construction period and during interim operation 60% capacity will be utilized due to reduced manpower.
15.	Used Oil	30 KL per annum	15 KL per annum	Used oil generation during interim period shall be 50% of the generation projected at 14 MTPA since any one module will be in operation.
16.	Manpower	Construction phase Direct (50), Indirect (700) Operation phase – Direct (149), Indirect (450)	Construction phase Direct (50), Indirect (700) Operation phase – Direct (110), Indirect (250)	No change in manpower requirement for construction phase. Reduced manpower requirement during interim operation of one module of 7 MTPA. During the interim period there would be marginal loss of job opportunities
17.	Socio economic upliftment activities	Budget – INR 37.05 crore Period of implementation -2 years	Budget – INR 37.05 crore Period of implementation -2 years	There would be no reduction in budget for socio economic development during the interim period
18.	Greenery development	Area covered – 16.19 ha (40% of project land) No. of trees – 40,475	Area covered – 16.19 ha (40% of project land) No. of trees – 40,475	No reduction in area under greenery and there would be positive impact on the local

Sl. No.	Description	As per EIA Report (August 2022) for 14 MTPA Pellet Plant (Recommended for EC by EAC – Industry 1)	Modified for operation during interim period (7 MTPA pellet production)	Remarks
				environment
19.	SPA requirement	Stack emission – PM – 20 mg/Nm ³ Zero Liquid discharge Greenbelt – 40% Socio economic development budget – 1.5 times of non-SPA area Fugitive dust emission control through dust suppression, water sprinkling, tyre washing system, avenue plantation & social forestry and maintenance of service road	Stack emission – PM – 20 mg/Nm ³ Zero Liquid discharge Greenbelt – 40% Socio economic development budget – 1.5 times of non-SPA area Fugitive dust emission control through dust suppression, water sprinkling, tyre washing system, avenue plantation & social forestry and maintenance of service road	During interim period all requirements of SPA will be complied



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1 - INTRODUCTION

1.1 PURPOSE OF THE REPORT

M/s Essar Minmet Limited (EML) has proposed to setup a 14 MTPA (2 x 7 MTPA Greenfield Pellet Plant near Paradip in Jagatsinghpur District, Odisha.

According to paragraph 2, sub-paragraph (i) of the notification of the Government of India in the Ministry of Environment and Forests number S.O. 1533 (E) dated the 14th September, 2006, published in the Gazette of India, Part II, Section 3, Sub-section (ii), "All new projects or activities listed in the Schedule to this notification" shall require prior environmental clearance from the concerned regulatory authority.

The proposed Greenfield project fall under Category 'A' of item 3(a) "Metallurgical Industries (ferrous & non-ferrous)" of the Schedule to the EIA Notification 2006 and amendments thereof and therefore, shall require prior environmental clearance from the Central Government in the Ministry of Environment, Forest and Climate Change (MoEFCC).

Application (Filled up Form 1, Pre-feasibility Report and proposed Terms of Reference) for prior environmental clearance for the above proposal was submitted to the MoEFCC vide Proposal No. IA/OR/IND/194461/2021 on 23rd January, 2021 and subsequently revised application vide Proposal No. IA/OR/IND/198977/2021 on 19th February, 2021. The proposals were considered in the 30th and 31st meeting of the Reconstituted Expert Appraisal Committee (Industry-1) held on 10-11th February, 2021 and 25-26th February, 2021 to determine the Terms of Reference (ToR) for undertaking the detailed



1 - Introduction (cont'd)

EIA study. The ToR for EIA of the proposed project is accorded by the MoEFCC vide their File No-J-11011/38/2021-IA.II(I), dated 4th March, 2021.

This Report has been revised in view of the EDS raised by MoEFCC on 19.03.22, 07.04.22, 04.05.22 and 18.07.22 after incorporation of comments/suggestions of the public received during PH and formulation of time bound physical action plan to address issues raised by the public.

The objective of the EIA study report is to gauge the prevailing baseline environmental quality, assess the potential impacts of the proposed project on the environment and plan appropriate mitigation measures to minimize adverse impacts and maximize beneficial impacts of the proposed project.

1.2 PURPOSE OF REVISION OF THE REPORT

For the interim period when beneficiation plant and slurry pipeline are not ready, the iron ore concentrate will be transported from Paradip port through the return side of the pipe conveyor which is envisaged for transporting pellet to the port during normal operation. This report has been revised in view of the ADS raised by MoEFCC on 02.11.23.

1.3 IDENTIFICATION OF PROJECT & PROJECT PROPONENT

1.3.1 Project Proponent

Essar Group is a US\$ 14 Billion conglomerate having multi verticals in the sectors viz. Energy, Metals & Mining, Technology, Infrastructure and Services across the globe.



1 - Introduction (cont'd)

Essar Global Fund Limited (EGFL) is the Principal investment holding company of all Essar companies. EGFL is a global investor with majority or total ownership in several world class assets diversified across the core sector of

- i) Energy (Comprising of refinery, power generation and exploration and production)
- ii) Metals & Mining (Comprising of core mining & pellet making)
- iii) Infrastructure (Comprising ports and EPC business)
- iv) Services (Primarily comprising shipping, oil fields and technology business)
- v) Essar Global has invested in several world-class assets diversified across Metals & Mining, Energy, Infrastructure, Technology and Services. It has invested in over 25 portfolio companies with combined revenue of US\$ 14 bn (March'20).

Energy:

Oil & Gas:

- i) 10 MTPA operating refining capacity.
- ii) Stanlow Refinery, 2nd largest in UK, meets 16% of country's road fuel demand.
- iii) 20 TCF Unconventional Gas in place globally.
- iv) Largest CBM player in India.

Power:

3,330 MW commissioned capacity.

Infrastructure:

Ports:

- i) India's 2nd largest private port company.
- ii) Operational port assets in strategic locations in India.
- iii) Current capacity of 110 MTPA to be scaled up to



1 - Introduction (cont'd)

~200 MTPA.

Projects:

- i) \$ 800 mn+ order book.
- ii) 50-year track record and global operations.
- iii) Offer full-spectrum Value-Engineered EPC solutions though a low cost base.
- iv) Owner's perspective.

Metals and Mining:

Metals and Minerals:

- i) 150 Million tonnes of coal reserves in US and Indonesia.
- ii) 2.3 Billion tonnes iron ore reserve in North America.
- iii) 7 Million tonnes per annum Pellet Plant project under completion in North America.

Services:

Shipping:

- i) 12 ships including a VLCC, Minicapes, Panamaxs, Supramaxes and Handysizes; 4 ships on order.
- ii) Aggregate shipping capacity of 1.12 mn DWT.
- iii) Oilfield Services: 15 land rigs, 1 semi-submersible offshore rig.

IT:

- i) Global Solution Provider representing the world's best brands.
- ii) 8000+ technology clients in 30+ countries across 6 continents.
- iii) Acquired Black Box Corporation (erstwhile NASDAQ: BBOX), a leading digital solution provider in the US, January 2019.



1 - Introduction (cont'd)

Essar Minmet Limited (EML) is Essar Company under Metals & Mining vertical of Essar Global Fund Limited (EGFL). EML is wholly owned by Essar Investment Holdings Mauritius Limited (EIHML).

1.3.2 Project

EML has proposed to set up a Greenfield Pellet plant near Paradip in Jagatsinghpur district, Odisha for production of 14 MTPA (2 x 7 MTPA) pellets. The proposed pellet plant is envisaged to produce both Blast Furnace (BF) grade (70-75%) and Direct Reduction (DR) grade (25-30%) pellets, which will be sold to the international as well as domestic market.

EML also intends to set-up a Greenfield 14.3 MTPA Iron Ore Beneficiation plant at Tikarpada in Keonjhar District, Odisha for production of 14.3 MTPA pellet feed iron ore concentrate (on dry basis) and long distance below ground iron ore slurry pipeline (about 250 km length & 22 inch/560 mm dia). Also parallel to the slurry pipeline corridor, it is proposed to have Return Water Pipeline (22 inch dia) from pellet plant at Paradip to beneficiation plant at Tikarpada in Keonjhar district of the same distance for being utilized as make-up in the beneficiation process after consumption as make-up and other water requirement for the proposed pellet plant.

Director- Projects /DGM - Projects of EML is the responsible authority for this EIA Report. The contact information is given below:

Name	- P C Mohapatra/Amol Dangore
Designation	- Director - Projects/DGM - Projects
Department	- Projects
Address	- 3rd Floor UCCI Building, Nayapalli, Bhubaneswar, Odisha – 751015



1 - Introduction (cont'd)

1.4 BRIEF DESCRIPTION OF THE PROJECT

1.4.1 Nature of the Project

The proposed Greenfield project would fall under Category 'A' of item 3(a) "Metallurgical Industries (ferrous & non-ferrous)" of the Schedule to the EIA Notification 2006 and amendments thereof. Bhitarkanika Wildlife Sanctuary falls at 7.8 km, NE from the project boundary. Therefore, the proposed project attracts the General Condition of EIA Notification 2006.

1.4.2 Size of the Project

The proposed project would be designed to produce 14 MTPA BF and DR grade pellets in 2 modules (Module-I and Module-II, each of 7 MTPA capacity). The design basis considered for the plants is enumerated below:

- Annual throughput of the pellet plants, MT	..	14
- Number of effective working days/year	..	330
- Working hours per day in 3 shift operation	..	24

During interim period any one module would be in operation with annual throughput of 7 million tons.

1.4.3 Location of the Project

The proposed Pellet Plant is in Kujanga Tehsil of Jagatsinghpur district of Odisha state. The project area is 40.49 Hectare. The project site is tentatively bounded by 20°17'1" N to 20°17'25" N latitude and 86°37'54"E to 86°38'45"E longitude. The proposed Pellet Plant would be located within port based, capital intensive industries as part of Industrial Park under Paradeep Smart Industrial Port City (SIPC) project which is in a Severely Polluted Area with CEPI index of 60. General location of the project site is shown in Fig. 1-1. Specific location of the plant boundary on Google Maps is shown in Fig. 1-2. The corner coordinates of the project site are as follows:



1 - Introduction (cont'd)

Sl. No.	Coordinate
1.	20.289 N, 86.633 E
2.	20.290 N, 86.645 E
3.	20.286 N, 86.642 E
4.	20.283 N, 86.632 E

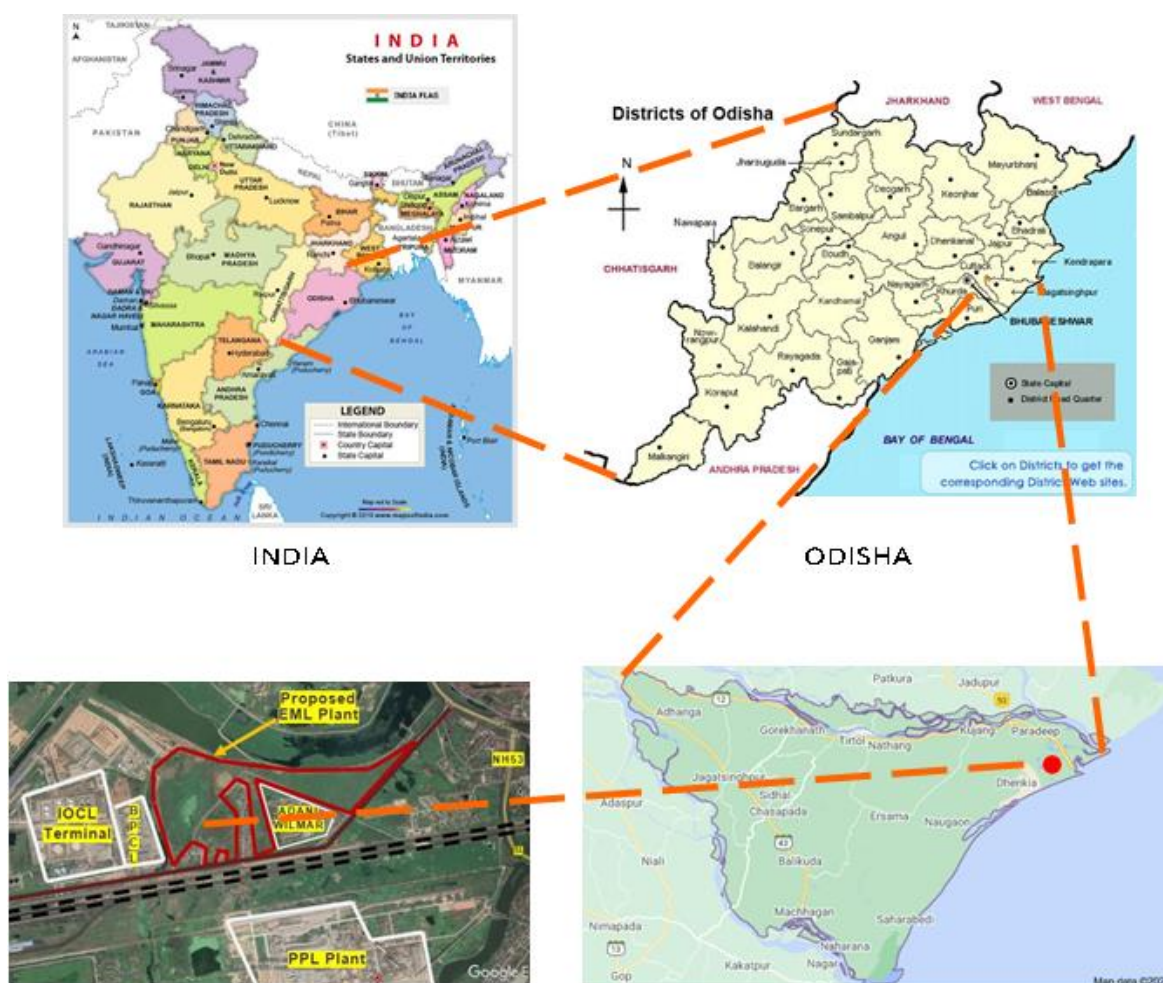
Layout has been prepared based on unidirectional flow of material, 3 tier greenbelt and 8-10 m high wind curtain all along the habitation area to restrict the dust carry over to the residential area. The major plant facilities are placed in such a way that there will be minimum impact of dust and noise in the nearby habitation area. The modified Plant General Layout along with the coordinates of the corner points is presented in Drg. 11572-97A-000-ENV-0002. The details of the plant site are given below:

Town	.. Paradip
Tehsil	.. Kujang
District	.. Jagatsinghpur
State	.. Odisha
Plot/Survey/Khasra No.	.. 268, 271-275, 279, 307, 309, 311, 312 (Details are given in Appendix 1-1)
Pin Code	.. 754142
Topo Sheet (OSM) Nos.	.. F45U11
Maximum elevation above MSL	.. 2 m
Distance of nearest Highest Flood Level	.. 3.9 km (Mahanadi River) +5.5 m CD recorded during super cyclone
Seismic Zone	.. III (IS-1983(Part-1):2002)
Nearest Airport	.. Biju Patnaik International Airport, Bhubaneswar (125 km by road)
Nearest Port	.. Paradip (3.5 km SE)
Nearest Town	.. Paradip, 3 km, SE
Ecosensitive Zone	.. Bhitarkanika Wildlife Sanctuary (7.8 km, NE)

1 - Introduction (cont'd)

1.4.4 Ecological Sensitivity of the location of the Project

Bhitarkanika Wildlife Sanctuary is located at a distance of about 7.8 km NE of the project site and the project is located in Paradeep which is a Severely Polluted Area. Apart from this, there are no Wildlife sanctuary, National Park, Protected Area, Biosphere reserve, Tiger reserve, Elephant reserves, Critically Polluted Area, Eco-sensitive area, Eco-sensitive Zone, State/UT Boundary, International Boundary, areas protected under international convention, national legislation, local legislation, cultural or other related value, wetlands, pilgrim areas, tourist areas, defense installations within 10 km from the project site.



1 - Introduction (cont'd)

EML Pellet Plant Location

JAGATSINGHPUR

FIG. 1-1 - GENERAL LOCATION OF SITE



FIG. 1-2 - SPECIFIC LOCATION OF SITE

1.4.5 Project Highlights

Following are some of the highlights of the proposed project:

Location	.. Industrial Park of Paradip Port Trust in Jagatsinghpur district, Odisha
Plant area	.. 40.49 hectares (100 acres)
Saleable Product	.. 14 MTPA pellet
Water requirement	.. 375 m ³ /hr
Power requirement	.. 69 MW (avg); 87 MW (max)
Employment	.. Direct - 199, Indirect - 1,150
Estimated Investment	.. Rs. 3,347 crore
Completion period	.. 30 months



1 - Introduction (cont'd)

1.5 IMPORTANCE OF THE PROJECT OF THE COUNTRY & REGION

Pellet making helps in utilizing the unused Iron rich fines and slimes which after Beneficiation are converted into Pellet feed Concentrate suitable for making Pellets. Due to this reason, iron rich fines and slimes which are lying as waste till date, will also get used for iron and steel making. Hence, the proposed Project is the right direction for effective utilization of iron ore fines and slimes.

The proposed plant will also have positive impact on socio-economic development of local people and will generate considerable foreign exchange as Pellet demand from overseas will also be met through the project.

The steel industry in India is focused toward achieving 300 million tons of crude steel production capacity by 2030 end. Iron ore pellets are expected to play a crucial role in achieving this goal.

During the construction & operation phases both direct & indirect workers would be required. It is estimated that about 450 people will be indirectly and 149 people will be directly employed during operation phase of this project. During construction phase, around 700 people will be indirectly and 50 people will be directly employed leading to creation of wealth to the country & region.

During the interim period, it is estimated that about 250 people will be indirectly and 110 persons will be directly employed during the operation phase of the project.

1.6 SCOPE OF THE STUDY

As per the Environment Protection (EP) Act, 1986 and amendments thereafter, it is required to obtain Environmental Clearance (EC) of the proposed Project from the MoEFCC, Government of India and



1 - Introduction (cont'd)

Consent to Establish (CTE) from the Odisha State Pollution Control Board (OSPCB), prior to take up any construction activities at the project site.

Accordingly, EML applied to the MoEFCC vide Proposal No. IA/OR/IND/198977/2021 on 19th February, 2021 for firming up of the ToR of EIA, which would form the scope for conducting the EIA study. The Expert Appraisal Committee of MoEFCC has evaluated the ToR Application and has finalised the ToR for EIA of the proposed project seeking EC. The ToR of EIA as confirmed by the MoEFCC in their letter F.No-J-11011/38/2021-IA.II(I), dated 4th March, 2021 is furnished in Appendix 1-2 for reference.

1.7 APPLICABLE REGULATIONS

The following regulations/policies have been considered during preparation of the EIA report and need to be complied with, while monitoring the implementation and performance of the environmental management mitigation measures:

- i) Environmental Protection Act, 1986 and Rules thereunder and its subsequent amendments
- ii) Section 21 of the Air (Prevention and Control of Pollution) Act, 1981
- iii) Sections 25 and 26 of the Water (Prevention and Control of Pollution) Act, 1974
- iv) The Manufacture, Storage and Import of Hazardous Chemicals Rules, 2000 (MSIHC) and its subsequent amendments
- v) Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016
- vi) Noise Pollution (Regulation and Control) Rules, 2000
- vii) Construction and Demolition Waste Management Rules, 2016



1 - Introduction (cont'd)

- viii) Plastic Waste Management Rules, 2016
- ix) Solid Waste Management Rules, 2016
- x) Public Liability Insurance Act, 1991 and its subsequent amendments
- xi) Odisha Factories Act, 1948 & Factories Rule, 1950 and their subsequent amendments
- xii) Explosive Act, 1884 & Explosive Rules, 1983 and their subsequent amendments
- xiii) The Electricity Act, 2003 & India Electricity Rules, 1956 and their subsequent amendments
- xiv) Odisha Fire Services Act, 1993 and subsequent amendments
- xv) E-waste (Management) Rules, 2016
- xvi) Office Memorandums and Gazette Notifications of MoEFCC and CPCB as and when notified
- xvii) The Water (Prevention and Control of Pollution) Cess Act, 1977 and their subsequent amendments
- xviii) Bio-Medical Waste Management Rules, 2016

1.8 STRUCTURE OF THIS REPORT

This Report is prepared in line with the suggested generic structure of EIA prescribed by MoEFCC. There are twelve Chapters complete with relevant Tables, Figures, Drawings, Photographic Exhibits and Appendices. Contents of the Chapters are given below:

Chapter 1 - Introduction

The chapter includes the purpose of the report, description of project background, nature, size, location of the project, scope of the study and format of this report.

Chapter 2 - Project Description

This chapter provides information on project and capacity, need for the project, location, size or magnitude of operation, technology and process description, drawings showing project layout, component of projects etc.



1 - Introduction (cont'd)

Chapter 3 - Description of the Environment

This chapter deals with the methodology and findings of field studies undertaken with respect to meteorology, ambient air, water, soil, noise levels, ecology and human environment.

Chapter 4 - Anticipated Environmental Impacts and Mitigation Measures

In this chapter environmental impacts due to project location, possible accidents, project design, project construction, regular operations are discussed along with the measures for minimizing and/or offsetting adverse impacts identified.

Chapter 5 - Analysis of Alternatives (Technology & Site)

In case, the scoping exercise results in need for alternatives then this chapter will include the description of each alternative, summary of adverse impacts of each alternative, mitigation measures proposed for each alternative and the selection of alternative.

Chapter 6 - Environmental Monitoring Program

This chapter will include technical aspects of monitoring the effectiveness of mitigation measures (incl. Measurement methodologies, frequency, location, data analysis, reporting schedules, emergency procedures, detailed budget & procurement schedules)

Chapter 7 - Additional Studies

This chapter will include outcomes of public consultation, risk assessment, social impact assessment, R&R action plan, wildlife conservation plan etc.

Chapter 8 - Project Benefits

This chapter deals with improvements in the physical infrastructure, social infrastructure, employment potential and other tangible benefits due to proposed project.

Chapter 9 - Environmental Cost Benefit Analysis

This chapter includes the cost benefit analysis of the project, if recommended at the Scoping stage.

Chapter 10 - Environmental Management Plan



1 - Introduction (cont'd)

This chapter will include the description of administrative aspects of ensuring that the mitigation measures suggested are implemented and their effectiveness is monitored, after approval of the EIA.

Chapter 11 - Summary

This will constitute the summary and conclusion of EIA Report.

Chapter 12 - Disclosure of Consultant

This will include the names of the consultant engaged in preparation of EIA and nature of consultancy rendered.

The various field data as recorded for proposed project during field survey (March 2021 to May 2021) within the study area of 10 km aerial coverage from the boundary of Pellet plant are attached at the end of this Report in a separate Appendix (Appendix - Field Data).

1.9 AUTHORIZATION

EML has appointed M/s. M. N. Dastur & Company (P) Ltd, Consulting Engineers, Kolkata (NABET/QCI accredited Company) to undertake EIA Study and prepare EIA Report in accordance with the approved ToR of MoEFCC. The details of the NABET accreditation along with the expert details are enclosed in Appendix 1-3. The baseline data was monitored by M/s. Envirocheck (MoEFCC & NABL accredited company) under the supervision of M/s. M. N. Dastur & Company (P) Ltd. Both the accreditation certificates of M/s. Envirocheck are attached in Appendix 1-4.

1.10 ACKNOWLEDGEMENT

Consulting Engineers gratefully acknowledge the co-operation and assistance extended by EML and various Govt. Offices for carrying out the field study and preparation of the EIA report as well.



1 - Introduction (cont'd)



2 - PROJECT DESCRIPTION

This Chapter describes the project description of proposed installation of 2 x 7 MTPA Pellet plant at Paradip in Kujanga Tehsil of Jagatsinghpur district of Odisha state. This description forms the basis of Environmental Impact Assessment (EIA) of the proposed project.

2.1 TYPE OF THE PROJECT

The proposed Greenfield project would fall under Category 'A' of item 3(a) "Metallurgical Industries (ferrous & non-ferrous)" of the Schedule to the EIA Notification 2006 and amendments thereof.

2.2 NEED FOR THE PROJECT

This has been addressed in Section 1.4 of Chapter - 1.

2.3 LOCATION OF THE PROJECT

This has been addressed in Section 1.3.3 of Chapter - 1.

2.3.1 Major Industries in the Study Area

Following are the list of major industries located within the 10 km radial coverage from the plant:

Sl. No.	Name of the Company	Category	Distance from plant boundary
1.	Adani Wilmar Ltd	Edible oil refinery	Adjacent
2.	IFFCO	Fertilizer	3 km
3.	AM/NS India ltd	Iron & Steel	3.4 km
4.	Paradip Phosphate Ltd	Fertilizer	0.5 km
5.	Indian Oil Corporation Ltd	Oil & gas, Petrochemicals	5 km
6.	Goa Carbon ltd	Pet Coke	2.4 km
7.	Essar Power Plant	Thermal Power Plant	2.3 km
8.	Kalinga Calcination	Petroleum coke	1.7 km
9.	Paradeep Port Trust	Port	3.3 km
10.	Hindustan Petroleum	Petroleum Terminal	1 km



2 - Project Description (cont'd)

2.4 SIZE OR MAGNITUDE OF OPERATION

The proposed project would be designed to produce 14 MTPA BF and DR grade pellets in 2 modules (Module-I and Module-II, each of 7 MTPA capacity). The design basis considered for the plants is enumerated below:

- Annual throughput of the pellet plants, MT	..	14
- Number of effective working days/year	..	330
- Working hours per day in 3 shift operation	..	24

During the interim period any one module would be in operation with annual throughput of 7 million tons.

2.5 CAPITAL COST

The capital cost (Gross of GST) for the pellet plant is estimated at about Rs. 3,583 Crore and capital cost as Net of ITC is estimated at about Rs. 3,347 Crore considering GST credit amount as about Rs. 236 Crore. The price levels, taxes and duties are considered based on the prevailing rate during 2nd quarter of FY 2020-21. The break-up of the cost is given in Table 2-1.

2.5.1 Mode of Financing

The total capital requirement of the project is proposed to be provided by debt-equity ratio of 70:30, debt with an interest @ 6.5% per annum.



2 - Project Description (cont'd)

TABLE 2-1 - CAPITAL COST BREAK-UP

Sl. No.	Particulars	Amount (in Crore)
A	EPC Cost	
A.1	Engineering	31
A.2	Procurement -Offshore	668
A.3	Procurement -Onshore	559
A.4	Construction	1,068
A.5	Freight, inland transport etc.	43
	Sub- Total (A)	2,369
B	Owners cost	
B.1	Land & Site development	35
B.2	Power deposits, substation, etc.	51
B.3	Custom Duty	19
B.4	Others	25
B.5	DE	12
	Sub-Total (B)	142
	Total Hard Cost (A + B)	2,511
C	Soft Cost	
C.1	IDC & upfront fee	148
C.2	Contingency	251
C.3	Pre-Operative Expenses	128
C.4	DSRA (3 months interest)	37
C.5	Margin Money for Working Capital	80
	Sub-Total (C)	644
D	Total Project Cost without GST(A + B+C)	3,155
E	GST	428
F	Total Project Cost with GST(D + E)	3,583
G	GST Credit	236
H	Net Project Cost (F-G)	3,347

2.6 SCHEDULE FOR APPROVAL AND IMPLEMENTATION

23 rd January 2021	-	Submission of Form 1
19 th February 2021	-	Re-submission of Form 1
14 th March 2021	-	ToR issued by MoEFCC
September 2021	-	Draft EIA submitted for PH
January 2022	-	PH
March 2022	-	Final EIA submitted to MoEFCC for EC
August 2022	-	EAC meeting
September 2022	-	EC recommended by EAC (Industry 1)
November 2023	-	Revised EIA submitted to MoEFCC



2 - Project Description (cont'd)

The implementation of the project will be taken up after receipt of Environment Clearance (EC) from MoEFCC and Consent to Establish (CTE) from OSPCB. The project is envisaged to be implemented within a period of thirty (30) months after receipt of EC & CTE. The break-up of activities is given in Table 2-2.

TABLE 2-2 - PROJECT SCHEDULE

Description	Duration of Activity (Months)	Overall Schedule from Start of the Project
Basic Engineering	10	10
Detail Engineering	21	24
Manufacturing and delivery of equipment at site	22	26
Construction	23	28
Testing and Commissioning	3	30

2.7 TECHNOLOGY AND PROCESS DESCRIPTION

2.7.1 Slurry Receiving and Filtration Facilities

EML has proposed to install long distance below ground slurry pipeline for transporting 14.3 MTPA pellet feed iron ore concentrate in the form of slurry from the proposed beneficiation plant at Tikarapada in Keonjhar district to the proposed pellet plant site at Paradeep area in Jagatsinghpur district, Odisha.

The approximate length of the pipeline is predicted to be 250 km. EML has already conducted the route survey of the corridor identified for laying the slurry pipeline and applied for permission to obtain Right of Way (ROW). The proposed slurry pipeline route map is shown in Fig. 2-1. Installation of a Return Water Pipeline to Tikarapada beneficiation plant area is also intended to reuse the recovered water from iron ore concentrate after consumption by the proposed pelletization plant. Both Slurry Pipeline and Return Water Pipeline are of 22 inch (560 mm) diameter and one OFC cable also runs along the pipelines. The width of ROW applied is of 1.5 m in the utility corridor of

2 - Project Description (cont'd)

National Highways. The proposed slurry pipeline route will mostly pass along NH-20, NH-16 and NH-53. The slurry comprises of around 65% solids and the rest is water.

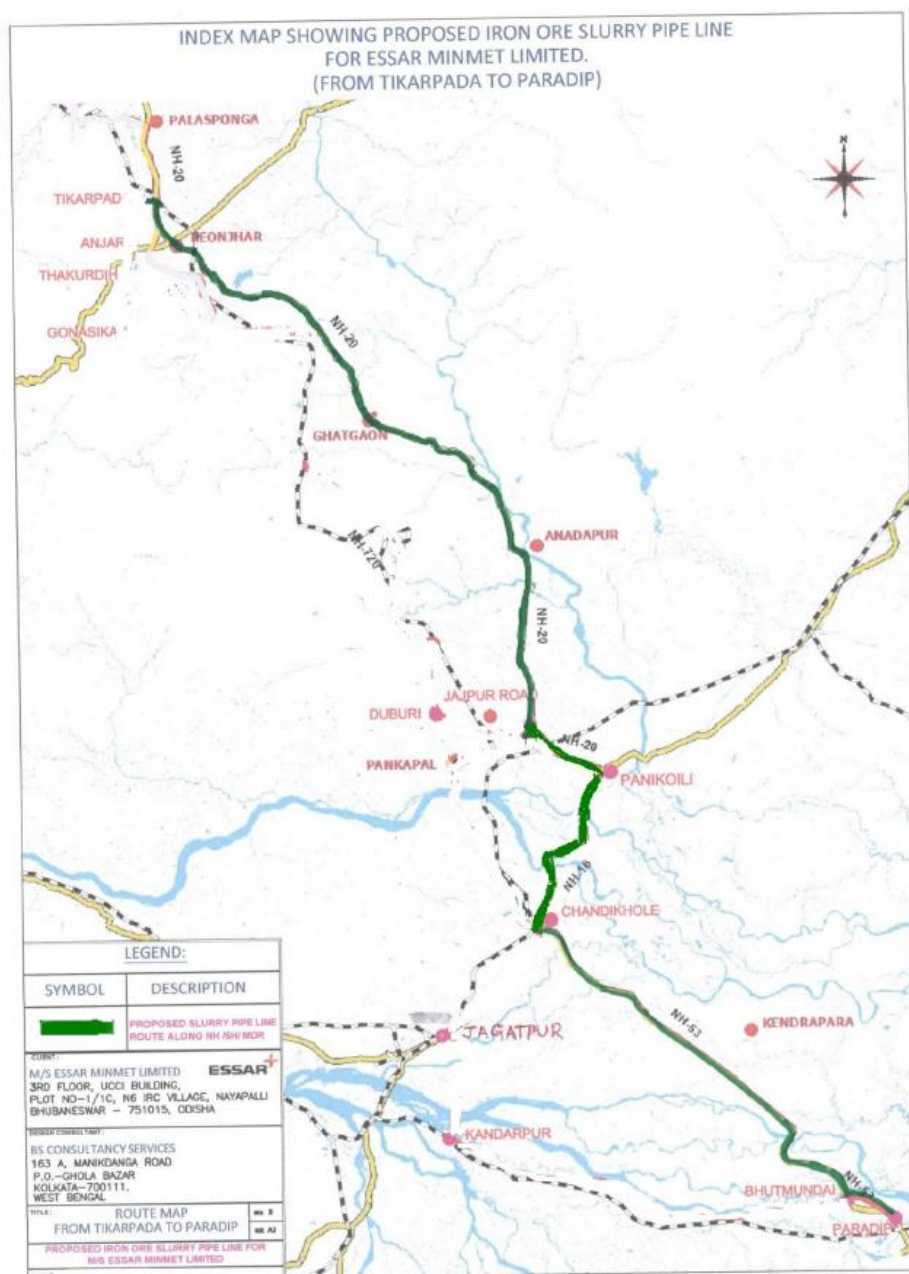


FIG. 2-1 - ROUTE MAP OF THE PROPOSED SLURRY PIPELINE SYSTEM

2 - Project Description (cont'd)

2.7.2 Interim period Iron Ore Concentrate Receipt and Transfer

For the interim period, when beneficiation plant and slurry pipeline are not ready, the iron ore concentrate will be transferred from Paradip port through the return side of the pipe conveyor envisaged for transfer of product pellet to Paradip port.

It is proposed to commission and operate the pellet plant till the operation of captive beneficiation plant and slurry pipeline transfer by sourcing pellet feed iron ore concentrate from external sources through Paradip port.

Approximate length of the pipe conveyor is 5 km. EML has received the RoW from Paradip port vide letter no. AD/EST/LAND-I-30/2020/3705 dated 19.12.2023 to lay the said conveyor. Paradip port has been informed for handling of iron ore concentrate for the interim period from their existing berth. The proposed conveyor connectivity from plant to port and water pipeline route from Taladanda canal is shown in Fig 2-2.

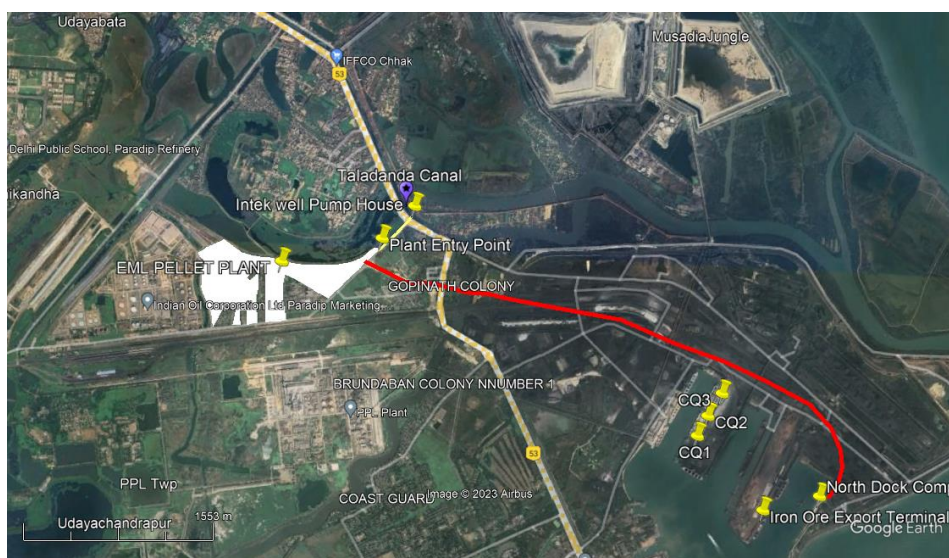


FIG. 2-2 - ROUTE MAP OF THE PROPOSED PIPE CONVEYOR AND WATER PIPELINE



2 - Project Description (cont'd)

2.7.3 Pelletization Plant

The raw materials for proposed pellet process are iron ore concentrate, flux materials, binders and solid fuel like coke breeze/coal. To obtain green balls with the required strength, the fineness of the materials must be ensured, which is determined by adequate laboratory test. Characteristics of ore fines governs the degree of fineness and it has been observed that under Indian condition, grinding of ore to size 60-80% passing through 325 mesh (-0.044 mm) is necessary for production of high strength green pellets and will be met through Beneficiation process. Other materials will be dried and ground to requisite fineness through vertical or Ball Mills.

Iron ore concentrate, limestone (and dolomite), binder bentonite and coal would be stored in separate bins within the Mixing Building. The materials from these bins would be drawn out in requisite proportions by means of suitable weigh feeders and fed into mixers through feeding conveyor. Water would be added in the mixers for consistency of green ball.

The thoroughly mixed pre-wetted material shall be conveyed and distributed to mixed material bins in the balling section. For production of green balls, 14 numbers of DISC Pelletisers will be installed for each module. Each of these circuits shall comprise a mixed material bin, a variable discharge belt feeder, balling disc and single deck screen downstream of each disc. Green pellets predominantly of 6 to 18 mm size shall be produced. The single deck screen provided with each disc shall separate out the degraded undersize fines which shall be recycled back to the mixed material bins through conveyor system. The accepted size green balls shall only be transported by conveyor to feed to a wide belt conveyor upstream of the travelling grate feeding system, through an oscillating short conveyor. Due care needs to be adopted in



2 - Project Description (cont'd)

the design to achieve smooth transfer by minimizing the transfer height of the green balls. The green balls thus laid over the wide-belt conveyor shall then be charged onto the double deck roller screens for uniform screening of 6 to 18 mm green balls. The undersize (-)6 mm and the oversize (+)16 mm green balls shall be separated by the screen and re-circulated to the mixed material bins through a conveyor system provided with disintegrator so that the same can be charged onto the balling discs for balling. The green balls from the double deck roller screens shall be fed into the travelling-grate pallet cars for the indurating process.

Heat treatment of green pellet is carried out in the induration furnace in stages comprising drying, pre-heating, firing, after firing and cooling of the green balls. The indurating sections like drying, preheating, firing, after firing and cooling shall be achieved by designated wind box arrangement below the travelling grate coupled with the overhead indurating hood wherein the burners are provided in the firing section. The interconnecting process gas duct shall ensure up draft and down draft drying and recuperated pre-heating, burner-controlled firing and forced draft cooling. The green ball drying takes place at about 400°C, pre-heating from 400 to 1,150°C and induration takes place from 1,250 to 1,300°C. Thermal conditions of different zones are controlled by the process gas system suitably through circulation fans and with the burners provided in preheating and firing zones of Induration furnace.

The indurated pellets duly cooled to ambient shall be discharged by the traveling grate at the tipping station and collected in a discharge bin for onward transportation to screening station. At the screening station, the pellets shall be first fed to a screen to separate out the hearth layer grade (10 to 12 mm), which shall be conveyed to the hearth layer bin located at the feed station of the travelling grate. After



2 - Project Description (cont'd)

the hearth layer screen, the burden shall be fed to a second screen to separate the fines as reject. In the event the hearth layer bin is full, the entire burden will bypass the first screen and shall get exposed to second screen for fines separation. The product pellet, thus screened out, shall then be transported for storage and dispatch to port through conveyor.

The chemical analysis of the pellet is computed based on the qualities of raw materials and additives and is given in Table 2-3.

TABLE 2-3 - DESIRED CHEMICAL ANALYSIS OF PRODUCT PELLETS

Product	Fe, %	SiO₂, %	Al₂O₃, %	P, %
BF grade pellet	> 62.5	3.29 - 3.31	3.09 - 3.11	0.045
DR grade pellet	> 66.0	1.24 - 1.26	1.45 - 1.47	0.045

The desired physical and metallurgical characteristics of BF and DR grade pellets to be produced in the plant are given in Table 2-4 and Table 2-5 respectively:

TABLE 2-4 - DESIRED CHARACTERISTICS OF BF GRADE PELLET

Property	Value
Size distribution:	
(+)18 mm	1 % maximum
(-)18 (+)5 mm	90 % minimum
(-)5 mm	5 % maximum
Compressive strength	230-240 kg/pellet
Tumbling index:	
(+)6.3 mm	93 % (minimum)
(-)500 micron	5 % (maximum)
Reducibility	55 % (minimum)
Swelling index	18 % maximum

2 - Project Description (cont'd)

TABLE 2-5 - DESIRED CHARACTERISTICS OF DR GRADE PELLET

Property	Acceptable Value	Preferred value
Size distribution: Nominal 9-16 mm (-)5 mm	5-18 mm 85% min 5% max	6-16 mm 95% min 3% max
Compressive strength Avg < 50 kg	250 kg min. 5% max	270 kg min. 2% max
Tumbling index: (+)5 mm (-)650 micron	92% min 6% max	95% min 4% max
Reduction characteristics Midrex Linder test (760°C) Metallization Degradation (-3 mm)	91% min 5% max	93% min 2% max
Hot load test (815°C) Tumble strength Avg compressive strength	90% min 50 kg min	95% min 100 kg min

It is suggested that attainment of the above properties should be ensured by adopting appropriate process parameters established through necessary pot-grate test work before implementation of the project. The pellet plant would comprise the following facilities:

- a) Storage, handling and preparation including dry grinding of binder and additive.
- b) Receipt of iron ore concentrate (iron ore fines in initial years) and additives/binder.
- c) Iron ore fines wet grinding
- d) Proportioning and mixing.
- e) Green balling.
- f) Induration-drying, pre-heating, firing, after firing and cooling.
- g) Product screening.
- h) Finished product handling and storage.

The schematic drawing of the pelletization process is depicted in Fig. 2-3.

2 - Project Description (cont'd)

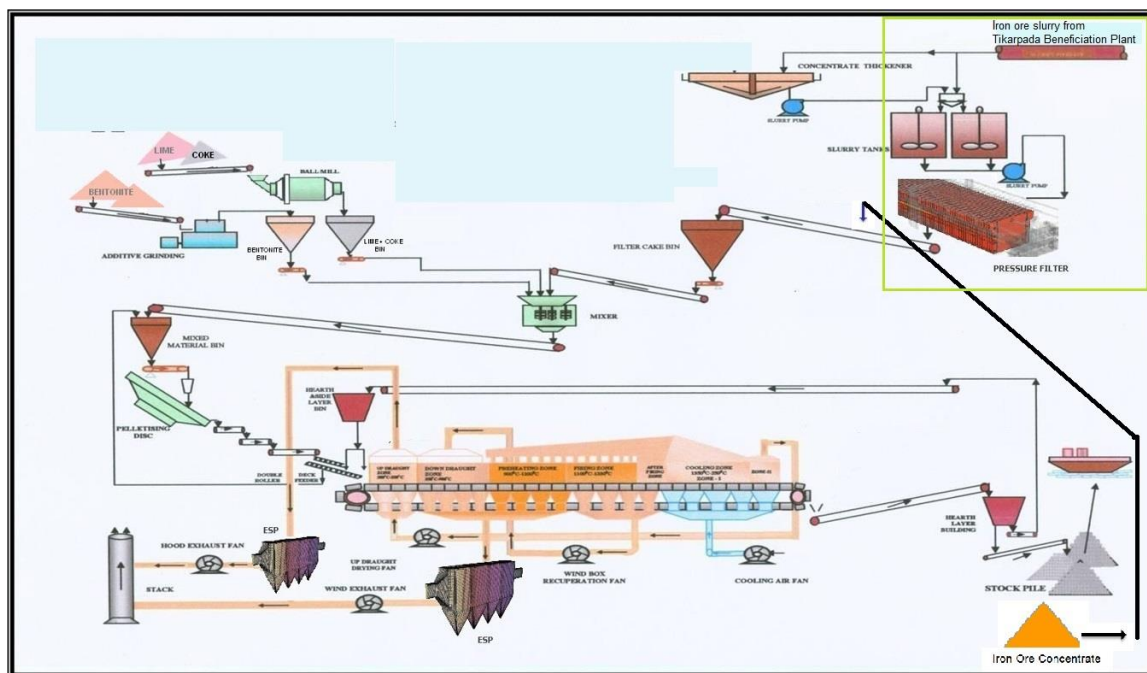


FIG. 2-3 - SCHEMATIC DRAWING OF PELLET PLANT

2.8 PROJECT DESCRIPTION

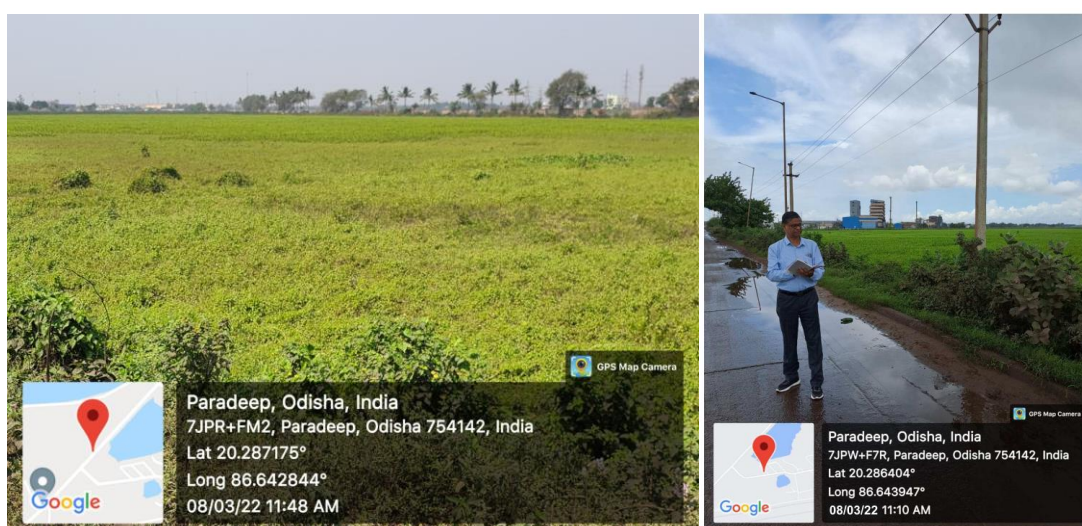
2.8.1 Layout

The plant general layout of the proposed project is shown in Drg. 11572-97A-000-ENV-0002. The layout indicates the plant units, administrative buildings, water reservoir including rainwater harvesting structure, storage area for raw materials & products, solid waste storage, road network, assembly points and greenbelt. Layout has been prepared based on unidirectional flow of material, 3 tier greenbelt and 8-10 m high wind curtain all along the habitation area to restrict the dust carry over to the residential area. The major plant facilities are placed in such a way that there will be minimum impact of dust and noise in the nearby habitation area.

2 - Project Description (cont'd)

2.8.2 Land Classification of the Project Site

Presently the proposed land is in possession of Paradip Port Trust Authority. The land would be taken on long term lease basis for sixty (60) years from the Paradip Port Trust Authority (please refer Appendix 2-1). The present status of the land is industrial land. The proposed project site is not located in CRZ area. The plant boundary is superimposed on the approved CZMP map of the area and shown in Drg. No. 1572-97A-000-ENV-0004. Geotagged photographs of the proposed project site are shown below.



PROPOSED SITE PHOTOGRAPHS

2.8.3 Plant Units and Facilities

The proposed facilities required for the project are shown in Table 2-6. The production facilities would be adequately supported by necessary auxiliary facilities such as raw materials storage, electric power receiving and distribution stations, various utility facilities, water treatment and distribution system, etc.



2 - Project Description (cont'd)

TABLE 2-6 - MAJOR PLANT UNITS AND CAPACITIES

Sl. No.	Name	Proposed Units	
		Configuration	Production, MTPA
1	Pellet Plant (Module-I and Module-II)	2 x 7 MTPA	14
2	Proportioning and mixing, green balling, induration drying, pre-heating, firing, after firing and cooling and product screening	-	Matching Capacity
3	Terminal facilities (slurry receiving, thickening and filtration) for iron ore slurry	-	Matching Capacity

2.8.4 Raw Materials and Chemicals

The estimated consumption of raw materials for 14.0 MTPA pellet plant (net and dry basis) is presented in Table 2-7 and for the interim period in Table 2-8.

TABLE 2-7 - RAW MATERIALS (NET AND DRY BASIS)

Sl. No.	Raw Material	Total Annual requirements, tons	Source	Distance from site (km)	Mode of Transportation
1	Iron ore concentrate	14,294,000	Proposed captive beneficiation plant at Keonjhar district, Odisha, through slurry pipe line.	250	Slurry Pipeline
2	Bentonite	80,000	Procured from Gujarat	4	Sea (by road from Paradeep Port to plant site)
3	Limestone	320,000	Imported from Middle East Countries (UAE, Oman)	4	Sea (by road from Paradeep Port to plant site)
4	Dolomite	156,000			
5	Anthracite coal	202,000	Imported (Russia/ Vietnam/ Indonesia/Australia)	4	Sea (by road from Paradeep Port to plant site)

During interim period, iron ore concentrate of 7 MTPA will be imported through Paradip port. Same will be transferred to pellet plant on the return side of the dedicated pipe conveyor which is being installed for transfer of pellets to port.



2 - Project Description (cont'd)

TABLE 2-8 - RAW MATERIALS (NET AND DRY BASIS) FOR INTERIM PERIOD

Sl. No.	Raw Material	Total Annual requirements, tons	Source	Distance from site (km)	Mode of Transportation
1	Iron ore concentrate	7,000,000	Imported through Paradip port	5	Pipe Conveyor
2	Bentonite	40,000	Procured from Gujarat	4	Sea (by road from Paradeep Port to plant site)
3	Limestone	160,000	Imported from Middle East Countries (UAE, Oman)	4	Sea (by road from Paradeep Port to plant site)
4	Anthracite coal	101,000	Imported (Russia/ Vietnam/ Indonesia/Australia)	4	Sea (by road from Paradeep Port to plant site)

2.8.5 Fuels

It is envisaged to operate the plant with Natural Gas and during non availability of Natural gas, furnace oil will be used till the gas supply is resumed. It is envisaged that Furnace Oil will be brought in road tankers and unloaded into the storage tanks through unloading pumps. There would be a small requirement of LDO for auxiliary units. The hourly requirements of natural gas for 2 x 7 MTPA pellet plants are given in Table 2-9 and for interim period in Table 2-10.

TABLE 2-9 - HOURLY REQUIREMENT OF NATURAL GAS

Type of Fuel	Hourly requirement, Nm ³ /hour
Natural Gas	30,000

TABLE 2-10 - HOURLY REQUIREMENT OF NATURAL GAS DURING INTERIM PERIOD

Type of Fuel	Hourly requirement, Nm ³ /hour
Natural Gas	15,000



2 - Project Description (cont'd)

The annual requirement of Furnace Oil and LDO for 2 x 7 MTPA pellet plants and for interim period is given in Table 2-11 and 2-12 respectively.

TABLE 2-11 - ESTIMATED FUEL REQUIREMENT

Fuel oil	Annual requirement, kl
Furnace Oil (FO)	210,000
LDO	440

TABLE 2-12 - ESTIMATED FUEL REQUIREMENT FOR INTERIM PERIOD

Fuel oil	Annual requirement, kl
Furnace Oil (FO)	105,000
LDO	220

Following facilities for fuel oil system have been considered for the proposed pellet plant and associated facilities:

- a) Two numbers of over-ground storage tank, having 2,000 kl capacity each and requisite unloading, pumping and piping system for FO.
- b) One number of LDO day tank having 750 kl capacity.
- c) LDO/FO pipe-work.

2.8.6 Fuel Scenario for carbon footprint reduction

As Paradeep is connected with Natural Gas supply, EML has already signed Term Sheet with GAIL & IOCL, the two major PSUs who are going to supply piped natural gas in Paradeep. The quantity, quality etc. are assured by the suppliers. The Gas Sale Agreement will be signed after obtaining the statutory approvals for the project. The use of Natural Gas instead of Furnace Oil will reduce the Carbon Footprint significantly. Being a clean fuel, natural gas will then be adopted as fuel for pellet plant. In the event of availability, natural gas pipeline may be



2 - Project Description (cont'd)

laid from any nearby available natural gas metering station, located outside the plant boundary, up to the furnaces and other respective consuming points of the pellet plants. From the battery limit outside the plant, necessary pipework and instrumentation along with supporting structures and civil foundations, as found suitable, will be carried out up to the consuming points.

Burners for pellet plant have been envisaged as dual fuel type burners, compatible to both FO/LDO and natural gas.

2.8.7 Utilities and Services

Water: The estimated water requirement for the various activities of the proposed project is around 375 m³/hr. This requirement will be met by the recovered water after dewatering/filtration of iron ore concentrate slurry (769 m³/hr) and partly by recycling of treated water from CETP (80 m³/hr) and treated water of STP (6 m³/hr). Around 8 m³/hr water for drinking and sanitation would be supplied by Paradeep Port Trust. The water requirement during the interim period for 7 MTPA operation would be about 214 m³/hr (233 m³/hr for 22 hours per day) and would be sourced from Taladanda Canal.

The unit wise requirement of water for various processes of the pellet plant and source at 14 MTPA is shown in Table 2-13 and for the interim period (7 MTPA) in Table 2-14. Water balance diagram for the proposed project is shown in Fig 2-4 and for the interim period in Fig 2-5.

TABLE 2-13 - WATER REQUIREMENT

The diagram illustrates the water balance for the plant, showing the flow of water through various processes and treatment stages. The flows are as follows:

- Slurry Dewatering System:** Receives 970 m³/hr of slurry and produces 201 m³/hr of filter cake and 769 m³/hr of filtrate.
- Filtrate:** 769 m³/hr of filtrate is sent to the thickener.
- Thickener:** Receives 769 m³/hr of filtrate and produces 14 m³/hr of thickener overflow and 375 m³/hr of thickener underflow. The thickener underflow is sent to the CETP.
- Drinking & Sanitation Water:** 8 m³/hr (from Paradeep Port Trust) is sent to the STP.
- STP:** Receives 8 m³/hr of drinking and sanitation water and produces 6 m³/hr of effluent, which is sent to the plant greenbelt.
- Plant Greenbelt:** Receives 6 m³/hr of effluent from the STP and 15 m³/hr of effluent from the CETP.
- Emergency Cooling:** Receives 50 m³/hr of water from the thickener underflow and produces 10 m³/hr of effluent, which is sent to the plant greenbelt.
- Soft Water:** Receives 30 m³/hr of water from the thickener underflow and produces 10 m³/hr of effluent, which is sent to the plant greenbelt.
- Equipment Washing:** Receives 10 m³/hr of water from the thickener underflow and produces 15 m³/hr of effluent, which is sent to the plant greenbelt.
- Flushing Water:** Receives 70 m³/hr of water from the thickener underflow and produces 15 m³/hr of effluent, which is sent to the CETP.
- Process Mixing:** Receives 70 m³/hr of water from the thickener underflow and produces 20 m³/hr of effluent, which is sent to the CETP.
- Compressor Cooling:** Receives 90 m³/hr of water from the thickener underflow and produces 22 m³/hr of effluent, which is sent to the CETP.
- Cooling Water:** Receives 55 m³/hr of water from the thickener underflow and produces 10 m³/hr of effluent, which is sent to the CETP.
- CETP:** Receives 375 m³/hr of thickener underflow, 15 m³/hr of effluent from flushing water, 20 m³/hr of effluent from process mixing, 22 m³/hr of effluent from compressor cooling, 10 m³/hr of effluent from cooling water, and 82 m³/hr of effluent from the thickener underflow. The CETP produces 2 m³/hr of effluent, which is sent to the plant greenbelt, and 15 m³/hr of effluent, which is sent to the DS/Dry Fogging system.
- DS/Dry Fogging:** Receives 15 m³/hr of effluent from the CETP and produces 50 m³/hr of effluent, which is sent to the plant greenbelt.
- Plant Greenbelt:** Receives 6 m³/hr of effluent from the STP, 15 m³/hr of effluent from the CETP, 10 m³/hr of effluent from emergency cooling, 10 m³/hr of effluent from soft water, 15 m³/hr of effluent from equipment washing, and 2 m³/hr of effluent from the CETP.

NOTE : 1. ALL QUANTITIES ARE IN m³/hr
 2. SPECIFIC WATER CONSUMPTION IS 0.23 m³/t PELLET
 3. WATER ALLOCATION FOR GREENERY DEVELOPMENT IS 12.45 L / TREE

2-17

2 - Project Description (cont'd)

TABLE 2-14 - WATER REQUIREMENT FOR INTERIM PERIOD

S1. No.	Consumers	Water consumption, m ³ /hr	Source
1.	Soft Water	15	Taladanda Canal
2.	Equipment washing	6	
3.	Emergency cooling	20	
4.	Flushing	37	
5.	Process Mixing	38	
6.	Compressor cooling	48	
7.	Cooling water	30	
8.	Losses in CETP	3	-
9.	Greenery development	12 (Additional 3.5 from STP)	Treated water from CETP and STP
10.	Dry Fogging and dust suppression	11	Treated water from CETP
11.	Addition to concentrate for Green balling	40	Incoming concentrate will have 7% moisture. The net requirement is 10.5% moisture
	Total	214	
	Drinking water	5	From Paradip Port Trust (3.5 m ³ /hr treated water from STP is used for greenery development)

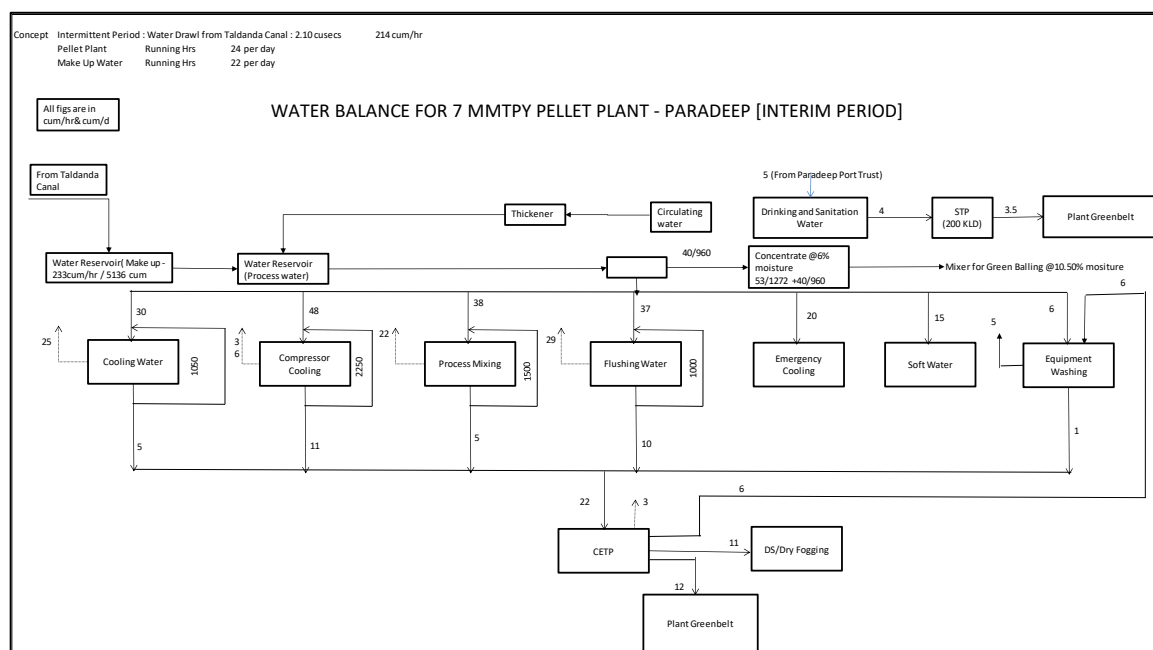


FIG. 2-5 - WATER BALANCE DIAGRAM OF THE PROPOSED PROJECT IN THE INTERIM PERIOD



2 - Project Description (cont'd)

Electrical Power: The estimated power requirement of the proposed project is given in Table 2-15.

TABLE 2-15 - POWER REQUIREMENT

Annual energy consumption, kWh x 10 ⁶	605
15 minute maximum demand, MW	87
1 minute peak demand, MW	97

Power Source: Pellet plant will receive power at 220/132 kV from state grid/ private power producer. It is envisaged that power of required quantum at 220/132 kV will be made available from the referred sources through double circuit overhead line from Paradipgarh switchyard of OPTCL. During the interim period the power consumption would be about 38 MW. EML is on the verge of signing PPA for Solar Power supply (95 MW Solar Plant) with Essar Power Limited. This would contribute towards reducing the Carbon Footprint.

Power at 220/132 kV will be stepped down to 33 kV over 220/132/34.5 kV transformers at MRSS and power at 33 kV will be distributed to various load block step-down substations (LBSS) located at pellet plant, dewatering/filtration/return water unit and RMHS area. At respective LBSSs, power at 33 kV will be stepped down to 6.6 kV over 33/6.9 kV transformers to cater loads at 6.6 kV.

For feeding power at low voltage, 6.6/0.433 kV load centre substations (LCSS) will be established. Reactive power compensation will be provided as required to improve the power factor. Local diesel generator (DG) sets will be provided to supply power at 415 V to emergency loads and illumination system during power failure. The 415 V switch board for the above loads will be provided with two incomers and automatic bus transfer facility. One incomer will be fed from local diesel generator and other incomer will be fed from grid source.



2 - Project Description (cont'd)

To meet any exigency of total power failure, provision will be made for local emergency DG sets of required capacity (2 x 2050 kVA) to ensure human safety and safeguard critical equipment of various plant units. DG sets will be provided with auto mains failure and control panel. Emergency lighting power supply for these plant units will also be taken from the DG sets. For other areas not provided with DG sets, provision will be made for taking emergency lighting power supply in the substations, control rooms, etc. from the static emergency power (SEP) units with battery back-up.

The plant's 6.6 kV systems will be earthed through resistance, so as to reduce the earth fault current. The 220 kV, 33 kV, 690 V and 415 V systems will be solidly earthed. In designing the plant electrical installation, due attention will be given to the necessity for effective and efficient earthing of all non-current carrying metallic parts of various electrical equipment. A detailed earthing design evaluation will be done and accordingly the number of earth pits, type of earth pits etc to be decided. Separate earth pits to be considered for lightning arrestors.

In order to provide effective protection against travelling waves due to lightning strokes on the overhead lines as well as switching surges, station type lightning arresters are proposed at the receiving end and near the step-down transformers at each substation.

Lightning protection system as required will be provided for substations, plant buildings including ancillary buildings, chimneys, overhead tanks, etc. Special surge protection system will also be provided for protection of critical items from voltage transient as required.



2 - Project Description (cont'd)

Well glass LED light fittings are proposed to be considered in plant buildings, conveyor galleries, junction houses, cable vaults etc. LED based flood light fittings will be considered as per application requirement. However, for substation and electrical rooms, LED batten luminaries are envisaged. Decorative type LED lighting fixtures will be provided for office rooms and control rooms. Well glass fittings with LED fittings are envisaged for low bay areas. High bay type fittings with LED lamps will be provided for high bay areas.

For the illumination of outdoor yards, flood light fittings on high mast towers are envisaged. Lighting fittings with LED type road light fittings giving maximum light on the road surface are proposed for road lighting. Aviation obstruction lamps will be provided on taller structures as well as stacks as per ICAO guidelines.

In substations, control rooms and other critical areas of the plant, emergency lighting will be provided in addition to the general lighting.

Compressed Air System: Compressed air (plant and dry grade) will be required operation of pressure filters of dewatering plant (pressing and drying operation), pneumatic devices, instruments and controls, cleaning of bag filters used in dust extraction systems of pellet plants as well as for general purpose uses in various production units. The compressed air scenario is given Table 2-16.



2 - Project Description (cont'd)

TABLE 2-16 - COMPRESSED AIR SCENARIO

Item	For Dewatering Facility	For Pellet Plant
Total dry air (DCA) required, Nm ³ /hr	52,800	10,500
Total CA required, Nm ³ /hr	26,400	4,500
Specific consumption of CA + DCA, Nm ³ /ton of pellet	45	8.5
Centrifugal compressors installed	5 Compressors (4 working + 1 standby)	4 Compressors (3 working + 1 stand-by)
Capacity of each compressor, Nm ³ /hr	20,000	5,000
Refrigerated dryers installed	4 Dryers (3 working + 1 standby)	4 Dryers (3 working + 1 stand-by)
Capacity of each dryer, Nm ³ /hr	9,000	3,500

Five numbers (four working and one standby) centrifugal air compressors, each having a capacity of 20,000 Nm³/hr each, at a discharge pressure of 8 barg, have been envisaged to meet various air requirements of the proposed filtration plant facilities (plant and dry grade) at Paradip. Four numbers (three working and one standby) centrifugal air compressors, each having a capacity of 5,000 Nm³/hr each, at a discharge pressure of 8 barg, have been envisaged to meet various air requirements of the proposed pellet plant facilities (plant and dry grade).

To meet the requirements of dry, oil-free instrument grade air, four numbers (three working and one standby) of refrigeration type air dryer of 9,000 Nm³/hr capacity each, will be installed for filtration plant facilities and four numbers (three working and one standby) of refrigeration type air dryer of 3,500 Nm³/hr capacity each, will be installed for pellet plant facilities and. The compressors, dryers, air receivers and other accessories will be located in a dedicated compressor house for the plant.



2 - Project Description (cont'd)

Compressed air (both plant air as well as dry air) from the compressor plant will be piped to the various consumers, at an average pressure of 6 to 8 kscg. For pneumatic tools, on line lubricators will be provided, terminating with hose connections. Ring mains will be suitably provided around the shops. The compressed air pipe-work for different zones will be interconnected with those of the adjacent zones wherever feasible for greater flexibility of supply.

2.8.8 Storage Facilities

A dedicated conveying system will be provided to feed the concentrate generated from the filtration plant directly to the proportioning bins of two numbers of pellet plants. A stockpile of around 48,000 tons capacity (approximately one day storage) shall be provided for storage of iron ore filter cake received from filtration plant. Hopper on the reclaim conveyor will be provided for reclaiming the iron ore filter cake by pay loader and conveying to the pellet plant as and when needed. Out of two Nos. product (Pellet) stock pile, north side stock pipe to be converted for concentrate receipt & storage for interim period.

Additives like anthracite coal, limestone, bentonite etc. will be received inside plant boundary by trucks/dumpers and materials would be stored under covered sheds. Pay loaders will be used for manual reclaiming of the additives and feeding to the storage bins of the pellet plants through conveying system. The various additives will be feed to various roller grinder and store in the hopper. The ground additive will be transported to mixing bin pneumatically.

Product pellets from the pellet plants would be discharged to stockyard through stackers. The product is reclaimed through reclaimer to the shipping conveying system for transportation to the Paradip port terminal. Around 2,00,000 tons capacity storage (about 5 days storage) has been envisaged for pellet stockpile.



2 - Project Description (cont'd)

2.8.9 Logistics for Raw Material Transportation

Iron ore concentrate through slurry pipeline will be brought from the central pumping station located at Tikarpada beneficiation plant site, Odisha to the proposed filtration and pellet plant site with a pipeline distance of about 250 km of the proposed plant. The slurry after dewatering is conveyed through conveyors for further processing.

During the interim period, when slurry pipeline and captive beneficiation plant are not commissioned, the iron ore shall be transported from Paradip port to pellet plant through pipe conveyor.

Limestone and anthracite coal as required for the proposed pellet plant are envisaged to be imported from suitable sources and will be delivered by ship to the Paradip port terminal. Subsequently, the imported limestone, anthracite coal and bentonite shall be transported to respective stock piles within the pellet plant boundary by road through trucks/dumpers.

Bentonite will be received by trucks from suitable domestic sources and stored in the storage shed within the pellet plant boundary.

Natural gas pipeline will be laid from nearby available natural gas metering station. Furnace oil required for the pellet plant will be brought to the plant by road through suitable capacity fuel tankers and will be stored in fuel storage yard.

Pellets will be transported from pellet plant site to Paradip port terminal by conveyors and ship loaders, which will be subsequently dispatched by ship for selling the same in domestic and international market.



2 - Project Description (cont'd)

The projected number of vehicles for transportation of raw materials from port and other domestic sources is shown in Table 2-17.

TABLE 2-17 - PROJECTED VEHICULAR TRAFFIC

Sl. No.	Raw Materials	Capacity of vehicle	Vehicles per day
1	Iron Ore Concentrate	14.3 MTPA	Slurry Pipeline
2	Limestone and Dolomite	20 t	80
3	Anthracite	20 t	40
4	Bentonite	20 t	15
5	Furnace Oil	20 kl	35

2.8.10 Manpower

During the construction & operation phases both direct & indirect workers would be required. Number of workers at different phases is given below:

Manpower	Construction Phase	Operation Phase	During interim period - Operation phase
Direct	50	149	110
Indirect	700	450	250

2.9 POLLUTION MITIGATION MEASURES

Several pollution mitigation measures in respect of air and water environment have been considered as an integral part of the proposed project. The following description gives an overview of the pollution control measures as envisaged for the proposed facilities:

2.9.1 Air Pollution Control (APC) Measures

Various mitigation measures adopted in the proposed project is mentioned below:

- i) Collection of fumes from pellet plant waste gas system (Induration furnace) and discharging them to the atmosphere through ID fan and stack after cleaning in Electro Static Precipitator (ESP). ESP of suitable capacity, capable to handle the waste gas generated will be provided. Hearth layer separation and discharge end will also be connected to ESPs.



2 - Project Description (cont'd)

- ii) Removal of dust generated from additive grinding process and discharging to atmosphere through ID fan and stack after cleaning in PTFE dipped Bag Filter (Pulse jet type). Bag Filter of suitable capacity, capable to handle the dust generated will be provided. The outlet dust emission level will be 20 mg/Nm³ (maximum).

The stack schedule with design details and emissions is presented in Table 2-18.

TABLE 2-18 - STACK DETAILS

Sl. No.	Plant Unit	Ht. (m)	Exit Temp (°C)	Top Dia (m)	APCD	Gas Qty (Nm ³ /hr)	Pollution load					
							PM		SO _x		NO _x	
	Module 1 (7 MTPA)						mg/Nm ³	kg/hr	mg/Nm ³	kg/hr	mg/Nm ³	kg/hr
1	Induration Furnace	80	150	8	ESP	1000000	20	20	50	50	100	100
2	Hearth Layer Separation Building	30	40	1.125	ESP	80000	20	1.6	0	0	0	0
3	Additive Building	40	40	1	Bag Filter	50000	20	1	0	0	0	0
4	Discharge End	30	40	1.125	ESP	60000	20	1.2	0	0	0	0
	Module 2 (7 MTPA)											
1	Induration Furnace	80	150	8	ESP	1000000	20	20	50	50	100	100
2	Hearth Layer Separation Building	30	40	1.125	ESP	80000	20	1.6	0	0	0	0
3	Additive Building	40	40	1	Bag Filter	50000	20	1	0	0	0	0
4	Discharge End	30	40	1.125	ESP	60000	20	1.2	0	0	0	0
	Total					2380000		47.6		100		200

* During Interim period only one Module will be in operation

2.9.2 Noise Pollution Control Measures

The continuous noise would arise from the operation of pumps, compressors, exhausters, blowers and fans.

The design criteria of noise levels for the new equipment and machineries which would remain outdoor would be fixed at 85 dB(A) Leq within 3 m distance from the noise prone equipment. Highly noise prone equipment having Leq above 90 dB(A) would either be housed separately or the attending personnel need to be housed in a noise-shielded cubicle. In addition, the noise prone rotating/vibrating equipment would be provided with vibration dampening anchoring. The following mitigation measures are envisaged for mitigation of noise pollution:



2 - Project Description (cont'd)

- i) In order to mitigate the workzone noise level, it is proposed to confine all those noise prone equipment, which do not require continuous attendance in a separate housing.
- ii) At the time of design and engineering of the proposed project, special attention would be provided for selection of low noise prone equipment. Rotary equipment prone to vibration would require vibration dampening at the time of grouting of those equipment. In addition, process fans based on requirement are provided with silencers of appropriate designs.
- iii) Use of earmuffs by the operational and maintenance personnel would be required to work in noisy environment for a short duration.
- iv) Administrative control by preparing appropriate rosters of the operating personnel so that no one stays beyond 8 hrs on a continuous basis in noisy environment of Leq above 85 dB(A).
- v) With the above stated noise mitigation measures, the ambient noise level at the plant boundary would not have adverse impact. However, on the finalisation of expected octave band details of the critical noise prone equipment and their engineering layout, software like CadnaA, SPM 9613, CUSTIC etc may be run to generate noise isopleths of the critical work zone noise-prone areas and take further mitigation measures, if necessary.

2.9.3 Water Management and Pollution Mitigation Measures

Filtrate from the pressure filter is pumped to the thickener.

The solids settle down in the thickener is recycled to incoming slurry tanks by thickener underflow pumps. The clear thickener overflow water is taken to process water reservoir. Part of water (375 m³/hr) is treated in water treatment plant and used for pellet plant operation. The balance water approx. 370 m³/hr is pumped back in return water pipeline to Beneficiation plant.



2 - Project Description (cont'd)

The plant layout is designed to have separate streams of process water and storm water to avoid any contamination all throughout the year. Additionally, clarifloculator of 150 KLD is incorporated in the flowsheet to treat the rain water during monsoon to avoid any contamination.

Floor wash water is collected into the sumps and same is pumped to thickener mechanically.

The plant would operate on Zero Effluent Discharge Basis. A separate rainwater harvesting scheme for collection of water during rain is envisaged in the plant layout. Wastewater generation and treatment method is shown in Table 2-19 for 14 MTPA and in Table 2-20 for interim period (7 MTPA).

TABLE 2-19 - WASTE WATER GENERATION AND TREATMENT METHOD

Sl. No.	Source	Quantity of wastewater generated, m ³ /hr	Treatment method and recycle
1	Cooling Tower blowdown	10	Recycling for use in dust suppression, equipment washing and plant greenbelt after treatment in CETP
2	Compressor cooling	22	
3	Process mixing	20	
4	Flushing water	15	
5	Equipment washing	15	
6	Sewage Treatment Plant	6	Use for plant greenbelt development

TABLE 2-20 - WASTE WATER GENERATION AND TREATMENT METHOD DURING INTERIM PERIOD

Sl. No.	Source	Quantity of wastewater generated, m ³ /hr	Treatment method and recycle
1	Cooling Tower blowdown	6	Recycling for use in dust suppression, equipment washing and plant greenbelt after treatment in CETP
2	Compressor cooling	11	
3	Process mixing	15	
4	Flushing water	10	
5	Equipment washing	7	
6	Sewage Treatment Plant	6	Use for plant greenbelt development



2 - Project Description (cont'd)

2.9.4 Solid Waste Generation and Re-utilisation Measures

The principal solid wastes that would be generated from the production of pellet are fines during induration process and from dedusting equipment which would be about 70,000 TPA. The dust collected in the hoppers is converted into slurry and pumped to thickener. The same is recycled with incoming slurry and converted into pellets. The other wet scrubber's slurry is also treated in the same way. Used oil (30 kl/annum) would be handed over to authorized recycler for disposal/recycling and STP sludge (110 TPA) would be reused as manure for greenbelt.

The bag filters provided in Additive Grinding, Bin mix Building become part of process equipment to recover the particles and discharge into the bin and air is released to atmosphere.

During the interim period, the principal solid waste generation would be about 35,000 TPA that would be generated from the production of pellet are fines during induration process and from dedusting equipment. Used oil (15 kl/annum) would be handed over to authorized recycler for recycling.

2.10 IDENTIFICATION OF HAZARDS

Hazard identification and risk management has been addressed in Chapter 7 - Additional Studies.

2.10.1 Risk Management Measures

The risk management measures for the proposed project activities require adoption of best safety practice at respective construction zones within the Works boundary. In addition, the design and engineering of the proposed facilities would take into consideration proposed protection measures for air and water environment as outlined earlier.



2 - Project Description (cont'd)

2.11 SAFETY DURING CONSTRUCTION

Safety during construction would be an important aspect with regards to risk analysis of the project. The safety during construction would be prescribed as follows:

- i) All employees and contract workers to be well versed with the safety guidelines of the organisation and well equipped with the Personal Protective equipments (PPEs) such as safety helmets, safety shoes, goggles, hand gloves, safety jackets, earmuffs, etc.
- ii) The construction Safety Manual elaborating all the safety rules/guidelines to be in place and followed by all concerned directly or indirectly involved in construction.
- iii) Safety gears like fall arresters, lifelines etc. to be used compulsorily for height work
- iv) The operating procedures and control management system to be in place and meticulously followed by all workers.
- v) Display signs for restricted area, material strictly prohibited inside any work premises like inflammable materials, firearms, weapons & ammunitions, etc.
- vi) Direction signs (night glowing) and speed limit signs along the construction roads.
- vii) Clear demarcation of passage within Construction area with proper safety arrangements,
- viii) 'Dos' & 'Don'ts' during various types of works like working at heights, etc.
- ix) Emergency control mechanisms like switch, valve and emergency lamp to be covered with shield, water & shock resistance cover during rain etc and paddle switch for bigger rotating machinery mixer etc.
- x) No temporary cable joints and open air working switch yard at enriched level.



2 - Project Description (cont'd)

- xi) Adequate information about emergency numbers to be displayed everywhere. There would be emergency control room, emergency controller, shift emergency controller to take proper control of any unwanted situation and have an overall control.

Following the above measures would ensure that safety is being strictly followed during all construction activities.

2.11.1 Electrical Safety

Adequately rated quick-response circuit breakers, aided by reliable, selective digital/microprocessor-based electro-magnetic protective relays would be incorporated in the electrical system design for the proposed Project. The metering instruments would be of proper accuracy class and scale dimensions. Appropriate use of ELCBs shall be ensured for all construction related low voltage work.

2.11.2 Fire Prevention

Major facilities envisaged for fire protection system are as follows:

Fire Alarm System (FAS): FAS is provided in all the critical areas of the plant viz. central control room, all electrical panel rooms, cable cellars, office building with central monitoring by Fire Department.

Fire hydrant system: Fire hydrant system consisting of internal as well as external hydrants will be provided in entire pellet plant area. Fire fighting pump house will be used for the fire hydrant system.

Portable fire extinguishers: As a first aid measure fire extinguishers and sand buckets will be provided in all electrical & instrument control rooms, all control rooms, shift office and lab as per Statutory norms.



3 - DESCRIPTION OF THE ENVIRONMENT

To assess the potential environmental impacts arising out of the proposed project activities, the pre-project environmental settings, that is the prevailing baseline environmental status in the study area has been ascertained in this chapter. The pre-project environmental status would provide the basis to assess the potential impacts arising out of the proposed project activities within the study area.

3.1 STUDY AREA

For the purpose of Environmental Impact Assessment (EIA), the study area has been classified into two areas, namely,

- i) The proposed plant area of 100 acre (40.47 ha) where the proposed project facilities would be installed; and
- ii) The study area, surrounding the project site, with an aerial coverage of 10 km from the periphery of the existing boundary.

3.2 COMPONENTS AND PERIOD OF BASELINE STUDY

In order to determine the pre-project environmental status of the study area, field monitoring was carried out for generation of primary baseline data during the period from March 2021 to May 2021. The analysis was done by NABL & MoEFCC accredited laboratory of M/s Envirocheck.

The monitoring was carried out at the specific locations/ villages within the study area for various physico-chemical, biological & human environment as per the ToR granted by MoEFCC vide File No-J-11011/281/2007-1A.II(I) dated 28th April, 2021 for the various environmental components which are given in the following sections.



3 - Description of the Environment (cont'd)

3.3 PHYSICAL FEATURES OF THE STUDY AREA

3.3.1 Physiography

Physiographically the district Jagatsingpur can be broadly divided into the following two distinct units.

- i) Saline marshy tract along the coast
- ii) Gently sloping plain

Saline marshy tract forms a long and narrow strip along the coast with the width varying from 3 to 10 km and is intersected by tidal streams and shrubby vegetation.

The gently sloping plain occurs to the west of the saline marshy tract and forms the most fertile part of the district. General slope of this tract is towards east and southeast (Source CGWB Groundwater Booklet of Jagatsinghpur)

The study area has both the physiographic features.

3.3.2 Topography

The study area is plain flat land and hardly shows any significant relief. Upper or the northern part of the study area is predominant by land surface whereas the southern part is mostly covered by sea. The general elevation of the study area varies from 0 m to about 10 m above mean sea level (amsl). A few stranded beach ridges in the form of low linear mounds form relatively high grounds. Otherwise the landscape is featureless, an end product of sustained cultural modification of the fertile land of the Mahanadi delta. The topographic features of the study area also include an intricate network of tortuously meandering channels. Some of these channels are distributaries of the Mahanadi River. The landform elements of the southern part of the study area include such coast line features as pro-grading barrier beach-sand

3 - Description of the Environment (cont'd)

dune-sand spit-creek system separating the inland areas from open sea. The huge deposit of silt of rivers has built up the present alluvium tracts at their meeting places with the sea. The topographical features of the study area can be seen from the Survey of India OSM Nos. F45U11 and F45U12. The broad topographic features of the study area have been presented in Drg. 11572-97A-000-ENV-0001.

The digital elevation model (DEM) of the study area (10 km radius circle marked in black) developed from SRTM-1 degree arc resolution data as presented in Fig. 3-1 shows the elevation ranges from 0 to 20 m amsl.

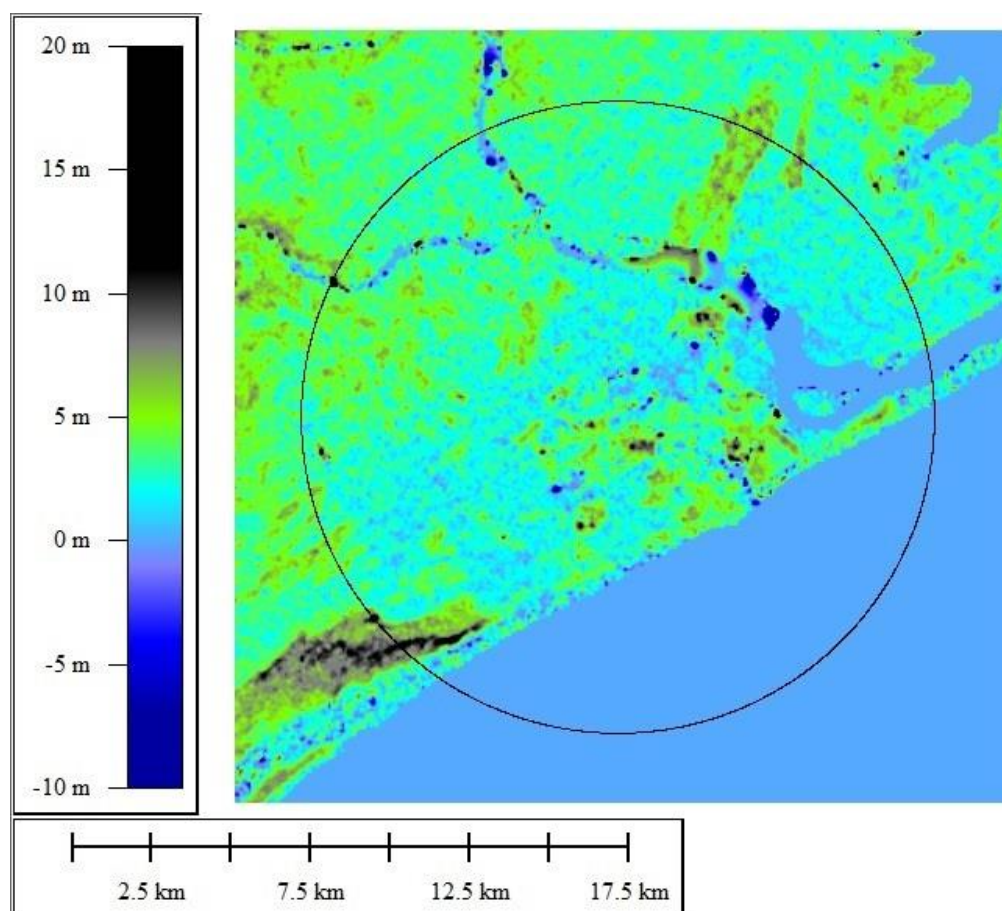


FIG. 3-1 - DIGITAL ELEVATION MODEL (DEM) OF THE STUDY AREA

3 - Description of the Environment (cont'd)

3.3.3 Drainage

The study area is drained by Mahanadi river. Nuna nadi and Kharinasi nadi joins Mahanadi from the north western side and north Eastern side respectively in the study area. The distributary of Mahanadi known as Santra nadi flows and Mahanga nadi flows through the western side of the study area. Many small river/stream are present in the study area. Taldanda canal flows through the northern side of the study area.

All the coastal rivers and creeks including the Mahanadi river flow parallel to the coast for some distance before they meet the sea. The mouths of such creeks and rivers often shift along the coast and are constricted by subaqueous to sub-aerial bars. The drainage pattern is dendritic in study area with a significant meander in the streams.

The drainage map of study area (around 5 km radius from plant periphery) is shown in Fig. 3-2.

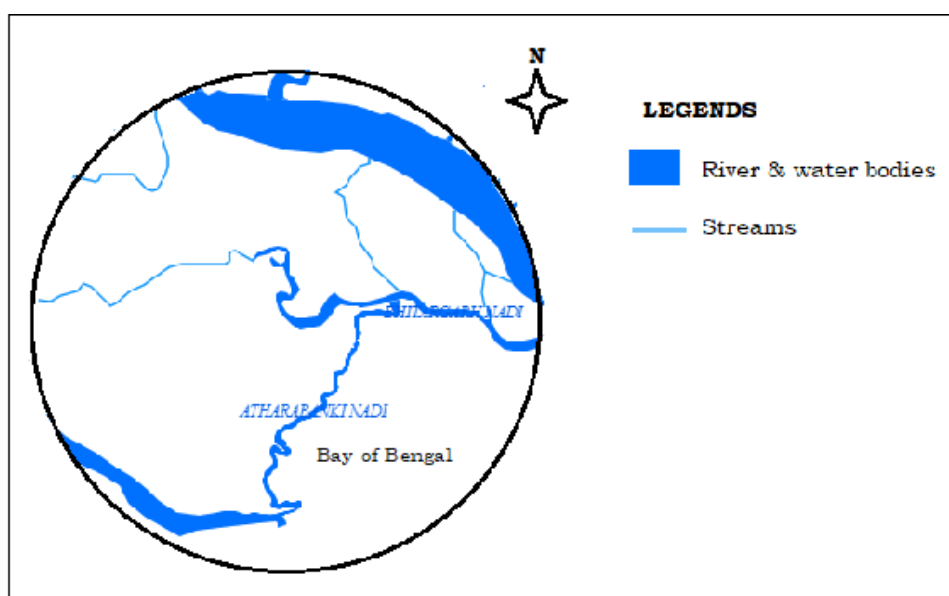


FIG. 3-2 - DRAINAGE MAP OF THE STUDY AREA

3 - Description of the Environment (cont'd)

3.3.4 Seismology

As per IS:1893 (Part-1) : 2002 of Bureau of Indian Standards, the study area falls in seismic Zone III classified as “moderate damage risk zone” in a scale of Zone II to Zone V with Zone V being the highest risk zone. Although there is no historical record of significant intensity earthquake occurring in this part of Orissa coastal area, a number of sub-surface faults in the basement have been mapped during geophysical exploration revealing ridges and depressions in the sub-surface.

3.3.5 Land Use and Land Cover

The land use/land cover mapping was carried out using digital satellite image procured from NRSC, Hyderabad. Details of the satellite data are as given in below:

Satellite	Sensor	Bands	Year
RS 2	LISS IV - FMX	2, 3, 4	Feb 2021

The satellite imagery procured from NRSC is presented in Fig. 3-3.



FIG. 3-3 - SATELITE IMAGERY OF THE STUDY AREA



3 - Description of the Environment (cont'd)

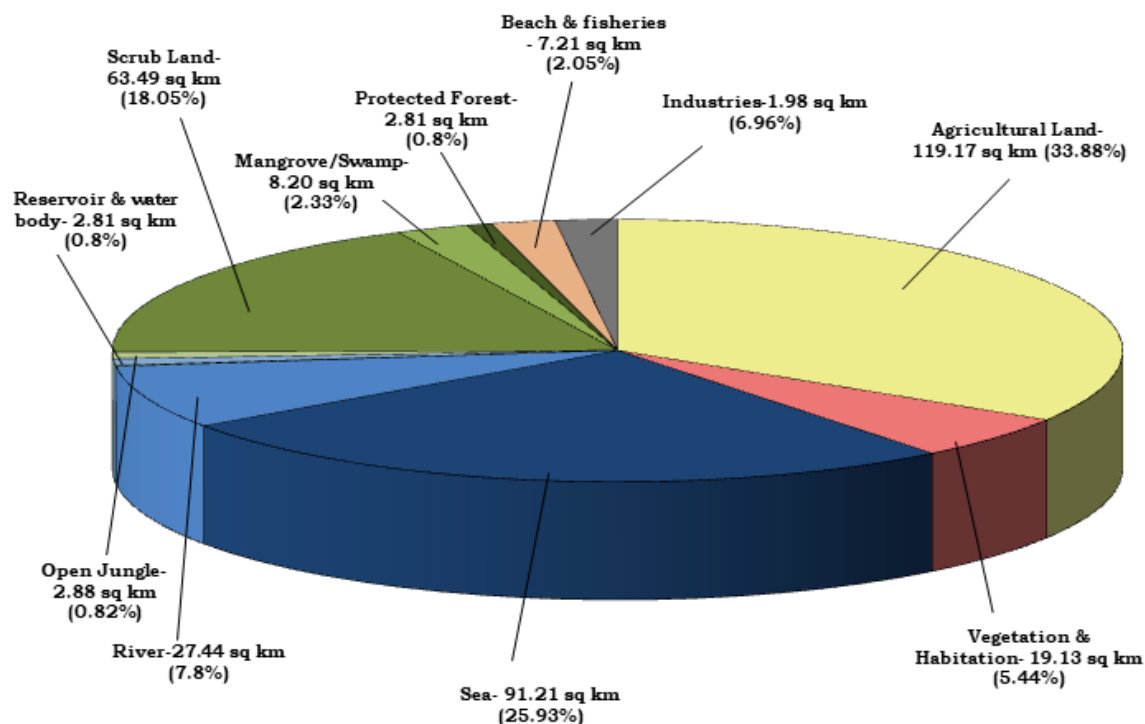
The analysis of data was preceded by collection of ancillary data like the Survey of India OSM Nos. F45U11, F45U12 of 1:50,000 scale as base information for interpretation. The study area was demarcated on the ancillary map collected.

The landuse study for 10 km radial area coverage from the proposed plant periphery was conducted by mapping the area using satellite imageries by way of digital image processing which includes image rectification; image enhancement; visual interpretation & land use mapping. The Survey of India OSM and Google Earth map were used for the geo-reference and validation. The authentication by some reference data/ground control points through field visit was conducted for finalizing the map.

Finally, from the image analysis, interpretation and generated data of the study area during field validation, a thematic land use map of the study area has been prepared and presented in Drg 11572-97A-000-ENV-0003. Relative distribution of land class units of the core zone and the study area is depicted in Fig. 3-4.

In the buffer zone of area around 351.74 sq km, the agricultural land is the most dominant land class covering 33.88% (119.17 sq km) of the study area. Sea covers 25.93% (91.21 sq km) followed by scrub land 18.05% (63.49%) of the study area. Vegetation with Habitation covers round 5.44% (19.13 sq km) and river covers 7.8% (27.44 sq km) of the study area. Industrial Area and the Project area constitute 1.98% (6.96 sq km) and 0.12% (0.42 sq km) respectively of the study area. Other categories namely Protected Forest, Open Jungle, Mangrove/swamp, Reservoir & water body and beach & fishery constitute 0.8% (2.81 sq km), 0.82% (2.88 sq km), 2.33% (8.20 sq km), 0.8% (2.81 sq km) and 2.05% (7.21 sq km) respectively of the study area.

3 - Description of the Environment (cont'd)



Pre-Project Land Use of the Study Area (351.74 sq km)

FIG. 3-4 - LANDUSE PATTERN OF THE PROJECT SITE AND STUDY AREA

3.3.6 Geology

The district is covered by Quaternary sediments overlain by Baripada beds of Tertiary age. Sedimentary sequences ranging in age from Cretaceous to Recent resting on metamorphic basement have been encountered in the sub-surface area. No hard rock exposures related to basement lithology is encountered in this region at relatively shallow depth. A generalized stratigraphy of the region is presented in Table 3-1.

3 - Description of the Environment (cont'd)

TABLE 3-1 - GENERALIZED STRATIGRAPHY OF THE REGION

Sl. No.	Age	Geological formation
1	Recent	Alluvium
2	Plio - Pleistocene	Laterites
3	Mio - Pleistocene	Claystone, sandstone and fossiliferous limestone
4	Lower Triassic to Cretaceous	Medium to coarse sandstones and shales
5	Precambrian	Metasediments and volcanics Quartzites, Khondalites, Charnockites and Anorthosites

The geological map of the study area developed from Regional Geological Map of Odisha (Source: Compiled by N K Mahalik @ SGAT 1998) is presented in Fig. 3-5.

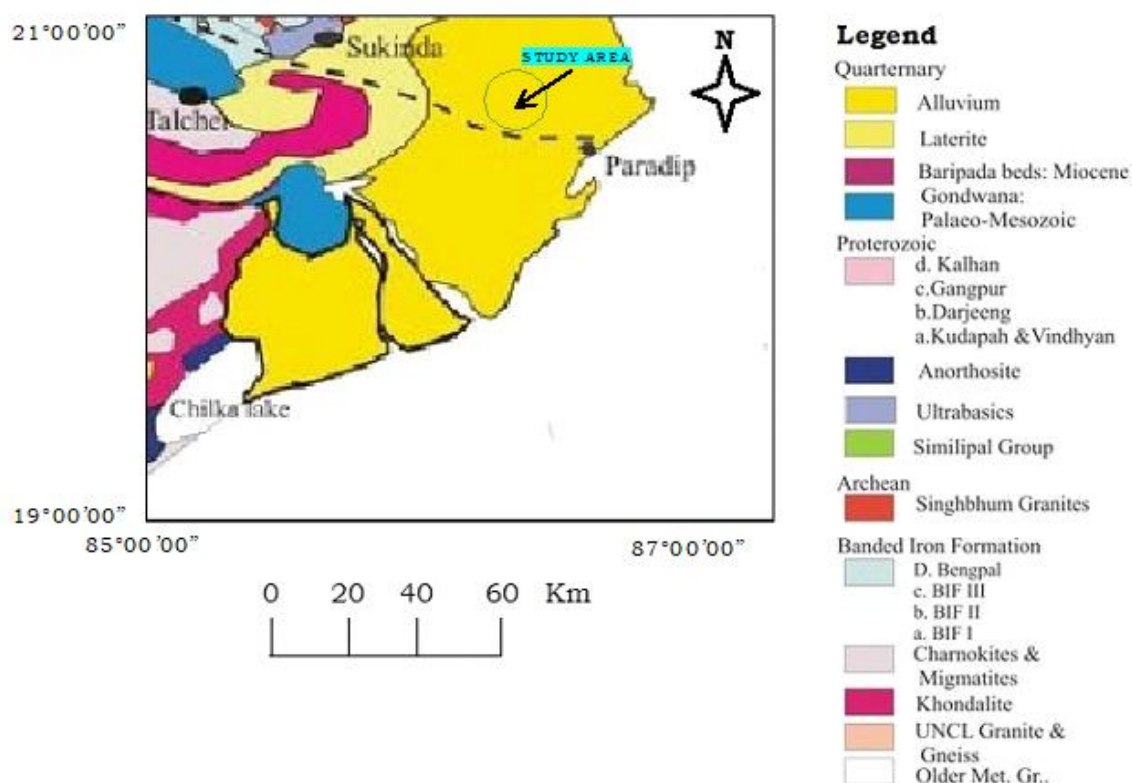


FIG. 3-5 - GEOLOGICAL MAP OF THE STUDY AREA



3 - Description of the Environment (cont'd)

3.3.7 Geo-Hydrological Status of the Study Area

In the district, the ground water occurs in the intergranular pore spaces. Sand and gravel layers act as repository of ground water. Ground water occurs under unconfined condition in the shallow aquifer zone and perched water table condition within sand dunes underlain by clay beds. The ground water is also found under semi-confined condition in the deeper aquifer zones. The coastal tract held promise for large-scale development for ground water. But the coastal tract is beset quite often with salinity problems both in shallow as well as in deeper aquifers.

Based on the behavior and occurrence of ground water, the regional ground water flow system of the district has been described under two distinct categories viz. i) Shallow aquifer zone to a depth of 50 m and ii) Deeper aquifer zone lies between 50 and 300 m or more.

Shallow Aquifers: The area is traversed by innumerable nalas, mostly perennial, besides the main stream and presents a favorable ground water condition. The shallow aquifer consists of a mixture of sand and clay with little gravel at places. The thickness of the saturated sediments varies from 10 to 35 m. Ground water in these sediments usually occurs under water table condition, where as in coastal tract it occurs under perched water table condition underlain by clay beds in sand dunes area. Open wells and shallow tube wells are used to develop ground water from this aquifer mainly for domestic and minor purposes in the alluvial tracts. The open wells receive their recharge mainly from the local precipitation. There are many shallow tube wells for domestic use in the area particularly in the eastern part by tapping 3 to 6 m zone within 30 to 50 m depth.

Deeper Aquifers: The occurrence of fresh water bearing deeper aquifers is identified from available bore hole data down to a maximum depth of 612m. In the major part of the district the depth of



3 - Description of the Environment (cont'd)

the bore holes are restricted to 300 m. The available information indicates that there is considerable variation in the granularity and thickness of the aquifers of the area. The aquifers occurring at the depth range of 50 to 300 m below ground level (bgl) are grouped in this category. At greater depth, the aquifer zone becomes thicker but alteration of clay bands still continues except some areas where there are no clay bands even upto a depth of 200 m bgl. The Nos. of irrigational tube wells constructed by the PHED and RWSS, Govt. of Odisha in coastal tract in Ersama block tapped the granular zones 40-60 m thick within the depth ranges 135 to 165 m bgl. There are few numbers of flowing wells with poor discharge.

The distribution of Saline/fresh water Aquifers: It is well informed that adequate thickness of fresh water aquifers occurs in the area at different depths and scope of ground water development by means of shallow and deep tube wells is very high. Saline zones in the east close to the coastline restrict the occurrence of fresh water aquifer. The coastal saline tract is about 10 km wide in outfall areas of Mahanadi but expands to a maximum width of 45 km in Ersama block. In the coastal saline tract all the aquifers down to about 20 m bgl contain brackish to saline water. Below 317 to 350 m bgl the aquifers are fresh and suitable for drinking and irrigation uses falling in Kujang and Ersama blocks. Only in parts of Kujang block shallow fresh water aquifers occurs within 20 m bgl on the top of the bore hole. Where as in the block of Tirtol, part of Balikuda, Naugaon blocks, fresh ground water aquifer occur above 80-120 m bgl and saline zones occur below this depth. The fresh water aquifers occur intensively in the remaining part of the area of the district.

In Kujang-Ersama Blocks where the study area lies, the saline water bearing granular zones occur at several depths close to the coast line extending right from Paradeepgarh to the extreme south



3 - Description of the Environment (cont'd)

eastern part of Ersama block in the district. In Mahanadi basin of Jagatsinghpur district large area falling in Kujang and Ersama blocks, top granular zones down to a depth of 18 to 350 m are saline to brackish in nature and fresh water granular zones occur below this depth. In parts of Kujang block, shallow fresh water granular zones do occur locally i.e. within sand dune area. The salinity of the water in the shallow granular zone in the low lying swampy coastal areas may be attributed to the tidal effects of the meandering nalas due to the poor drainage conditions. The fresh water granular zones in these areas are founds as under:

- a) Shallow Aquifer zones: 16 to 28 m bgl - average thickness decreases towards northwest.
- b) Deeper Aquifer Zones: 130 to 138 m bgl - cumulative thickness decreases 317 to 350 m bgl towards northwest.

In these areas only deep tube wells are feasible to exploit fresh water below 317 m depth by tapping 30 to 40 m of granular zones that may yield 13-50 lps for draw down of 6-12 m. Shallow tube well is not suitable to sink in saline tract because after running well for more than 2 to 3 hours well may start yielding saline water in place of fresh water.

Hydraulic characteristics of Aquifers: The alluvial deposit is a good repository of ground water. The thickness of sediments increases towards coast and is high as 600 m in southeastern part of the district (Mahanadi delta region). The deep aquifers are confined by extensive clay beds. The wide range of permeability and Storativity values indicates that the aquifer in the area is heterogeneous laterally. There is a sequence of alternating clayey and sandy layers with occasional presence of thin arenaceous materials. The wells tapping fresh water-bearing zones in coastal alluvial tracts yield copious quantities water with economic drawdown.

3 - Description of the Environment (cont'd)

The transmissivity value varies from 1,800 to 9,360 m²/day, whereas Storativity varies from 1.918×10^{-4} to 4.68×10^{-4} . The hydraulic conductivity values ranges from 44 to 253 m/day.

3.3.8 Water Level

Depth to Water Level (Pre-monsoon): Depth to water level during April, 2020 as measured by CGWB (**Source:** CGWB Groundwater Year Book of Odisha, 2020-21) for ground water monitoring in Jagatsinghapur district indicates the following two groups based on the range of water levels.

Range of Water levels (m bgl)	% of monitored wells
0-2	0
2-5	100

As reported, the depth to water level of the monitored sources ranges from 2.30 m to 4.80 m bgl.

The depth to water level map has been shown in Fig. 3-6.

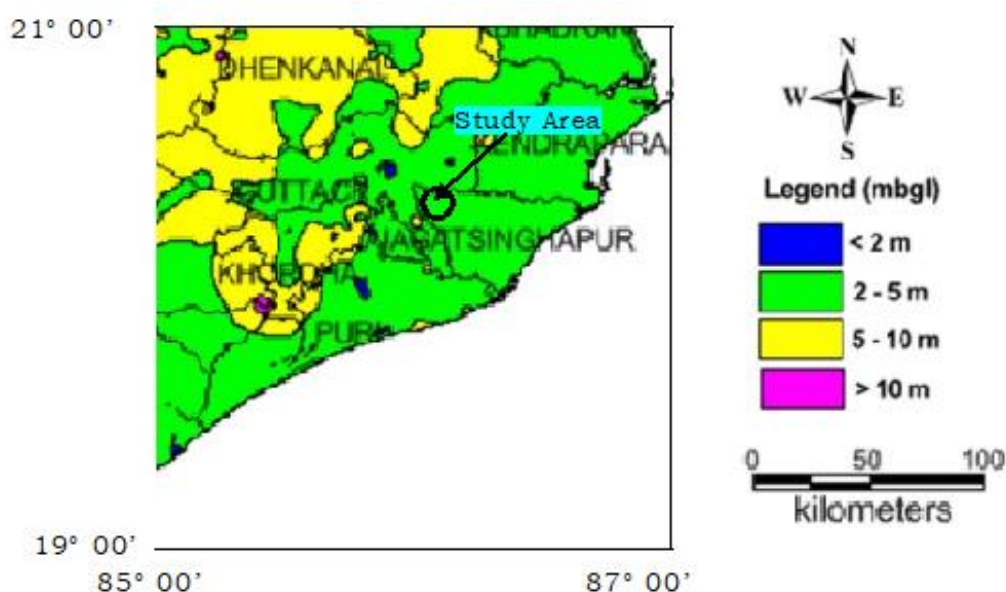


FIG. 3-6 - DEPTH TO WATER LEVEL MAP (PRE-MONSOON)

3 - Description of the Environment (cont'd)

Depth to Water Level (Post-monsoon): Depth to water level during November, 2020 as measured by CGWB (**Source:** CGWB Groundwater Year Book of Odisha, 2020-21) for ground water monitoring in Jagatsinghapur district indicates the following two groups based on the range of water levels.

Range of Water levels (m bgl)	% of monitored wells
0-2	90.91
2-5	9.09

As reported, the depth to water level of the monitored sources ranges from 0.68 m to 4.03 m bgl.

The depth to water level map has been shown in Fig. 3-7.

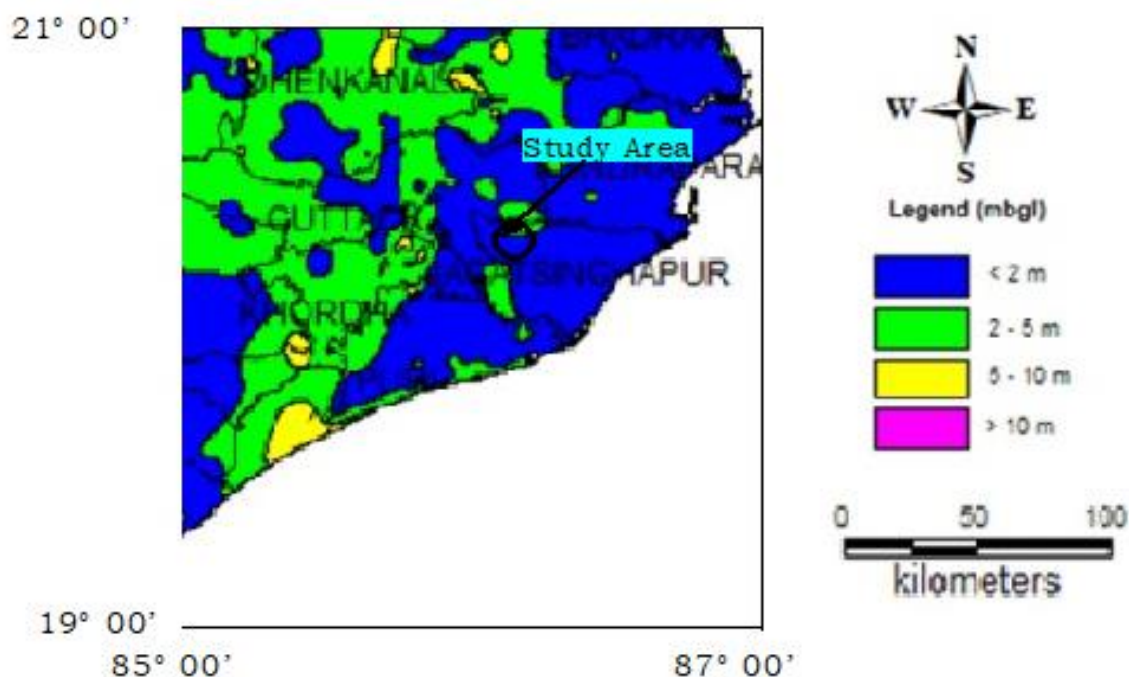


FIG. 3-7 - DEPTH TO WATER LEVEL MAP (POST-MONSOON)

3 - Description of the Environment (cont'd)

3.3.9 Water Level Monitoring in and around Plant Area

Water level monitoring of 18 wells was conducted in the study area during the field visit (May, 2021). Mostly the ground water is developed by way of dug wells, bore wells and shallow tube wells fitted with hand pumps for domestic purpose and shallow to medium depth/deep tube wells for irrigation and industrial purpose. The depth of dug wells inventoried varies from 0.40 m to 2.70 m bgl where as depth of bore wells monitored was around 400 m bgl. The monitored water level data is shown in Table 3-2 and their locations are presented in the in Fig. 3-8. Exhibit 3-1 showing water level monitoring exercise is provided below.

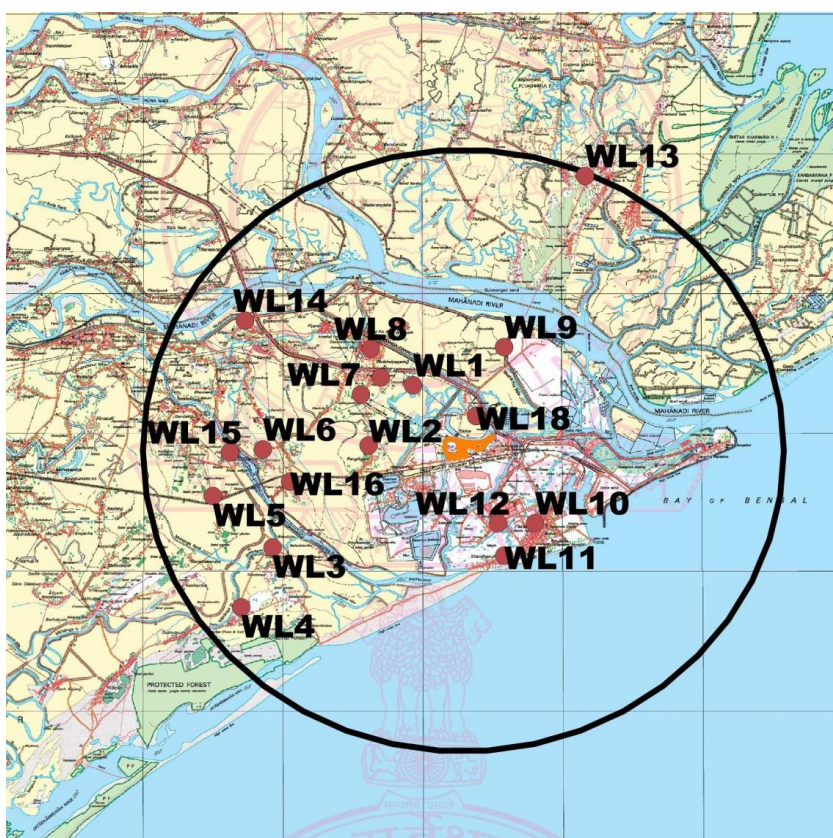


FIG. 3-8 - WATER LEVEL MONITORING LOCATIONS

3 - Description of the Environment (cont'd)



EXHIBIT 3-1 - WATER LEVEL MONITORING AT RANGIAGARH VILLAGE

TABLE 3-2 - WATER LEVEL INFORMATION OF MONITORED SOURCES IN THE STUDY AREA

Sl. No.	Location	Source	Latitude	Longitude	Elevation (m)	Water level (m)
1	Village Udayabata	DW	20° 18' 20.67" N	86° 37' 19.82" E	10	0.6
2	Village Rangiagarh	DW	20° 17' 15.58" N	86° 36' 32.11" E	1	0.5
3	Village Trilochanpur	DW	20° 15' 25.30" N	86° 34' 48.84" E	10	1.7
4	Village Dhinkia	DW	20° 14' 20.61" N	86° 34' 15.08" E	4	1.0
5	Village Jatadharpur	DW	20° 16' 20.93" N	86° 33' 44.52" E	7	1.2
6	Village Jhimani	DW	20° 17' 11.28" N	86° 34' 38.29" E	8	0.6
7	Village Nimidihi	DW	20° 18' 10.69" N	86° 36' 23.84" E	5	1.5
8	Village Pradeepgarh	DW	20° 19' 00.05" N	86° 36' 34.34" E	10	0.5
9	Village Musadia	DW	20° 19' 01.86" N	86° 38' 57.77" E	3	0.5
10	Paradeep Port Trust	DW	20° 15' 51.58" N	86° 39' 31.11" E	6	0.8
11	Paradeep (Sandhakud)	DW	20° 15' 16.56" N	86° 38' 57.98" E	5	1.6
12	Paradeep Housing Board	DW	20° 15' 51.42" N	86° 38' 51.39" E	16	0.4
13	Village Ramanagar	DW	20° 22' 06.79" N	86° 40' 24.77" E	11	0.7
14	Village Bhutmundai	DW	20° 19' 30.58" N	86° 34' 19.05" E	7	1.7
15	Village Fatapur	DW	20° 17' 08.17" N	86° 34' 02.79" E	3	1.6
16	Village Bagadia	DW	20° 16' 36.47" N	86° 35' 07.68" E	5	1.0
17	Village Nimidihi	DW	20° 18' 28.89" N	86° 36' 45.22" E	5	1.3
18	Village Balijhara	BW	20° 17' 47.27" N	86° 38' 27.73" E	4	2.1

BW- Bore Well, **DW**-Dug Well

3 - Description of the Environment (cont'd)

The analyzed data is graphically represented in the given Fig. 3-9. The compiled data shows that water level of the monitored sources varies from 0.4 m to 2.1 m bgl indicating a broad similarity to reported CGWB (CGWB Ground Water Yearbook 2020-21, SER - Sep, 2021) monitored post-monsoon groundwater level data (0.68 m to 4.03 m bgl) of April 2020.

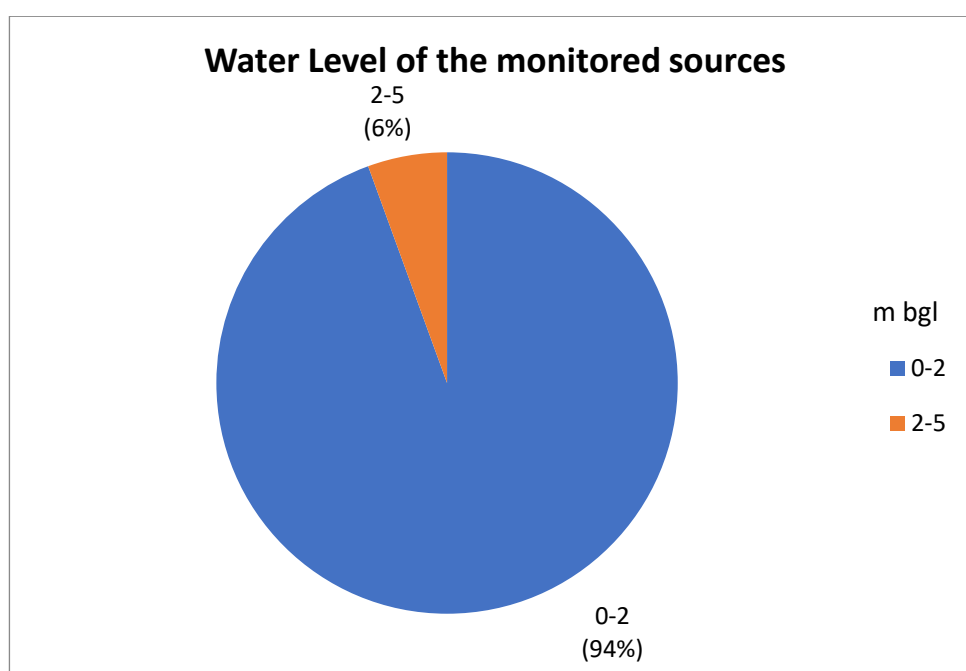


FIG. 3-9 - WATER LEVEL OF THE MONITORED SOURCES

3.3.10 Ground Water Resources

The groundwater as estimated by CGWB in the year 2020 for the Jagatsinghpur and Kendrapara district where the study area lies are provided in Table 3-3. The stage of groundwater development in Jagatsinghpur and Kendrapara district are 55.84% and 43.81% respectively which falls in safe category (stage of groundwater extraction $\leq 70\%$) from ground water development point as per GEC 2015 Methodology.

3 - Description of the Environment (cont'd)

TABLE 3-3 - DYNAMIC GROUNDWATER RESOURCES

Particulars	Quantity (Ha m)	
	Jagatsinghpur	Kendrapara
Total Groundwater Recharge (monsoon and non-monsoon)	48106.82	26244.17
Total Natural Discharges	4526.39	2309.38
Annual Extractable Groundwater Resources	43580.43	23934.79
Groundwater Extraction for Irrigation	21482.10	9202.83
Groundwater Extraction for Industrial use	482.52	145.40
Groundwater Extraction for Domestic use	2370.54	1136.84
Total Groundwater Extraction	24335.16	10485.07
Annual GW Allocation for Domestic use as on 2025	3219.49	4395.05
Net Ground Water Availability for future use	19154.54	13372.82
Stage of Ground Water Extraction (%)	55.84	43.81

Source: Dynamic Groundwater Resources Assessment of India- 2020

The ground water resources as assessed through joint task of by the Central Ground Water Board and Ground Water Survey and Investigation, Department of Water Resources, Govt. of Odisha, adopting methodology recommended by Groundwater Estimation Committee(GEC-97) during 2009, indicates that the overall stage of ground development the districts Jagatsinghpur and Kendrapara are is 43.37% and 52.97% respectively (CGWB Groundwater Information Booklet of Jagatsinghpur and Kendrapara).

The groundwater resources of Kujanga blocks of Jagatasinghpur district where the proposed plant area lies as per CGWB are presented in Table 3-4.



3 - Description of the Environment (cont'd)

TABLE 3-4 - GROUND WATER DEVELOPMENT OF KUJANGA BLOCK IN JAGATSINGHPUR DISTRICT (AS ON 31ST MARCH 2009)

		(Figures in Ha m)
Net Annual Ground Water Availability	..	6,409
Existing gross ground water draft for irrigation	..	3,583
Existing gross ground water draft for domestic and industrial water supply	..	415.16
Existing gross ground water draft for all uses	..	3,998
Allocation for domestic and industrial requirement supply up to next 25 years	..	554
Net ground water availability for future irrigation development	..	2,272
Stage of ground water development (%)	..	62.38

Source: Groundwater Information Booklet of Jagatsinghpur Dist., May 2013

As can be inferred from the above data the stage of ground water development in Kujanga block Jagatsinghpur is 62.38%, which is higher as compared to district average of 55.84% (Source: National compilation of Groundwater Resources of India 2020) but still falls under safe category as per GEC norms. The part of study area lying in Kendrapara district is also safe. However considering the stage of groundwater development in these block approaching semi critical (>70%) and saline nature of groundwater, judicious & conjunctive use of groundwater is suggested with further very limited ground water development through suitable ground water abstraction structures in various hydro-geological settings. It is also suggested that in the salt-water infested areas of both the districts, suitable rain water harvesting is necessarily implemented.

3.4 PHYSICO-CHEMICAL COMPONENTS

The physico-chemical aspects comprise of meteorology, air, water, soil and noise. Table 3-5 presents the details of sampling including the methodology followed for individual components.



3 - Description of the Environment (cont'd)

TABLE 3-5 - SAMPLING DETAILS AND METHODOLOGY FOR PHYSICO-CHEMICAL COMPONENTS

Component	No of Stations	Sampling Parameters	Sampling period	Sampling frequency	Methodology
Meteorology	1 location	Temperature Wind Speed Wind direction Rainfall Relative humidity	1season (March to May 2021)	Hourly	The meteorology parameters were recorded using automatic micro-meteorological equipment consisting of anemometer, wind wane and thermometer. Review of secondary data collected from IMD for the last 30 years. Rainfall was recorded every day using Rain Gauge. Humidity was recorded using wet and dry thermometer and Psychometric chart.
Ambient Air Quality	8 locations	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO, O ₃ , NH ₃ , C ₆ H ₆ , BaP, Pb, As, and Ni	1season (March to May 2021)	Weekly twice for each location	Gravimetric method for PM _{2.5} (USEPA 1997a) and PM ₁₀ (IS 5182 part-23) Modified West and Gaeke method for SO ₂ (IS-5182 part 2) Modified Jacob-Hochheiser method (IS-5182 part 6) for NO _x . NDIR method for CO (IS 5182 part 10). UV photometry method for O ₃ (IS 5182 part 9)
Geohydrology - Ground water level	16 locations	Total depth & water level	Once (December 2021)	Once during monitoring season	Using Measuring tape
Water Quality	16 locations within the study area (8 surface water, 8 ground water)	Surface water - pH, TSS, TDS, BOD, COD, chloride, Cr, Coliform etc	1season (March to May 2021)	Thrice in the monitoring season	Grab sampling analysis as per APHA methods.
		Ground water- As per IS: 10500-2012	1season (March to May 2021)	Thrice in the monitoring season	
Soil Quality	3 locations	Soil profile, Chemical Constituents	1season (March to May 2021)	Once during monitoring season	Analysis was carried out as per standard methods
Noise Quality	8 locations	Leq as per The Noise Pollution (Regulation And Control) Rules, 2000	1season (March to May 2021)	Once during study period, hourly for 24 hrs	24 hours equivalent using Noise level meter

3 - Description of the Environment (cont'd)

3.4.1 Micro-Meteorology

In order to determine the micro-meteorological conditions of the study area, a temporary continuous weather monitoring station was installed on the rooftop (around 10 m height) of a house at Udayabata village, Jagatsinghpur, Odisha. This weather station was operational from 1st March 2021 to 31st May 2021 and had facilities to record dry bulb temperature, relative humidity, wind direction, wind speed and rainfall. The cloud cover was measured visually. The wind rose of the study area as monitored is shown in Fig. 3-10. The site-specific micrometeorological data as recorded during the study period along with the climatic normals are presented in Table 3-6.

TABLE 3-6 - SUMMARY OF SITE-SPECIFIC MICRO-METEOROLOGICAL RECORDINGS OF STUDY AREA

Monitoring Site

Location : Udayabata village
 Lat/Long : 20°18'30"N/86°37'32"E
 Elevation above MSL : 10 M

Climatic Normal

Station : Paradeep Port
 Lat/Long : 20°18'N/86°41'E
 Elevation above MSL : 8 M

Parameters	Climatic Normal				Monitored (March-May 2021)
	Summer	Monsoon	Post Monsoon	Winter	
Max. DB Temp. (°C)	33.1	32.7	32.0	29.1	41.0
Avg. DB Temp. (°C)	28.7	28.9	27.8	23.1	29.9
Relative humidity (%)	81.6	85.0	80.0	74.5	77.9
Avg. wind speed, (kmph)	21.5	20.1	13.5	12.3	8.6
Predominant wind direction	SW, S	SW, S	SW, S	N, NE	SW, W, S
Total rainfall (mm)	104.5	900.0	557.9	45.8	209.5

Notes: Climatic Normals (1951-1980)

3 - Description of the Environment (cont'd)

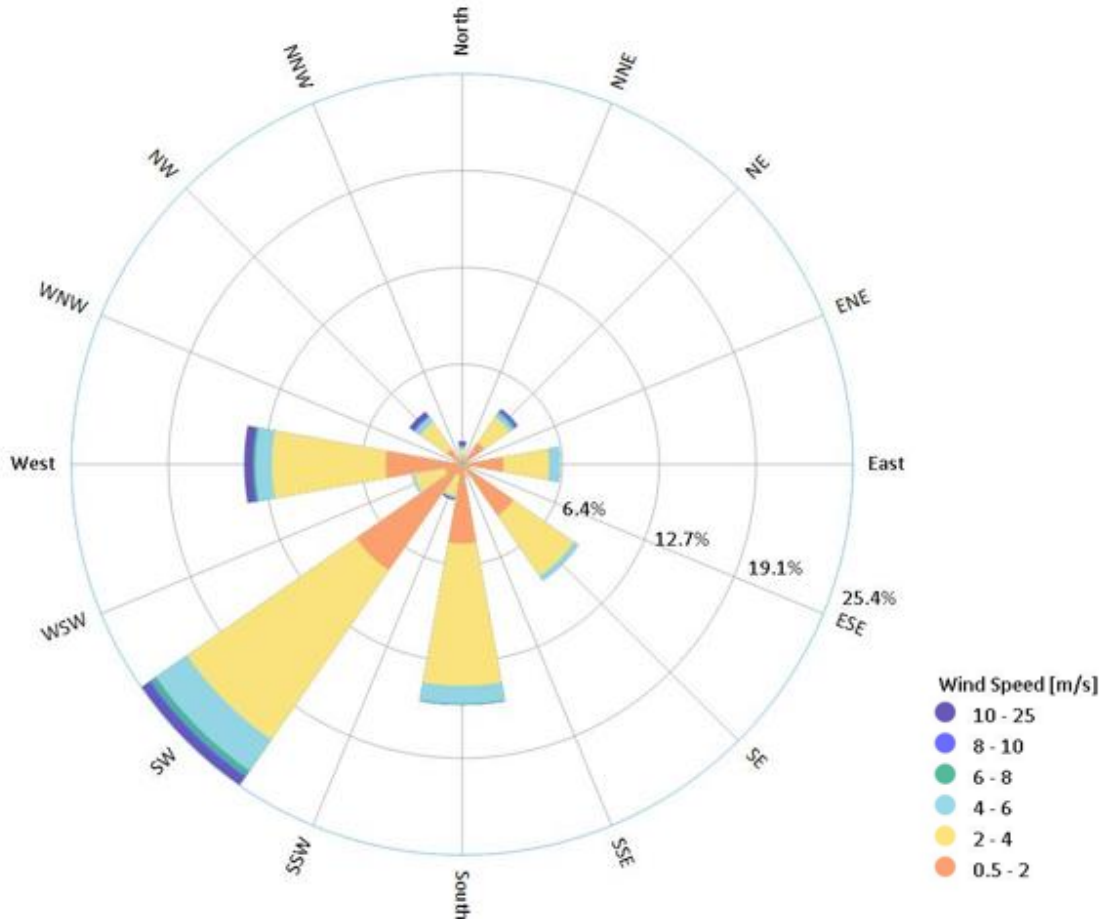


FIG. 3-10 - WINDROSE OF THE REGION

3.4.2 Mixing Height

The site-specific mixing height and atmospheric stability class data were not recorded during the monitoring period. The data required for prediction of ground level concentrations (glcs) of likely air emissions from the plant have been obtained from the CPCB publication on 'Spatial Distribution of Hourly Mixing Depth over Indian Region' - PROBES/88/2002-03.



3 - Description of the Environment (cont'd)

3.4.3 Ambient Air Quality (AAQ)

The study area for the proposed project is a mixture of rural & urban in nature where air pollution is primarily attributed due to industrial & vehicular emissions and other anthropogenic activities. For the present study, AAQ monitoring has been carried out at 8 different locations within 10 km of the study area to measure and assess the prevailing air quality in and around the study area. A sample ambient air quality monitoring is shown in Exhibit 3-2.

Basis of Location of AAQ Stations: The selection of the nine AAQ monitoring locations is principally governed by the wind rose of the region. The predominant wind direction for the monitoring period as per Climatic Normal data is SSW, SW, S and NE as shown in Table 3-7. In addition, the accessibility of sites was also taken into consideration.

In view of the above, monitoring locations were selected at upwind, downwind and crosswind locations in the study area.

The locations of the AAQ stations (distance, direction, and coordinates) where monitoring was carried out are given in Table 3-7 with justification for its selection and the location map is shown in Fig 3-11.



3 - Description of the Environment (cont'd)

TABLE 3-7 - DETAILS OF AAQ MONITORING LOCATIONS AND BASIS OF SELECTION

Station ID	Coordinate	Distance from Plant Boundary (km)	Direction	Basis for selection
A1	20°14'52"N, 86°34'58"E	6.6	SW	Upwind of predominant wind direction. Near IOCL Paradip.
A2	20°16'10"N, 86°33'55"E	7.19	WSW	Upwind of predominant wind direction. Pratappur village (Sensitive receptor due to human habitation)
A3	20° 56' 09"N, 86°37'44"E	1.35	SSW	Upwind of predominant wind directions. Near B.P Hospital, Paradeep (Sensitive receptor)
A4	20°18'30"N, 86°37'32"E	2.17	NNW	Downwind of 2 nd and 4 th predominant wind direction. Near convergence of NH53 & SH 12. Also a sensitive receptor due to its location within Paradeep town.
A5	20°19'19"N, 86°34'23"E	7.19	NW	Crosswind. In populated region of Bhutmundai village.
A6	20°21'09"N, 86°37'32"E	7.00	N	Downwind of second predominant wind direction. Near Eco sensitive zone of Bhitarkanika Wildlife Sanctuary
A7	20°17'33"N, 86°36'58"E	1.69	WNW	Crosswind. Just outside IOCL township (Sensitive receptor due to human habitation)
A8	20°19'13"N, 86°39'47"E	4.38	NE	Downwind of predominant wind direction. Near AMNSI pellet plant and IFFCO plant

3 - Description of the Environment (cont'd)

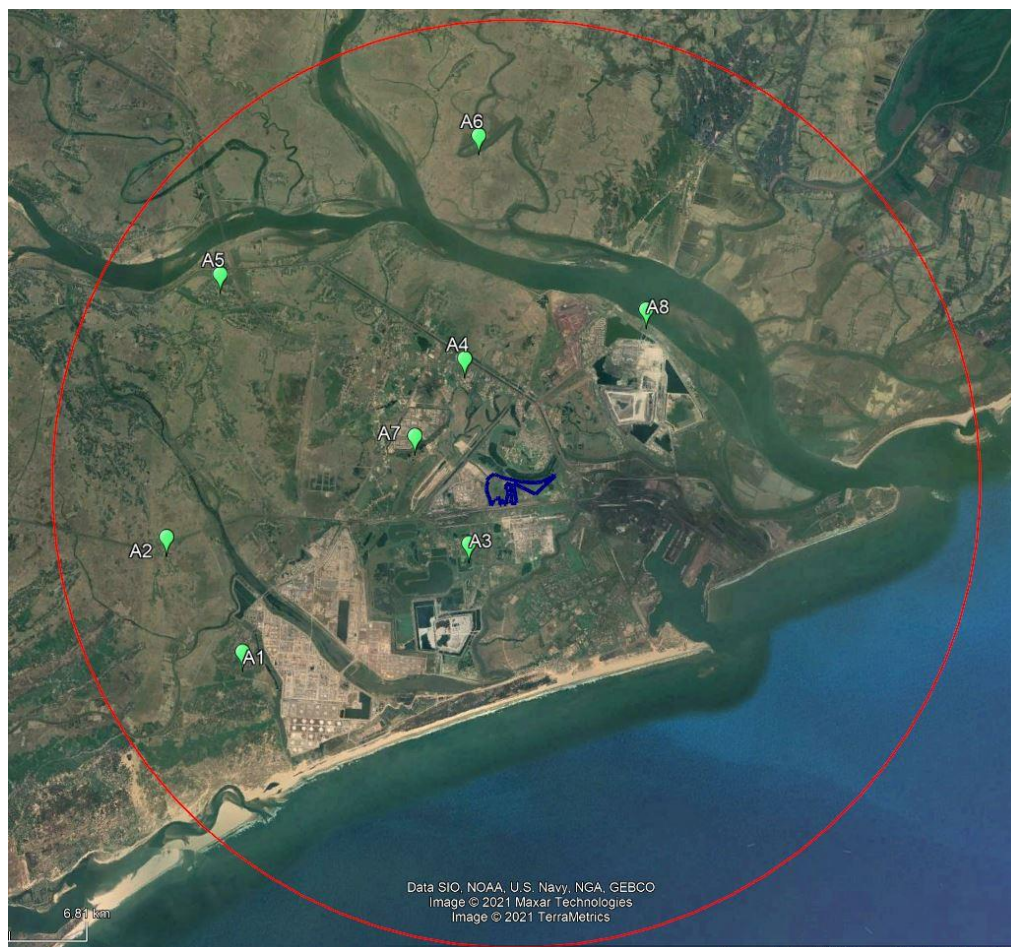


FIG. 3-11 - AAQ MONITORING LOCATIONS

Parameters Recorded: The parameters recorded during the data generation for ambient air quality are PM₁₀ (≤ 10 micron), PM_{2.5} (≤ 2.5 micron), SO₂, NO_x, CO, O₃, NH₃, C₆H₆, BaP, Pb, As, and Ni.

Ambient Air Quality as Recorded: The specific station wise recorded ambient air quality (AAQ) values for the monitoring period (March to May 2021) are presented in Table 3-8.

3 - Description of the Environment (cont'd)

TABLE 3-8 - AMBIENT AIR QUALITY IN THE STUDY AREA

Monitoring Period : Mar - May'21 (Twice a week)
 Standard : NAAQS 2009 (Refer Appendix 3-1)

[Pollutants in $\mu\text{g}/\text{m}^3$ (24 hrs), BaP, As & Ni in ng/m^3 , CO in mg/m^3]						
Stn. Code	Location	Parameter	Max	Min	Avg.	P ₉₈
A ₁	Dhenkia	PM ₁₀	120.1	68.2	89.4	118.3
		PM _{2.5}	65.8	34.5	52.2	64.4
		SO ₂	12.5	4.8	7.3	12.1
		NO ₂	36.8	12.5	25.2	36.5
		C ₆ H ₆	<0.74	<0.74	<0.74	<0.74
		NH ₃	<4.18	<4.18	<4.18	<4.18
		O ₃ (8 hours)	<10	<10	<10	<10
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	<0.36	<0.36	<0.36	<0.36
		CO (8 hours)	0.4	0.2	0.2	0.3
A ₂	Pratappur	PM ₁₀	83.5	70.1	75.5	83.0
		PM _{2.5}	42.8	30.1	35.4	42.7
		SO ₂	<4.0	<4.0	<4.0	<4.0
		NO ₂	26.2	15.0	19.2	25.6
		C ₆ H ₆	<0.74	<0.74	<0.74	<0.74
		NH ₃	<4.18	<4.18	<4.18	<4.18
		O ₃ (8 hours)	<10	<10	<10	<10
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	<0.36	<0.36	<0.36	<0.36
		CO (8 hours)	<0.1	<0.1	<0.1	<0.1
A ₃	Paradeep (near Biju Patnaik hospital)	PM ₁₀	120.6	81.2	97.5	120.5
		PM _{2.5}	71.5	46.2	55.1	69.3
		SO ₂	12.5	6.8	8.8	11.8
		NO ₂	35	23.5	27.9	33.9
		C ₆ H ₆	0.96	0.78	0.9	1.0
		NH ₃	<4.18	<4.18	<4.18	<4.18
		O ₃ (8 hours)	26.5	15	19.5	25.7
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	0.5	0.4	0.4	0.5
		CO (8 hours)	0.4	0.16	0.2	0.4
A ₄	Udayabata	PM ₁₀	126.5	73.2	95.2	124.9
		PM _{2.5}	71.5	38.5	52.9	69.7
		SO ₂	21.5	6.2	12.2	20.7
		NO ₂	35	11.8	24.2	34.0
		C ₆ H ₆	0.96	0.8	0.9	0.9
		NH ₃	<4.18	<4.18	<4.18	<4.18
		O ₃ (8 hours)	25	12.5	18.2	24.3
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	0.56	0.4	0.5	0.5
		CO (8 hours)	0.56	0.12	0.3	0.5
A ₅	Bhutmundai	PM ₁₀	91.2	61.5	77.0	88.4
		PM _{2.5}	51.6	31.8	41.0	51.4
		SO ₂	7.2	4.8	5.6	7.0
		NO ₂	28.5	16.2	23.3	28.5
		C ₆ H ₆	<0.74	<0.74	<0.74	<0.74
		NH ₃	<4.18	<4.18	<4.18	<4.18

3 - Description of the Environment (cont'd)

Stn. Code	Location	Parameter	Max	Min	Avg.	P ₉₈
		O ₃ (8 hours)	<10	<10	<10	<10
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	<0.36	<0.36	<0.36	<0.36
		CO (8 hours)	<0.1	<0.1	<0.1	<0.1
A ₆	Akhadasali	PM ₁₀	81.2	51.8	67.3	80.6
		PM _{2.5}	43.6	23.2	33.6	43.2
		SO ₂	<4.0	<4.0	<4.0	<4.0
		NO ₂	26.5	10.5	18.6	25.7
		C ₆ H ₆	<0.74	<0.74	<0.74	<0.74
		NH ₃	<4.18	<4.18	<4.18	<4.18
		O ₃ (8 hours)	<10	<10	<10	<10
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	<0.36	<0.36	<0.36	<0.36
		CO (8 hours)	<0.1	<0.1	<0.1	<0.1
A ₇	Niharunikandha	PM ₁₀	132.8	73.6	99.6	130.3
		PM _{2.5}	71.2	38.5	53.1	70.0
		SO ₂	25	6.2	13.3	24.4
		NO ₂	38.2	16.2	28.7	37.3
		C ₆ H ₆	1.1	0.8	0.9	1.1
		NH ₃	<4.18	<4.18	<4.18	<4.18
		O ₃ (8 hours)	28.5	12.5	20.1	27.5
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	0.62	0.4	0.5	0.6
		CO (8 hours)	0.68	0.16	0.4	0.6
A ₈	Musadia	PM ₁₀	120.8	61.8	86.1	118.3
		PM _{2.5}	65.1	30.5	46.2	64.9
		SO ₂	14.2	5.6	9.0	13.7
		NO ₂	36.5	15	24.1	36.3
		C ₆ H ₆	<0.74	<0.74	<0.74	<0.74
		NH ₃	<4.18	<4.18	<4.18	<4.18
		O ₃ (8 hours)	25	15	19.3	25.0
		Lead	<0.01	<0.01	<0.01	<0.01
		As	<0.01	<0.01	<0.01	<0.01
		Ni	<0.02	<0.02	<0.02	<0.02
		B(a)P	<0.36	<0.36	<0.36	<0.36
		CO (8 hours)	0.42	0.2	0.3	0.4

Notes: 1. Method of measurement - as per schedule VII of National Ambient Air Quality Standard (NAAQS of CPCB)
2. For more details, refer Section-I of Appendix- Field Report

It may be seen that the P₉₈ values of PM₁₀ and PM_{2.5} are in the range of 80.6-130.3 µg/cu m and 42.7-70.0 µg/cum respectively. The SO₂ and NO_x values are well within the permissible values for rural/industrial areas as set by NAAQS (2009). The CO and O₃ values are either below detection limit (bdl) or much below the approved values set by NAAQS. Other parameters (NH₃, Pb, C₆H₆, As, Ni, BaP) are reported to bdl in most of the monitoring sites. The elevated levels of PM in the



3 - Description of the Environment (cont'd)

Paradeep Industrial Area are mainly attributed to the volume of truck movement. This heavy vehicle movement is contributed by both industries in Paradeep area as well as outside truck movement to and from the port. During traffic monitoring it was observed that the average daily traffic to and from port was 27,499 PCU/day on the road between IFFCO Chowk and Paradeep port. In addition, the fugitive emission from other roads such as SH 12, NH 53 and village roads contributes PM in the Paradeep Industrial Area. However, the contribution from industrial emissions is quite nominal as compared to fugitive emission from truck movement. Moreover, the poor road condition in Paradeep area along with the constant heavy vehicle movement aggravates the dust levels in the area. It is also observed that a few trucks carrying material to Paradeep port area are not properly covered leading to further emission of fugitive dust. Paradeep Industrial Area is a severely polluted area (CEPI score - 60).

3.4.4 Ground Water Quality

Ground Water Quality was monitored at eight (8) different locations within the study area once every month in the monitoring period March-May 2021 as given in Table 3-9 and shown in Fig. 3-10. Summary of recorded values of the various parameters are presented in Tables 3-10 and 3-11.

TABLE 3-9 - GROUND WATER QUALITY MONITORING LLOCATIONS

Station	Location	Latitude	Longitude
GW1	Musadia Villagr (Tubewell water)	20°19'15" N	86° 39' 17" E
GW2	Rangiagadh Village (Tubewell water)	20°17'29" N	86° 38' 39" E
GW3	Paradeepgarh village (Tubewell water)	20°19'08" N	86° 36' 45" E
GW4	Sripur village (Tubewell water)	20°19'49" N	86° 28' 18" E
GW5	Udayabata village (Tubewell water)	20°18'22" N	86° 37' 23" E
GW6	Pratappur village (Tubewell water)	20°16'50" N	86° 33' 38" E
GW7	Dhenkia Village (Tubewell water)	20°14'04" N	86° 34' 03" E
GW8	Bhutmundai Village (Tubewell water)	20°19'34" N	86° 35' 12" E



3 - Description of the Environment (cont'd)

**TABLE 3-10 - CHARACTERISTICS OF GROUND WATER QUALITY
FOR GW1 TO GW4**

Parameters	GW1	GW2	GW3	GW4	IS-10500-2012
Odour	Odourless	Odourless	Odourless	Odourless	Unobjectionable
Colour (Hazen)	1.00	1.00	1.00	1.00	5
Taste	Acceptable	Acceptable	Acceptable	Acceptable	Agreeable
Temperature (°C)	21.00	20.00	20.67	20.83	-
Total Suspended Solid (mg./l)	14.00	13.03	14.97	13.65	-
Total Dissolved Solid (mg/l)	2154.00	1570.00	1653.33	1230.00	500 (max)
Electrical Conductivity	3340.33	2435.67	2545.00	1911.00	-
Turbidity (NTU)	12.33	12.97	11.83	7.43	1
pH	7.66	7.56	7.51	7.59	6.5-8.5
Total Hardness (mg/l)	518.16	505.63	558.96	510.53	200 (max)
Dissolved Oxygen (mg/l)	6.73	7.13	7.20	7.27	-
BOD at 27°C for 3 days (mg/l)	<2.0	<2.0	<2.0	<2.0	-
COD (mg/l)	<5.0	<5.0	<5.0	<5.0	-
Carbonate (mg/l)	< 1.2	< 1.2	< 1.2	< 1.2	-
Alkalinity (mg/l)	141.93	140.93	155.53	153.13	200 (max)
Total Nitrogen (mg/l)	8.21	7.30	7.58	18.17	-
Phenol (mg/l)	<0.001	<0.001	<0.001	<0.001	0.001 (max)
Nitrate + Nitrite (mg/l)	6.85	5.86	4.68	16.07	45 (max) (Nitrate)
Chloride (mg/l)	416.50	503.33	385.00	376.73	250 (max)
Fluoride (mg/l)	<0.1	<0.1	<0.1	<0.1	1.0 (max)
Sulphate (mg/l)	316.17	366.67	301.67	176.53	200 (max)
Bi Carbonate (mg/l)	173.16	171.94	189.75	238.77	-
Residual Chlorine (mg/l)	<0.04	<0.04	<0.04	<0.04	0.2 (max)
Ortho-Phosphate (mg/l)	< 0.01	< 0.01	< 0.01	< 0.01	-
Calcium (mg/l)	113.77	113.62	116.50	109.33	75 (max)
Magnesium (mg/l)	56.23	53.32	59.49	57.06	30 (max)
Potassium (mg/l)	12.38	12.46	16.66	11.63	-
Sodium (mg/l)	288.33	384.00	240.33	252.10	-
Manganese (mg/l)	0.15	0.20	0.25	0.23	0.1 (max)
Boron (mg/l)	<0.1	<0.1	<0.1	<0.1	0.5 (max)
Lead (mg/l)	<0.005	<0.005	<0.005	<0.005	0.01 (max)
Arsenic (mg/l)	<0.01	<0.01	<0.01	<0.01	0.01 (max)
Zinc (mg/l)	0.20	0.29	0.25	0.22	5.0 (max)
Iron (mg/L)	4.84	5.08	5.19	4.97	0.3 (max)
Copper (mg/l)	0.66	0.63	0.39	0.54	0.05 (max)
Chromium (VI) (mg/l)	<0.02	<0.02	<0.02	<0.02	0.05 (max)
Nickel (mg/l)	<0.01	<0.01	<0.01	<0.01	0.02 (max)
Mercury (mg/l)	<0.001	<0.001	<0.001	<0.001	0.001 (max)
Cadmium (mg/l)	<0.002	<0.002	<0.002	<0.002	0.003 (max)
Cyanide (mg/l)	<0.01	<0.01	<0.01	<0.01	0.05 (max)
Aluminium (mg/l)	<0.02	<0.02	<0.02	<0.02	0.03 (max)
Total Coliform (CFU/100 ml)	<1	<1	<1	<1	Nil
Fecal Coliform (CFU/100 ml)	<1	<1	<1	<1	Nil

Note: For more details, refer Section-II of Appendix- Field Report.



3 - Description of the Environment (cont'd)

**TABLE 3-11 - CHARACTERISTICS OF GROUND WATER QUALITY
FOR GW5 TO GW8**

Parameters	GW5	GW6	GW7	GW8	IS-10500-2012
Odour	Odourless	Odourless	Odourless	Odourless	Unobjectionable
Colour (Hazen)	1.00	1.00	1.00	1.00	5
Taste	Acceptable	Acceptable	Acceptable	Acceptable	Agreeable
Temperature (°C)	20.17	19.17	21.17	20.17	-
Total Suspended Solid (mg./l)	13.40	14.37	<10	10.80	-
Total Dissolved Solid (mg/l)	1598.00	1624.00	1665.33	1478.00	500 (max)
Electrical Conductivity	2477.33	2511.00	2583.33	2291.00	-
Turbidity (NTU)	8.77	11.03	4.00	4.87	1
pH	7.80	7.69	7.65	7.66	6.5-8.5
Total Hardness (mg/l)	524.49	509.25	596.88	605.59	200 (max)
Dissolved Oxygen (mg/l)	7.20	6.73	6.80	6.87	-
BOD at 27°C for 3 days (mg/l)	<2.0	<2.0	<2.0	<2.0	-
COD (mg/l)	<5.0	<5.0	<5.0	<5.0	-
Carbonate (mg/l)	< 1.2	< 1.2	< 1.2	< 1.2	-
Alkalinity (mg/l)	180.07	141.67	140.80	155.33	200 (max)
Total Nitrogen (mg/l)	6.30	6.38	10.08	7.54	-
Phenol (mg/l)	<0.001	<0.001	<0.001	<0.001	0.001 (max)
Nitrate + Nitrite (mg/l)	4.64	4.26	7.61	4.99	45 (max) (Nitrate)
Chloride (mg/l)	369.31	288.99	414.83	354.96	250 (max)
Fluoride (mg/l)	<0.1	<0.1	<0.1	<0.1	1.0 (max)
Sulphate (mg/l)	339.50	135.00	331.67	331.23	200 (max)
Bi Carbonate (mg/l)	219.68	172.83	171.78	189.51	-
Residual Chlorine (mg/l)	<0.04	<0.04	<0.04	<0.04	0.2 (max)
Ortho-Phosphate (mg/l)	< 0.01	< 0.01	< 0.01	< 0.01	-
Calcium (mg/l)	120.92	110.51	127.84	125.70	75 (max)
Magnesium (mg/l)	53.47	56.23	66.70	70.07	30 (max)
Potassium (mg/l)	14.56	14.80	15.18	12.91	-
Sodium (mg/l)	277.89	418.79	257.33	220.33	-
Manganese (mg/l)	0.28	0.21	0.18	0.13	0.1 (max)
Boron (mg/l)	<0.1	<0.1	<0.1	<0.1	0.5 (max)
Lead (mg/l)	<0.005	<0.005	<0.005	<0.005	0.01 (max)
Arsenic (mg/l)	<0.01	<0.01	<0.01	<0.01	0.01 (max)
Zinc (mg/l)	0.11	0.17	0.36	0.22	5.0 (max)
Iron (mg/L)	5.23	5.08	1.71	3.92	0.3 (max)
Copper (mg/l)	0.45	0.34	0.35	0.26	0.05 (max)
Chromium (VI) (mg/l)	<0.02	<0.02	<0.02	<0.02	0.05 (max)
Nickel (mg/l)	<0.01	<0.01	<0.01	<0.01	0.02 (max)
Mercury (mg/l)	<0.001	<0.001	<0.001	<0.001	0.001 (max)
Cadmium (mg/l)	<0.002	<0.002	<0.002	<0.002	0.003 (max)
Cyanide (mg/l)	<0.01	<0.01	<0.01	<0.01	0.05 (max)
Aluminium (mg/l)	<0.02	<0.02	<0.02	<0.02	0.03 (max)
Total Coliform (CFU/100 ml)	<1	<1	<1	<1	Nil
Fecal Coliform (CFU/100 ml)	<1	<1	<1	<1	Nil

Note: For more details, refer Section-II of Appendix- Field Report.



3 - Description of the Environment (cont'd)

The total hardness (TH) and total dissolved solids (TDS) content in ground water are found to be in the range 505.63-605.59 mg/l and 1230-2154 mg/l respectively at the selected locations as against the allowable standards of 200 mg/l for TH and 500 mg/l for TDS. The highest TH was recorded at Bhutmundai village and highest TDS was recorded at Musadia village. These high values indicate that the upper stratum of the ground water is saline due to coastal influence which is corroborated by high chloride level. Iron content lies within the range of 1.71-5.23 mg/l (highest value was reported at GW1 - Musadia village). Chromium, lead, arsenic, mercury, and other heavy metals are reported to below detection limit (bdl).

The upper stratum of ground water is saline in nature due to coastal influence. This water infiltrates into the deeper aquifer thereby increasing the TDS, hardness, and salinity in ground water. This is also corroborated by higher chloride and sodium content of ground water. It may be seen from the tables that ground water of the study area is suitable for human consumption except at Musadia village where the TDS level was found to be more than the permissible limit (2000 mg/l) of drinking water standards. The hardness is also found to be high at all locations in general. Therefore, treatment of the groundwater by softening is advisable before use, wherever possible.

3.4.5 Surface Water Quality

Surface Water Quality was monitored at eight (8) different locations within the study area once every month in the monitoring period March - May 2021 as given in Table 3-12. Summary of recorded values of the various parameters are presented in Tables 3-13 and 3-14.



3 - Description of the Environment (cont'd)

TABLE 3-12 - SURFACE WATER QUALITY MONITORING LOCATIONS

Station	Location	Latitude	Longitude
SW1	River Mahanadi (Near Musadia Village)	20°19'33" N	86° 38' 51" E
SW3	River Mahanadi (Near Baladia Village)	20°20'16" N	86° 33' 22" E
SW3	River Mahanadi (Near Baladia Village)	20°20'16" N	86° 33' 22" E
SW4	River Mahanadi (Near Sripur Village)	20°19'59" N	86° 28' 58" E
SW5	River Mahanadi (Near Uchabanandpur village)	20°19'17" N	86° 33' 21" E
SW6	Lake near Paradeep port	20°17'26" N	86° 38' 43" E
SW7	Reservoir	20°17'26" N	86° 38' 43" E
SW8	Pond in Rangaiagadh village	20°17'70" N	86° 36' 44" E

TABLE 3-13 - CHARACTERISTICS OF SURFACE WATER QUALITY FOR SW1 TO SW4

Parameters	SW1	SW2	SW3	SW4
Odour	Odourless	Odourless	Odourless	Odourless
Temperature (°C)	24.83	23.33	25.00	20.67
pH	7.57	7.91	7.63	7.18
Total Suspended Solid (mg./l)	14.00	15.00	13.67	14.00
Total Dissolved Solid (mg./l)	14496.67	41333.67	14516.67	12601.67
Electrical Conductivity	22580.00	60926.67	22593.00	19586.67
Turbidity	2.20	3.07	4.53	2.57
Total Hardness (mg/l)	1627.33	6351.13	1528.07	1573.67
Dissolved Oxygen (mg/l)	5.47	5.20	6.00	6.13
BOD , 3 days at 27°C (mg./l)	8.67	9.33	6.67	8.00
COD (mg./l)	38.02	47.84	20.63	31.73
Oil & Grease (mg./l)	<1.0	<1.0	<1.0	<1.0
Salinity (ppt.)	Nil	Nil	Nil	Nil
Kjeldahl Nitrogen (mg/l)	4.95	6.33	9.64	8.42
NH ₃ - N (mg/l)	1.52	1.99	2.33	1.79
Nitrate + Nitrite (mg/l)	7.59	10.61	9.95	6.53
Chloride (mg/l)	4212.29	17127.37	4528.85	4397.63
Fluoride (mg/l)	0.35	0.40	0.40	0.33
Sulphates as SO ₄ (mg/l)	1560.00	1760.00	2320.00	1746.67
Alkalinity	65.73	373.73	128.87	92.07
Bi-Carbonate (mg/l)	80.20	122.16	157.22	112.32
Total P (mg/l)	0.75	95.74	1.30	1.02
Phosphate (mg/l)	0.49	0.86	0.76	0.80
Calcium (mg/l)	134.87	343.97	133.52	117.73
Magnesium (mg/l)	309.80	1318.31	286.78	307.18
Potassium (mg/l)	94.76	216.91	98.37	59.39
Sodium (mg/l)	2427.76	9410.16	2240.17	14873.20
Manganese (mg/l)	0.72	0.84	0.75	0.75
Boron (mg/l)	<0.1	<0.1	<0.1	<0.1
Lead (mg/l)	<0.005	<0.005	<0.005	<0.005
Arsenic (mg/l)	<0.01	<0.01	<0.01	<0.01
Zinc (mg/l)	0.36	0.18	0.18	0.16
Iron (mg/l)	1.47	3.60	1.49	1.70
Chromium (Total) (mg/l)	<0.02	<0.02	<0.02	<0.02
Hexavalent Chromium (mg/l)	<0.1	<0.1	<0.1	<0.1
Nickel (mg/l)	<0.01	<0.01	<0.01	<0.01
Mercury (mg/l)	<0.001	<0.001	<0.001	<0.001
Cadmium (mg/l)	<0.002	<0.002	<0.002	<0.002
Total Coliform / 100 ml.	2366.00	1500.00	1633.00	1633.00
Fecal Coliform /100 ml.	626.00	763.00	866.00	753.00

Note: For more details, refer Section-III of Appendix- Field Report

3 - Description of the Environment (cont'd)

TABLE 3-14 - CHARACTERISTICS OF SURFACE WATER QUALITY FOR SW5 TO SW8

Parameters	SW5	SW6	SW7	SW8
Odour	Odourless	Odourless	Odourless	Odourless
Temperature (°C)	20.33	20.00	20.17	20.00
pH	7.51	7.77	7.66	7.57
Total Suspended Solid (mg./l)	13.67	11.67	15.00	17.33
Total Dissolved Solid (mg./l)	13752.67	12410.00	9103.33	12703.33
Electrical Conductivity	21493.33	19363.33	14346.67	20270.00
Turbidity	3.20	2.60	2.70	3.20
Total Hardness (mg/l)	1669.37	1624.03	1284.37	1722.97
Dissolved Oxygen (mg/l)	5.67	6.73	6.80	5.27
BOD , 3 days at 27°C (mg./l)	11.67	5.33	6.67	20.67
COD (mg./l)	52.24	30.33	20.81	67.12
Oil & Grease (mg./l)	<1.0	<1.0	<1.0	<1.0
Salinity (ppt.)	Nil	Nil	Nil	Nil
Kjeldahl Nitrogen (mg/l)	12.27	5.33	3.87	10.08
NH ₃ - N (mg/l)	3.83	1.53	1.85	3.23
Nitrate + Nitrite (mg/l)	5.00	4.51	3.16	2.96
Chloride (mg/l)	4688.86	3931.05	3784.88	3997.54
Fluoride (mg/l)	0.82	0.35	0.32	0.37
Sulphates as SO ₄ (mg/l)	1546.67	1306.67	1313.33	1413.33
Alkalinity	129.27	103.07	70.47	89.07
Bi-Carbonate (mg/l)	157.70	125.74	85.97	108.66
Total P (mg/l)	1.21	0.96	6.91	1.32
Phosphate (mg/l)	0.79	0.47	2.88	0.55
Calcium (mg/l)	140.15	115.03	97.90	124.36
Magnesium (mg/l)	316.83	320.89	249.63	339.05
Potassium (mg/l)	75.29	75.79	55.17	108.01
Sodium (mg/l)	2495.45	1987.46	1830.42	2816.08
Manganese (mg/l)	0.70	0.72	0.83	1.18
Boron (mg/l)	<0.1	<0.1	<0.1	<0.1
Lead (mg/l)	<0.005	<0.005	<0.005	<0.005
Arsenic (mg/l)	<0.01	<0.01	<0.01	<0.01
Zinc (mg/l)	0.30	0.30	0.15	0.24
Iron (mg/l)	2.31	1.75	0.90	1.87
Chromium (Total) (mg/l)	<0.02	<0.02	<0.02	<0.02
Hexavalent Chromium (mg/l)	<0.1	<0.1	<0.1	<0.1
Nickel (mg/l)	<0.01	<0.01	<0.01	<0.01
Mercury (mg/l)	<0.001	<0.001	<0.001	<0.001
Cadmium (mg/l)	<0.002	<0.002	<0.002	<0.002
Total Coliform / 100 ml.	1533.00	1500.00	1366.00	1400.00
Fecal Coliform /100 ml.	783.00	830.00	593.00	573.00

Note: For more details, refer Section-III of Appendix- Field Report.



3 - Description of the Environment (cont'd)

The average DO level for all surface streams ranges between 5.2-6.8 mg/l. The lowest DO value is reported for Mahanadi river near the sea confluence. Total dissolved solids (TDS) ranges from 9103.33 - 41333.67 mg/l. The highest TDS was reported at Mahanadi river near sea confluence. Total coliform count ranges from 1366 in the Reservoir to 2366 CFU/100 ml at Mahanadi river near Musadia village. Presence of fecal coliform signifies that the water is not fit for human consumption without disinfection. As per CPCB Designated Best Use, the surface streams of the study area would fall under Class E (Irrigation, Industrial Cooling, Controlled Waste disposal).

3.5 SOIL QUALITY

In order to ascertain the baseline status of the soil environment, field study was carried out in the month of May, 2021. The locations were selected with the objective to cover the different land use patterns in study area to get a proper understanding of the soil characteristics. The formation of land of the study area is subject to gradual accretion and recession of river Mahanadi and soil erosion or deposit of sand due to high tide and ebb of the Bay of Bengal. The soil of the land is mostly alluvial and sandy because of continuous siltation through the Mahanadi river system and tide in the Bay of Bengal.

3.1.2 Objective

It is necessary to conform that there is no change in the soil characteristics and cropping pattern from the prevalent status in the close vicinity of the plant. Therefore, it is objective to determine the soil quality in the study area & identify the impact which may arise due to the project activities on the soil along with formulating a mitigation measures. The information on soil has been collected from various secondary sources together with primary soil sampling & analysis.



3 - Description of the Environment (cont'd)

3.2.3 Nature and Types of Soil and Soil Fertility

Jagatsinghpur district belongs to the east and south eastern coastal plains with a hot and humid climate. The soil of Jagatsinghpur district is categorized into three types i.e. laterite, alluvial and saline. Texture of soil of the district is mostly loamy, sandy, sandy loamy and clay-loamy.

Sandy and Sandy loamy Soil: This type of soil is mainly noticed in the South of the Jagatsinghpur blocks and North of the Kujanga blocks i.e. specifically in the side of the river Devi and Mahanadi and also in the Kujanga, Erasama blocks towards the Bay of Bengal that includes major part of the study area.

Loamy and Clay loamy soil: This category of soil is found in rest part of this district. This soil is quite fertile and suitable for most of the crops. (Source: Jagatsinghpur District Gazetteers, 10.05.2018, Govt. of Odisha).

Locations for Soil Sampling and Monitoring: Representative soil samples were collected from three locations comprising i) Project site, ii) Forest lands and iii) Prime agricultural lands within the study area. Standard procedures (IS-2720) were followed for the sampling and analysis of physico-chemical parameters. Detailed of soil sampling locations are given in Table-3-15 and depicted in Soil monitoring location map Fig. 3-12.

3 - Description of the Environment (cont'd)



FIG. 3-12 - MONITORING LOCATION MAP FOR SOIL QUALITY

TABLE 3-15 - LOCATION FOR SOIL SAMPLING

Code	Location	Direction	Latitude	Longitude
Project Site				
S1	Near Atharabanki Railway Colony	Adjacent	21°17'06"N	86°38'18"E
Forest Lands				
S2	Forest Soil at Musadia Jungle	NE	20°19'26"N	86°39'21"E
Prime Agricultural Lands				
S3	Pratappur Village	NW	21°16'54"N	86°33'41"E
S4	Bhutmundai Village	SW	21°19'30"N	86°33'19"E
S5	Ramanagar Village	N	21°22'07"N	86°40'15"E

3.5.1 Baseline Soil Quality and Characteristics

Table 3-16 represents the typical characteristics of the soil quality as sampled in the month of May, 2021. The result of soil analysis shows that soil is slightly reddish to greyish in colour and has a sandy



3 - Description of the Environment (cont'd)

loam texture. It is observed that the soil samples have a higher percentage of sand particles than silt and clay particles, which corroborates with the more than moderate level of porosity in the range of 38.0 - 46%. Hence, soil has a moderate to low water-holding capacity. The soil sample analysis reveals that the soil is slightly alkaline in nature with pH value ranging from 7.2 to 7.52. Availability of more than sufficient nutrients in agricultural lands, having nitrogen in the range of 985 mg/kg to 1480 mg/kg, phosphate in the range of 680 mg/kg to 850 mg/kg & potassium in the range of 1250 mg/kg to 1520 mg/kg, promotes suitable agricultural growth which is corroborated with the total organic carbon present in the soil in the range of 6.2 gm/kg to 7.5 gm/kg and sufficient microbial population in the range of 6.9×10^4 to 7.2×10^4 CFU/ gm. The results of SAR value in the range of 5.68 to 6.32 indicate moderate level of sodium present in soil of the study area indicates no potential of sodium hazards in soil which is helpful for cultivation which is corroborated with the Cation Exchange Capacity of agricultural soil in the range of 21.03 meq/100gm to 26.80 meq/100 gm and electrical conductivity observed in the range of 1.3- 1.8 ds/m. The Soil is rich in iron content, varies from 2,150 mg/kg to 2,595 mg/kg. The concentrations of heavy metals like lead, chromium are reported to be <3.0 mg/kg and <0.20 mg/kg respectively, which indicate very lower concentration.

The physical characteristics like Sand percentage (%), Hydraulic conductivity (cm/sec), Bulk Density (gm/cc) and Infiltration rate (cm/hrs) is higher at Forest Soil at Mausadia Jungle and Project Site Soil near Atharabenki Railway Colony than Agricultural Soil. Whereas the chemical characteristics like available nitrogen (mg/kg), phosphate (mg/kg), potassium (mg/kg), organic carbon (gm/kg) is lower at Forest Soil at Mausadia Jungle and Project Site Soil near Atharabenki Railway Colony than Agricultural Soil. Hence, Agricultural soils in the study area are more fertile than forest soil and soil at project site.

3 - Description of the Environment (cont'd)

TABLE 3-16 - TYPICAL SOIL CHARACTERISTICS IN THE STUDY AREA

Monitoring Period : May, 2021
 Frequency : Once in a monitoring period

Key Parameters	Project Site Near Atharabenki Railway Colony (S1)	Forest Soil at Musadia Jungle (S2)	Agricultural land Near Pratappur Village (S3)	Agricultural land near Bhutmundai Village (S4)	Agricultural land near Ramanagar Village (S5)
Colour	Slightly reddish	Slightly reddish	Greyish	Greyish	Greyish
Soil Texture	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam
Sand (%)	70	75	65	60	65
Silt (%)	15	15	20	25	20
Clay (%)	15	10	15	15	15
Electrical Conductivity (dS/m)	1.5	1.6	1.3	1.5	1.8
Hydraulic conductivity (cm/sec)	2.9x10 ⁻²	2.6x10 ⁻²	1.4x10 ⁻³	2.2x10 ⁻³	2.4x10 ⁻²
Bulk Density (gm/cm ³)	1.52	1.5	1.42	1.42	1.38
Moisture (%)	18	16	24	23	25
Porosity (%)	42	38	46	42	40
Infiltration rate (cm/hr)	2.5	2.3	1.4	1.3	1.5
pH (1:2)	7.2	7.32	7.52	7.3	7.23
Alkalinity/Acidity	Very slightly alkaline	Very slightly alkaline	Slightly alkaline	Very slightly basic	Very slightly basic
Cation Exchange Capacity (meq/100g)	24.59	19.18	23.83	26.8	21.03
Available N ₂ (mg/kg)	720	820	1480	1080	985
Available P ₂ O ₅ (mg/kg)	650	750	850	680	720
Available K ₂ O (mg/kg)	985	920	1520	1450	1250
Chloride (mg/kg)	1820	850	920	850	980
Sulphate (mg/kg)	1250	1120	820	1285	925
Sodium absorption ratio (SAR)	5.11	6.32	5.68	6.12	6.32
Available Organic Carbon (gm/kg)	4.8	6.5	7.2	7.5	6.2
Calcium (mg/kg)	1480	980	1158	1365	1185
Magnesium (mg/kg)	1620	1250	1685	1850	1320
Iron (mg/kg)	2380	3850	2150	2595	2385
Copper (mg/kg)	2.5	1.8	2.1	1.23	1.2
Lead (mg/kg)	<3.0	<3.0	<3.0	<3.0	<3.0
Chromium (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
Microbial Population (No./gm)	3.4x10 ⁴	5.6x10 ⁴	7.2x10 ⁴	6.9x10 ⁴	7.2x10 ⁴

Note: For more details, see Section-V of Appendix- Field Report

3 - Description of the Environment (cont'd)

3.6 NOISE

The ambient noise levels Leq for one (1) hour interval was recorded at eight (8) different locations as shown in Fig. 3-13. In the commercial area of Biju Patnaik market Complex and Maduban market Complex, noise levels were recorded as 65.67 dB (A) & 63.74 dB (A) during daytime and 64.65 dB (A) & 59.64 dB (A) during night time during April 2021 against the regulatory standard of 65 dB(A) and 55 dB(A) respectively. In the industrial areas around I.O.C.L gate and IFFCO plant, noise levels were recorded as 67.87 dB (A) & 66.78 dB (A) during daytime and 65.43 dB (A) & 64.13 dB (A) during night as against the Regulatory standard of 75 dB (A) and 70 B (A) respectively. The daytime & nighttime Leq for Biju Patnaik Memorial hospital (Silence Zone) was recorded to be 64.44 dB (A) and 60.44 dB(A) respectively against regulatory norm of 50 dB (A) and 40 dB (A) respectively. The elevated noise levels are because of traffic in front of the hospital.



FIG. 3-13 - AMBIENT NOISE LEVEL MONITORING LOCATIONS



3 - Description of the Environment (cont'd)

The noise levels recorded in the study area are presented in Table 3-17.

TABLE 3-17 - RECORDED NOISE LEVEL IN THE STUDY AREA

Station	Location	Day Time Leq (dbA)	Night Time Leq (dbA)
N1	I.O.C.L Gate	67.87	65.43
N2	Near IFFCO Plant	66.78	64.13
N3	Siju Village	60.67	57.33
N4	IOCL Township	65.65	63.15
N5	Biju Patnaik Mkt Complex	65.67	64.65
N6	Maduban Mkt Complex	63.74	59.64
N7	Bethany Convent School	63.26	60.52
N8	Biju Patnaik Mem Hospital	64.44	60.44

Note: i) Day time: 6 AM to 10 PM; Night time: 10 PM to 6 AM
 ii) National Ambient Standard for Noise (CPCB) - Refer Appendix 3-1
 iii) For more details, please refer Section-V of Appendix- Field Report

3.7 TRAFFIC STUDY

Traffic survey was conducted at Adani Gate and Athar Banki on NH-53 for 4 days (from 29.07.2021 to 02.08.2021). 4-Day (24 hrs) continuous volume counts were undertaken to obtain a realistic picture of the current volume and composition of the traffic. The analysis of traffic counts provided an estimate of the Average Daily Traffic (ADT) and the analysis has been carried out in terms of total number of vehicles as well as in respect to Passenger Car Unit (PCU). Location wise results of traffic analysis are done.

At Adani Gate

Total ADT at this survey location were recorded as 8024 in terms of number and 10460 in terms of PCU. Fast moving vehicles were recorded as 71.32% of the total traffic (in No.). Summary of classified traffic volume count survey results is shown in Table 3-18. Peak hour traffic flow summary is present in Table 3-19. The directional distribution for all vehicles observed is 51% flow towards up direction and 49% towards down direction.



3 - Description of the Environment (cont'd)

TABLE 3-18 - SUMMARY OF CLASSIFIED VOLUME COUNT SURVEY AT SURVEY LOCATION

Sl. No.	Location	ADT (No.)	ADT (PCU)	Directional Distribution (%)	
				UP	DN
1	Adani Gate	8024	10460	51%	49%

*UP: Adani Gate to NH-53 & Down: NH-53 to Adani Gate

TABLE 3-19 - SUMMARY OF PEAK HOUR TRAFFIC FLOW AT SURVEY LOCATION

Sl. No.	Day	Peak Traffic (No.)	Peak Traffic (Hour)
1	Day -1	597	12:00 - 13:00
2	Day -2	643	12:00 - 13:00
3	Day -3	531	13:00 - 14:00
4	Day -4	561	08:00 - 9:00

*UP: Adani Gate to NH-53 & Down: NH-53 to Adani Gate

At Athar Banki

Total ADT at this survey location were recorded as 30529 in terms of number and 27499 in terms of PCU. Fast moving vehicles were recorded as 82.26% of the total traffic (in No.). Summary of classified traffic volume count survey results is shown in Table 3-20. Peak hour traffic flow summary is present in Table 3-21. The directional distribution for all vehicles observed is 55% flow towards up direction and 45% towards down direction.

TABLE 3-20 - SUMMARY OF CLASSIFIED VOLUME COUNT SURVEY AT SURVEY LOCATION

Sl. No.	Location	ADT (No.)	ADT (PCU)	Directional Distribution (%)	
				UP	DN
1	Athar Banki	30529	27499	55%	45%

*UP: IFFCO Chowk to Paradeep Port & Down: Paradeep Port to IFFCO Chowk



3 - Description of the Environment (cont'd)

TABLE 3-21 - SUMMARY OF PEAK HOUR TRAFFIC FLOW AT SURVEY LOCATION

Sl. No.	Day	Peak Traffic (No.)	Peak Traffic (Hour)
1	Day -1	2348	10:00 - 11:00
2	Day -2	2584	13:00 - 14:00
3	Day -3	2252	13:00 - 14:00
4	Day -4	2347	13:00 - 14:00

*UP: IFFCO Chowk to Paradeep Port & Down: Paradeep Port to IFFCO Chowk

3.8 BIOLOGICAL ENVIRONMENT

In order to ascertain the baseline status of the biological environment comprising terrestrial and aquatic ecology, field study were carried out during May, 2021. During the field survey qualitative and quantitative data on flora and fauna was collected from important terrestrial and aquatic ecological habitats in the study area, as well as relevant secondary data was also collected from the respective forest range office “Kujang Range” of Mangrove Forest Division (Wildlife), Rajnagar and records in the Jagatsinghpur District Gazetteers, 10.05.2018, Govt. of Odisha. During field visit information also gathered through interaction with the local residents of the study area. Following paragraphs provide review of the published data and the results of field survey as a brief description of ecological status of the study area.

3.8.1 Objective

The ecological survey was carried out with the following objectives in terrestrial and aquatic habitats of the study area:

- i) To assess the nature and distribution of flora and fauna in the important habitats available in the study area.
- ii) To assess the species diversity in vegetation community and planktonic population in the study area.



3 - Description of the Environment (cont'd)

- iii) To ascertain their economic importance, degree of protection schedule provided by the Indian Wildlife Protection Act 1972 & its subsequent amendments and conservation status in IUCN Red List (Version 2021-1).
- iv) To ascertain the presence of protected areas, migratory routes of fauna, presence of breeding grounds and sensitive habitats in the study area, if any.
- v) To review the information from secondary sources and discuss the issues of concern with the relevant authority, if any.
- vi) Impact prediction based on primary and secondary data sources and formulates a suitable mitigation measures.
- vii) Formulating a greenbelt development plan to minimize the impact of air and noise pollution, as well as generate new habitats of flora and fauna in and around the project site.

3.8.2 Habitats Description of the Study Area

The flora and fauna of a specific area are determined by its location, climate, land form, soil and water bodies. The study area exhibits fertile cultivated alluvial plain lands formed by the deposits of its great rivers Mahanadi and its tributaries. There are strips of protected forest along the banks of Mahanadi river and coast line which acts to stabilize the coastal sand dunes areas. There are also several low-lying areas with average elevation less than 1 m that gets brackish water ecosystem as well as fresh water ecosystem. The aquatic ecosystem of the study area enriched by tidal influx from Bay of Bengal through Mahanadi river and many other streams. The study area is a part of the Coromandal Coast of Bay of Bengal that represents marine coastline ecosystem.



3 - Description of the Environment (cont'd)

3.8.3 Climatic Factor for Vegetation

The principal direct effects of climate on plants are rain fall, soil moisture, humidity, temperature (including soil temperature), sunlight and wind. Thus the growth of vegetation is dependent on climate. The climate of the study area is characterized by high humidity, nearly all round the year, oppressive summer and good seasonal rainfall. The study area is prone to cyclonic rainfalls during the monsoons. The annual average rainfall at Paradeep area is around 1608 mm. The highest maximum temperature ever recorded at Paradip Port was 41.4°C on 27 May 1974 and the lowest minimum temperature ever recorded was 9.6°C on 12 January 1978. During the cold/winter days fog occurs occasionally. The climatic condition and alluvial soil of the study area favours growth of Betel (*Piper betle*), Cashew nut (*Anacardium occidentale*), Casuarina (*Casuarina equisetifolia*) and Palm trees. The swamp area exhibits wild growth of reeds, mangroves and macrophytes.

3.8.4 Locations for Biological Sampling and Monitoring

The selection of terrestrial and aquatic ecological sampling and monitoring location was based on land use pattern, topography, eco sensitivity of the habitats, close proximity, upwind & downwind direction of the proposed project site. The terrestrial ecological survey was carried out in Protected Forest (PF) area and non-forest area (roadsides, urban & semi-urban homestead lands) and aquatic ecological survey was carried out at rivers, ponds and canal within the study area. The list of sampling locations selected for biological environmental study is given in Table 3-22 and depicted in Monitoring Location Map Fig. 3-12.



3 - Description of the Environment (cont'd)

TABLE 3-22 - SAMPLING LOCATIONS FOR BIOLOGICAL ENVIRONMENTAL STUDY

Location Code	Name of Location with Latitude & Longitude	Direction	Distance in km
TERRESTRIAL ECOLOGY			
TE1	Protected Forest near Musadia Village Latitude: 20°19'24"N, Longitude: 86°39'24"E	NE	4.5
TE2	Protected Forest near Udaychandrapur Village Latitude: 21°13'56"N, Longitude: 86°34'36"E	SW	9.0
TE3	Jogidhankud Protected Forest Latitude: 21°19'20"N, Longitude: 85°41'14"E	NE	6.5
TE4	Saralikud Protected Forest Latitude: 21°18'49"N, Longitude: 86°43'35"E	NE	7.5
TE5	Sanatubi Protected Forest Latitude: 21°21'06"N, Longitude: 85°42'33"E	NE	9.8
TE6	Open Jungle near Paradeep Port Latitude: 20°17'02"N, Longitude: 86°41'58"E	E	3.5
TE7	Open Jungle near Bhakud Village Latitude: 20°20'15"N, Longitude: 86°39'19"E	N	6.0
TE8	Mangrove Swamp near Paradeep Port Latitude: 20°17'08"N, Longitude: 85°40'59"E	E	5.0
AQUATIC ECOLOGY			
AE1	Mahanadi River near Musadia Village Latitude: 20°19'33"N, Longitude: 86°38'51"E	NE	5.5
AE2	Mahanadi River near Sea Confluence Latitude: 20°17'35"N, Longitude: 86°43'02"E	E	5.3
AE3	Mahanadi River near Baladia Village Latitude: 20°20'16"N, Longitude: 86°33'22"E	NE	5.6
AE4	Haldipani Nadi near Zhimani Village Latitude: 20°17'08"N, Longitude: 86°34'08"E	W	6.5
AE5	Mahanadi River near Uchabanandpur Village Latitude: 20°19'17"N, Longitude: 86°33'21"E	NE	9.5
AE6	Atharbanki Nadi near Jayan Mandap Latitude: 20°16'07"N, Longitude: 86°38'24"E	SE	2.0
AE7	Reservoir near Project Site Latitude: 20°17'26"N, Longitude: 86°38'43"E	N	0.2
AE8	Taldhanda Canal near Bhutmundia village Latitude: 20°17'26"N, Longitude: 86°38'43"E	NW	8.5



3 - Description of the Environment (cont'd)

3.9 METHODOLOGY ADOPTED FOR ECOLOGICAL SURVEY

3.9.1 Literature Survey

The literature survey were carried out on flora fauna of the study area referring published records in website and records in List of Flora and Fauna in “Kujang Range Office” of Mangrove Forest Division (Wildlife), Rajnagar; published records in Jagatsinghpur District Gazetteers, 10.05.2018, Govt. of Odisha; List of flora in published in Fascicles of flora of India by Botanical survey of India (<https://bsi.gov.in/page/en/fascicles-of-flora-of-india> and List of Fauna of Mahanadi Estuary, Orissa published by Zoological Survey of India Calcutta. (<http://faunaofindia.nic.in/PDFVolumes/ess/003/index.pd>. Fauna of Orissa. Part-3. State Fauna Series-1. Zoological Survey of India.1991, <https://zsi.gov.in/App/regcenters.aspx?reg=544&link=538>.

3.9.2 Field survey for Terrestrial Ecology

The quadrature method involves laying down square sample plots for quantitative analysis of vegetation and listing of observed vegetations randomly for qualitative estimation of floral inventory. Quadrature size of 10 m x 10 m was taken for estimation of diversity index, evenness index and richness at selected locations for trees species. The trees, shrubs, herbs and climbers were enumerated in the forest area as well as non forest area. The medicinal plants, horticultural crops and agricultural crops grown in the study area were also listed.

The methodology adopted for faunal survey involved faunal habitat assessment, opportunistic observation, diurnal bird observation, identification of call of birds, active search for reptiles and amphibians, observations of feathers, scats, foot prints and excreta etc. During survey line transects and patches were laid at the selected monitoring stations and birds, butterflies, mammals, reptiles and amphibians were identified, counted and noted. The identification was made by using standard field guides.



3 - Description of the Environment (cont'd)

3.9.3 Field survey for Aquatic Ecology

Observations were made for listing of macrophytes including free floating, submerged, rooted emergent, rooted marshy and riparian vegetations. The planktonic samples and sediment samples were collected from surface water bodies considering up stream & downstream for estimation of planktonic population & species diversity index. Observations were made for listing of semi aquatic birds, fishes, amphibians, mollusks and insects. The semi aquatic birds were identified with the help of 10 x 50 Nikon binocular.

3.9.4 Collection of Secondary Data

During the field survey relevant information on floral & faunal recorded during interaction with the local residents of the study area and forest officials of the respective forest area. The record of information on flora and fauna was also collected from the Office of the Mangrove Forest Division (Wildlife), Rajnagar", Govt. of Odisha.

3.10 TERRESTRIAL ECOLOGICAL STATUS (TES)

3.10.1 Present Status of Natural Vegetation

Natural vegetation represents climatic condition and habitat characteristic of wild animals prevailing in study area. Since natural vegetation of mangrove and semi mangrove plant species are abundant at mangrove swamps/protected forest near Paradip Port at mouth of the Mahanadi River and its opposite side, included in the study area. According to Champion and Seth classification, the forest land in the study area can be considered as Beach Forest type under the sub division Littoral and Swamp Forests of Tropical Moist Forests as shown in Table 3-23. Vegetations in the forest area primarily comprising of Casuarina (*Casuarina equisetifolia*), Cashew (*Anacardium occidentale*), Akashmoni (*Acacia moniliformis*) and Nilgari (*Eucalyptus citriodora*) are semi evergreen trees, planted to stabilize the sand ridges. As mono

3 - Description of the Environment (cont'd)

cultural practices were followed by planted the species of Casuarina, Nilgari and Akashmoni, hence, individual species were found as dominant tree in different tracts of these forest lands.

TABLE 3-23 - PROTECTED FOREST/MANGROVE SWAMPS WITHIN 10 KM RADIUS OF PROJECT SITE

S1. No.	Name of Forest	Type of vegetations recognized	Direction	Distance km
1.	P.F. near Musadia	OMJ mainly Casuarina	NE	4.5
2.	P.F near Udaychandrapur	OS mainly Casuarina	SW	9.0
3.	Jogidhankud P.F	OS mainly Casuarina	NE	6.5
4.	Saralikud P.F			7.5
5.	Sonatubi P.F			9.5
6.	OMJ near Udayabata	OMJ mainly Casuarina	S	5.5
7.	OJ near Bahakud	OJ mainly Cashew	N	6.0
8.	Dense Scrub near Paradip Port	OS mainly Casuarina	E	3.5
9.	Mangrove near Paradip Port	Mangrove Swamp	E	5.0

Note: R.F= Reserve Forest, P.F= Protected Forest, OMJ= Open Mixed Jungle, OJ= Open Jungle, OS= Open Scrub

3.10.2 Vegetation in Forest Area and Mangrove Swamps

True Mangrove: The natural vegetation in mangrove swamps comprises of true mangrove species like *Avicennia officinales*, *Avicennia alba*, *Avicennia marina*, *Bruguiera cylindrica*, *Ceriops decandra*, *Phoenix paludosa*, *Rhizophora mucronate*, which are more abundant on the banks of Mahanadi River mouth near Paradip Port and its opposite banks.

Mangrove Associates: The mangrove associates flora found in muddy swamps coastal area includes *Acanthus ilicifolius*, *Acanthus volubilis*, *Clerodendrum inerme*, *Delbergia spinosa*, *Ipomea tuba* which are very common species.

Back Mangrove: The back mangrove flora found in mangrove swamps in coastal area includes *Allophylus serratus*, *Azima tetracantha*, *Caesalpinia bonduc*, *Caesalpinia crista*, *Cyperus arenarius* which are very common species.

3 - Description of the Environment (cont'd)

Beach flora: The beach flora found in coastal area includes *Canavalia maritima*, *Cyperus arenarius*, *Ipomoea pes-caprae*, *Hydrophylax maritima* which are very common species.

The other true mangroves, mangrove associates, back mangrove and beach flora available in the mangrove swamps of the study area are listed in Appendix 3-2 & 3-2A and Exhibit 3-2 represents Casuarina plantation and Mangrove vegetation collected during field survey.



EXHIBIT 3-2 - CASUARINA PLANTATION AND MANGROVE VEGETATION

The vegetation in the Protected Forest (PF) area are raised through plantation by Forest Department, Government of Odisha to stabilize the coastal area mainly consist of Casuarina (*Casuarina equisetifolia*) and other associates like, Arjun (*Terminalia arjuna*), Babul (*Acacia arabica*), Cashew nut (*Anacardium occidentale*), Cassod (*Cassia siamea*), Indian tulip (*Thespesia populnea*), Jamun (*Syzygium cumini*), Kath badam (*Terminalia catappa*), Karanja (*Derris indica*), Neem (*Azadirachta indica*), Radhachura (*Peltophorum pterocarpum*), Sisoo (*Dalbergia sissoo*) and Teak (*Tectona grandis*). Among the tree species Cashew nut (*Anacardium occidentale*) and Casuarina (*Casuarina equisetifolia*) is widely dominated tree in the forest area.



3 - Description of the Environment (cont'd)

3.10.3 Vegetation in Non-Forest Area

Trees in the non-forest area including plantation at road sides, home stead lands and orchards are mixed tropical deciduous and semi evergreen in nature.

The most common species are Akashmoni (*Acacia moniliformis*), Banyan (*Ficus benghalensis*), Cassia (*Cassia siamea*), Jamun (*Syzygium cumini*), Mango (*Mangifera indica*), Neem (*Azadirachta indica*), Nilgari (*Eucalyptus citriodora*), Pipal (*Ficus religiosa*), Radhachura (*Peltophorum pterocarpum*), Sajna (*Moringa oleifera*), Semal (*Bombax ceiba*), Siris (*Albizia procera*), Sisoo (*Dalbergia sissoo*) and Teak (*Tectona grandis*). Among these species Cassia (*Cassia siamea*), Neem (*Azadirachta indica*), Radhachura (*Peltophorum pterocarpum*), and Siris (*Albizia procera*) are dominant trees with large canopy cover in non forest area.

The common shrubs distributed within the non-forested areas like road sides, homestead lands, barren lands, banks of rivers and canals, where main species represented by Akanda (*Calotropis procera*), Arni (*Clerodendrum phlomidis*), Arandi (*Ricinus communis*), Ber (*Zizyphus jujuba*), Dhutra (*Datura stramonium*), Ipomoea (*Ipomoea carnea*), Lal Bheranda (*Jatropha gossypifolia*), Lantana (*Lantana camara*) and Vasaka (*Adhatoda vasica*).

Herbs and grasses are found to be close association with shrubs. Among them, common species are *Abutilon indicum*, *Apluda mutica*, *Bulbustylis barbata*, *Cyperus corymbosus*, *Dioscorea bulbifera*, *Fimbristylis aestivalis*, *Indigofera glabra*, *Hibiscus tiliaceus*, *Sida cordifolia*, *Tridax procumbens*, *Cynodon dactylon*, *Saccharum spontaneum*, and *Cyperus rotundus*. The Bamboo clumps and Palms species of Tal (*Borassus flabelliform*), Narial (*Cocos nucifera*), Khajur



3 - Description of the Environment (cont'd)

(*Phoenix dactylifera*) are commonly found in study area. The thorny bushes of Phanimansha (*Opuntia dillenii*) and Tesiramonsa (*Euphorbia antiquorum*) also found along the road sides.

A list of flora in forest & non-forest lands, as observed and information collected during interaction with the local residents of study area is given in Appendix 3-2 & 3-2A.

3.10.4 Non Timber Forest Produce in the Study Area

There are no such important forest products that can contribute to the livelihoods of local people from the protected forest areas, however, the forest products like fire woods of Casuarina and fruits of Cashew are minor source of income among the peoples dwelling nearby forest area.

3.10.5 Medicinal Plants in the Study Area

Among the available floral species, forty three (43) of them has important medicinal value and contribute important role in economy of the state particularly, amongst rural, SC, ST's living in forest fringed areas. The list of medicinal plants is given in Appendix 3-3.

3.10.6 Agricultural Pattern of the Study Area

The single cropped agricultural lands available in the study area are cultivated only under rainfed condition. The main agricultural crop is Rice (*Oryza sativa*) followed by Maize (*Zea mays*), Wheat (*Triticum aestivum*), Sesame (*Sesamum indicum*), Black mustard seed (*Brassica nigra*), Black gram (*Vigna mungo*), Green gram (*Vigna radiate*), Sunflower (*Helianthus annuus*) and Sugarcane (*Saccharum officinarum*) cultivated in the study area. The vegetables grown in the study area observed during survey includes Brinjal (*Solanum melongena*), Cabbage (*Brassica oleracea* var. *capitata*), Cauliflower (*Brassica oleracea* var. *botrytis*), Chili (*Capsicum annuum*), Gourds (*Lagenaria siceraria*), Tomato (*Solanum lycopersicum*) and watermelon (*Citrullus lanatus*).

3 - Description of the Environment (cont'd)

3.10.7 Horticultural Crops of the Study Area

Cashew (*Anacardium occidentale*) and Pan (*Piper betle*) are the commercial horticultural crops found to be cultivated in the study area. Other important fruit plants found in the homestead plantation area are Banana (*Musa paradisiaca*), Mango (*Mangifera indica*), Jackfruit (*Artocarpus heterophyllus*), Papita (*Carica papaya*), Guava (*Psidium guajava*).

3.11 QUANTITATIVE SURVEY OF TERRESTRIAL FLORA

It is essential to know the numerical distribution of different species in the community especially in terms of species richness, evenness index and diversity index. For quantitative determination of plant community structure, the line transect with quadrat laid in the selected sample plots. Exhibit 3-3 represents photographs of quantitative survey collected at Protected Forest near Musadia Village.



**EXHIBIT 3-3 - PHOTOGRAPHS OF QUANTITATIVE SURVEY
COLLECTED AT PROTECTED FOREST NEAR MUSADIA VILLAGE**

3.11.2 Species Richness, Evenness & Diversity Index in the Study Area

Species diversity was evaluated by using Shannon - Weaver (1963) diversity index, from the data collected through quadrat method at selected sites of the study area. The Shannon - Weaver diversity index (H) is index that is commonly used to characterize species diversity in a



3 - Description of the Environment (cont'd)

community. The Species Richness, Evenness & Diversity index values were computed for the selected sites and the results are presented in Table 3-24.

TABLE 3-24 - SPECIES RICHNESS, EVENNESS & DIVERSITY INDEX

Location Code	Name of the Study Area	Species Richness (R)	Evenness index (E)	Shannon-Weaver diversity index (H')
TE1	P. F. near Musadia Village	17	0.90	2.04
TE2	P. F. near Udaychandrapur Village	4	0.76	1.05
TE3	Jogidhankud P. F.	3	0.97	1.06
TE4	Saralikud P. F.	4	0.80	1.11
TE5	Sanatubi P. F.	5	0.71	1.15
TE6	O J near Paradeep Port	10	0.56	1.81
TE7	O J near Bhakud Village	6	0.59	1.06
TE8	Mangrove Swamp near Paradeep Port	7	0.81	1.57

Shannon-weaver Diversity Index of trees in the protected forest area is appeared to be in the range of 1.05 - 2.04. It has been noticed that trees species diversity is highest at Musadia Protected Forest and lowest at Protected Forest near Udaychandrapur Village. Diversity Index of trees in the open jungle area is appeared to be in the range of 1.06 - 1.81. Diversity Index of trees in the Mangrove Swamp near Paradeep Port found to be 1.57. The Pielou's evenness index of species distribution is appeared to be in the range of 0.56 to 0.97, therefore, floral distribution in the study area is heterogeneous rather than homogeneous at Protected Forest area and richness of tree species is appeared to be in the range of 3 to 17 in the protected forest area. The richness of tree species is highest at Protected Forest near Musadia Village due to plantation of diverse species and lowest at Jogidhankud Protected Forest due to practice of mono culture plantation.



3 - Description of the Environment (cont'd)

3.11.3 Terrestrial Fauna

Mammals: The Wild animals like Indian grey mongoose (*Herpestes edwardsii*), Indian palm squirrel (*Funambulus palmarum*) and House rat (*Rattus rattus*) were observed during survey in the study area.

The documented species of wild animals (mammals) available in the study area are listed in Appendix 3-4 & 3-2A, which were also reported during interaction with local peoples and forest officials.

During survey the domestic animals observed in the study area were including Cow (*Bos indicus*), Buffalo (*Bubalus indicus*), Sheep (*Ovis aries*), Goat (*Capra hircus*), Pig (*Sus scrofa domesticus*), Dog (*Canis familiaris*) and Cat (*Felis domesticus*).

Reptiles: Reptiles in terrestrial ecosystem in the study area includes Chameleon, House Gecko, Lizards, Snakes and Skinks. The reptile species reported during interaction with forest officials and local people are listed in Appendix 3-4 & 3-2A which was confirmed from the secondary data source. During survey only Garden Lizard (*Calotes versicolor*) and Indian Rat Snake (*Ptyas mucosus*) were found during field survey in the study area.

Avifauna: A total of two hundred eighty one (281) avifauna (birds) species observed and reported during interaction with forest officials and local people in the study area are listed in Appendix 3-4 & 3-2A. Among them Asian pied starling (*Gracupica contra*), Black Drongo (*Dicrurus adsimilis*), Common crow (*Corvus splendens*), Common city pigeon (*Columba livia*), Koel (*Eudynamys scolopaceus*), Myna (*Acridotheres tristis*), House sparrow (*Passer domesticus*) and Spotted dove (*Streptopelia chinensis*) were very common birds.



3 - Description of the Environment (cont'd)

Invertebrates: Among the invertebrates varieties of butterflies observed during survey, among them Common grass yellow (*Eurema hecabe*), Common sailor (*Neptis hylas*), Crimson rose (*Pachliopta hector*), Great egg fly (*Hypolimnys bolina*), Lime butterfly (*Papilio demoleus*) were very common.

A list of Terrestrial Fauna (Wild Life) as observed and information collected during interaction with the local residents and forest officials of the study area and records in the secondary data source, given in Appendix 3-4 & 3-2A.

3.12 AQUATIC ECOLOGICAL STATUS (AES)

The Aquatic Ecological survey was conducted at eight selected locations in Mahanadi River, Haldipani Nadi, Atherbanki Nadi, Taldanga Cannal and Reservoir depicted in Monitoring Location Map Fig. 3-14.

3.12.1 Aquatic Flora

The aquatic macrophytes observed during survey in the study area are listed in Appendix 3-5 and depicted in Exhibit 3-4. Among them *Pistia sp.*, *Lemna sp.*, *Azolla sp.*, *Salvinia sp.*, *Eichhornia sp.* are the non anchored free floating hydrophytes, *Nymphaea sp.*, *Nilumbo sp.*, *Ipomea sp.* are anchored floating hydrophytes, *Potamogeton sp.*, *Ceratophyllum sp.* are non anchored submerged hydrophytes, *Hydrilla sp.*, *Vallisneria sp.*, *Utricularia sp.*, are the anchored submerged hydrophytes. There are also anchored emergent hydrophytes like *Sagittaria sp.*, *Aeschynomene sp.*, *Bacopa sp.*, *Limnophila sp.*, and *Typha sp.* and anchored marshy amphibious hydrophytes like *Polygonum sp.*, *Hygrophila sp.*, *Enhydra sp.*, *Ceratopteris sp.*, *Hygroryza sp.*, *Phyla sp.*, *Ipomoea sp.*, *Colocasia sp.* Among the macrophytes, *Colocasia esculenta*, *Eichhoria crassipes*, *Ipomoea carnea*, *Nymphaea sp.* & *Typha elephantine* are dominant species and widely distributed in surface water bodies and marshy areas in the study area.

3 - Description of the Environment (cont'd)



FIG. 3-14 - MONITORING LOCATION MAP



**EXHIBIT 3-4 - PHOTOGRAPHS OF QUANTITATIVE SURVEY
 COLLECTED AT PROTECTED FOREST NEAR MUSADIA VILLAGE**

3.12.2 Planktonic Population

Phytoplankton: A total of eleven (11) species have been identified in water sample collected from the surface water bodies in the study area. The total phytoplankton count was in the range of



3 - Description of the Environment (cont'd)

11.4 - 35.0 ($10^3/m^3$) in the surface water bodies indicating productivity within the satisfactory level. It has been noted that total count of phytoplankton is higher at Reservoir (AE7) near project site that indicating presence of higher level of productivity than Mahanadi River water. List of identified phyto plankton species are given in Appendix 3-6.

Zooplankton: A total of fifteen (15) zooplankton species have been identified in water sample collected from the surface water bodies. Cyclops sp. and Moina sp. were found to be the dominant groups. It has been noted that total count of zooplankton is higher at Reservoir (AE7) near project site that indicating presence of higher level of organic nutrients than Mahanadi River water. List of identified Zoo plankton species are given in Appendix 3-6.

Primary Productivity of Aquatic Eco-System: In order to assess the productivity of aquatic ecosystem prevailing in the study area Shanon and Weaver Diversity Index (H) of planktonic population was computed for all the five monitoring locations. The “H” values of respective water bodies are presented in the following Table 3-25.

TABLE 3-25 - PLANKTONIC DIVERSITY INDEX OF THE MONITORING LOCATIONS

Location Code	Name of the Location	Shannon - Weaver Diversity Index (H)	
		Phytoplankton	Zooplankton
AE1	Mahanadi River near Musadia Village	2.22	2.33
AE2	Mahanadi River near Sea Confluence	2.23	2.55
AE3	Mahanadi River near Baladia Village	2.25	2.43
AE4	Haldipani Nadi near Zhimani Village	2.18	2.51
AE5	Mahanadi River near Uchabanandpur Village	2.10	2.38
AE6	Atharbanki Nadi near Jayan Mandap	2.09	2.29
AE7	Reservoir near Project Site	2.19	2.42
AE8	Taldhanda Canal near Bhutmundia village	2.34	2.52



3 - Description of the Environment (cont'd)

From the Quantitative assessment of phytoplankton and zooplankton it has been derived that diversity index (Shannon-weaver), varies between 2.09 to 2.34 for phytoplankton and 2.29 to 2.55 for zooplankton respectively. This indicates presence of moderate level of organic nutrients and mesotrophic the aquatic ecosystem prevailing in the surface water bodies.

Aquatic Fauna: The aquatic faunal species which were observed in and around the water bodies includes Arthropods, Molluscas, Amphibians, Fishes, Semi-aquatic Avifauna, Reptiles (Turtles, Crocodiles, and Lizards) and Mammals (Dolphin, Otter, Porpoise).

Arthropods: Presence of total fifteen (15) athropods species reported in the study area, are listed in Appendix 3-2A & 3-4.

Mollusca: Presence of total seven (7) mollusca species reported in the study area, are listed in Appendix 3-2A & 3-4. Among them during survey only three molluscas species of benthic macro-invertebrates 1) *Epitonium spp.*, 2) *Umbonium spp.* and 3) *Hydrobis spp.* were found in the water bodies.

Amphibian: Presence of total five (5) amphibian species reported in the study area. Among them during field survey only three amphibian species 1) Indian cricket frog (*Rana limnocharis*), 2) Indian Skipper frog (*Rana cyanophlyctis*), 3) Common Indian Toad (*Bufo melanostictus*) were found within the study area.

Fish Fauna: Total twenty (20) fish species fairly available in the water bodies reported during interaction with the fishermen forest officials. The Mahanadi River and Bay of Bengal are the natural aquatic ecosystem supporting diversity of fish fauna in the study area. The commercial cultivation and harvesting of fish, prawn and crabs reported

3 - Description of the Environment (cont'd)

during interaction with local people within the study area. The maximum abundance of fishes was reported during April to July in these surface water bodies.

Semi Aquatic Birds: The semi aquatic birds observed during survey near Mahanadi River, Haldipani Nadi, Atherbanki Nadi, Taldanga Cannal, Reservoir and Ponds of the study area and reported by forest officials are listed in Appendix 3-2A & 3-4. Among them Eastern Common Crane (*Grus grus lilfordi*), Indian Pond Heron (*Ardeola grayii*), Little Egret (*Egretta garzetta*) and Little Cormorant (*Phalacrocorax carbo*) were commonly found near the water bodies. Figure-5 and Figure-6 are photographs of Little Cormorants and Eastern Common Crane respectively collected during field survey. Exhibit 3-5 is photographs of Little Cormorants and Eastern Common Crane respectively collected during field survey.



EXHIBIT 3-5 - PHOTOGRAPHS OF LITTLE CORMORANTS AND EASTERN COMMON CRANE COLLECTED DURING FIELD SURVEY

3.13 REVIEW OF PUBLISHED SECONDARY DATA AND RELEVANT STANDARDS FOR CROSS REFERENCING AND INTERPRETATION

The secondary data sources like (i) The Jagatsinghpur District Gazetteers, 10.05.2018, Odisha, (ii) Fauna of Mahanadi Estuary Orissa, Zoological Survey of India Calcutta, 1998, and (iii) Fauna of Orissa, Part 3. State Fauna Series 1. Zoological Survey of India, 1991,



3 - Description of the Environment (cont'd)

had been collected for cross referencing and interpretation of the identified flora-fauna in the study area. The conservation status of flora & fauna reviewed in IUCN Red list, Version 2021-1 and Indian wild Life Protection act, 1972 and its subsequent amendments.

3.13.1 Rare, Endemic and Endangered Plant Species

The International Union for Conservation of Nature & Natural Resources (IUCN) designated the terms "rare" and 'endangered' plant species in the "Red list". Among the recorded mangrove floral species, Hatal (*Phoenix paludosa*), Garana (*Ceriops decandra*) assigned as Near Threatened (NT) category and rest of the floral species are considered as Least Concern (LC) or Not Assessed (NA) or Data Deficient (DD) in the IUCN Red List of Threatened Species, Version 2021-1. Among the recorded terrestrial faunal species, the terrestrial fauna Fishing Cat (*Felis viverrina*), Sambar (*Cervus unicolor*), King Cobra (*Ophiophagus hannah*) are consider as Vulnerable (VU) and Indian Python (*Python molurus*) consider as Endangered (EN). Among the reported aquatic faunal species Little Indian Porpoise (*Neophocaena phocaenoides*) and Asian Giant softshelled Turtle (*Pelochelys bibroni*) are consider as Vulnerable (VU), Indian darter (*Anhinga melanogaster*) consider as Near Threatened (NT) and Irrawady Dolphin (*Orcaella brevirostris*), Batagur Turtle (*Batagur baska*), Green Sea Turtle (*Chelonia mydas*), Hawksbill Sea Turtle (*Eretmochelys imbricate*), Indian Flapshell Turtle (*Lissemys punctata punctata*), Indian SoftShelled Turtles (*Aspideratus gangeticus*), North Indian Roofed Turtle (*Kachuga tecta tecta*), Leatherback Sea Turtle (*Demochelys coriacea*), Olive Ridley Sea Turtle (*Lepidochelys olivacea*), Peacock Eye Turtle (*Trionyx hurum*), Salt water Crocodile (*Crocodilus porosus*), Indian Monitor Lizard (*Varanus bengalensis*), Water Monitor Lizard (*Varanus salvator*), Yellow Monitor Lizard (*Varanus flavescens*) are considered as Endangered (EN) and rest of the floral species are considered as Least Concern (LC) or Not Assessed (NA) or Data Deficient (DD) in the IUCN Red List of Threatened Species, Version 2021-1.



3 - Description of the Environment (cont'd)

3.13.2 Conservation status of Sighted Flora and Fauna

Conservation status of the sighted flora fauna has been checked in the Wildlife Protection Act, 1972 and its consequent amendments. Among the reported fauna most of the species are listed under Schedule- II, III & IV or not listed in any category as per Wildlife Protection Act (1972) and its subsequent amendments. The Schedule-I species reported in the study area are listed in Appendix 3-7 and need to prepare a site specific conservation plan for these Schedule-I species.

3.13.3 Eco-sensitive area

There is no Eco-sensitive area like National Parks and Wild Life Sanctuaries in the study area except Bhitarkanika Wild Life Sanctuaries with its rich bio-diversity in its mangrove forest and Gahirmatha Marine Wildlife Sanctuary under Rajnagar Mangrove Division adjacent to the study area occupy a unique place in the country for its sea-turtles. It is one of the largest breeding grounds of “Olive Ridley” sea turtles that come in Lakhs every year during the months from December to April from the distant Pacific Ocean to lay their eggs near the mouth of Mahanadi. But, Eco-sensitive Zone of Bhitarkanika Wild Life Sanctuary and Gahirmatha Marine Wildlife Sanctuary falls within the study area. The 10 km radius boundary of study area as well as boundary of Bhitarkanika Wild Life Sanctuary and Gahirmatha Marine Wildlife Sanctuary is presented in Fig. 3-15.

However, there are few plantation areas regarded as Protected Forest (PF) along the banks of Mahanadi River and coastal line which promotes to stabilize the sand dunes and acting as “pollutants absorber” of the study area. There are several surface water bodies including rivers, reservoirs, ponds, water logged areas and coastal areas that support the ongoing agriculture, fish cultivation and fish harvesting though out the study area. Therefore, felling of trees, discharges of liquid

3 - Description of the Environment (cont'd)

waste and dumping of solid waste in surface water bodies must be prohibited in this area. It is important to develop greenery in and around the project site and promote to develop afforestation in the study area.

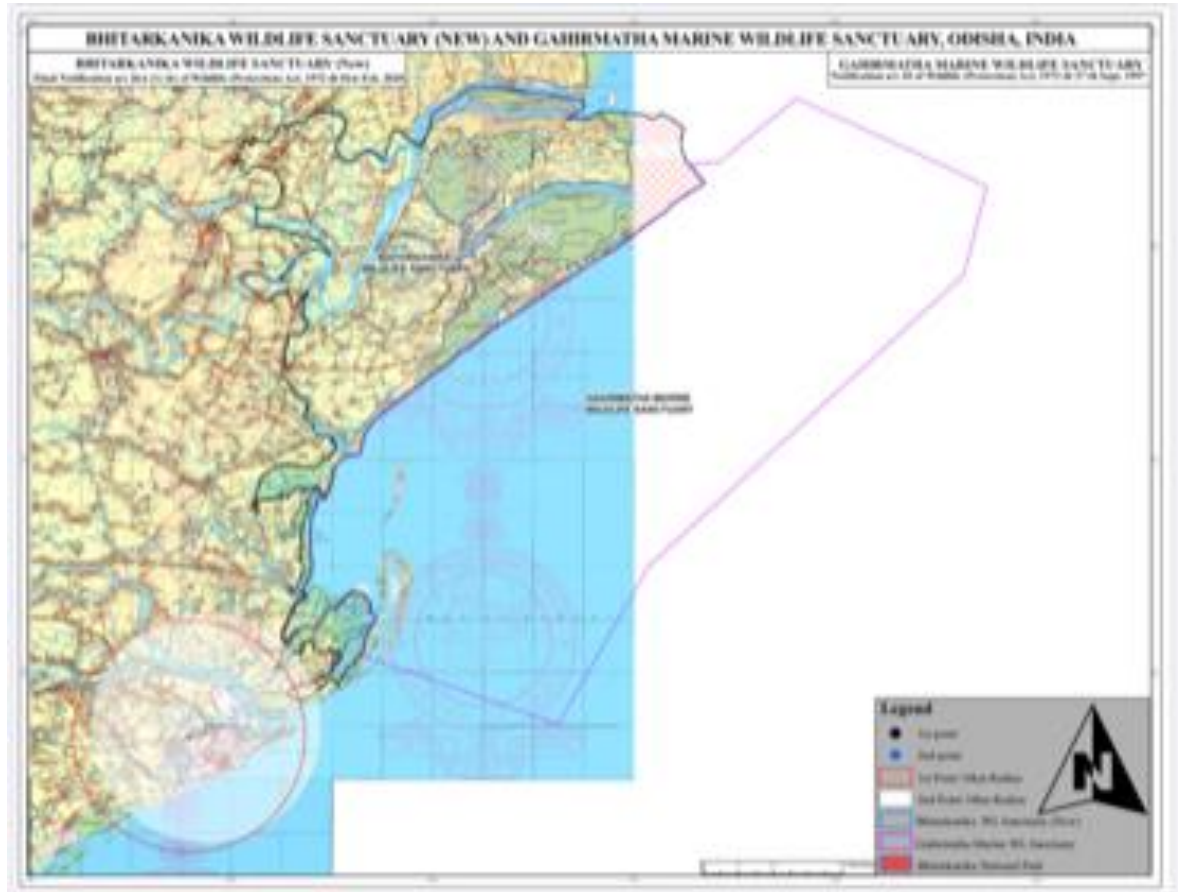


FIG. 3-15 - THE STUDY AREA AND BHITARKANIKA WILD LIFE SANCTUARY AND GAHIRMATHA MARINE WILD LIFE SANCTURARY



3 - Description of the Environment (cont'd)

3.14 HUMAN ENVIRONMENT

All developmental projects have direct as well as indirect relationship with socio-economic aspect, which also include public acceptability for new developmental projects. Hence the study of socio-economic components incorporating various aspects related to prevailing social and cultural conditions and economic status of the buffer zone is an important part of any EIA study. The proposed project is 'Setting up of a Greenfield Pellet Plant for production of 14 MTPA (2x7 MTPA) pellets near Paradip in Jagatsinghapur District, Odisha by ESSAR MINMET LIMITED.

3.14.1 Delineating of the Study Area

The central Point of our Study Area is Tarinigoda, an industrial area under Kujang Tehsil of Jagatsinghapur district of Odisha. From this point, the surrounding area of ten kilometre radius is our study area where we identified total 83 settlements. Within the area of 2 km radius we got total 10 settlements which we call as Zone A in our study. Within the area of 2 to 5 km radius we got total 21 settlements which we call as Zone B in our study. Within the area of 5 to 10 km radius we got total 52 villages of two districts Jagatshinghapur and Kedrapara of the State Odisha and we call this area as Zone C in our study. The Zones A and B possess both rural and urban area. The urban areas are wards under Paradip Municipality. Comparison of Demographic features and occupational distribution of the Study Area between Census Year 2011 and Study Year 2021 is depicted in Table 2-26.



3 - Description of the Environment (cont'd)

TABLE 3-26 - COMPARISON OF DEMOGRAPHIC FEATURES AND OCCUPATIONAL DISTRIBUTION OF THE STUDY AREA BETWEEN CENSUS YEAR 2011 AND STUDY YEAR 2021

Sl. No.	Demographic Parameters	2011	2021	Decadal growth In %
1.	Total Number of households	29819	36223	21
2.	Total population	149214	183115	23
3.	Density of population	906	1163	28
4.	Sex ratio	786	852	-
5.	Children (<6 years) Population	19121	23636	24
6.	Children (<6 years) Sex Ratio	724	818	-
7.	Scheduled Castes (%)	43	46	31
A	Scheduled Castes Male (%)	70	62	16
B	Scheduled Castes Female (%)	30	38	66
8.	Scheduled Tribe (%)	16	18	38
A	Scheduled Tribe Male (%)	51	51	38
B	Scheduled Tribe Female (%)	49	49	38
9.	Literate (%)	61	73	47
A	Literate Male (%)	67	59	29
B	Literate Female (%)	33	41	82
10.	Main Worker (%)	24	29	48
A	Main Worker Male (%)	88	84	42
B	Main Worker Female (%)	12	16	98
11.	Marginal Worker (%)	27	26	18
A	Marginal Worker Male (%)	49	53	28
B	Marginal Worker Female (%)	51	47	9
12.	Non Worker (%)	49	45	13
A	Non Worker Male (%)	32	33	16
B	Non Worker Female (%)	68	67	11

Source: Census 2011 and field survey in 2021

Observations from Table No 3-26 are as follows:

- i) Decadal growth in number of household and total population is very high in our study area
- ii) Hence density of population has also increased much, the growth rate is 28%. It is a developing area. As it is a port area, different industries which need navigation connection for import and export of both raw materials and finished products are being established here. As a consequence population is growing at a rate more than natural growth rate, and it is growing by migration.



3 - Description of the Environment (cont'd)

- iii) Sex Ratios of both adult and child have increase. It is a good sign which implies favour for girl child is increasing and a gender balance in population growth may be achieved in near future.
- iv) Growth in the literacy rate in the study area is also very appreciable. Growth in female literacy rate is more appreciable. Awareness for female education is growing.
- v) Schedule Caste population occupies a large part of the total population in this study area and increase at 31% rate from 2011 to 2021. There are some villages which are inhabited completely by SC population. But male female distribution in total SC population is very unequal. Still it is hopeful that growth rate in SC female population is much higher than that in SC male population.
- vi) Schedule Tribe population occupies a small part of the total population in this study area. Moreover, Male-Female distribution among ST population is more or less equal. It is observed that total ST population, ST male population and ST female population are growing at an equal rate.
- vii) Observation on occupational distribution among population in this study area is shown as main worker, marginal worker and non-worker classification. It is shown that very small part of the working population is engaged in the main work and a little greater part of the working population is engaged in the marginal work. This means a large part near about 50% of population is under nonworking population. But it is remarkable that growth rate in nonworking population is less than that in marginal working population and the growth rate main working population is much higher than these two. Moreover it is hopeful that growth rate in female population engaged in main work is very high in last decade. It implies that women are being educated and taking part in main occupation.



3 - Description of the Environment (cont'd)

3.14.2 Methodology

Sources of Data Collection: The information provided in the following section has been primarily derived from two major kinds of sources, i.e. the primary source and the secondary source:

Primary Source: Extensive field survey for current data and group discussion for checking the primary and secondary data.

Secondary Source: Census Survey of 2011, Government of India from Census of Orissa, websites.

Tools for Data Collection: Self developed formal schedule designed scientifically covering various socio-economic attributes.

Universe of the Study: All the human settlements within the area of ten kilometre radius are cantering the project site.

Sample Chosen: Revenue or Main villages within the study area of ten kilometre radius are cantering the project site.

3.14.3 The Process

Main villages within the buffer zone have been selected for sample survey on various aspects to decipher socio-economic and demographic profile. Data collected during survey have been compared with secondary data from the Census Survey of 2011, Government of India.

Sampling Respondents: A judgmental and purposive sampling method was used for choosing respondents of various sections of the society i.e. Sarpanch, adult males and females, teachers, medical practitioners, businessmen, agriculture labourers, unemployed group etc. judgmental and purposive sampling method includes the right cases

3 - Description of the Environment (cont'd)

from the total population that helps to fulfil the purpose of study needs. The discussions were made in the locality of some of the villages in the study area are shown in Exhibit 3-6 & 3-7 respectively.



EXHIBIT 3-6 - FGD AT DHINKIA VILLAGE



EXHIBIT 3-7 - FGD AT ABHAYCHANDRAPUR VILLAGE



3 - Description of the Environment (cont'd)

Field Survey and Observations: Field survey and observations were made at each sampling villages and the quality of life of that region is studied. Visits were made at hospitals, primary health centres and sub-centres to know the health status of the region. Various governmental organizations such as statistical department, department of census operations are visited to collect the population details of that region.

Interview: Structured interview method was used to collect data regarding the awareness and opinion from the sample selected of the various socio-economic sections of the community. Structured interviews involved the use of a set of predetermined questions that includes fixed and alternative questions. The questionnaire mainly highlighted the parameters such as income, employment and working conditions, housing, food, clothing, water supply, sanitation, health, energy, transportation and communication, education, infrastructure, environment and pollution to assess the quality of life of that particular region and general awareness and opinion of the respondents about the project. Interview method helped to collect more correct and accurate information as the interviewer remained present during the field survey. Socio-economic survey was conducted in 16 villages and one town within the study area located in all directions with reference to the project site. The respondents were asked for their awareness/opinion about the project and also the impacts of the project which is an important aspect of socio-economic environment, viz. job opportunities, education, health care, transportation facility and economic status.

Analysis and Assessment: The economic impact has been assessed on the basis of primary data (field survey data) comparing with the secondary data (census data of 2011) whereas social impact assessed from the results of Group Discussions with the villagers represented by

3 - Description of the Environment (cont'd)

their opinion leaders. But complete socio-economic impact comes as a result of consultation and consideration of all relevant theories of Impact Assessment and Cost-Benefit analysis. Some of the social impact appears as the interaction of individual community and the project going to be launched guided by the communities customs, status, education, and awareness etc. to feel this pulse Focussed Group Discussion is very effective tool. Ultimately Cost-Benefit Analysis is very helpful to identify the positive and negative impacts of the project. Chronological List of areas surveyed is shown in Table 3-27.

TABLE 3-27 - CHRONOLOGICAL LIST OF AREAS SURVEYED

Sl. No.	Locations	Zone	No. of Participants	FGD/SE Survey
1	Village Bibi Coloni	A	6	FGD
2	Village Bahakud	C	7	FGD
3	Village Rangiarh	B	6	FGD
4	Urban Gayetrinagar	A	3	FGD
5	Village Singitali	C	10	FGD
6	Village Pipal	C	19	FGD
7	Urban Sandhakundu (Bengali Para)	B	6	FGD
8	Village Abhaychandrapur	C	9	FGD
9	Village Trilochanpur	C	7	FGD
10	Village Dhinkia	C	10	FGD
11	Village Fatepur	C	8	FGD
12	Village Bara Jhimani	C	5	FGD
13	Village Kothi	C	7	FGD
14	Village Bhutmundi	C	5	FGD
15	Village Narendrapur	C	6	FGD

Zone A - 0 to 2 km;

Zone B - 2 to 5 km;

Zone C - 5 to 10 km.

FGD - Focus Group Discussion

FGD Points Map is depicted in Fig. 3-16.

3 - Description of the Environment (cont'd)

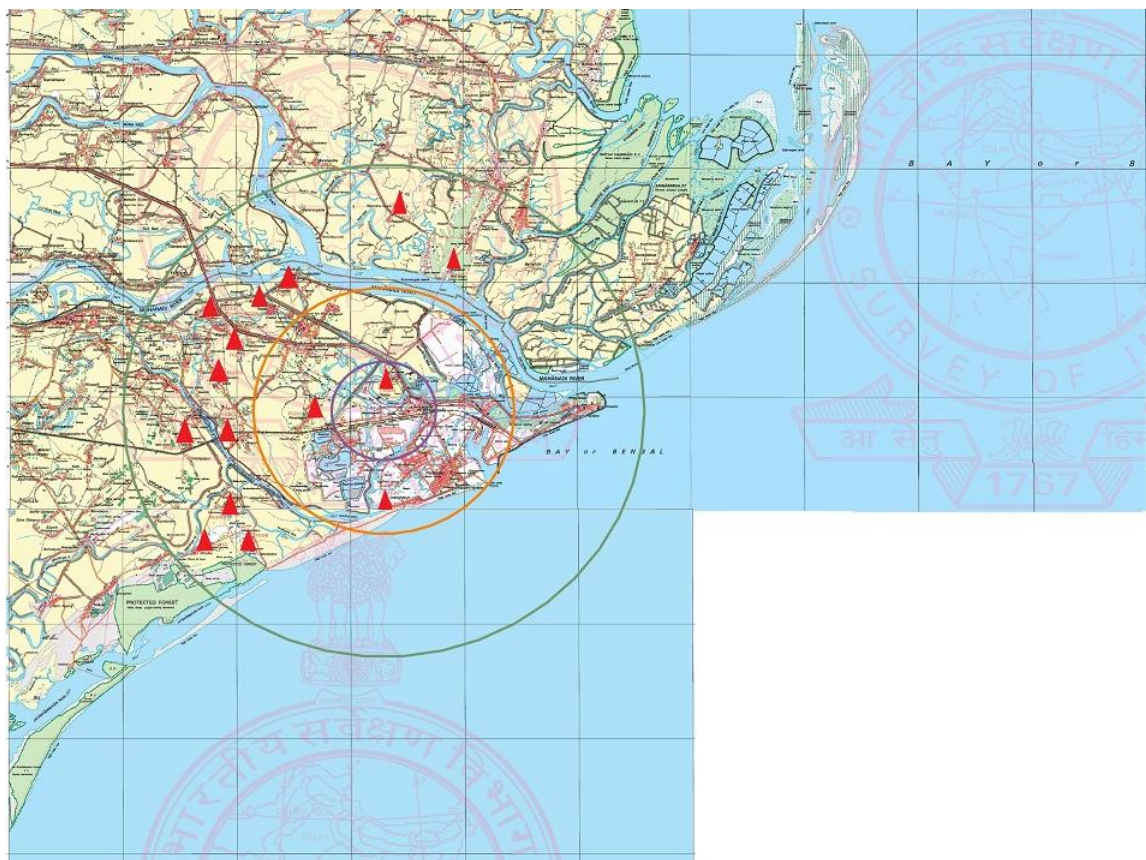


FIG. 3-16 - FGD POINTS MAP

3.14.4 FGD Result

Village Bibi Colony under Petchila G.P.: Small business and factory workers are accompanied with main occupation agriculture in this village. 60 to 70% of villagers are of SC-ST categories, but all are Hindu. Income ranges from Rs. 200 - 500 per day. There are one primary school, one high school up to 10th class and also one private degree college. Nearby hospital is at 6/7 km distant from this village and no medical service provision here except one ASHA. During emergency they use private auto service or personal transit like motorbike. Private tube wells are the only source of water. But they buy the drinking water as it is a saline and iron prone area. Total Sanitation Campaign is successful here, so no open defecation. Electricity and cooking gas (private) all are



3 - Description of the Environment (cont'd)

present. Post Office is at Kochila, 5 km distant and Police Station is at Marandi, 6 km distant from this village. Some of them have got houses under Pradhan Mantri Awas Yojna, but the number is very small. There are two playgrounds where football and cricket matches are organised by the villagers. Women are members of Self Help Groups. There are 50 such groups at present but no training centre and no NGO came here to serve. Triratri Kirtan at Chaitra (Bengali month) end, Durga Puja with fair, Ramchandi Mela and Rathayatra are the main festivals of this village. Malaria, Fyleria, TB are found often as general diseases and liquor addiction among adult male members is a serious social evil. The source of such liquor identified by the villagers is the nearby village Ramnagar.

About this particular project they know about it and in favour of it because they need employment and want it in their nearby locality. The youths of the village are now going to join their job far crossing the Mahanadi with great fear during storm and cyclone.

Village Bahakud under Ramnagar G.P.: Small business like betel shop, garment shop etc. and service like auto driving are there with the main occupation as farming. Income ranges from Rs. 200 to Rs. 500 per day. But farmers produce most for their self-consumption. 37% of population is of minority and rests are Hindu. Hindus are all SC category. There is only one primary school and no other school in this village. Primary Health Centre is at 5 km distant the village in Ramnagar. No other medical facility exists here except one ASHA. They use Ambulance (108) in emergency to go to hospital. Private tube wells are only source of water and iron is abundant in water. There is one Anganwadi Centre. Post Office is in Ramnagar and Police Station is in Jambu, 7 km distant from this village. Cooking gas is available. Some households have got house under Pradhan Mantri Awas Yojna. Total



3 - Description of the Environment (cont'd)

Sanitation Campaign is 80% successful. There are two playgrounds where football, cricket tournaments are organized by the villagers. Women are members of Self Help Groups. At present there are 30 such groups, but there is no training centre or no NGO to organize any training. Manasa puja with fair, Durga puja, Shivratri, Roza utsav are the festivals of this village. Liquor addiction among adult males is a serious social evil in this village. There is a club named Baba Balakeshwar Yuvak Sangh which is engaged in the development of locality.

They don't know about this particular project, but they know the negative effects. They complained about skin diseases, TB, cancer and kidney diseases which they have identified as the pollution effects of existing industries. Yet they are in favour of industries because employment will increase. They more expect training centre and liquor de-addiction programmes.

Village Rangiagar: Small businesses like grocery shop, masonry work are the occupation with the main occupation agriculture in this village. Some factory (IFCO) workers are also there. Income ranges from 3,000/- or 4,000/- per month to Rs. 10,000/- or 12,000/- thousand per month. There are one primary school and one junior high school but no high school. There is no Primary Health Centre or private clinic. In emergency they go to Biju Memorial Hospital at 5/6 km distance from this village one medical check-up team from IOCL came 4 years back. There are two ASHAs and two Anganwadi Centres. Women are members of Self Help Groups. At present there are 18 SHGs. One NGO imparts them training on phenyl and dhup making. Tank water in 3 days gap from IOCL service is available here which is only source of drinking water. No drainage system, no waste collection system and no playground are there in this village. There is also no system of regular



3 - Description of the Environment (cont'd)

football or cricket playing arrangements. Liquor addiction among adult males is a serious problem. Gajalaxmi puja, Kali puja, Viswakarma puja, Ganesh puja and fair in Dolpurnima are the main festivals in this village.

About this particular project they know and in favour of it in expectation of medical facilities, better water supply, high school and English medium school and vocational training centre developed by such companies. Pipeline water is required and expected from the company and Drainage system is also demanded.

Urban Gayetrinagar under Paradip Municipality: It is an urban area near to Tarinigoda Project site and it is under Paradip Municipality. This is a developing area where multi storied housing are being developed by private developers. The households are mainly engaged in secondary and tertiary sectors. There are 3 private schools at ½ km distant in Jyotinagar. Health, education all facilities are there in Jyotinagar. There is no problem of water as Municipality water supply is there in their house. Cooking gas and electricity is also available according to requirement. But approach road is not reachable by car yet.

About this particular project they know and they have no problem with existing factories or plants. So they welcome new factories.

Village Singitali under Noagoda G.P.: Agriculture is the main occupation, but farmers of this village produce mostly for their self and family consumption. Income ranges from Rs. 5,000/- to Rs, 15,000/- per month. There is no Primary Health Centre, but it is at 2.5 km distant in Balidiha. Hospital is at 7 km east in Kujang or at 7 km west in Authorabanki. In emergency they go any of these two by ambulance (108) or private communication. There is one primary school, but no high school, it is at 3 Km distant in Chakradharpur. Pipeline water is there but not suitable to drink. They carry drinking water from



3 - Description of the Environment (cont'd)

1 km distant by Jeri can. There are two Anganwadi Centres and on ASHA. Women are members of Self Help Groups. At present there are 10 groups but they got no training. There is no training centre in this village. One small playground is there for volleyball playing. Dangerous snakes are found here and snake bite is an often case. Astaprahar Kirtan, Kartik puja are the main festivals in this village.

About this particular project they know about it and they complained of some problems like skin disease from waste water of plant through bathing i.e. water pollution. They also complained for air pollution from gases of plant which make their coconuts black and trees are not so productive now. They said without pollution and treated water factory or industry plant is welcome to them.

Village Pipal under Bhutmundi G.P.: ishermen, painters, masons, labours are living with farmers in this village. Income ranges from Rs. 2,000 to Rs. 12,000 per month. Farmers produce most for their self and family consumption. No Primary Health Centre is available in this village, but there is one private Ayurved skin clinic. Nearest hospital is in Atharabanki at 12 km distant from this village. In emergency they go to this hospital by ambulance (108). There is one primary school but no high school. It is in Chakradharpur. Drinking water supply is not available in this village. The villagers carry drinking water from 3 to 5 km distant by Jeri can. There is one ASHA and one Anganwadi Centre. Women are members of Self Help Groups. At present there are 22 such groups but they got no training.

About this particular project they know it and said that smoke and dust from such factory are harmful for their agriculture, so they are not in favour of such plant.



3 - Description of the Environment (cont'd)

Urban - Sandhakundu (Bengali Para) under Paradip Municipality: It is an urban area under Paradip Municipality. Though it is named as Bengalipara yet it can be said that only 30% of population is Bengali, other 30% of population is Telegu, 30% of population is Oria and rest 10% are others. All these 90% of population Bengali, Telegu and Oria are Hindu by religion where as those rest 10% of population includes Muslims and Christians. The population engaged in different works like car driving, building materials contractors, construction labour, milkman, fisherman etc. Income ranges from Rs. 4,000/- to Rs. 9,000/- per month. There is no Primary Health but 4 ASHAs. The nearest hospital is at 7 km distant Atharbanki. In emergency they use ambulance to go to that hospital or private communication. There are 5 Anganwari Centres. There are two primary schools but no high school. Drinking water is a problem here as pipeline system is not working properly and quality of this water is not good. So they buy it or drink tube well water. Electricity is available but interrupted, load shedding is frequent case. Cooking gas is available. But Pradhan Mantri Awas Yojna is not working here because the land is of Orissa Government. There is no market in this area. Women are members of Self Help Groups. At present there are 50 such groups but they got no training. There is no training centre. There is a wine shop and adult males are liquor addict and liver problem is frequent among them.

About this particular project they do not know but they have the idea of pollution from such factories. They complained for temperature increase, air pollution, water pollution and skin disease for such factories.

Village Abhaychandrapur under Dhinkia G.P.: Agriculture is the main occupation in this rural area. Pan Boroj is the main agricultural field. Some persons are owner of Boroj and some are worker in other persons' Boroj. Income ranges from Rs. 5,000/- to



3 - Description of the Environment (cont'd)

Rs. 12,000/-. Villagers in this village are OBC category. There is no Primary Health Centre and no ASHA or any medical provision. In emergency they are bound to go to Paradip hospital at 20 km distant by private communication service. There is no primary school, it is at 4 km distant in Dinkia and high school is at 8 km distant in Trilochanpur. Private tube well is the only source of water to drink and all purpose use. But it is iron abundant water. Total Sanitation Campaign is failed and open defecation is being continued. Cooking gas is not available. They cook by woodchips. Electricity is available but supply is interrupted. There is no Anganwadi Centre also and Pradhan Mantri Awas Yojna is not available. No approach road is there. Post Office is at Dinkia. Most of the houses are semi pucca. Women are member of Self Help Groups but they get no training. No playground is there and no other provision for recreation.

About this particular project they do not know and they complained that gas from factory hampers their daily life in winter most. They get no help from such industrial authorities. They needed school, Anganwadi Centre, temple and playground.

Village Trilochanpur under Dinkia G.P.: Small business like grocery shop, Xerox machine shop and IOCL labour are the side occupation with main occupation agriculture. Income ranges from Rs. 2,000/- to Rs. 10,000/- per month. There is no Primary Health Centre and no other medical provision except 2 ASHAs. They go to PHC at 2 km distant in Dinkia. In emergency they go to Paradip hospital at 7 to 8 km distant by private communication. There is one primary school and one junior high school up to 8th Class. No high school is there, it is at Dinkia. There is one Anganwadi Centre. For drinking water IOCL supply regular tank water and it is of standard quality. Women are members of Self Help Groups. At present there are 20 groups but they



3 - Description of the Environment (cont'd)

got no training. No NGO serve in this village. No playground is there and no provision for recreation. Viswakarma puja, Oria Navabarsha are the festivals of this village.

About this particular project they have heard about it but complained for sound pollution and gas from plant caused for skin problem.

Village Dhinkia: Agriculture is the main occupation in this village and Pan Boroj is the main agricultural field. Some persons are Pan Boroj workers and some are owner of Pan Boroj. Income ranges from Rs. 10,000/- to 20,000/-. Some unemployed educated youths are there. There is one Primary Health Centre and 3 ASHAs, but in emergency they go to Paradip hospital at 14 km distant by private communication service. There are 5 Anganwadi Centres. Pipeline water supplied by Panchayat is the source of water for drink and other purpose and it is good. Villagers are SC and OBCs. This is a Malaria and Dengue prone area. Women are members of Self Help Groups and at present there are above 60 groups but they get no training. There is no training centre also. Total Sanitation Campaign is not successful in this village. Pradhan Mantri Awas Yojna is not also running here due to land ownership problem. There is one playground where football, cricket and volleyball matches are organized by the villagers. Agni Utsav is their main festival.

About this particular project they have heard about it and they are in favour of such industries. Still they complained that IOCL gas affects their skin, lungs and heart.

Village Fatepur: Agriculture is the main occupation and rice and vegetables are the main agricultural products in this rural area. But the farmers produce mainly for their self and family consumption. Four-fived persons are doing permanent job in the nearby factories and



3 - Description of the Environment (cont'd)

some other persons are labour under contractor. Some persons are also there who are young and technically educated but unemployed. There is no Primary Health Centre in this village it is at 2 km distant in Malanka. The nearest hospital is at 7 km distant in Kujang. In emergency they go to this hospital by ambulance (108) or using private communication. No medical provision is there except 3 ASHAs. There is one primary school and no high school, it is at 3 km distant in Jhimani. Total sanitation Campaign is successfully implemented and cooking gas is available to the 50% of households. There are 2 Anganwadi Centres. For drinking water they depend on tube well made by Panchayat. Near about 20 persons has got house sanction under Pradhan Mantri Awas Yojna but those are under process. There is no training centre. There is one playground where cricket is played. Market is at Malanka. Women are members of Self Help Groups. At present about 46 groups are there and they are working on mushroom, terracotta, dry-fish, and nursery with proper training. Post Office is at 3 km distant in Gopikudu and Police station is at 7 km distant in Kujang. No NGO works there. Ganesh puja, Kartik puja, Saraswati Puja are the festivals of this village.

About this particular project they have heard but complained that gas from existing factories affects their skin and lungs.

Village Bara Jhimani under Bogodia G.P.: Some occupations like mason, knitting of fish net, betel shop etc. are there with the main occupation of agriculture. Income ranges from Rs. 5,000/- to Rs. 12,000/- per month. There is one Primary Health Centre but no doctor. In emergency they go to Kujang or Atharbanki hospital by ambulance (108) or private communication service. Both hospitals are at 9 km distant from this village. There are one primary school, one junior high school, one high school and also one degree college of Arts and Commerce. There is no training centre. Malaria, typhoid and dengue are main diseases in this village. There is one Post Office but Police Station



3 - Description of the Environment (cont'd)

is at 7/8 km distant in Paradip Lock. There is no playground and football or cricket playing arrangements. Total Sanitation Campaign is successfully implemented and Pradhan Mantri Awas Yojna is also running successfully. Women are members of Self Help Groups. At present 10 such groups are there. They got training of mushroom farming and are doing business on it now successfully. There is a nala in this village which helps them in irrigation to the agriculture, but it is going to become dry. Sankranti Utsav in the month of April is their main festival.

About this particular project they have heard but they complained about the existing factories. Gas from factory causes their lungs problems. They need reform of the existing nala for irrigation water and road development from industrial authority.

Village Kothi: Agriculture is the main occupation of this village. But farmers claim that they produce only for their self and family consumption. There remains no marketable surplus. Some persons are factory workers but they are all labours under a contractor and it is temporary, no permanent job in factory. There is no Primary Health Centre, it is at 8 km distant in Kujang. There is no medical provision except three ASHAs. In emergency they go to hospital at Atharbanki by ambulance (108). There is no Post Office, it is at 1 km distant in Jhimani. There are two primary schools and one high school up to 10th Class. There are two Anganwadi Centre, but no training centre. The private tube well is the only source of drinking water. Total sanitation Campaign is successfully run here. Some have got houses under the Pradhan Mantri Awas Yojna. Malaria and typhoid are their frequent diseases. There is one playground where football and cricket matches are organised by the villagers. Women are members of Self Help Groups. At present there are near about 30 groups but they get no training. Liquor



3 - Description of the Environment (cont'd)

addiction among adult male is a serious problem of this village. The source of liquor is a nearby village. Raja - Oria New Year and Makar Sankranti fair are the main festivals in this village.

About this particular project they know about it and they are in favour of it. But they complained about the gas from existing factories damage their crops, coconut and causes cancer. Still they want permanent fob in factories. They need livelihood training for SHGs.

Village Bhutmundi: Stationary shop, construction labour, Panchayat contractors are some of the occupations accompanying agriculture as the main occupation in this village. Income ranges from Rs. 10,000/- to Rs. 15,000/-. There is no Primary Health Centre. But there is one private doctor at one medical store and two ASHAs. In emergency they go to hospital at Kujang or Paradip or Katak by ambulance (108) or by private communication. There are one primary school and one high school up to 10th Class. No college or training centre. There are 4 Anganwadi Centres. Ground water is saline prone, not suitable for drinking. So they carry it from ½ km distant. The source is private. There is one Post Office and Police station at Paradip Lock. Electricity is not stable here, 2/3 hours load shedding is regular case. Women are members of Self Help Groups. Gram Devta puja in Magh (Bengali month) is only festival in this village.

About this particular project they know it. They complaint that they have cases of cancer & heart attack for pollution by carbon from the existing factories and plants. ESSAR and HPCL sent medical team once or twice in past. Regular monitoring is essential according to their opinion. They need permanent job, quality drinking water, medical treatment facility and drainage system.



3 - Description of the Environment (cont'd)

Village Narendrapur under Viswali G.P.: Agriculture is the main occupation in this village and also IFCO workers are found in this village. Farmers claim that they produce only for their self and family consumption. Income ranges from Rs. 10,000/- to Rs. 12,000/- in other occupations. There is no Primary Health Centre and no medical facility except two ASHAs. Hospital is at 15 km distant in Kujang. There is one primary school but no high school, it is at 3 km distant in Bhutmundi. Solar system bore well is the source of water to drink and all-purpose use. It is supplied by the Panchayat. There is one Anganwadi Centre. Women are member of Self Help Groups. At present there are 20 such groups. There is one playground where cricket and volleyball matches are organised by the villagers. Astaprahar kirtan in March and Dolpurnima are the main festivals of this village.

About this particular project, they know it. They complained that gas, bad odour from the existing factories pollute the air and destruct their crops. Except this water logging and unemployment among educated youth are their serious problems and they need solutions from such industrial authorities.

3.14.5 Assessment of Physical Infrastructure in the Study Area

Education:

- i) No Govt or private Pre-primary School,
- ii) Govt Primary School at least one in all villages except Chauliapalanda & Abhaychandrapur Udaychandrapur, Udayabata Niharuni and Jaganathapur; one private primary school in Gayetrinagar and Nuagarh also.
- iii) Govt Middle School one in each village of Rangiagarh, Trilochanpur, Bara Jhimani
- iv) Govt High School one in each village of Bibi Colony, Dhinkia, Bara Jhimani, Kothi, Bhutmundi, Ramnagar, Chakradharpur, Musadia, Nuagarh, Rangiaghrh and



3 - Description of the Environment (cont'd)

Trilochanpur. One Municipality High School is in Madhuban and one English Medium School at Barporia.

- v) Degree College is available in Jhimani, Kujang, Paradip and Bibi Colony has one private college, No Training Centre and no school for disable.

Health:

- i) Primary Health Centre is available in Ramnagar, Balidiha, Atharobenki, Dhinkia, Malanka and Jhimani
- ii) Village Ramnagar has one TB clinic, one Alternative medicine hospital with medical and paramedical staff, and one Veterinary hospital.
- iii) Village Fatepur and Bhutmundi have non-government medical facility two in each village.
- iv) Hospital is available Kendrapara, Kujang, Atharobenki and Paradip
- v) One private hospital is in Gayetrinagar, one Ayurvedic Skin clinic in Pippal, one doctor in one medical store in Bhutmundi.
- vi) ASHA is available in all villages except village Abhaychandrapur

Water:

- i) Tap water is available in 16% villages, uncovered well is available in 80% villages and is functioning round the year.
- ii) Hand pump in all villages is the source of water. In Gayetrinagar and Singitali, pipeline water is available but in Singitali it is not drinkable, so they buy and carry it far from their locality.



3 - Description of the Environment (cont'd)

- iii) Pippal, Sandhakundu and Bhutmundi have no source of drinking water so they buy it and carry it far from their locality.
- iv) Authority of IOCL supplied their tank water in Rangiagarh and Trilochanpur
- v) In Dhinkia and Narendrapur Panchayat supply water by solar system bore well.
- vi) Tank and pond water is available in 80% villages.

Sanitation:

- i) Drainage - No drainage system Kuccha or pucca, covered or uncovered is found
- ii) TSC Status - Total Sanitation Campaign is 90 to 98% successful in 60% villages and 80 to 90% successful in 20% villages and rest 20% villages it is failed yet. Villages like Rangiagarh, Singitali, Abhayvhandrapu and Dhinkia continue open defecation and no Community Toilet Complex for general people
- iii) Community Waste Disposal System - No system is found and garbage on road is available in each village.

Post and Telegraph:

- i) Telephone Landline is available in 70% villages
- ii) Public Call office is available in 40% villages
- iii) Post Office is available at Kochila, Ramnagar Dhinkia Gopiakudu, Jhimani, Bhutmundi, Mullasahi, Mangarajpur, Singatalia, and Paradipgada.
- iv) 40% of villages have private courier service.
- v) All villages are under mobile phone coverage.



3 - Description of the Environment (cont'd)

Transport and Communication:

- i) Public Bus service is available in all urban areas and 40% of villages near to urban areas
- ii) Private Bus service is also available in urban areas and 30% villages near to urban areas
- iii) Railway station is there at Nimdihi, Rangiagarh, Mullasahi, Mangarajpur and Raghunathpur.
- iv) Auto is available in 50% of settlements
- vii) Taxi is available in 20% of settlements
- viii) Van is available in 10% and tractor is available in 60% of settlements.
- ix) Cycle Rickshaw is available in almost all villages and urban settlements
- x) Carts driven by animal is available in almost all villages
- xi) Ferry Service is available in village Bahakudu, Kodakam, Pitapat, and Chakradharpur
- xii) National Highway is available in villages Bhutmundi, Narendrapur, Musadia, Nuagarh, Udayabata, Chunablar Nimdihi and in urban areas.
- xiii) State Highway is available in 60% villages with urban areas
- xiv) Major District Road is available in 40% villages and 20% villages have other district road
- xv) Black topped pucca road is available in all villages and kuccha road also, but all weather roads are not available in any village whereas footpath is available in all villages



3 - Description of the Environment (cont'd)

Banking Service:

- i) ATM, Commercial Bank, Cooperative Bank, nothing is found in rural areas but are found in urban areas under Municipality
- ii) Only village Ramnagar possesses one Cooperative Bank and one Agricultural Credit Society

Food and Security:

- i) Public Distribution System is available in 60% villages
- ii) No regular market is available; weekly haat is available in villages Niharuni Kandha, Indrapa, Ramnagar, Pippal, Mangarajpur, Dinkia and Bilasahi.
- iii) Agricultural Marketing Society is available Musadiha, Indrapa, Katakulla, and more 16 villages
- iv) There 50% ICDS and 93% Anganwadi Centre are available in all villages

Recreation:

- i) Community Centre is available in 30% villages
- ii) Sports field is available in 50% villages.
- iii) Sports/Recreation Club is also available in 50% villages
- iv) Cinema/video hall is available 20% villages and public library or public reading rooms are also available in 20% villages
- v) All villages have daily newspaper

Administration:

Assembly Polling Station is available in 90% villages but no birth and death registration centre is available.



3 - Description of the Environment (cont'd)

Electricity Supply:

Electricity for domestic use is available for all villages, for use in agriculture is available in 70% villages, for commercial use available in 60% villages and electricity for all users is also available in 60% villages.

Products:

- i) The First product is Paddy, the second agricultural product is black gram and green gram for Mankadakhia, pulses for Fatepur, and vegetable for Raghunathpur, the third agricultural product is Mung for Indrapa, Chilli for Mankadakhia and dairy farm for Raghunathpur.
- ii) There is no manufacturing product and no handicraft product.

Self Help Groups:

SHGs are available in all villages. In some villages like Fatepur, Jhimani and Rangiagarh SHGs have got different livelihood training and became financially self dependent.



4 - ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

This chapter discusses the anticipated impact of the proposed project at its construction & operational stage from the environmental point of view and the mitigation measures to be adopted to minimise the adverse impacts on the prevailing environment.

4.1 OBJECTIVES OF EIA

The objective of conducting EIA during conceptual stage of the project is to assess the overall impacts due to the proposed project activities, identify & predict the probable environmental impacts and plan suitable mitigation measures for the entire life cycle of the project, that is, from concept to operation for sustainability of the project.

4.2 SCOPING OF EIA

In consideration of the proposed project, the Expert Appraisal Committee of the MoEFCC has firmed up the scoping for the EIA, as stated in the ToR of EIA given in Appendix 1-2.

4.3 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

In the earlier chapters, the process technology to be adopted for the proposed project has been discussed with reference to environmental impact potential. The following analysis covers the impacts on the prevailing environment and the suggested mitigation measures.

4.4 SCOPING OF IMPACTS

In consideration to the proposed project and prevailing site environment, impact on the following aspects of the environment would be assessed during construction as well as operation phase:



4 - Anticipated Environmental Impacts & Mitigation Measures (cont'd)

- i) Impact on land
- ii) Impact on soil quality
- iii) Impact on water resource & quality
- iv) Impact on air environment
- v) Impact due to plant noise generation
- vi) Impact due to solid wastes generation
- vii) Impact on biological environment, both terrestrial & aquatic ecology
- viii) Impact on social environment

The following text discusses each of such impacts and their mitigation measures.

4.5 IMPACT DURING CONSTRUCTION PERIOD

The construction activities involve site preparation, earth work, concreting, structural steel work and erection. It is expected that most of the civil construction materials like steel, cement, sand & stone chips would come by rail & road from adjoining regions and plant & machineries by rail/road from different parts of India and by sea from abroad. The construction period would be 30 months from “Go-Ahead date”.

4.5.1 Impact due to Solid Waste Generation

Solid waste during the construction phase would consist primarily of Construction & Demolition (C & D) waste like excess concrete & cement, rejected components & materials, packing & shipping materials including waste plastics, hazardous wastes like paint containers and used oil & grease as well as Municipal Solid Waste (MSW) including kitchen waste, canteen waste, waste from landscaping & greenery development etc. Proper disposal of the solid wastes as per the provisions laid down in C & D Waste Management Rules 2016, Solid Waste Management Rules 2016, Plastic Waste management Rules 2016 & Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 would be carried out to avoid adverse impact due to these wastes.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Mitigation Measures:

- i) Onsite segregation of the wastes generated would be carried out as per the regulations.
- ii) The recyclable materials would be segregated and sold to external agencies for secondary use.
- iii) Hazardous waste would be stored in a separate earmarked area and disposed as per prevalent regulations.
- iv) Cleaning of site from all sorts of construction wastes would be done from the respective construction zones. The construction wastes would be stockpiled in earmarked area within the plant, recycled wherever applicable.
- v) The balance material would be cleared from the site by authorised external agencies for proper disposal as per prevalent regulations.
- vi) MSW produced during construction would be collected in colour coded bins for segregation and disposed as per prevalent regulations.

4.5.2 Impact on Soil Quality

The proposed project would come up within the 100-acre land area of EML at Paradeep. The excavated topsoil would be kept in an isolated earmarked area with tarpaulin cover and utilized for landscaping and greenbelt development. Hence, no significant impact is envisaged on the soil quality of the project area.

Construction activities would be confined to the plant boundary. Therefore, no impact on the soil quality of the study area located beyond the plant boundary has been envisaged.

4.5.3 Impact on Water Quality

There would be generation of wastewater including surface run-off, sanitary and kitchen wastewater during the construction phase, which if released untreated would have adverse impact.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Mitigation Measures:

- i) A Sewage Treatment Plant of about 8 m³/hr capacity would be installed for treatment of drinking and sanitary wastewater
- ii) The stockpiles of construction material like sand, cement etc. would be protected with toe wall of adequate height along with concrete garland drain & catch pits to prevent uncontrolled discharge of runoffs during monsoon and reuse the collected waste water for construction purpose after primary settling. The settled solids would be disposed as per provision of C&D Waste Management Rules

4.5.4 Impact on Air Quality

Particulate matter would be the predominant pollutant affecting the air quality during the construction phase. The following activities would generate considerable amount of dusts & fumes:

- i) Excavation for foundations and backfilling activities
- ii) Concreting work
- iii) Road making activities
- iv) Vehicle transportation of building material to site
- v) Running of DG sets

Mitigation Measures:

- i) Unloading of construction materials like stone chips & sand and stockpiling of the same at the earmarked site would be provided with water sprinkling to arrest fugitive dust emission. Additionally, wind barrier screen would be provided around stockpiles to reduce the wind speed and consequently, reduce the fugitive dust emission.
- ii) Logistics would be designed to maximize transportation of major raw materials by rail, minimizing movement of trucks. Optimization of the quantity of construction materials stored at site will be administered.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

4.5.5 Impact of Noise Level

The major noise generating source during the construction phase would be vehicular traffic, construction equipments like dozer, scrapers, concrete mixer, crane, generators pumps, and compressor, rock drills, pneumatic tools, vibrators, DG sets, etc. Though temporary, exposure to higher noise levels during construction period may cause various adverse effects including hearing & other health issues and overall ecological disturbance.

Mitigation Measures:

- i) Provision of Personal Protective Equipment (PPE) like ear muffs, ear plugs etc.
- ii) DG sets would conform to the latest regulatory norms and would be provided with integral acoustic enclosure.

4.6 IMPACT DURING OPERATION PHASE

4.6.1 Impact on Land Environment

The proposed project would be set up at the land allotted to EML by Paradeep Port Trust which is industrial land. Since the industrial land use of the site would remain unaltered, there would be no impact on the land environment in terms of loss of agricultural land or loss of vegetation.

The proposed project would further lead to enhancement of trade and commerce, commercial establishments, generation of employment, etc. In other words, the project would have beneficial impact on the land valuation, benefitting private land owners.

During the interim period the incoming raw material would be transported from Paradip port through a pipe conveyor envisaged for transportation of product pellet during normal operation. Since the pipe conveyor is completely sealed with no leakage points, there would be no additional impact during the interim period.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Mitigation Measures: As stated earlier there would be marginal impact on land environment due to temporary storage of raw materials & solid wastes. The following measures would be undertaken to mitigate the same:

- i) All raw material stockpiles would be compacted & stored in paved areas to avoid leaching to groundwater and soil.
- ii) The aim for solid waste management would be recycling of the solid wastes in the pelletization process. The solid wastes management plan has been discussed separately under 'Impact due to solid wastes' in this chapter as well as in Chapter-2.

4.6.2 Impact on Soil Quality

During the operation stage, there would be deposition of the emitted particulate matter on the soil in the study area. However, in view of the air pollution control measures, management measures for solid wastes and adoption of ZLD as described in Chapter 2, there would be no significant impact on the quality of soil in the project area as well as study area. Soil testing would be done once a year to assess the soil quality of the project area & study area. There would be no additional impact during the interim period of operation.

4.6.3 Impact on Surface Water Resource

The proposed pellet plant would meet the make-up water requirement entirely through the recovered water from slurry dewatering. Therefore, the project would have no impact on surface water resource of Mahanadi River. There would however be a cumulative impact on the surface water resource for the Beneficiation Plant at Tikarapada village.

Mitigation Measures: In view of the cumulative negative impact rendered due to additional withdrawal, the following water conservation measures have been considered:



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

- i) Closed loop-cooling circuit for each production unit requiring water for cooling purpose
- ii) Use of treated wastewater from the respective production units as well as non-production facilities.
- iii) Use of blow down water from respective production units in various low-end uses like dust suppression, dry fogging, gardening and equipment washing.
- iv) Harvesting of rainwater and collection in the Storm Water storage pond which would provide make up water during lean season and allow more water to be returned back to the beneficiation plant.
- v) Adoption of 'ZLD' i.e. complete recycling of treated wastewater within the plant
- vi) Calculation of water footprint, water auditing and provision of water consumption meters for each production facility to facilitate water budgeting, minimize losses and monitor water consumption on regular basis.

With these conservation measures and harvesting of storm water, the withdrawal of surface water at Tikarapada would be optimized.

Surface run off would be utilised to the extent possible after settling of solids and deoiling and only the excess amount would be discharged to Mahanadi following CPCB guidelines. Monitoring of discharged storm water would be conducted periodically as per the CPCB norms at the outlet of storm water discharge.

4.6.4 Impact on Ground Water Resource and Quality

The proposed project has not been planned based on ground water extraction as water source. Thus, there would be no impact on ground water resource.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

There may be contamination of ground water due to seepage if untreated wastewater is discharged. There may also be impact on ground water quality due to leaching from the raw materials stockpiles & solid wastes stored temporarily on the ground.

During the interim period the incoming raw material would be transported from Paradip port through a pipe conveyor envisaged for transportation of product pellet during normal operation. Since the pipe conveyor is completely sealed with no leakage points, there would be no additional impact during the interim period.

Mitigation Measures: The proposed project has been designed on Zero Effluent Discharge, hence the possibility of any ground water contamination due to release of plant wastewater is ruled out. Moreover, concrete box drains would be constructed to prevent any water loss through seepage and subsequent ground water contamination. For temporary storage of solid wastes, the storage yard would be lined with suitable liner to avoid leaching through soil bed leading to contamination of ground water. Run off from solid wastes storage site would have surrounding garland drains with catch pits to collect the rainwater to separate out the suspended solids for in-plant use.

In view of the above mitigation measures, the impact on ground water quality would be insignificant.

4.6.5 Impact on Air Environment

The proposed set up would emit particulate matter (PM), SO₂, NO_x, etc from its various units proposed. Post project, there would be around 8 stacks designed to vent off the gas loaded with the pollutants. Further to the point source emissions, there would also be fugitive emissions from raw material and finished product stockpiles. The controlled emission inventories of PM, SO₂ and NO_x are estimated to



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

be **47.6 kg/hr, 100 kg/hr and 200 kg/hr** respectively during full operation and **23.8 kg/hr, 50 kg/hr and 100 kg/hr** respectively during the interim operational period. During the interim period the incoming raw material would be transported from Paradip port through a pipe conveyor envisaged for transportation of product pellet during normal operation. Since the pipe conveyor is completely sealed with no leakage points, there would be no additional impact during the interim period.

4.6.6 Management Measures for Air Pollution

Air pollution mitigation measures form an integral part of the project. Best practices would be adopted as mentioned in Chapter 2.

As observed from the monitored baseline data, ambient PM₁₀ levels in the study area range from 80.6 µg/m³ at Akhadasali on the other bank of Mahanadi River to as high as 130.3 µg/m³ at Niharunikandha. The contributions to the ambient dust levels are attributed to the presence of multiple manufacturing units including IOCL, Paradeep Phosphate and other associated anthropogenic activities in the study area. The level of the pollutants is determined through modelling to understand the contribution of the existing plant to the ambient air quality. There would be rise in the level of the pollutants post project as predicted by the air dispersion modelling study.

To predict the post project ground level concentrations (glcs) of PM₁₀, PM_{2.5}, SO₂, NO_x and CO respectively, BREEZE ISCST3, US-EPA approved software was used. The input provided to the model comprises of the stack data for proposed pellet plant, the site specific meteorological data for the monitoring period (Mar - May 2021) and the terrain elevation data (Cartosat from NRSC - Bhuvan Portal). Cartesian grid type receptors were considered with flagpole height of 1.5 m (average breathing height).

4 - Anticipated Environmental Impacts & Mitigation Measures (cont'd)

The glcs determined for the proposed project have been modelled and shown in Figs. 4-1 to 4-5 in the following pages. The incremental contribution due to the proposed project at the air quality monitoring locations distributed within the study area and the predicted post project AAQ are presented in Table 4-1 and Table 4-2 respectively. During the interim period since only one module would be operational the glc values would be 50% of that predicted at 14 MTPA stage.

TABLE 4-1 - CONTRIBUTION OF THE PROPOSED PROJECT

Station name	AAQ Station (Distance and direction w.r.t. project site)	Pollutant	Contribution from vehicular movement (for PM only) & point source emission, $\mu\text{g}/\text{m}^3$ (B)
Dhenkia	A1 (6.6 km SW)	PM ₁₀	0.53
		PM _{2.5}	0.26
		SO ₂	0.7
		NO _x	1.3
		CO (8 hrs avg)	4.78
Pratappur	A2 (7.19 km WSW)	PM ₁₀	0.05
		PM _{2.5}	0.03
		SO ₂	0.4
		NO _x	0.7
		CO (8 hrs avg)	4.78
Paradeep (near Biju Patnaik hospital)	A3 (1.35 km SSW)	PM ₁₀	1.01
		PM _{2.5}	0.5
		SO ₂	1.9
		NO _x	3.7
		CO (8 hrs avg)	20.56
Udayabata	A4 (2.17 km NNW)	PM ₁₀	2.92
		PM _{2.5}	1.46
		SO ₂	2.2
		NO _x	4.3
		CO (8 hrs avg)	28.45
Bhutmundai	A5 (7.19 km NW)	PM ₁₀	0.05
		PM _{2.5}	0.03
		SO ₂	0.7
		NO _x	1.3
		CO (8 hrs avg)	0.83
Akhadasali	A6 (7 km N)	PM ₁₀	0.53
		PM _{2.5}	0.26
		SO ₂	2.2
		NO _x	4.3
		CO (8 hrs avg)	20.56
Niharunikandha	A7 (1.69 km WNW)	PM ₁₀	1.48
		PM _{2.5}	0.74
		SO ₂	1.3
		NO _x	2.5
		CO (8 hrs avg)	12.67
Musadia	A8 (4.38 km NE)	PM ₁₀	0.53
		PM _{2.5}	0.50
		SO ₂	1.6
		NO _x	3.1
		CO (8 hrs avg)	16.62

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

TABLE 4-2 - POST PROJECT PREDICTED AMBIENT AIR QUALITY

AAQ Station (Distance and direction w.r.t. project site)	Pollutant	Baseline (P ₉₈) µg/m ³ (A)	Contribution from vehicular movement (for PM only) & point source emission, µg/m ³ (B)	Post project Ambient Air Quality, µg/m ³ (A + B)	NAAQ Standard, µg/m ³
A1 (6.6 km SW)	PM ₁₀	118.3	0.53	118.83	100
	PM _{2.5}	64.4	0.26	64.66	60
	SO ₂	12.1	0.7	12.8	80
	NO _x	36.5	1.3	37.8	80
	CO (8 hrs)	300	4.78	304.78	2000
A2 (7.19 km WSW)	PM ₁₀	83.0	0.05	83.05	100
	PM _{2.5}	42.7	0.03	42.73	60
	SO ₂	<4.0	0.4	4.4	80
	NO _x	25.6	0.7	26.3	80
	CO (8 hrs)	<100	4.78	104.78	2000
A3 (1.35 km SSW)	PM ₁₀	120.5	1.01	121.51	100
	PM _{2.5}	69.3	0.5	69.8	60
	SO ₂	11.8	1.9	13.7	80
	NO _x	33.9	3.7	37.6	80
	CO (8 hrs)	400	20.56	420.56	2000
A4 (2.17 km NNW)	PM ₁₀	124.9	2.92	127.82	100
	PM _{2.5}	69.7	1.46	71.16	60
	SO ₂	20.7	2.2	22.9	80
	NO _x	34.0	4.3	38.3	80
	CO (8 hrs)	500	28.45	528.45	2000
A5 (7.19 km NW)	PM ₁₀	88.4	0.05	88.45	100
	PM _{2.5}	51.4	0.03	51.43	60
	SO ₂	7.0	0.7	7.7	80
	NO _x	28.5	1.3	29.8	80
	CO (8 hrs)	<100	0.83	100.83	2000
A6 (7 km N)	PM ₁₀	80.6	0.53	81.13	100
	PM _{2.5}	43.2	0.26	43.46	60
	SO ₂	<4.0	2.2	6.2	80
	NO _x	25.7	4.3	30	80
	CO (8 hrs)	<100	20.56	120.56	2000
A7 (1.69 km WNW)	PM ₁₀	130.3	1.48	131.78	100
	PM _{2.5}	70.0	0.74	70.74	60
	SO ₂	24.4	1.3	25.7	80
	NO _x	37.3	2.5	39.8	80
	CO (8 hrs)	600	12.67	612.67	2000
A8 (4.38 km NE)	PM ₁₀	118.3	0.53	118.83	100
	PM _{2.5}	64.9	0.50	65.4	60
	SO ₂	13.7	1.6	15.3	80
	NO _x	36.3	3.1	39.4	80
	CO (8 hrs)	400	16.62	416.62	2000

From the above tables, it may be seen that PM₁₀, SO₂ and NO_x levels in the ambient air during operation of the plant post project would rise as expected. SO₂ and NO_x would comfortably well within the National Ambient Air Quality Standards (NAAQS) by MoEFCC as presented in Appendix 3-1.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

The post project ambient air quality levels in terms of PM would exceed NAAQS levels due to the already elevated levels of dust as mentioned previously. The mitigation measures to bring down the dust in the entire Paradeep area would require the area to be divided into zones which would be adopted by groups of industries and the following measures are suggested to be implemented:

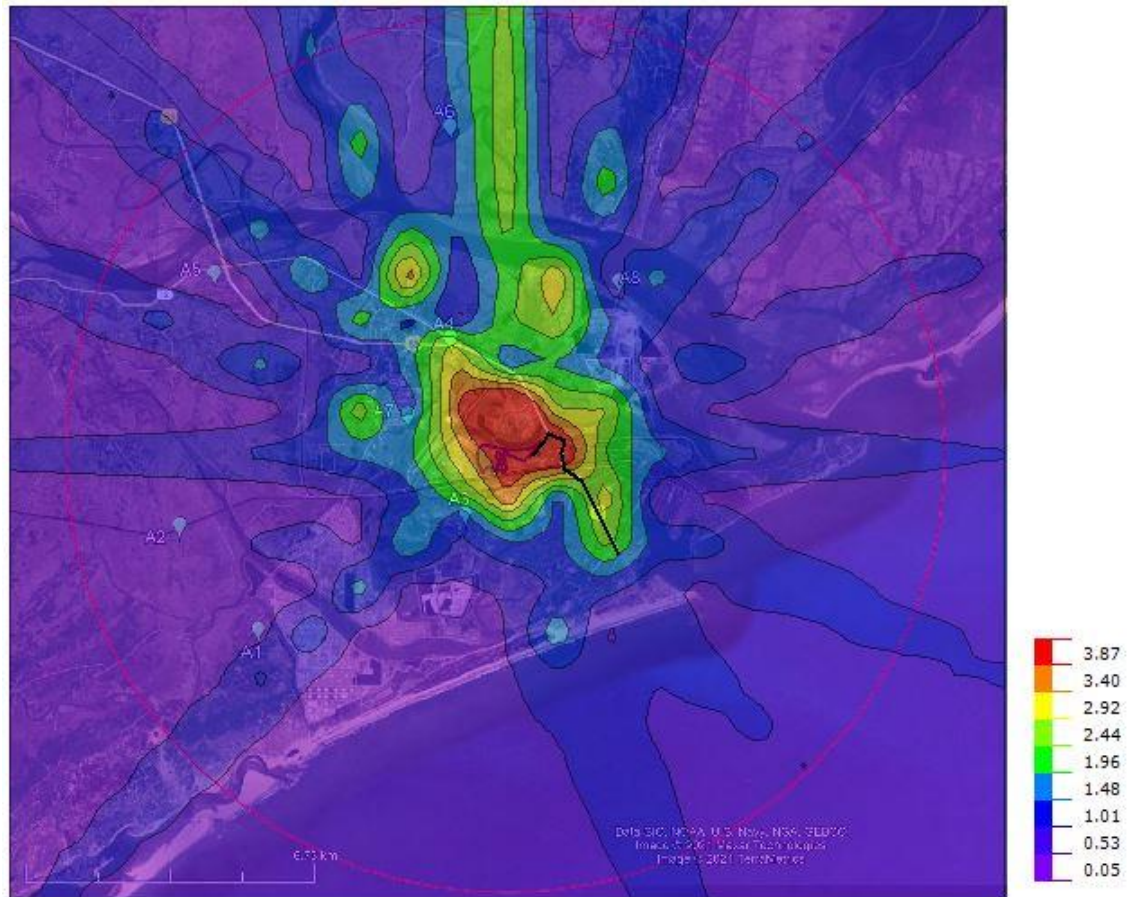
- i) Regular maintenance of road
- ii) Water sprinkling every 2 hours
- iii) Installation of vehicle tyre washing at the entry of industrial area
- iv) Avenue plantation along all internal roads
- v) Concreting of all kutcha roads

It is also required to conduct carrying capacity study of the industrial area by the relevant government body and coordination with industries to implement the said mitigation measures.

Additionally, EML proposes to install tyre washing facilities at the exit side of material gate (Gate#2). In addition to the regular water sprinkling by Paradip Port Authority on the road leading to the plant from Terminal Chowk, EML will also carry out water sprinkling.

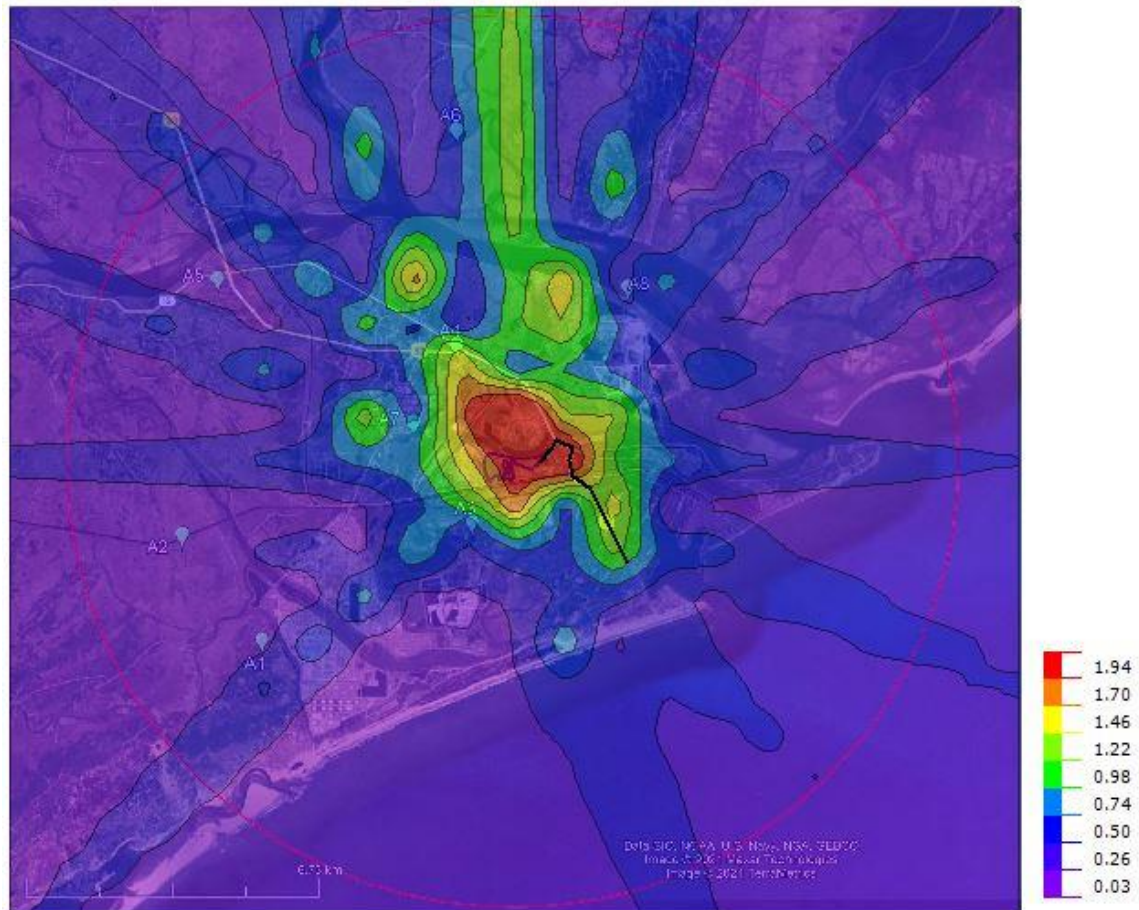
EML will also develop avenue plantation in this stretch of about 1 km from Terminal Chowk to the plant. EML will approach NHAI for giving permission for avenue plantation for a stretch of 2 km on NH-53. EML will explore planting trees for additional greenery in the available State Govt. land in the nearby area.

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)



**FIG. 4-1 - PREDICTED 24-HOURLY AVERAGE GLC OF PM₁₀ IN
µG/CUM**

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)



**FIG. 4-2 - PREDICTED 24-HOURLY AVERAGE GLC OF PM_{2.5} IN
µG/CUM**

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

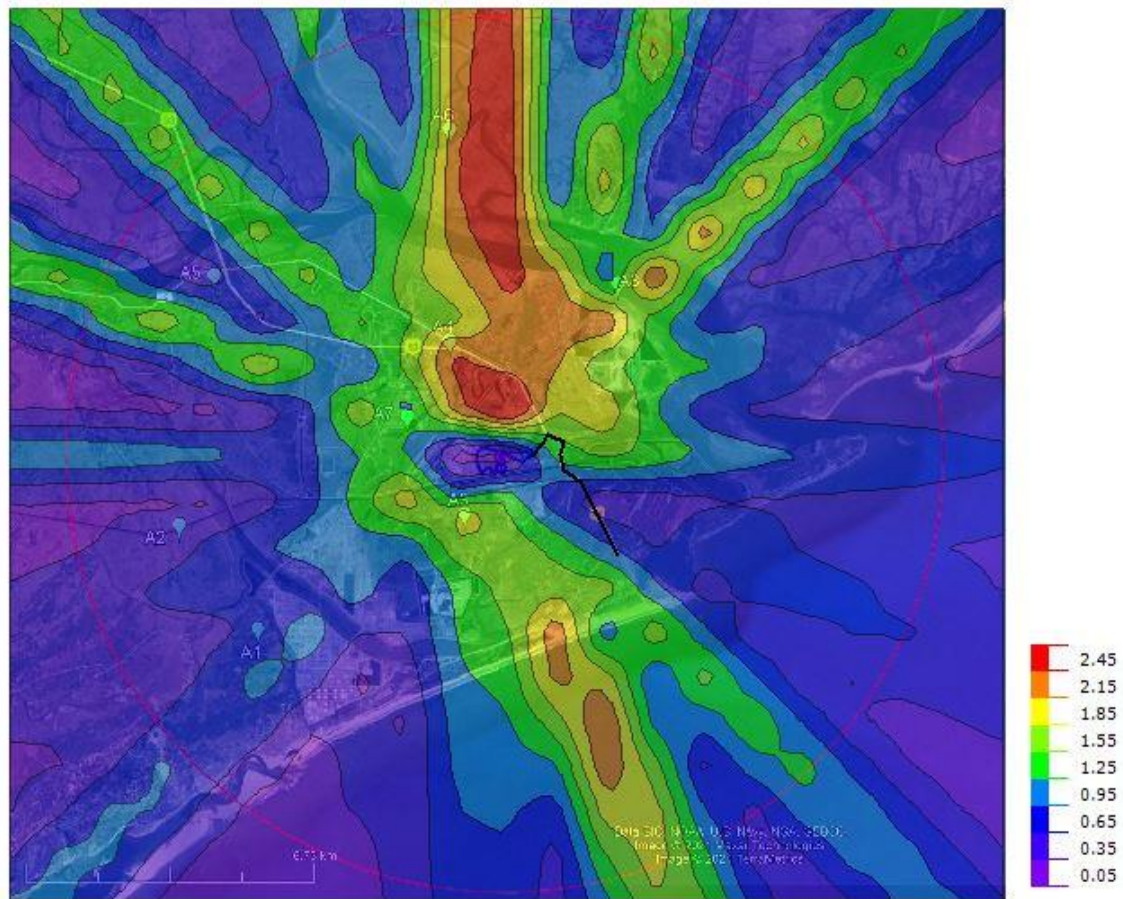


FIG. 4-3 - PREDICTED 24-HOURLY AVERAGE GLC OF SO₂ IN µG/CUM

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

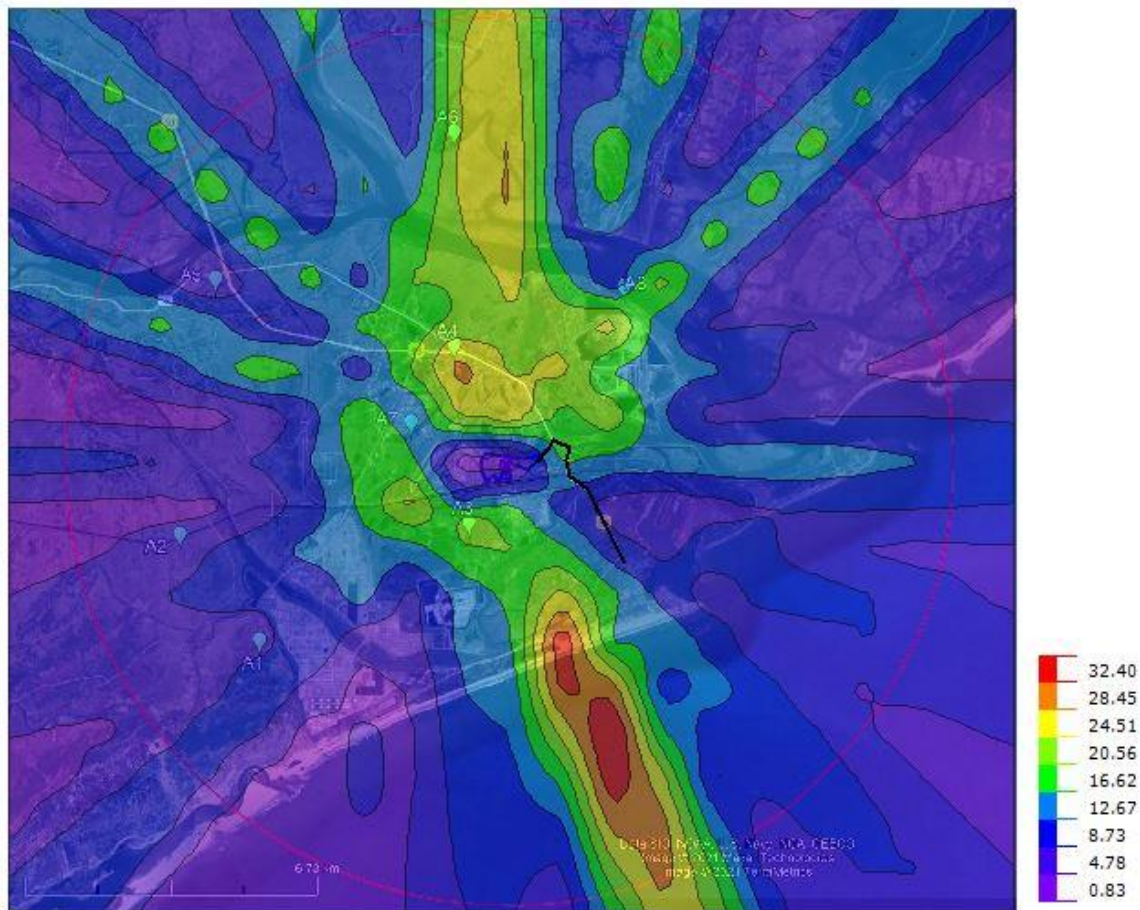


FIG. 4-5 - PREDICTED 24-HOURLY AVERAGE GLC OF CO IN µG/CUM

In addition to the mitigation measures stated in Chapter-2, the other mitigation measures proposed to be adopted in view of the high pollution level of the region are as follows.

- i) Pneumatic or covered truck transportation would be employed for the collected dusts from the dust catchers of various units.
- ii) Plant roads would be black topped & kept dust free by using industrial vacuum cleaners and water sprinkling at regular intervals.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

- iii) Installation of tyre washing system at the exit side of material gate (Gate#2) to reduce the fugitive dust due to movement of heavy vehicles.
- iv) Provision of wind barrier specially around stockpiles to reduce wind-borne emissions
- v) Dedicated truck parking would be provided and idle running of vehicles would be minimized
- vi) In future the LDO is envisaged to be replaced with Natural Gas subject to availability
- vii) PTFE dipped bag filters would be utilized for all Dedusting stacks to keep PM emission below 20 mg/Nm³
- viii) Development of 3 tier greenbelt along plant periphery and wind curtain of 8 - 10 m to minimize fugitive dust emission

4.7 IMPACT ON TRAFFIC LOAD

The details of vehicular load due to the proposed project have been described in Chapter 2. The total traffic load due to the proposed project considering incoming and outgoing traffic for transportation of raw material is about 629 PCU/day (considering 3.7 PCU per truck/dumper).

The baseline traffic load from IFFCO Chowk to Paradeep port as measured at Atharbanki is 27,499 PCU/day. Therefore, the post project traffic load on the road to Paradeep port would be 28,128 PCU/day. The present LOS of the road considering existing V/C is C and there would be no change in LOS considering the additional traffic due to the proposed project.

In order to mitigate the additional impact due to increased vehicular load, it is proposed to ensure that vehicles moving within the study area shall meet the latest Emission Standards applicable in the region. Moreover, it is proposed to augment the use of mass



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

transportation system, that is, buses adhering to BS-V standards in order to reduce traffic as well as pollution load. Roads and crossings would be suitably planned to avoid traffic congestion. As mentioned before, heavy trucks would be parked in a separate place and idle running would be avoided. Further, major raw materials would come by sea and transported to the plant area by road in covered trucks for a short distance. Finished product would be dispatched via sea route and the pellet would reach the port area through covered conveyor.

Fugitive emission arising from vehicular movement for transportation of raw materials & finished products would be mitigated by installation of tyre washing system as mentioned earlier.

During the interim operational period, the impact due to vehicular traffic would be 50% of the vehicular traffic load stated above.

4.8 IMPACT DUE TO NOISE

Project activities would add to the noise level generated by existing units & activities. Elevated noise levels would have detrimental impact on the health of working personnel in and around the plant premises. Health effects due to noise include hearing impairment, hypertension, cardiovascular diseases and sleep disturbance. Beyond these effects, elevated noise levels can create stress, increase workplace accident rates, and stimulate aggression and other anti-social behaviours. Higher noise levels also have traumatizing effect on animals.

Noise attenuation measures have been considered as a part of plant design as described in Chapter 2. The monitored baseline data shows that the existing noise level for industrial area are mostly within the regulatory standards. The integrated noise mitigation measures would control the generated noise due to the proposed project and there



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

would be no impact due to the additional generation of noise. Apart from these measures, the peripheral greenbelt would help in containing the generated noise within the plant boundary.

4.9 IMPACT DUE TO SOLID WASTE GENERATION

The generated solid waste, as described in Chapter 2 would be mostly fines generated in the process and recovered in dedusting equipment. The generated solid waste would also cause secondary issues like fugitive emissions if not stored and disposed in a proper manner. E-waste generated from the plant would contain trace metals like mercury, lead, cadmium etc. which are toxic in nature and possess the potential to contaminate soil and ground water. Other than these waste oil would be generated which would be handed over to Authorised Recyclers for further processing. The MoU signed with the Authorised Recycler is given in Appendix 4-1.

4.9.1 Management Measures for Solid Waste

The reuse/recycling techniques that have been envisaged for the proposed project are standard practices which form an integral part of the process flow. The solid waste re-utilisation measures have already been described in detail in Chapter 2. E-waste would be handed over to authorised recyclers as laid down in E-waste management Rules, 2016.

After adoption of the mentioned waste utilization/disposal techniques it is envisaged that the impact due to solid waste generation from the proposed project would be insignificant.

4.10 IMPACT ON ECOLOGY DURING CONSTRUCTION PHASE

4.10.1 Impact on Terrestrial Ecology and Mitigation Measures

Due to removal of vegetations: The impact of construction activities would be primarily confined to the project sites, covering a total of 100.13 acres land within EML plant boundary. As stated earlier,



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

the site area is non agricultural barren land, cover with weeds and common grasses. The site development works leads to land clearing & leveling activities involves removal of these vegetations within the project area. Removal of these vegetations would not have any significant ecological impact as these species are very common and widely available in this area.

Due to deposition of dust on pubescent leaves:

Construction activities leads to removal of top soil, often leads to soil erosion that generate fugitive dust due to vehicular movement. The generation of fugitive dust due to vehicular movement would have negative impact on the surrounding vegetation due to deposition of dust on pubescent leaves which may lead to temporary reduction of photosynthesis. However, this would be confined to the initial periods of the construction phase and would be minimized through water sprinkling, paving roads and phase wise judicious construction management plan.

Due to increase noise level: Additional vehicular movement for import of construction materials and operation of construction machineries may lead to increase of noise level in the surrounding environment causing adverse impact on human health and disturbance to faunal species. Noise prone construction activities such as piling, drilling, excavation, cutting, etc. would be done during daytime only. The noise pollution certified construction machineries would be allowed for operation at site, thus, increased noise level at project boundary would be contained below the permissible limit.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

4.10.2 Impact on Aquatic Ecology and Mitigation Measures

Due to construction waste water: Runoff construction waste water from project site may drain into nearby reservoir that causes water pollution in the reservoir, however, it is proposed that no waste water would be discharged and it will be reused for plantation through settling basin. Hence, no impact on aquatic ecology envisaged.

4.11 IMPACT ON ECOLOGY DURING OPERATION PHASE

4.11.1 Impact on Terrestrial Ecology and Mitigation Measures

Due to stack emission and fugitive dust: During the Operation phase, the anticipated impact on vegetations and agricultural crops from stack emission and fugitive dust, that would be mitigated through necessary control measures for air pollution as detailed mention in Chapter-2.

Due to increase noise level: Disturbance from noise to the resident faunal species in forest area would be mitigated through greenbelt development, boundary wall and other necessary control measures for noise pollution, as detailed mention in Chapter-2.

Due to fugitive dust from solid waste storage area: The solid waste storage area would be impervious floor to prevent seepage and surrounded by a well developed greenbelt that would restrict fugitive dust emission.

In addition to the said control measures 40 acres of land area, i.e. 40% of the EML total project area 100.13 acres, would be covered with green vegetation comprising of native & fast growing trees and shrubs species.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

4.11.2 Impact on Aquatic Ecology and Mitigation Measures

The plant would be operated based on Zero Effluent Discharge model as described earlier in chapter-2, hence there would not be any chance to discharge of waste water from the proposed project facilities. Hence, no impact on aquatic ecology is envisaged.

4.12 SITE SPECIFIC WILDLIFE CONSERVATION PLAN

The commonly found fauna in Rajnagar Wildlife Division are: Crocodiles, Dolphins, Turtles including Olive Ridley Turtle, Spotted Deer, Barking Deer, Wild Pig, Hyena, Jackal, Indian Hare, Palm Squirrel, Hanuman Langur and small Indian Mongoose etc. Birds seen in this area are Parakeets, Spotted Dove, Crow, House Sparrow, Crow Pheasant, Blue Jay, Black Drongo, Spotted Owlet, Spotted Munia, Sunbirds, Tailor Bird etc. Reptiles that are commonly reported are Python, Cobra (*Naja naja*), Rat Snake, Sand Boa, House Geko, Keel Back, etc.

Human-animal conflict has been noticed at moderate to low rate. The proposed project is located near Paradip port and no forest land is involved. Hence the effective impact on wildlife is almost nil. However, due to the implementation of the project the vehicular movement and human movement will increase in the area. Due to the presence of Schedule I species in the study area it is required to prepare a Site Specific Wildlife Conservation Plan as per ToR. The Site specific Wildlife Conservation plan has been authenticated by the Office of PCCF and Chief Wildlife Warden, Odisha vide letter no. 3203/CWLW-FDWC-MISC-0006-2022. Since Bhitarkanika Wildlife Sanctuary falls within 10 km radius, the map of the project site vis-à-vis location of national parks, wildlife sanctuaries etc. has also been authenticated by the Chief Wildlife Warden, Odisha and is part of the Site specific Wildlife Conservation plan. The Wildlife Conservation Plan is given in Appendix 4-2.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

The summary of the activities proposed and the budget allocated for each activity is as follows:

- i) Annual maintenance, Inspection of propulsion system, Stationing of technical support staff at Gahirmatha Range Headquarter, Replacement of lube oils, filters. Periodical inspection of electrical control & safety for 5 years of 2 Govt. high speed boats (Gahirmatha-I & II) & Govt. trawlers @ 5.50 lakh/year/Govt. high speed boat engaged for Olive Ridley conservation. Total Rs. 55.00 lakhs for 10 years.
- ii) Spare part cost of speed boat/year for 5 year for 2 Govt. high speed boats (Gahirmatha-I & II) & Govt. trawlers@ Rs. 3.00 lakhs/year. Total Rs. 30.00 lakhs.
- iii) Procurement & hiring of vehicles, vessels, mechanised boat. & POL cost. Procurement of equipment for monitoring, patrolling & logistics supply and protection of Olive Ridley Sea Turtles, dolphin & marine wildlife conservation Total Rs. 60.00 lakhs.
- iv) Procurement & hiring of vehicle, vessel, mechanised boats & POL cost. Procurement of equipment for Salt Water Crocodile & other mangrove ecosystem conservation is Rs. 40.00 lakhs.
- v) Upgradation of Range level wild animal rescue and conflict management through procurement & hiring of customised vehicle, purchase of trapping cage/nets, equipment for installation of signages for reduction of human wildlife conflicts.. The amount proposed is Rs. 40.00 lakh.
- vi) Maintenance of Divisional & Range level wildlife control room. The amount proposed is Rs. 10.00 lakh.
- vii) Field Monitoring Station, Section & Beat office upgradation & maintenance for crocodile, Olive Ridley & dolphin conservation. The cost proposed is Rs. 25.00 lakhs.
- viii) Awareness drive on wildlife conservation. The cost proposed is Rs. 15.00 lakhs.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

- ix) Procurement of GPS and Smart patrol equipments. The cost proposed is Rs. 20.00 lakhs.
- x) Monitoring & evaluation. The cost proposed is Rs. 3.151 lakhs.
- xi) 20% escalation cost amounting to Rs. 59.630 lakhs is also proposed.

This plan has been prepared for 10 years and may be revised thereafter considering the changes which may take place in the forest in question after implementation of this plan.

The total allocation of funds during the plan period is Rs. 357.781 lakhs, which shall be deposited with the Forest department/D.F.O. Rajnagar Wildlife Division for execution of the above activities within the project impact area.

Inference and Mitigation Measures: Presence of protected forests, development of greenbelt all along the project boundary, implementation of conservation plan for flora-fauna and other mitigation measures as described in Chapter-2, ensures that there would be insignificant impact on the terrestrial and aquatic ecology of the study area due to the proposed project activities. Thus, no significant stress on terrestrial and aquatic flora & fauna in the study area is foreseen.

4.13 GREENBELT DEVELOPMENT PLAN

The green belts are acting as a natural barrier to noise and buffer of air pollutants that also boosts eco-restoration and aesthetics of the area. Leaves adsorb pollutants on their surface, especially near the tree crown thus effectively reducing pollutant concentration in the ambient air. Often the adsorbed pollutants are incorporated in the metabolic pathway and the air is purified. Apart from function as



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

pollution sink, greenbelt would also provide suitable habitats for birds and other small animals. Checking soil erosion, restoring water balance and enhancing micro climatic conditions are some of the other objectives of greenbelt development.

4.13.1 Design of Greenbelt

Out of 100.13 acres of EML pellet plant area, 40 acres (40%) of land to be develops as a green belt and landscaping by special attention to the native plant species in the areas along the plant boundary, around the waste dump and between various facilities. A green belt of average 10 - 100 m wide has been proposed all around the periphery of the plant. On an average 2,500 trees per hectare with local native species and other suitable species would be planted. A total of 40,475 trees would be planted. However, the density of plantation would depend on factors such as the type of species and location factors. However, treated sewage water would be used for landscaping and green belt development purposes.

4.13.2 Greenbelt Development Methodology and Approach

Preparation of Plantation Area: Plantation site would be cleared from all wild vegetation. Suitable soil and water conservation measures would be adopted. If planting area is large, it would be divided into blocks inter-linked by paths laid out in such a way that every tree is accessible for all post plantation care. The planting arrangement and size would be based on the optimum use of the available land, quantum of irrigation water, purpose of plantation and the tree species.

Greenbelt Development Plan: Greenery would be develops along the periphery of the plant boundary, around the waste dumps and other vacant areas in various patches within the plant facilities and along the internal roads. The proposed greenbelt is shown in the plant general layout (Refer Drg. 11572-97A-000-ENV-0002).



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Location for proposed Greenery Development: The areas considered to special attention for plantation in the project area are

- i) Along the plant boundary
- ii) Around the waste dump
- iii) Around the administrative buildings
- iv) Patches between various shops
- v) Roadside plantation at approach road and internal roads

Selection of the plant species for proposed greenbelt:

Selection of the plant species has been conducted reviewing, CPCB (March, 2000), Guidelines for developing green belts PROBES/75/1999-2000, Anticipated Performance Index (API) of plants against air pollution (International Research Journal of Plant Science (ISSN:2141-5447) Vol.2(4)PP.099-106, April-2011) and adhere to the following specific requirements, a list of selected trees and shrubs given in Table 4-3.

- i) Availability of seed material and resistance to specific air pollutants.
- ii) Tolerance to wide adaptability to eco-physiological conditions.
- iii) Fast growing, native and large canopy.
- iv) Extensive foliar area to provide maximum impinging surface for continued efficient adsorption & absorption of pollutants.
- v) Capacity to endure water stress and climatic extremes after initial establishment.
- vi) Differences in height, growth habits and bole shapes.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

TABLE 4-3 - SELECTED TREES AND SHRUBS FOR GREENBELT

Greenbelt Layer	Common Name	Scientific Name
1st Layer (Curtain Belt)	Chakundi	<i>Cassia siamea</i>
	Debadaru	<i>Polyalthia longifolia</i>
	Dhala Siris	<i>Albizia procera</i>
	Jamun	<i>Syzygium cumini</i>
	Kala Siris	<i>Albizia lebbeck</i>
	Karanja	<i>Pongamia glabra</i>
	Neem	<i>Azadirachta indica</i>
	Palas	<i>Butea monosperma</i>
	Sagun	<i>Tectona grandis</i>
	Sisoo	<i>Dalbergia sissoo</i>
2nd Layer (Middle Belt)	Aswatha	<i>Ficus religiosa</i>
	Bat	<i>Ficus benghalensis</i>
	Chakundi	<i>Cassia siamea</i>
	Jarul	<i>Lagerstroemia speciosa</i>
	Kadamba	<i>Anthocephalus cadamba</i>
	Kala Siris	<i>Albizia lebbeck</i>
	Karanja	<i>Pongamia glabra</i>
	Neem	<i>Azadirachta indica</i>
	Tentul	<i>Tamarindus indica</i>
3rd Layer (Inner Belt)	Ashok	<i>Saraca indica</i>
	Babool	<i>Acacia arabica</i>
	Bougainvillea	<i>Bougainvillea spectabilis</i>
	Ber	<i>Zizyphus sp.</i>
	Duranta	<i>Duranta sp.</i>
	Karanja	<i>Pongamia glabra</i>
Approach Roadside Plantation	Akashmoni	<i>Acacia auriculiformis</i>
	Jamun	<i>Syzygium cumini</i>
	Kadamba	<i>Anthocephalus cadamba</i>
	Neem	<i>Azadirachta indica</i>
	Rain tree	<i>Samanea saman</i>
	Sagun	<i>Tectona grandis</i>
	Sisoo	<i>Dalbergia sissoo</i>
	Tentul	<i>Tamarindus indica</i>
Internal Roadside Plantation	Amaltas	<i>Cassia fistula</i>
	Bougainvillea	<i>Bougainvillea spectabilis</i>
	Cassia	<i>Cassia auriculata</i>
	Chakundi	<i>Cassia siamea</i>
	Debadaru	<i>Polyalthia longifolia</i>
	Gulmohar	<i>Delonix regia</i>
	Jarul	<i>Lagerstroemia speciosa</i>
	Java-ki-rani	<i>Cassia javanica</i>
	Kadamba	<i>Anthocephalus cadamba</i>
	Karabi	<i>Nerium indicum</i>
	Yellow Karabi	<i>Thevieta peruviana</i>

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Greenbelt Layer	Common Name	Scientific Name
Around the shops, office buildings and other available stretches	Am	<i>Mangifera indica</i>
	Amla	<i>Phyllanthus emblica</i>
	Arjuna	<i>Terminalia arjuna</i>
	Bahada	<i>Terminalia bellirica</i>
	Bakul	<i>Mimusops elengi</i>
	Bhalia	<i>Semecarpus anacardium</i>
	Copperpod	<i>Peltophorum pterocarpum</i>
	Champa	<i>Michelia champaca</i>
	Chatim	<i>Alstonia scholaris</i>
	Daba baunsa	<i>Bambusa arundinacea</i>
	Gamhar	<i>Gmelina arborea</i>
	Guava	<i>Psidium guajava</i>
	Harida	<i>Terminalia chebula</i>
	Katha Champa	<i>Plumeria rubra</i>
	Kachnar	<i>Bauhinia variegata</i>
	Kurchi	<i>Holarrhena antidysenterica</i>
	Kusum	<i>Schleichera oleosa</i>
	Mahua	<i>Madhuca indica</i>
	Mahogini	<i>Sweitenia mahogini</i>
	Phasi	<i>Anogeissus acuminata</i>
	Rubber Fig	<i>Ficus elastica</i>
	Sal	<i>Shorea robusta</i>
	Sausage Tree	<i>Kigelia pinnata</i>
	Sidha	<i>Lagerstroemia parviflora</i>
	Simul	<i>Bombax ceiba</i>
	Weeping Fig	<i>Ficus benjamina</i>

Some Additional Information about Plantation: To undertake plantation on site for different purposes, following steps would be involved:

- 1) Raising seedlings in nursery
Seedlings would be raised in nurseries. Adequate number of surplus seedlings should be available considering 10% mortality factor. Healthy seedlings should be ready for transfer to permanent location before rainy season.
- 2) Preparation of pits and preparing them for transfer of seedlings
 - i) Standard pit size would be 60 cm x 60 cm x 60 cm



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

- ii) The distance between pits would vary depending on their location
 - iii) The pits should be filled using good soil (3 parts) and Farm yard manure (1 part)
 - iv) Rhizobium commercial preparation (1 kg/1000 kg)
 - v) BHC powder, if the soil inhabits white ants (Amount variable)
 - vi) The pits should be watered prior to plantation of seedlings
- 3) After-care i.e. nurturing the sapling for proper growth (Plantation Work Plan and After Care)

The detailed plantation work plan and final selection of species shall be finalized in consultation with the State Forest Department. Species and location wise plan of the plantation would be depicted on a general layout plan before the actual plantation work begins. The required seedling would be raised in the nursery established at the site for the purpose of plantation or would be procured from the local forest department/private nursery grower/agencies to meet the requirement of the plantation. Adequate arrangement for watering, particularly during early years, weeding and hoeing and replacing the dead saplings would be envisaged in the plan. The plantation pattern would be in three tire systems as given in Table 4-4.

TABLE 4-4 - PLANTATION PATTERN FOR GREENBELT DEVELOPMENT

Tire	Habit	Height (m)
1st Tire (Towards	Trees	> 10
2nd Tire (Middle layer)	Small Trees	5-10
3rd Tire (Towards Plant)	Shrubs	≤ 5

Implementation Programme: The Greenbelt Development programme would be implemented within one year from start of construction as shown in Table 4-5.

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

TABLE 4-5 - IMPLEMENTATION PROGRAMME FOR GREENBELT DEVELOPMENT

Plan period	Area (%)	Plantation Area	Tree Species
1st year	100	Along the periphery (1st Tire)	Chakundi, Debadaru, Dhala Siris, Jamun, Kala Siris, Karanja, Neem, Palas, Sagun, Sisoo
		Along the periphery (2nd Tire) and approach road	Akashmoni, Aswatha, Bat, Chakundi, Jamun, Jarul, Kadamba, Kala Siris, Karanja, Neem, Tentul,
		Along the periphery (3rd Tire) and internal road side within plant area	Amla, Ashok, Babool, Bougainvillea, Ber, Duranta, Guava, Karanja, Weeping Fig
		Along internal road side within plant area and available patches after establishment of all facilities	Am, Arjuna, Bahada, Bakul, Bhalia, Copperpod, Champa, Chatim, Daba baunsa, Gamhar, Harida, Katha Champa, Kachnar, Kurchi, Kusum, Mahu, Mahogini, Phasi, Rubber Fig, Sal, Sausage Tree, Sidha, Simul,

4.13.3 Budgetary Allocation for Plantation and Maintenance

Approximately Rs. 330 lakh and 10 lakh considered for Capex and annual maintenance in the proposed greenbelt and landscaping area.

4.14 SOCIO-ECONOMIC IMPACTS OF THIS GREENFIELD PROJECT

Here we need to describe some important features of this Greenfield project which have socio-economic impacts positively or negatively. Proposed activities and possible impacts are shown in Table 3-6 and the cost benefit analysis is shown in Table 3-7.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

TABLE 4-6 - PROPOSED ACTIVITIES AND POSSIBLE IMPACTS

Sl. No.	Proposed Activities	Possible Impacts
1	The project will employ persons 149 directly and 450 indirectly during operation and 50 directly and 700 indirectly during construction.	<ul style="list-style-type: none"> • A bulk increase in local employment level directly and also indirectly. • Income of local people will increase as the industry itself and other indirect sources will appear as potential alternative sources of livelihood. • Level of expenditure will also increase • Demand for education, health facilities, improved market will increase • Work distribution will be changed in favour of secondary sector and to some extent on tertiary sector also • Demand for entertainment and recreational services will increase. Lack of such facilities may direct towards addiction to liquor and also antisocial recreational activities to some extent.
2	Major raw material – iron ore concentrate will be transported from the proposed captive beneficiation plant at Tikarpada, Keonjhar district Odisha.	<ul style="list-style-type: none"> • The products of the beneficiation plant of the company will get stable market within. Their cost of transportation as well as time consumption will decrease. • There will be no advertisement cost, marketing cost and no possibilities of unsold surplus.
3	Another raw material Bentonite will be procured from Gujarat	<ul style="list-style-type: none"> • Both states Odisha and Gujarat will become financially strong • Internal trade will flourish • State revenue will increase
4	Other raw materials Lime stone, and Anthracite coal will be imported	<ul style="list-style-type: none"> • International trade will flourish • State revenue will increase
5	The proposed pellet plant is envisaged to produce both Blast Furnace (BF) grade and Direct Reduction (DR) grade pellets, which will be sold to the international as well as domestic market	<ul style="list-style-type: none"> • Internal trade as well as international trade will flourish • State revenue will increase
6	Required water would be drawn from Taldanda Canal/Mahanadi River.	<ul style="list-style-type: none"> • Over extraction of river water • Pressure on natural resource of water
7	Power will be received at 220/132 kv from State Grid/ Private Power producers available from Odisha Power Transmission Corporation Limited.	<ul style="list-style-type: none"> • Power producing unit will increase their production to meet the need of this project. • Power production unit will earn more • State revenue will increase • Local area electricity supply may improve
8	Waste water for this project filtrate from the pressure filter is pumped to the thickener. The solids settle down in the thickener is recycled to incoming slurry tanks by thickener	<ul style="list-style-type: none"> • Minimization of extraction of water • Minimization of dust pollution



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Sl. No.	Proposed Activities	Possible Impacts
	underflow pumps. The clear thickener overflow water is taken to process water reservoir. Part of water is treated in water treatment plant and used for pellet plant operation. The balance water is pumped back in return water pipeline to Beneficiation plant	
9	The principal solid wastes that would be generated from the production of pellet are fines during various screening and bag filter dust. All these wastes would be recycled back into the process in the iron ore grinding unit.	<ul style="list-style-type: none"> • Possibilities of dust pollution • Possibilities of water pollution • Possibilities of negative Impacts on agricultural production • Possibilities of adverse Impacts on health of nearby people
10	The process gas from Induration machine after heat recovery passes through Electro Static Precipitator	<ul style="list-style-type: none"> • Minimization of air pollution • Minimization of dust pollution • Minimization of negative Impacts on agricultural production • Minimization of adverse Impacts on health of nearby people
11	Removal of dust generated during various operations at different areas including RMHS area (except remote area) and discharging them to atmosphere through ID fan and stack after cleaning in ESP/Bag Filter.	<ul style="list-style-type: none"> • Minimization of air pollution • Minimization of dust pollution • Minimization of negative Impacts on agricultural production • Minimization of adverse Impacts on health of nearby people
12	Project land use will be of 40% Green Belt and 67% Built-up area of plant facilities including canteen, medical facilities and fire management provisions, roads, etc..	<ul style="list-style-type: none"> • Environmental up gradation will take place • Food security of the employees will be provided • Health security of the employees will be provided • Protection against fire disaster will be provided
13	The selected land for the proposed plant is non-agricultural waste land and does not entail issues related to 'Rehabilitation and Resettlement' of the local human settlements including those of encroacher and squatter groups.	<ul style="list-style-type: none"> • No eviction is involved • No R&R work is involved • No deforestation work is involved • No agricultural loss is involved



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

TABLE 4-7 - COST BENEFIT ANALYSIS

Sl. No.	Socio-economic Cost Involved	Sl. No.	Socio-economic Benefit Obtained
1.	A part of local population will get extra money in hand. More inequality in local income distribution.	1.	Local Unemployment level will decrease
2.	Absence of sufficient local market their demand for more and higher quality consumer goods cannot be supplied with. Hence a deficiency will create	2.	Potential alternative source of livelihood will expand.
		3.	Pressure on agricultural land will decrease
		4.	Number of Marginal Workers will decrease
3.	Local Deficiency in consumer goods will increase its local price level of the same.	5.	Local income level will increase
		6.	Local expenditure level will increase
		7.	A Chain effect of industry brings local economic development
		8.	Standard of living will improve
		9.	Number of pucca house will increase and also Number of personal vehicle will increase.
		10.	Demand for higher education will increase leading to more high school and colleges in more villages in the study area.
		11.	Demand for more medical facilities will increase leading to more PHC and SC in the villages of the study area.
		12.	Local Area Development CER and CSR
Total of 3Costs		Total of 12 Benefits	

Above Cost-Benefit table explains that there are total five possible cost and twelve possible benefits arise of this Particular project. Now we will have to find out the mitigation plan for such five costs as shown in Table 4-8.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

TABLE 4-8 - COST RECOVERY PLAN

Sl. No.	The Problem	The Mitigation Plan
1.	A part of local population will get extra money in hand. More inequality in local income distribution.	Efforts to introduce some agricultural based cottage industries for both men and women
2.	Absence of sufficient local market their demand for more and higher quality consumer goods cannot be supplied with. Hence a deficiency will create	Efforts to set up a daily local market in convenient distant interval for essential goods and also try for more weekly markets
3.	Local Deficiency in consumer goods will increase its local price level of the same.	
4.		Recreational arrangements such as sports, cultural activities, fair, festivals etc. must be organized by the Company efforts.
5.		Health awareness camps for general health and also for specific diseases A mobile health check-up and treatment unit

Result of the Cost-Benefit analysis: Therefore the Result of the Cost-Benefit analysis for this particular project is equal to the all costs that can be recovered or mitigated or more than one major benefit over the cost.

4.14.1 The Project-Impact Matrix Analysis

The Project-Impact Matrix Analysis is shown in Table 4-9.



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

TABLE 4-9 - PROJECT-IMPACT MATRIX ANALYSIS

Sl. No.	Criteria	Score				
		- 2	- 1	0	1	2
1.	Beneficiaries/ Affected Group	Both factory workers and staff and also buffer zone villagers will be affected	Factory workers and staff will be affected	None will be affected and none will be benefitted	Factory workers and staff will be benefitted	Both factory workers and staff and also buffer zone villagers will be benefitted
2.	Number of Beneficiaries/ Affected Persons	Habitat within 10 Km radius will be affected	Habitat within 5 Km radius will be affected	Habitat will neither be benefitted nor be affected	Habitat within 5 Km radius will be benefitted	Habitat within 10 Km radius will be benefitted
3.	Category of Beneficiaries/ Affected Persons	Women and children will be directly affected	Adult male only will be directly affected	None will be directly affected and none will be directly benefitted	Adult male only will be directly benefitted	Women and children will be directly benefitted
4.	Land Availability & Approval status	Company own land but Both eviction and deforestation will take place	Company own land but Only eviction will take place	Neither eviction nor deforestation will take place but approval from the appropriate authority is awaiting yet	Required land is already possessed by the Company, it is vacant but may not barren	Barren and vacant land has been acquired by the company
5.	Usage of existing social asset	Destruction of existing social asset	Only use of existing social asset	Neither use nor destruction of any existing social asset	Use and so development of existing social asset	Creation of new required social asset
6.	R & R Involvement	The company is aware about the present settlement and evicted them with no R & R	The company is not aware about the present settlement and R & R Process	There is no human settlement at present and no R & R work is involved	The company is not aware about the present settlement but they are ready for any R & R process	The company is aware about the present settlement and they have planned for R&R
7.	Use of Natural Resource	The Project will cause use of more than one Local Natural Resource	The Project will cause use of one Local Natural Resource	The Project will cause no use of Local Natural Resource	The Project will help in conservation of one Local Natural Resource	The Project will help in conservation of more than one Local Natural Resource



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Sl. No.	Criteria	Score				
		- 2	- 1	0	1	2
8.	Revenue Generation and Local Development	Only the Company will earn at the cost of both State and Local Development	Only the Company will earn with no cost of State but at the cost of Local Development	Only the Company will earn with no cost of State or Local Development	The Company will earn with a Revenue Generation for the State but no Local Development	The Company will earn with both a Revenue Generation and Local Development
9.	Opinion of Habitat on this Project	Know and against the project 50% of population	Know and against the project 25% of population	Not known to the buffer zone population	Know and in favour to the project 25% of population	Know and in favour to the project 50% of population
10.	Cost-Benefit Analysis Result	More than one major cost over the benefit cannot be recovered or mitigated	Only one major cost over the benefit cannot be recovered or mitigated	Cost = Benefit; and all cost can be recovered or mitigated	All cost can be recovered or mitigated and one major benefit over the cost	All cost can be recovered or mitigated and more than one major benefit over the cost
Total Score						

The Project-Impact (P-I) Matrix is a continuous scale of complete number points; the highest score is 20 and the lowest score is 20. Any project with Total P-I Matrix Score <0 implies that the project must be rejected because there is no scope to overcome the negative impacts. Otherwise the project may be accepted.

4.14.2 Criteria Analysis of this Project

- i) Both factory workers and staff and also buffer zone villagers will be benefitted
- ii) Habitat within 10 km radius will be benefitted
- iii) Adult male only will be directly benefitted
- iv) Neither eviction nor deforestation will take place but approval from the appropriate authority is awaiting yet
- v) Only use of existing social asset
- vi) There is no human settlement at present and no R&R work is involved



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

- vii) The Project will cause use of more than one Local Natural Resource
- viii) The company will earn with both Revenue Generation and Local Development
- ix) Know and in favour to the project 50% of population
- x) All cost can be recovered or mitigated and more than one major benefit over the cost

The Project Impact Matrix Result for this particular project is shown in Table 4-10.

TABLE 4-10 - PROJECT-IMPACT MATRIX RESULT

Sl. No.	Criteria	Score				
		- 2	- 1	0	1	2
1.	Beneficiaries/Affected Group					
2.	Number of Beneficiaries/Affected Persons					
3.	Category of Beneficiaries/Affected Persons					
4.	Land Availability & Approval status					
5.	Usage of existing social asset					
6.	R&R Involvement					
7.	Use of Natural Resource					
8.	Revenue Generation and Local Development					
9.	Opinion of Habitat on this Project					
10.	Cost-Benefit Analysis Result					
Total Score		- 2	-1	0	1	10

Total P-I Score = (- 2-1+1+10) = 8 and it is > 0
Therefore, this project may be accepted.

4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

4.15 NEEDS ASSESSMENT OF THE STUDY AREA

Sl. No.	Demands and Support Measures	Surveyed Locations with Respective Zones from the Project Boundary		
		Zone A	Zone B	Zone C
1.	Demand for water supply both for drinking and domestic purposes	Bibi Colony, Loknath Colony	Rangiagarh, Sandhakundu	Pippal, Singitali, Abhaychandrapur, Bhutmundi, Narendrapur
2.	Support towards construction and maintenance of roads	Dhanualia, Chaulimatha	Niharuni, Niharuni, Kandha, Jaganathapur	Abhaychandrapur, Jhimani, Baliasahi, Siju, Kochilabedi
	Demand for Bus stand and Bus service	-	Niharuni, Niharuni, Kandha, Jaganathapur	Nunukua, Mangarajpur
3.	Support towards health services (health check-up camps, medical aids) with special emphasis on women children and elderly	Bibi Colony, Baunab Island, Bhitargarh, Dhanulia	Rangiagarh, Musadia, Kaurdia,	Pippal, Bahakud, Abhaychandrapur, Kothi, Narendrapur
	Provision for Ambulance services/mobile vans in case of emergency, even at night	Baunab island, Bhitargarh,	Rangiagarh, Chanabelar, Katukula	Pippal, Fatepur, Kothi, Bhutmundi, Bhutmundi
4.	Demand for Vocational training / ITI courses for local populace	Bibi Colony, Loknath Colony	Rangiagarh, Sandhakundu, Katukula	Bahakud, Dhinkia, Fatepur, Jhimani, Kothi
	Support towards livelihood programmes with special focus on widows to make them self-sufficient	Chautrapalanda, Baunab island, Dhanulia, Udaychandrapur	Rangiagarh, Bhimanasi, Paradipgarh, Udayabata	Bahakud, Dhinkia, Koth, Batighar, Nipania
5.	Demand for local employment opportunities for both male and female population	Bibi Colony, Loknath Colony, Gayetrinagar, Atharabenki	Tapoban Colony, Brundaban Colony, Madhuban Colony, Jaganatha Colony	Bahakud, Kothi, Bhutmundi, Narendrapur, Biswali



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Sl. No.	Demands and Support Measures	Surveyed Locations with Respective Zones from the Project Boundary		
		Zone A	Zone B	Zone C
6.	Demand for Sanitation facility		All villages	Chhanda, Kodakana Raghunathpur, Garharomita
	Support sought towards maintenance of community toilets	All villages	All villages	All villages
	Support sought towards water supply in latrines	All villages	All villages	All villages
	Demand for drainage network	All villages	All villages	All villages
	Locals seek support towards maintenance of open drains which contribute to vector borne diseases	Bibi Colony, Gayetrinagar, Bhitargarh	Bhimasahi, Munadakati, Chanabelar	Dhinkia, Jhimani, Kothi, Kochilabedi, Mallasahi
	Requirement of garbage disposal initiatives	All villages	All villages	All villages
7.	Demand for installation of street light	Baunab Island, Atharabenki, Dhitargarh, Chaukumacha	Niharuni, Niharuni Kandha, Nimidihi, Udayabata, udaychandrapur	Sigatali, Trilochonpur, Siju
	Provision of electricity	-	Sandhakundu	Abhaychandrapur, Bhutmundi
8.	Support towards extracurricular activities (infrastructure towards sports activities) for the youth	Gayetrinagar, Baunab Island, Bithargarh	Tapoban Coloni Indrapa	Sunadia Kandha, Pratap pur
	Support towards provision of various scholarship programmes to strengthen and promote young talent in diverse fields	All villages	All villages	All villages
	Betterment of existing school infrastructure / Setting up new school	Chaulipalanda, Baunab Island	Rangiagarh, Sandhakundu, Udaychandrapur, Udayabata, Niharuni, Jaganathapur	Singitali, Abhaychandrapur, Fatepur, Narendrapur



4 - Anticipated Environmental Impacts & Mitigation Measures
(cont'd)

Sl. No.	Demands and Support Measures	Surveyed Locations with Respective Zones from the Project Boundary		
		Zone A	Zone B	Zone C
9.	Support towards recreational spaces for the locals	Bibi Colony, Loknath colony, Baunab Island	Rangiagarh, Udaychandrapur	Abhaychandrapur, Trilochanpur, Jhimani
	Promotion towards cultural activities	Atharabenki, Loknath Colony, Chautrapalanda	All villages	All villages
	Support towards maintenance of libraries	Bhitargarh, Chaukumacha	Rangiagarh, Udayabata, Chanabelar, Katukula	Garharomita, Akharhishai, Rajendranagar, Paligarh
10.	Demand for pollution control measures	Gayetrinagar, Bibicoloni, Loknath Colony	Sandhakundu, Madhuban Colony, Brundaban Colony, Tapoban Colony	Singitali, Pippal, Bhutmundi, Narendrapur
	Demand for existing pond development and canal reform for agriculture	Atharabenki, Bhitargarh, Dhanulia, Udaychandrapur, Chakumacha, Chautrapalanda	Bhimasahi, Munadakati, Nuagarh, Bijaychandrapur	Jhimani, Kothi, Fatepur, Siju
11.	Support towards setting up and maintenance of temple	-	-	Abhaychandrapur
	Demand for setting up and maintenance of a daily market	-	Sandhakundu, Udayabata	Fatepur, Nunukua, Uchchabanandapur
12.	Awareness camps related to addiction for the adult male members for a healthy social environment	Bibi Colony	Sandhakundu, Rangiagarh	Bahakud, Kothi

Note: Zone A - 0 to 2 km
Zone B - 2 to 5 km
Zone C - 5 to 10 km



5 - ANALYSIS OF ALTERNATIVES (TECHNOLOGY & SITE)

The scope of this Report has been prescribed vide the ToR issued by MoEFCC vide File No. J-11011/38/2021-IA.II(I), dated 4th March, 2021 is furnished in Appendix 1-1.

As per SO 1533 dated 14th September 2006, this chapter is to be prepared if it is prescribed at the scoping stage. Neither the analysis of alternative technologies nor the justification for selection of the site were recommended in the prescribed Scope, but it has been carried out for Green ball preparation and Induration process of Pellet plant. The findings for technological analysis are given below.

5.1 TECHNOLOGY ANALYSIS

5.1.1 Green ball preparation

The ground iron ore fines/concentrate along with additives and binder are converted to green pellets after thorough mixing. The degree of fineness of input materials, critical amount of water, amount of binder in the mix, etc. are most important for production of green pellets with adequate compressive strength and size. The strength of green Pellets results predominantly from capillary forces caused by wetting with water and mechanical consolidation, effected by rolling action. The critical amount of water varies from 8 to 11% depending upon the nature of feed material.

The types of equipment used in commercial plants for production of green pellets are drum, disc and cone pelletizers. However, majority of the Pellet Plants worldwide, use either drum pelletizer or disc Pelletizers. A comparison between drum and disc pelletizer is given in Table 5-1.



5 - Analysis of Alternatives (Technology & Site) (cont'd)

TABLE 5-1 - COMPARISON BETWEEN DRUM AND DISC PELLETIZER

Sl. No.	Parameters of Comparison	Drum Pelletizer	Disc Pelletizer
1	Suitability of Process	Suitable	Suitable
2	Commercial Application	Well established	Well established
3	Quality of Green pellets	Suitable for further processing	Suitable for further processing
4	Flexibility to Material Fluctuation	More Compared to Disc	Less Flexible
5	Quantity of recirculating materials	More	Less
6	Requirement of Space	More	30-40% less than Drum Pelletizers
7	Capital Investment	More	Less

Based on the above and considering the extent of commercial use, economic advantages, etc. Disc pelletizer for production of green pellets has been selected for the proposed plant.

5.1.2 Induration

The green pellets of desired size are subjected to thermal treatment viz. drying, preheating, firing and cooling; during which the pellets attain adequate strength to withstand handling, transportation and charging into furnace besides increased porosity, reducibility, reduction strength, etc. The major indurating processes developed for thermal treatment of green pellets are as follows.

- a) Shaft furnace process
- b) Grate-rotary hearth-shaft furnace process
- c) Annular furnace process
- d) Circular indurating furnace process
- e) Grate-kiln process
- f) Travelling grate process



5 - Analysis of Alternatives (Technology & Site) (cont'd)

However, 91% of total installed capacity in the world use either Travelling grate process or Grate-kiln process. Remaining processes namely, shaft furnace process, cold bonded process etc. accounts for a meager share. While Traveling Grate process, accounts for about 58% of the world capacity, Grate-Kiln process, accounts for about 33%. A comparison between Traveling Grate and Grate-Kiln process is given in Table 5-2.

TABLE 5-2 - COMPARISON BETWEEN TRAVELLING GRATE AND GRATE-KILN PROCESS

Sl. No.	Parameters of Comparison	Travelling Grate	Grate Kiln
1	Heat hardening cycle	Drying, preheating, induration and cooling are done on a single grate.	Drying and preheating on a grate, induration in rotary kiln and cooling in annular cooler.
2	Pellet movement	Pellets remain stationary throughout the process.	Pellets tumble continuously in rotary kiln.
3	Burners	Large number of burners along the length of induration furnace.	Single Burner is used for the Kiln.
4	Refractory lining	Direct contact with pellets	Contact with pellets and subjected to heavy wear
5	Major Fuel	Gaseous/liquid fuel	Gaseous/liquid fuel + pulverized coal
6	Pellet grades	Both BF & DR grades.	Both BF & DR grades.
7	Grate bars	Grate bars subjected to high temp; side & bed layers necessary.	No side or bed layers necessary. Bed depth is nearly half.
8	Others	-	Chunk formation inside rotary kiln

Although, both the processes are widely adopted for Pellet making, under Indian raw materials condition, Travelling grate process enjoys some distinct advantages with less fines generation, more flexibility in heating pattern with varied ore quality particularly to take care the LOI percentage of ore and having lower maintenance and less refractory failure.



5 - Analysis of Alternatives (Technology & Site) (cont'd)

5.1.3 Section of Process Route

On the basis of the above technological considerations, following processes for the proposed Pellet Plant have been selected.

- a) Disc pelletizer for production of green balls
- b) Travelling grate process for heat hardening of Pellets

5.2 ANALYSIS OF ALTERNATE SITE

For the proposed project, two land parcels were identified as follows:

- a. 70 Acres in Balidia & 30 Acres at Paradipgarh
- b. 100 Acres in Paradip Port Area

The factors considered for selection of site were:

- a. Contiguous Land Availability
- b. Category of Land - Pvt, Tribal land ,Govt, Forest
- c. Ease of Land Acquisition
- d. Issues Related to R & R
- e. Logistics & Infrastructure
- f. Environmental Issues

Based on the screening criteria as per the above factors, the land parcel of 100 acres in Paradip Port Trust area was found to be suitable for the proposed project.



6 - Environmental Monitoring Program (cont'd)

6 - ENVIRONMENTAL MONITORING PROGRAM

This Chapter describes the environmental monitoring plan including monitoring schedule, frequency, location, data analysis, reporting schedules, budget along with other necessary details.

6.1 MONITORING SCHEDULE AND PARAMETERS

The environmental monitoring is important in terms of evaluating the performance of pollution control equipment proposed for this project. The monitoring for various parameters of air, water, soil, noise etc. would be out by an authorized laboratory (NABL/MoEFCC accredited) as per the monitoring schedule. Monitoring of different environmental parameters on regular basis helps in to identify the critical changes that may occur due to the project and suggests preventive/mitigative measures to be undertaken by the project authorities.

The key objective of the environmental monitoring program would be:

- i) To identify the status of Pollution level within the plant and nearby areas
- ii) To check the effectiveness of installed pollution control system
- iii) To assess environmental impacts due to the project activity on the surroundings
- iv) To monitor & assess the trend of critical parameters
- v) To ensure compliances to the conditions of EC, CTE and CTO.
- vi) To submit periodical compliance reports to the concerned Regulatory authorities

6 - Environmental Monitoring Program (cont'd)

The following attributes would be regularly monitored:

- i) Meteorology - Meteorological parameters
- ii) Air quality - Ambient air quality, work zone air quality & stack emission monitoring
- iii) Water quality - Ground water, surface & waste water
- iv) Noise levels - Ambient & work zone
- v) Soil quality - Characteristics & TCLP test to assess the leachability of toxic elements into ground water
- vi) Inventory of solid waste including hazardous waste
- vii) Water consumption
- viii) Energy consumption

The schedule, duration, location and parameters for monitoring for the proposed facilities are given in Table 6-1.

TABLE 6-1 - MONITORING PARAMETER AND SCHEDULE

Sl. No.	Parameter	Location	Schedule of monitoring
1.	Meteorology: Dry bulb temp, wet bulb temp, relative humidity, wind speed, wind direction and rainfall	Meteorology data would be recorded at one (1) permanent station which will be installed in the plant premises at the roof top of Env. Engg. Department inside the plant.	Online continuous monitoring
2.	Air Quality Monitoring Parameters: PM _{2.5} , PM ₁₀ , SO ₂ , NO _x , CO, NH ₃ & O ₃	Three (3) monitoring stations will be installed by EML at following locations i) Near Personnel Entry Gate (Gate No-1) (South) ii) Towards Paradip Port Trust Water Reservoir (North) iii) At the Additive Storage Yard to Monitor PM ₁₀ & PM _{2.5} .	Continuous Ambient Air Quality Monitoring Stations (CAAQMS)
3	Stack Emission Monitoring: PM, SO ₂ , NO _x , CO	All major stacks For DE stacks only PM will be monitored The Additive grinding Bag filter stack sampling will be done once in a week to monitor the PM.	Online continuous monitoring system as per OSPCB's guidance



6 - Environmental Monitoring Program (cont'd)

Sl. No.	Parameter	Location	Schedule of monitoring
4	Fugitive dust emission and work zone dust monitoring	Near stock yard	Monthly once through labs recognized under E(P) Act, 1986.
5	Water Quality - effluents water quality, surface and ground as per CPCB standard.	Ground water -Two (2) locations i) Near raw material storage yard ii) Near Pellet stockpile Surface water - Two (2) locations i) Storm water outlet from the plant at NW end ii) Storm water drain at SE end Waste - Inlet and Outlet of ETP	Ground water quality analysis- twice in a year Surface water quality - Monthly once Surface & ground water - in pre & post monsoon Waste water - All parameters monthly once and weekly monitoring of common parameters
6	Ambient noise level	Noise levels will be monitored at the following locations: i) Process Fan area ii) Office Building	Monthly once for each location
	Work zone noise level	Following locations of work zone noise monitoring will be monitored. i) Process fan area ii) Filtration Building iii) Additives Grinding Building	Monthly once for each location
7	Soil quality	Two (2) locations within the plant (raw material storage area, solid waste storage area) and two (2) from outside plant area.	As per nutrient cycle by NABL/MoEFCC approved agency
8	TCLP test for solid wastes	One (1) location for hazardous waste storage	Once in a six (6) month or as directed by OSPCB
9	Inventory of solid waste	Within plant premises	Monthly or as directed by OSPCB
10	Water Consumption	Water meter at the intake point to plant	Continuous
11	Energy Consumption	All consumer points through energy meter	Continuous

6.2 MONITORING METHODS AND DATA ANALYSIS

Besides on-line monitoring devices integrated with major stacks there is continuous monitoring of ambient air quality (AAQ) at two (2) different locations outside the plant area, one at (i) Near Personnel Entry Gate (Gate No. 1) i.e., South side of EML and other at (ii) Towards Paradip Port Trust Water Reservoir i.e., North side of EML. The



6 - Environmental Monitoring Program (cont'd)

pollutants monitored include PM₁₀, PM_{2.5}, SO₂, NO_x, CO and O₃ as per the MoEFCC Notification No. GSR 826(E) dated 16th November 2009. The online stack monitoring devices, AAQ stations and effluent analysis sensors are directly connected to CPCB/OSPCB servers. These permanent AAQ monitoring locations are suitably distributed based on maximum coverage by the downwind and exposure to human settlements. PM_{2.5} & PM₁₀, SO₂ and NO_x will be monitored as per method mentioned in IS: 5182 Part 4, Part 2 & Part 6 respectively. Samples would be analyzed for PM_{2.5} & PM₁₀ in ambient air by Dust Sampler, SO₂ by improved West-Geake method and NO_x by Jacob and Hochheiser modified method. A permanent meteorological station will be set up to record dry bulb temperature, relative humidity (RH), wind speed, wind direction and rainfall. The wind sensor will be set up at 10 m height above the ground without any surrounding hindrances that may affect free flow of wind.

Similarly, on-line continuous monitoring of pH, TSS, BOD and COD of effluent streams would be carried out as per Guidelines for Water Quality Monitoring (MINARS/27/2007-08) by CPCB.

Inventorisation & characterization of the solid wastes would be done monthly or as directed by OSPCB. Inventorisation of 'E-Waste' would be done regularly to facilitate & ensure its proper disposal to 'E- Waste' management agency at periodic intervals

6.3 ENVIRONMENTAL DATA PROCESSING SYSTEM

The online monitored data would be recorded in a Central Computer of Environment Engineering Department for trend analysis, compliance performance and planning for continual improvement and taking corrective actions. The data processing system would be equipped with necessary hardware and software for data acquisition and support functions.



6 - Environmental Monitoring Program (cont'd)

The online monitoring systems are uplinked with the servers of SPCB and CPCB and the data is transmitted through GPRS system.

6.4 REPORTING PROCEDURE

The rationale behind routine monitoring of environmental parameters is to have a continuous check whether the plant is running within the design target of emission norms, discharge norms of wastes release quality and its quantity. If there is any deviation from the design norms in any production unit, the shift-in-charge and the Head of that particular malfunctioning production unit would be cautioned and advised to rectify the operation of anti-pollution equipment/systems. If faults are not rectified within a reasonable time-frame, the issues need to be brought to the notice of higher management with a note depicting the episode, duration, deviation from the design target, its impact on environment and remedial measures thereof.

Based on the routine surveillance of the pollution mitigation units, waste disposal, the Environment Department will prepare short term planning of those systems falling short of the performance target. Planning will include preparation of performance database, compare with the allowable norms as per regulation and benchmark targets. Long term planning in the case of process improvement, capital repair/replacement and R&D work related to environmental improvement will be taken up on case-to-case basis.

6.5 EMERGENCY PROCEDURES

In an emergency shutdown, all the safety precautions will be taken as per the procedure given by the respective equipment supplier.



6 - Environmental Monitoring Program (cont'd)

6.6 ESTIMATED CAPEX AND OPEX

The on-line emission monitoring system is an integral part of the plant and equipment. Online effluent quality monitoring systems which will be installed at CETP Plant are also integral part of the plant and equipment. Four (4) numbers of Continuous Ambient Air Quality Monitoring Stations will be installed and uplinked with SPCB & CPCB servers. The estimated Capital Expenditure (CAPEX) for the proposed facilities would be about Rs. 1150 lakh, the breakup of which is provided in Table 6-2. The recurring cost (OPEX) towards operation, maintenance, chemicals and consumable would be about Rs. 55 lakh per year.

TABLE 6-2 - CAPEX OF VARIOUS MONITORING PARAMETERS

Sl. No.	Description	CAPEX, Lakh	OPEX, lakh
1.	On-line stack monitoring equipment	300	30
2.	Ambient air quality monitoring equipment	750	5
3.	Water quality monitoring analyser	50	10
4.	Environmental laboratory	50	10
Total		1,150	55



7 - ADDITIONAL STUDIES

The outlines of the proposed project, the pre-project environmental status and the impact assessment along with proper mitigation measures have been duly addressed in the previous Chapters. This Chapter briefly encompasses the additional aspects that were also dealt upon while conducting EIA study for the proposed project.

7.1 PUBLIC CONSULTATION

- i) The Draft EIA Report was submitted to Odisha State Pollution Control Board (OSPCB) for public review and consultation. OSPCB in consultation with the office of Collector and District Magistrate (DM), Jagatsinghpur, Paradeep scheduled the Public Hearing (PH) which was held on 5th January 2022 in front of Municipality Kalyan Mandap, Paradeep in Jagatsinghpur District.
- ii) The Public Hearing (PH) schedule was notified in the Odia daily newspaper 'The Prameya' on 03.12.2021 and in the English daily newspaper 'The Times of India' on 03.12.2021, inviting suggestions, views and comments of local people surrounding the project area, NGOs and other stakeholders.
- iii) The public hearing was conducted as per the provisions of EIA Notification No. S.O. 1533(E) of dated 14th September 2006 of the MOEF & CC, Govt. of India.
- iv) The Draft EIA Report and Executive Summary were available in the offices of all local nodal bodies and were also uploaded in OSPCB website for awareness about the proposed project to all the stakeholders.
- v) The Public Hearing was presided by Sri Kahnu Charan Dhir, Additional District Magistrate, Paradeep and assisted by Er. Dillip Kumar Dash, Regional Officer, State Pollution Control Board, Odisha, Paradeep.
- vi) The meeting was attended by 100 people from different villages.



7 - Additional Studies (cont'd)

- vii) In the beginning Er. Dillip Kumar Dash, Regional Officer, State Pollution Control Board, Paradeep welcomed the public present in the meeting and briefly described the objective of the proposed project. He also explained about the requirement of Public Hearing in view of the mandatory Environment Clearance (EC) from Ministry of Environment and Forests & Climate Change (MOEF & CC), Govt. of India.
- viii) Sri Kahnu Charan Dhir, Additional District Magistrate, Paradeep and Er. Dillip Kumar Dash, Regional Officer, State Pollution Control Board, Paradeep requested the public to present their views about the environment impacts of the proposed project.
- ix) Then the Regional Officer invited the project proponent to describe before the public about the details of the project and its impact on the surrounding environment.
- x) Sri Prakash Chandra Mohapatra, Director (Projects), EML briefed about the importance of pellet plants in general and explained the significance of the proposed project detail.
- xi) Regional Officer, SPCB, Odisha, Paradeep then invited the public for their deliberations.
- xii) 24 people intended to deliver their views out of which 23 people took part in the deliberations. 2 written statements were received from the public during the public hearing.
- xiii) ADM, Paradeep clarified the issues raised by the public.
- xiv) Regional Officer, SPCB, Paradeep summarized the issues and invited the project proponent to offer their views on those issues.
- xv) Sri Prakash Chandra Mohapatra, Director (Projects), EML placed his views on the raised issues.
- xvi) Finally the meeting ended with a vote of thanks to the chair and other participants.



7 - Additional Studies (cont'd)

The summary of the issues raised in the public hearing is given Table 7-1 and the monitorable action plan for addressing the issues with timeline and budget in the form of Socio economic EMPs is given in Table 7-2. The proceedings of the public hearing are enclosed as Appendix 7-1.

TABLE 7-1 - SUMMARY OF ISSUES RAISED IN PUBLIC HEARING

Sl. No.	Name & Village	Issues Raised by Public	Response of Project Proponent
1	Amiya Prasad Das; Bijaychandrapur	Formation of a committee to review pollution status of Paradeep	All pollution control measures will be world class and all air and water pollution control measures will be taken as declared in the EIA report and committed during the public hearing.
2	Sarat Kumar Rout; Nua Bazar; Paradip	No issue He opposed the project.	-
3	Deba Kalyan Mohapatra; Adarsh Prayash; Paradip	a) pollution problem b) Health care facilities	Please refer to Sl. No. 1 The industry will take part in funding for establishment of Super speciality hospital and other common developmental activities at Paradeep with other Industry houses.
4	Brundaban Das; Uday Bihar Nagarika Parishad	Water and air pollution	Please refer to Sl. No. 1
5	Antaryami Pattnaik; Paradeepgarh	To develop employment opportunities for local people in all category posts after skill enrichment.	Skill development, employability of locals by signing agreement with local ITI. Skill development of women by arranging vocational training
6	Akhila Kumar Mallik; Bauriapalanda	Water logging during monsoon , CSR activities and employment	Drainage condition improvement will be taken up for villages Bauriapalanda & Balijhara
7	Bikash Sahu; Youth Federation; Bijaychandrapur	a) Education b) Health c) Employment d) To utilize CSR fund	Infrastructure improvement of schools Establishment of library infrastructure facilities in villages Please refer to Sl. No. 3 b Preference will be given to educated & suitable local candidates in all 3 categories Details given in this document



7 - Additional Studies (cont'd)

Sl. No.	Name & Village	Issues Raised by Public	Response of Project Proponent
8	Seshadeba Senapati; Balijhara; Paradip	a) Rebuilt the road connecting PPL main gate to National highway.	For Road development Allocation to Paradip Municipality Other Village Road Development will be taken up.
		b) Water logging in Basti area.	Please refer to Sl. No. 6
9	Jyotish Dash; Paradeep	To rehabilitate Bauriapalanda Basti	Rehabilitation of Basti will be taken up with District Administration and Paradip Port Trust
10	Ratnakar Jena; Paradip	a) Good Roads	Please refer to Sl. No. 8 a
		b) Water supply	Drinking water facility for nearby Basti /villages
		c) Hospital	Please refer to Sl. No. 3 b
		d) Employment opportunities for Local People	Please refer to Sl. No. 7 c
11	Shiba Charan Biswal; Paradip Environment Trust; Paradeep	He opposed the project	-
12	Ayashkant Roy; Paradip Nagarika Mancha	a) Plantation activity with start of site work	Plantation at the site will be started immediately after construction of the boundary wall. Plantation outside the plant area to improve the green cover.
		b) Rehabilitation of nearby Basti	Please refer to Sl. No. 9
13	Pratap Kumar Samal; Paradeep Garh	a) Local employment as per Government rules	Please refer to Sl. No. 7c
		b) Local contractors to be engaged in the industries	Preference will be given to local contractors as per their eligibility
		c) District administration should take up action for establishment of super speciality hospital.	Please refer to Sl. No. 3 b
14	Sankarshan Das; Chakradharpur	Company to fulfil all commitments	All commitments regarding Pollution Control, Plantation, local employment, etc will be fulfilled.
15	Nirmal Samantray; Pipal	a) To fulfil all commitment	Please refer to Sl. No. 14
		b) To solve storm water drainage problem of Pipal and Paradeep Garh	Please refer to Sl. No. 6
		c) Good health care facility	Please refer to Sl. No. 3 b
16	Pramod Kumar Jena; Nuagarh G.P.	a) Rehabilitation of nearby Basti	Please refer to Sl. No. 9
		b) Diploma institute at Paradip	Please refer to Sl. No. 5
		c) Traffic post near IFFCO/AM/NS square	It is under jurisdiction of District Administration
17	Bishnu Charan Swain; Pankapal Kujang	a) To solve water drainage problem.	Please refer to Sl. No. 6
		b) Peripheral development	Please refer to Sl. No. 12 a
18	Bimal Pattnaik; Nuagarh G.P.	No issue	-



7 - Additional Studies (cont'd)

Sl. No.	Name & Village	Issues Raised by Public	Response of Project Proponent
19	Sudhal Kumar Swain (M.P. Representative); Nuagarh	a)To take responsibility for benefits of Basti people.	Please refer to Sl. No. 6
		b)To start plantation activity	Please refer to Sl. No. 12
		c) Formation of 25 member committee involving 10 local basti people.	EML will follow guidelines of District Administration in this regard.
20	Sarada Prasanna Behera; Paradeep	Recruitment of local degree engineers.	Please refer to Sl. No. 7c
21	Nagendra Kumar Swain; Bisuali	To resolve water drainage issue in nearby area.	Please refer to Sl. No. 6
22	Harekrusna Mohanty; Kujang	Absent	-
23	Ajay Kumar Chowdhury; Chakradharapur	a)Construction of damaged road from PPL main gate to National Highway and expansion of existing road from Bhutamundai to Dochhaki	Please refer to Sl. No. 8 a
		b)Avenue plantation and afforestation in vacant area.	Please refer to Sl. No. 12 a
24	Manoj Kumar Nayak; Paradeep Youth Association	a)Water drainage problem in Basti area.	Please refer to Sl. No. 6
		b)Drinking water supply in Basti area.	Please refer to Sl. No. 10 b
		c)Local employment	Please refer to Sl. No. 7c
		d)Establishment of Super speciality hospital	Please refer to Sl. No. 3 b
		e)Establishment of technical institution.	Please refer to Sl. No. 5

TABLE 7-2 - MONITORABLE PHYSICAL ACTION PLAN FOR ADDRESSING PH ISSUES

Description	Year 1	Year 2	Total (in Rs. Lakhs)
Area Development			
Development of village roads	Balijhara village 2km in length. Paradipgarh village -2km Bijaychandrapur village- 2km Udaybhat village – 2 km Allocation of fund to Paradip Municipality for repairing of damaged road. The agreement with Paradip Municipality will be intimated to MoEFCC during six(6) monthly compliance		550
Improvement of drainage condition of Bauriapalanda & Balijhara villages - total 8km	Construction of drain (total 8 km length) in Bauriapalanda & Balijhara villages and connection to existing drainage network of Paradip Municipality		205



7 - Additional Studies (cont'd)

Description	Year 1	Year 2	Total (in Rs. Lakhs)
Health care facilities	Strengthening of primary health care unit in Nuagarh & Biswali villages. The need will be assessed in consultation with local administration and will be informed to MoEFCC during 6 monthly compliance. The EML will provide funds to local administration for development of hospital and the scheme will be informed to MoEFCC through six(6) monthly compliance.	Procurement of mobile health care unit for conducting medical campaign in Bhutmundai, Paradipgarh, Nuagarh & Biswali villages.	750
Establishment of library infrastructure facilities with 500 books, 10 bookshelves and 4 numbers of computers with internet facilities in villages	Bijaychandrapur & Bhutmundai	Nuagarh, Balidia, Chakradharpur & Paradipgarh	200
Skill development training on welding, electrician course, machinery, carpentry etc. and livelihood program	200 persons	400 persons	300
Local students training through ITI list – 2 ITIs in Paradipgarh, 1 ITI in Nuagarh, and 1 ITI in Mangrajpur.	40 students	20 students	60
Strengthening of school library & up gradation of existing village schools by providing Chair, table & books & 4 Nos of computers with internet to each library	Three schools 1. Pipal UP School 2. Govindchandra High school Nuagarh 3. Balidia Nodal UP School	Five schools 1. Paradip Port High school Bhutmundai 2. Nabjyoti Girls' High school Biswali 3. Chakradharpur High School 4. Srimaa Aurobindo School Paradipgarh 5. Bijaychandrapur UP School	240
Infrastructure improvement of Bauriapalanda Basti	Rehabilitation of Basti will be taken up with District Administration and Paradip Port Trust & the development plan will be intimated to MoEFCC	Continued in 2 nd year	600
Provision of drinking water through pipelines & installation of portable RO in peripheral villages or contribution to government fund for the same	Six villages 1. Balijhara 2. Musadia 3. Bauriapalanda 4. Bijaychandrapur 5. Bhutmundai 6. Nuagarh	Two villages 1. Balidiha 2. Chakradharpur	500



7 - Additional Studies (cont'd)

Description	Year 1	Year 2	Total (in Rs. Lakhs)
Vocational training on tailoring, farming, poultry for skill development of women. Selection of villages will be decided in discussion with Local administration	300 women	600 women	300
Total (in INR lakhs)	2185	1520	3705

EML would adopt two villages, Nuagarh and Balidia for development under their CSR plan. EML stands committed to engage an agency to organize input of clothes and market readymade garments made by the village women of Balidia village under CSR.

7.2 ENVIRONMENTAL RISK ASSESSMENT

Environmental risk assessment is a systematic approach for identification, evaluation, mitigation and control of hazards that could occur as a result of failures in process, procedures, or equipment. Increasing industrial accidents, loss of life & property, public scrutiny, statutory requirements and intense industrial processes, all contribute to a growing need to ensure that risk management is conducted and implemented.

Industries have recognized the significance of Safe Working Environment and are progressively trying to prevent hazardous events, avoid production & manpower losses and other fallouts associated with industrial accidents by conducting risk assessment, onsite & off site management plan and adopting the safety measures. This also assists industries to enhance employee knowledge of operations, improve technical procedures, maintain accurate process safety information, and increase overall productivity. This Chapter gives an outline of the associated environmental and other risks, their assessment, and remedial measures. It also describes an approach for emergency planning to be adopted by the Plant management.



7 - Additional Studies (cont'd)

7.3 OBJECTIVES

The objectives of environmental risk assessment are governed by the following, which excludes natural calamities:

- a) Identifying the potential hazardous areas so that adequate safety measures can be adopted to reduce the likelihood of accidental events.
- b) Identifying the stakeholders and evaluating their risk along with proposing adequate control techniques.
- c) Managing the emergency situation or a disastrous event, if any, during the plant operation.

7.4 ENVIRONMENTAL RISK EVALUATION

From environmental hazards point of view, risk analysis (RA) acts as a scrutinizing vehicle for establishing the priority in risk management that concerns human health, loss of productivity and environmental quality in general. The proposed facility would have installations, such as, storage and handling of fuel oil and fuel gases which would be under the purview of Manufacture, Storage, and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and its amendments thereof.

Raw materials & consumable chemicals, and processing of the same in various production units, along with relative risk potential analysis is made on the following three factors using a P/I (Probability/Impact) analysis methodology:

- i) likelihood of occurrence
- ii) likelihood of detection
- iii) severity of consequence

Each of these factors is graded and compiled to determine the risk potential. The factors governing the determination of relative risk potentials are presented in Table 7-3.



7 - Additional Studies (cont'd)

TABLE 7-3 - DETERMINATION OF RISK POTENTIAL

(A)		(B)		(C)	
Likelihood of occurrence		Likelihood of detection		Severity of consequence	
Criteria	Rank	Criteria	Rank	Criteria	Rank
Very High	5	Very High	1	None	2
High	4	High	2	Minor	4
Moderate	3	Moderate	3	Low	6
Low	2	Low	4	Moderate	8
Very Low	1	Very Low	5	High	10

$$\text{RISK POTENTIAL (RP)} = (\text{A} + \text{B}) \times \text{C}$$

Based on the above stated criteria for assessing the risk, each probable event has been evaluated by addressing several questions on the probability of event occurrence in view of the in-built design features, detection response, operational practice and its likely consequence. A summarized list of environmental risk potential for the likely events is presented in Table 7-4.

This assessment is based on the past experience in the operation of similar installations and best practicable designs for the proposed Project. The present risk potential evaluation is primarily based on human errors or faulty operation or failure of the control systems.



7 - Additional Studies (cont'd)

TABLE 7-4 - ENVIRONMENTAL RISK POTENTIAL EVALUATION

Sl. No.	Event	Rank			Risk potential
		Likelihood of occurrence	Likelihood of detection	Severity of consequence	
i)	LDO leak from the storage tank	Low (2)	Low (4)	Moderate (8)	48
ii)	Transformer oil leak and fire	Very low (1)	Low (4)	Moderate (8)	40
iii)	Uncontrolled dust emissions/failure of emission control system	Low (2)	Moderate (3)	Moderate (8)	40
iv)	Uncontrolled discharge of untreated plant wastewater	Very low (1)	High (2)	Low (6)	18
v)	Uncontrolled fire in FO storage tank	Very low (1)	Low (4)	High (10)	50

As risk from FO leak is maximum and has the maximum severity of consequence, consequence modeling for leakage scenarios of FO tank has been carried out using DNV Phast Lite 7.1 to quantify the extent of the impact from this event. For leakage from FO tank, heat radiation from early pool fire, late pool fire and jet fire.

The intensity radii for jet fire, early pool fire and late pool fire arising due to leakage from FO tank have been shown in Fig. 7-1, 7-2 and 7-3 respectively. Three radiation levels of interest have been plotted corresponding to 4 kW/m² (pain threshold), 12.5 kW/m² (first degree burns) and 37.5 kW/m² (100% fatality and damage to process equipment without thermal protection) and the results have been tabulated in Table 7-5.

7 - Additional Studies (cont'd)

TABLE 7-5 - RADIUS OF INFLUENCE OF HAZARD SCENARIOS FOR LEAKAGE FROM FO STORAGE TANK

Hazard scenario	Radiation levels		
	4 kW/m ²	12.5 kW/m ²	37.5 kW/m ²
	Distance of influence (in m)		
Jet Fire	56	42	35
Early Pool Fire	32	23	12
Late Pool Fire	71	34	-

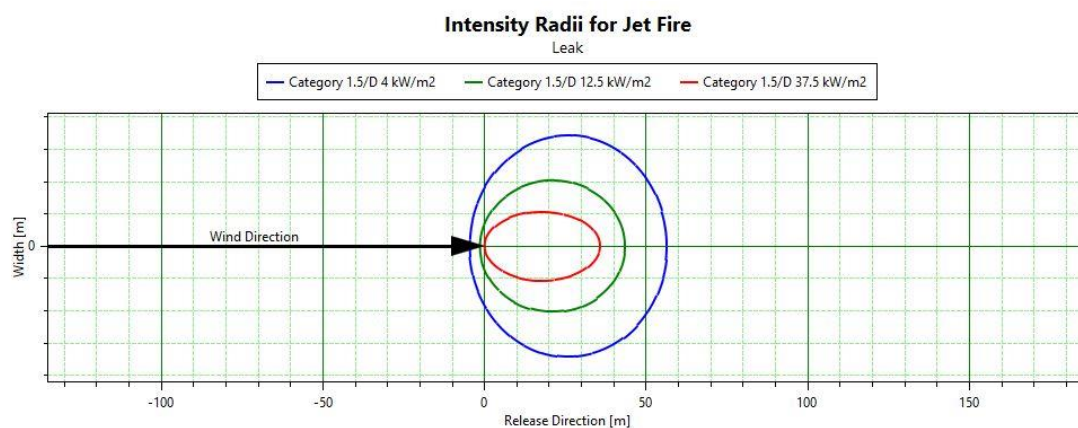


FIG. 7-1 - DISTANCE OF INFLUENCE OF HEAT RADIATION FROM JET FIRE

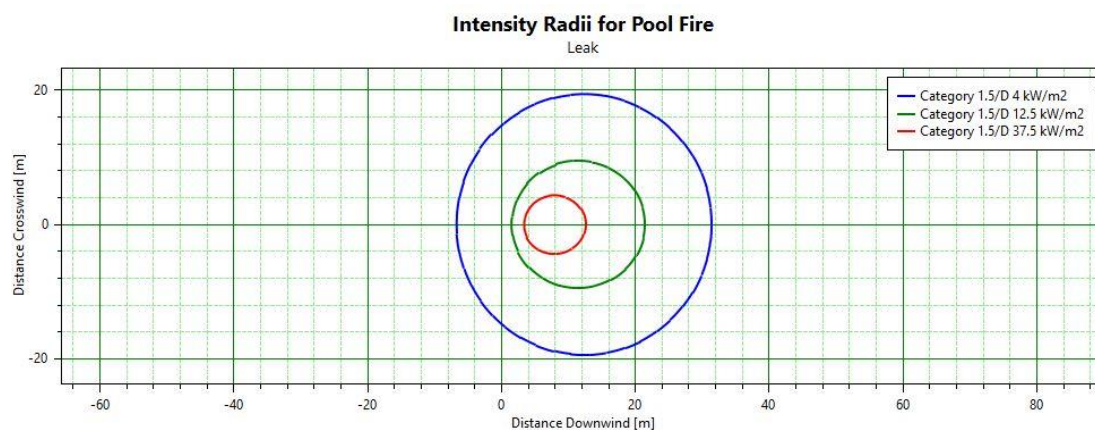


FIG. 7-2 - DISTANCE OF INFLUENCE OF HEAT RADIATION FROM EARLY POOL FIRE

7 - Additional Studies (cont'd)

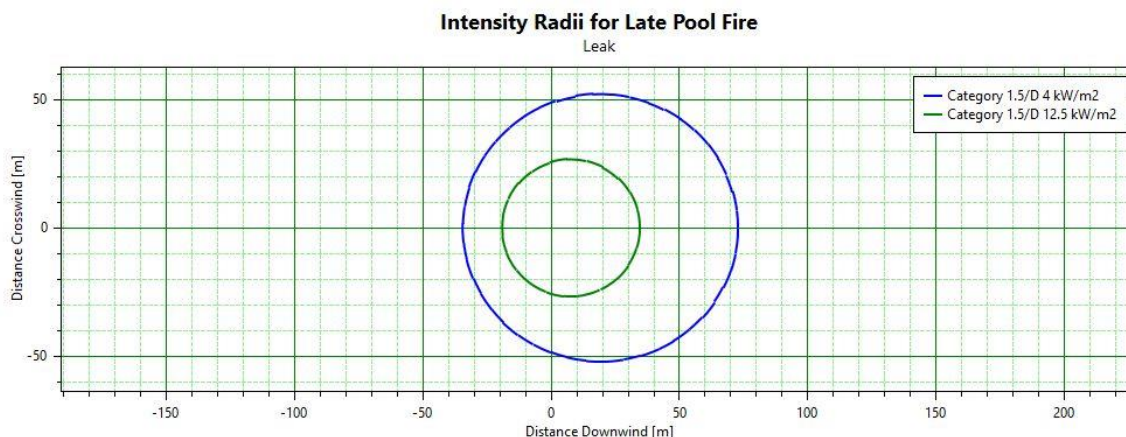


FIG. 7-3 - DISTANCE OF INFLUENCE OF HEAT RADIATION FROM LATE POOL FIRE

A HAZOP Study for the selected units/areas needs to be undertaken at the 'design-freeze' stage, when P&I diagrams, shop layout drawings, control logic diagrams, technical specifications etc are made ready. For these areas, 'Fault Tree Analysis' of the failure of equipment/ valve component or due to human error can be carried out to assess more realistically the risk involved and draw up final management measures. It is also suggested to conduct HAZOP Study for the fuel gas distribution network to incorporate last minute corrections in the design of the system from fail-safe angle, prior to commissioning.

7.5 ON-SITE AND OFF-SITE EMERGENCY MANAGEMENT PLAN

Emergency planning is an integral part of the overall loss control program and is important for effective management of an accident to minimize the losses to the people and property, both in and around the facility.

EML would implement an On-site Emergency plan approved by Director (Factories and Boiler), Bhubaneswar. The objectives of this On-site Emergency Plan would be:

7 - Additional Studies (cont'd)

- i) Rapid control and containment of possible hazardous situations.
- ii) Minimizing the risk and the impact of accident.
- iii) Effective rehabilitation of affected persons.

Head-Plant would be designated as Works Main Controller (WMC) who assumes overall responsibility for implementation of emergency planning at the time of crisis on the site. He is assisted at next level by Head EHS who acts as Site Incident Controller (SIC), who coordinates with Combat Team Leader (CTL), Rescue Team Leader (RTL) and Auxiliary Team Leader (ATL) to mitigate the emergency situation.

The Emergency command structure of the plant is shown in Fig 7-4.

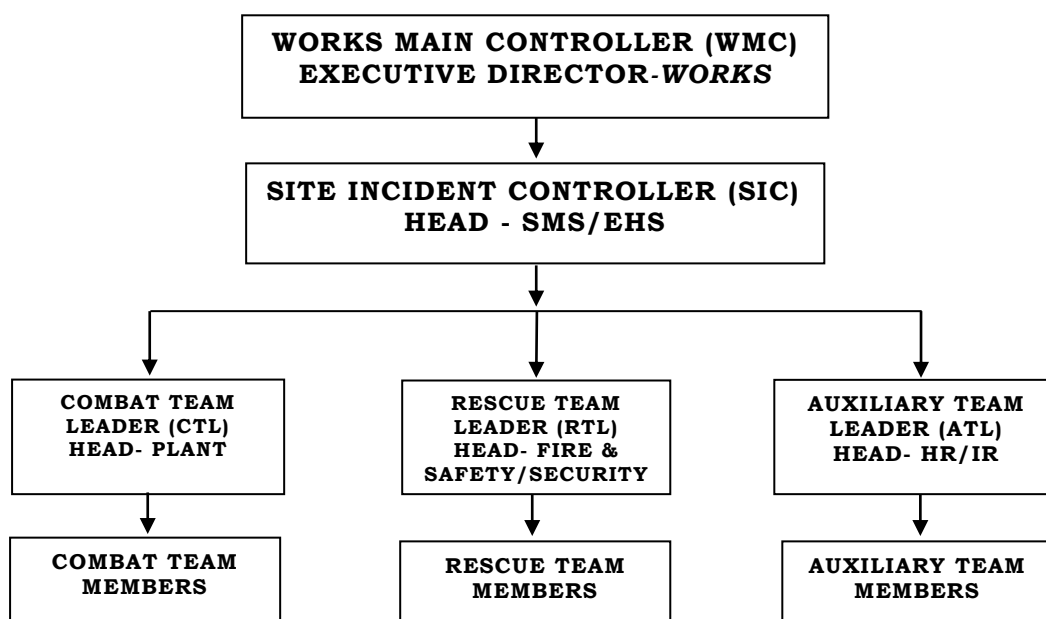


FIG. 7-4 - EMERGENCY COMMAND STRUCTURE

The action plan for on -site emergency plan is presented below in Table 7-6.



7 - Additional Studies (cont'd)

TABLE 7-6 - ACTION PLAN FOR ON-SITE EMERGENCY

Step No.	Initiator	Responsibilities
1	The person noticing the emergency	<ul style="list-style-type: none"> Inform Security Gate, CTL & the concerned Shift-in-charge immediately.
2	CTL	<ul style="list-style-type: none"> Inform SIC and rush to spot and organize his team. Take charge of the situation, arrange for fire fighting and medical first-aid available at site. To start combating, shut-down equipments, arrest the leakage of gas/fire.
3	SIC	<ul style="list-style-type: none"> Inform WMC and rush to emergency site. Discuss with CTL, assesses the situation and call the RTL & ATL Organize the Rescue Team and Auxiliary Team and send the rescue Team to site. Arrange to evacuate the unwanted persons and call for additional help. Pass information to the WMC periodically about the position at site.
4	WMC	<ul style="list-style-type: none"> Rush to emergency site and observe the ongoing activities. Take stock of the situation in consultation with the SIC. Move to Emergency Control Room. Take decision on declaration of emergency. Advise ATL to inform the statutory authorities and seek help of mutual aid from partners as required. Decide on declaration of cessation of emergency. Ensure that the emergency operations are recorded chronologically.
5	RTL	<ul style="list-style-type: none"> Consult with SIC and organize his team with amenities to arrest fire fighting and medical treatment. Rush to Emergency Site through safe route along with the team members. Arrange to set off the fire by fire fighting equipments and hydrant points to arrest the fire or to evacuate the area. Shift the injured persons to hospital by ambulance after providing necessary first aid. To inform the ATL for necessary help from mutual aid Partners.
6	ATL	<ul style="list-style-type: none"> On being directed by WMC, inform about the emergency to statutory authorities. Seek help of Mutual Aid partners and Coordinate with Mutual Aid partners to render their services. Arrange to inform the relatives of casualties. Take care of visit of the authorities to the Emergency site.
7	Team members	<ul style="list-style-type: none"> Each of the team members to follow the instruction of concerned team leader to mitigate the emergency.



7 - Additional Studies (cont'd)

The emergency control center would be located strategically in an area of minimum risk with easy access to concerned personnel. Emergency control centers would be stocked with the following infrastructural support facilities/equipment:

- i) An adequate number of external & internal telephones
- ii) Radio equipment/Public addressable system
- iii) Safety gears
- iv) First aid facilities, Stretchers, gas masks, etc
- v) Fire-fighting system with additional sources of water
- vi) Additional work and layout plans detailing alternate routes and affected areas, during an emergency.
- vii) Note pads, pens and pencils. viii) List of key personnel, with addresses, telephone numbers, etc.

The off-site emergency plan is also an integral part of any major hazard control system. This plan relates to only those accidental events, which could affect people and the environment outside the plant boundary. Incidents, which would have very severe consequences, yet have a small probability of occurrence, would be in this category.

The implementing authority of the off-site plan is the local authority and not the plant authority. Head of Plant in consultation with the Safety, Admin & other concerned department will be coordinating with the district administration/local authority for safeguarding nearby settlements during off-site emergency. Probability of such occurrence is though remote, but still there remains a probability.

The basic structure of the off-site emergency procedure will cover the following:

- i) Identification of local authorities like police, district collector's office, their names, addresses and communication links.



7 - Additional Studies (cont'd)

- ii) Details of availability and location of heavy-duty equipment like bull dozers, fire-fighting equipment etc.
- iii) Details of specialist agencies, firms, and people upon whom it may be necessary to call.
- iv) Details of voluntary organisations.
- v) Meteorological information.
- vi) Humanitarian arrangements like transport, evacuation centres, first aid, ambulance, community kitchen etc.
- vii) Public information through media, informing relatives, public address system etc.

7.6 DISASTER MANAGEMENT PLAN (DMP)

A disaster is a catastrophic event that causes serious injuries, loss of life & extensive damage to Plant & its surroundings. The types of possible disaster would be due to i) Disaster due to emergencies on account of fire, spillages, etc. ii) Disaster due to natural calamity on account of flood, earthquake, cyclone, storm, cloud burst, lightning and iii) Disaster due to external factors on account of food poisoning, sabotage etc.

The objective of the DMP is to make use of the combined resources of the plant and the outside services to achieve the following:

- i) Effective rescue and medical treatment of casualties
- ii) Safeguard other people
- iii) Minimize damage to property and the environment
- iv) Initially contain and ultimately bring the incident under control
- v) Identify any dead
- vi) Provide for the needs of relatives
- vii) Provide authoritative information to the news media
- viii) Secure the safe rehabilitation of affected area
- ix) Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.



7 - Additional Studies (cont'd)

In effect, DMP helps to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.

Few elementary disaster management measures undertaken to prevent disaster due to the above mentioned hazards are as follows:

- i) Design, manufacture, operation and maintenance of all plant machineries/structures as per applicable national and international standards as laid down by statutory authority
- ii) Preparation of layout to provide 'Assembly Point' and safe access way for personnel in case of a hazardous event/disaster, as can be inferred from Risk & Consequence modeling
- iii) Adherence to emergency (both on site & off-site) preparedness plan, emergency response team, emergency communication, emergency responsibilities, emergency facilities, and emergency actions
- iv) Proper Alarm system and training the personnel for appropriate response during disastrous situation.
- v) Complete fire protection coverage for the entire plant as per regulatory stipulations
- vi) Creation and maintenance of Disaster Control Room (DCR) with adequately trained personnel who can handle all sorts of emergency situation
- vii) Provision of funds for prevention of disaster, mitigation, capacity-building and preparedness.

During contingency, an officer will be manning the DCR having links with all plant control rooms. On getting information about any accident, the officer will verify from the affected plant control room and inform the Disaster Controller (DC) and/or other co-ordinators immediately.



7 - Additional Studies (cont'd)

The responsible officers of Disaster Control Group will assemble in the DCR and formulate control procedures as per the contingency plans and execute their responsibilities as per the plan. The functions of the various officers of the Disaster Control Group will be as follows:

Disaster Controller

- i) To declare "Disaster Emergency" after consulting senior officers available and inform Fire Station Control Room to sound the sirens accordingly and arrange to convey the message in public address system
- ii) To report to DCR immediately
- iii) To receive messages from the communication centre
- iv) To take decisions in consultation with the Commanding Officers of different services and convey them to the disaster point
- v) To be responsible for planning and provisions of assistance from township and from local authorities
- vi) To keep higher authorities informed about the situation

Officer In-charge

Disaster Controller will nominate an officer whose functions will be as follows:

- i) To be responsible for the operation of DCR and for the dispatch of messages
- ii) To keep liaison with all activities and give up to date and accurate appreciation of the situation
- iii) To be responsible for the efficient organisation of the DCR



7 - Additional Studies (cont'd)

The Commanding Officers of various services are designated Coordinator (services), Coordinator (Operation) and Coordinator (external services). The following are their functions:

- i) To report to the Control Post immediately on hearing "Disaster Siren"
- ii) To keep Disaster Controller posted with the up-to-date information regarding manpower and material available concerning their respective services
- iii) To assist Disaster Controller for provision of material and man power concerning his service
- iv) To convey message to his service teams through communication centre after consulting Disaster Controller

At present, the plant already has a firm DMP in place to deal with disasters, if any. There have not been any incidents to date. However, the existing DMP would be subjected to subsequent improvements as and when required for safe and efficient operation of the plan.

The WMC would be in communication with the District Disaster management Authority (DDMA) regarding pre-disaster activities in alignment with the overall plan developed by the DDMA or the Collector. EML would adhere to the relevant rules regarding prevention of disasters, as stipulated by relevant local authorities.

7.7 ACCIDENT STATISTICS

Safety department also record the events of both minor and major accidents, listing all the details such as place, date & time, duration, probable cause, extent of damage, personnel affected, man-hours lost, medical assistance provided etc. to analyse these data for drawing up necessary corrective measures.



7 - Additional Studies (cont'd)

7.8 SAFETY INSPECTIONS

Monthly safety inspection is carried out by concerned officials as well as Safety department. Additionally, Safety Audit is performed including all aspects of Occupational Health & Safety for all the areas.

7.9 TESTING OF EMERGENCY PLAN

The plant authority conducts periodic testing the efficacy of on-site emergency plan by conducting mock drills. One essential component of this mock drill is to see that whether procedures related to communication, mobilization of equipment and overall co-ordination to face the crisis is in order or not.

7.10 REHABILITATION AND RESETTLEMENT

The proposed site is located in industrial land allocated by Paradip Port Trust inside Paradeep Industrial Area. No human settlements (including encroacher or squatter groups) or local economic units (like general stores, eateries) in the vicinity of the proposed site are impacted by aspects of resettlement and rehabilitation. Therefore the regulation of *The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (and its subsequent amendments)*, would not be under the purview of this study.





8 - PROJECT BENEFITS

Implementation of the proposed project of EML in Jagatsinghpur District of Odisha would be beneficial to the society of the region. Due to the investment in the Project, overall importance of the area will increase. Such project is also expected to accelerate the rate of peripheral development.

8.1 IMPROVEMENTS IN THE PHYSICAL INFRASTRUCTURE

The project is expected to accelerate the physical infrastructure development in the study area, such as transport facilities (roads, railways and other local transport facilities), communication facilities, installation of street lights etc.

The project will create community infrastructures like installation/repair of hand pumps and bore wells, de-siltation and deepening of dug wells, recreational spaces such as parks, play grounds, community halls etc.

8.2 IMPROVEMENTS IN THE SOCIAL INFRASTRUCTURE

Through the proposed project it is expected to improve hospitality services such as hotels, lodgings houses, restaurants, fast food centers, transport services, shopping, hospitals, nursing homes as well as education facilities in the region.

8.3 SOCIO-ECONOMIC ACTIVITIES WITH PHYSICAL TARGETS

As per the directions of MoEFCC, EML has reserved funds (1.5 times of prescribed slab as per CER O.M.) and prepared a monitorable physical action plan with time schedule to address the concerns raised by the public during the Public Hearing as shown in Table 8-1. Implementation of these activities would commence from the initiation of construction activities.



8 - Project Benefits (cont'd)

TABLE 8-1 - SOCIOECONOMIC EMPS WITH SCHEDULE AND ALLOCATED BUDGET

Description	Year 1	Year 2	Total (in Rs. Lakhs)
Area Development			
Development of village roads	Balijhara village 2km in length. Paradipgarh village -2km Bijaychandrapur village- 2km Udaybhat village – 2 km Allocation of fund to Paradip Municipality for repairing of damaged road. The agreement with Paradip Municipality will be intimated to MoEFCC during six(6) monthly compliance		550
Improvement of drainage condition of Bauriapalanda & Balijhara villages - total 8km	Construction of drain (total 8 km length) in Bauriapalanda & Balijhara villages and connection to existing drainage network of Paradip Municipality		205
Health care facilities	Strengthening of primary health care unit in Nuagarh & Biswali villages. The need will be assessed in consultation with local administration and will be informed to MoEFCC during 6 monthly compliance. The EML will provide funds to local administration for development of hospital and the scheme will be informed to MoEFCC through six(6) monthly compliance.	Procurement of mobile health care unit for conducting medical campaign in Bhutmundai, Paradipgarh , Nuagarh & Biswali villages.	750
Establishment of library infrastructure facilities with 500 books, 10 bookshelves and 4 numbers of computers with internet facilities in villages	Bijaychandrapur & Bhutmundai	Nuagarh, Balidia, Chakradharpur & Paradipgarh	200
Skill development training on welding, electrician course, machinery, carpentry etc. and livelihood program	200 persons	400 persons	300
Local students training through ITI list – 2 ITIs in Paradipgarh, 1 ITI in Nuagarh, and 1 ITI in Mangrajpur.	40 students	20 students	60



8 - Project Benefits (cont'd)

Description	Year 1	Year 2	Total (in Rs. Lakhs)
Strengthening of school library & up gradation of existing village schools by providing Chair, table & books & 4 Nos of computers with internet to each library	Three schools 1. Pipal UP School 2. Govindchandra High school Nuagarh 3. Balidia Nodal UP School	Five schools 1. Paradip Port High school Bhutmundai 2. Nabjyoti Girls' High school Biswali 3. Chakradharpur High School 4. Srimaa Aurobindo School Paradipgarh 5. Bijaychandrapur UP School	240
Infrastructure improvement of Bauriapalanda Basti	Rehabilitation of Basti will be taken up with District Administration and Paradip Port Trust & the development plan will be intimated to MoEFCC	Continued in 2 nd year	600
Provision of drinking water through pipelines & installation of portable RO in peripheral villages or contribution to government fund for the same	Six villages 1. Balijhara 2. Musadia 3. Bauriapalanda 4. Bijaychandrapur 5. Bhutmundai 6. Nuagarh	Two villages 1. Balidiha 2. Chakradharpur	500
Vocational training on tailoring, farming, poultry for skill development of women. Selection of villages will be decided in discussion with Local administration	300 women	600 women	300
Total (in INR lakhs)	2185	1520	3705

EML would adopt two villages, Nuagarh (population: 2561 as per 2011 census) and Balidia (population: 1972 as per 2011 census) for development under their CSR plan.

The model villages will be developed within a span of 10 years with special emphasis on the following activities/facilities:

- Health - Community health centres will be established in each village with emphasis on maternal & child care (including provision of neonatal care unit) and registration of child births.
- Drinking water - The villagers will be provided with clean drinking water through tankers/pipeline or contribution to Govt. drinking water scheme (if already under planning & execution).



8 - Project Benefits (cont'd)

- Sanitation - Common toilet blocks will be constructed and financial aid would be provided for construction of toilets in economically backward households to achieve 100% open defecation free village.
- Education - School with library and computers with internet facility will be established to provide better access to educational resources. Computer literacy programs for the local youth will be conducted.
- Aid for farmers - Education pertaining to agricultural sciences for the local farmers will be sponsored by EML. Pumps will be provided to farmers for better access to irrigation facility.
- Telecom connectivity - EML will collaborate with telecom companies for improvement of mobile and internet connectivity in the area.
- Road - Damaged village roads will be repaired and converted to pucca road which will be connected to the main arterial roads.
- Solar lighting - Solar powered LEDs will be installed on village roads and in front of every village house.
- Plantation - Social forestry program will be undertaken which will not only benefit the environment but also contribute to the aesthetics of the village.
- Parks - Community parks and playgrounds for various sports will also be developed. Parks will be landscaped for beautification.
- Women empowerment - Self-help groups will be established for women to enable them to achieve self-reliance.
- Awareness will be created for providing primary education to children as the first step towards achieving 100% child-labour free village.

The above-mentioned activities will be carried out under CSR activities in coordination with the local Gram Panchayat.



8 - Project Benefits (cont'd)

EML stands committed to engage an agency to organize input of clothes and market readymade garments made by the village women of Balidia village under CSR.

8.4 EMPLOYMENT POTENTIAL

8.4.1 Direct Employment

During the construction phase 50 people will be directly employed & in operation phase, 149 people will be directly employed. Local people will be given the preference in employment as per their skill and qualification. This will enhance the present socio-economic status of the local people.

8.4.2 Indirect Employment

The project is also expected to create large opportunities for indirect employment in the form of drivers and attendants of new trucks & passenger carrying vehicles, plumbers, electricians, security personal and masons. Ancillary growth of shop establishments (like that of grocery shops, garment shops, furniture shops), medical stores etc. will also create opportunities for indirect employment. Apart from that, 700 people will be indirectly employed during the construction phase & 450 people will be indirectly employed during operation phase.

8.5 OTHER TANGIBLE BENEFITS

The project benefits also entail revenue earnings to the district and state through road tax, income by registration of trucks & trailers, income tax, corporate tax etc. Corporate Responsibility for Environmental Protection (CREP) for steel industry would be fully complied. This would result in low emissions, water conservation, recycle of treated wastewater, solid waste management etc. which result the low cost of production.



9 - ENVIRONMENTAL COST BENEFIT ANALYSIS

The Scope of this report has been prescribed vide the ToR issued by MoEFCC vide File No. J-11011/38/2021-IA.II(I), dated 4th March, 2021 which is furnished in Appendix 1-1.

As per SO 1533 dated 14th September 2006, this chapter is to be prepared if it is prescribed at the scoping stage. Since it was not recommended in the prescribed Scope, Environmental cost benefit analysis was not carried out.



10 - ENVIRONMENTAL MANAGEMENT PLAN (EMP)

This Chapter describes the managerial and supervisory requirements covering organizational structure for effective implementation of mitigation measures recommended for the proposed project. It also covers occupational health care of plant personnel and workers.

10.1 ENVIRONMENTAL MANAGEMENT PLAN WITH ADMINISTRATIVE ASPECTS

Proposed management measures for pollution control and environmental management in the project area are given in Table 10-1.

TABLE 10-1 - ADMINISTRATIVE CONTROL OF IMPLEMENTATION OF EMPS

Discipline	Potential impacts	EMP	Administrative Authority
Construction Phase			
Air environment	Emission of dust due to construction activities leading to adverse health & environmental impacts	<ul style="list-style-type: none"> - Water sprinkling to arrest fugitive dust emission. - Wind barrier screen provided to reduce the wind speed and consequently, reduce the fugitive dust emission. - Logistics would be designed to minimize movement of trucks transporting construction materials and optimize storage of construction materials at site 	Head – Environment
Water quality	Discharge of construction wastewater including sanitary and kitchen wastewater causing adverse health & ecological impacts	<ul style="list-style-type: none"> - Labour hutments would be provided with proper sanitation facilities - The stockpiles would be protected with toe wall of adequate height along with concrete garland drain & catch pits to prevent uncontrolled discharge of runoffs during monsoon. 	Head – Environment



10 - Environmental Management Plan (EMP) (cont'd)

Discipline	Potential impacts	EMP	Administrative Authority
Noise	Increase in noise level due to construction activities causing health effects	<ul style="list-style-type: none"> - Provision of Personal Protective Equipment (PPE) like ear muffs, ear plugs etc. - Noise prone construction activities such as piling, drilling, excavation, cutting, etc. would be done during daytime only 	Head – Environment
Land environment	Adverse impact on land due to dumping of solid waste C & D waste, Plastic waste and MSW like construction & demolition debris, excess concrete & cement, rejected components, packing & shipping materials and domestic waste.	<ul style="list-style-type: none"> - Proper segregation of the wastes and use of recyclable materials within the plant/ sell to external agencies for secondary use - Handling & disposal of wastes by authorized agencies as per prevalent regulations - MoU has been signed with Authorised Used Oil Recycler for disposal of used oil 	Head – Environment
Socio-Economics	<p>Increase in local direct and indirect employment</p> <p>Income of local people will increase as the industry itself and other indirect sources will appear as potential alternative sources of livelihood.</p> <p>Level of expenditure will also increase</p> <p>Demand for education, health facilities, improved market will increase</p>	<p>Employment will be provided through local employment exchange</p> <p>The employment opportunities would be primarily based on the prevailing guidelines of wage structure, notified by the Government of Odisha in the official gazette</p> <p>Support towards vocational and industrial training of local population (having basic qualification) will be provided for up-gradation of skill</p> <p>Implementation of socioeconomic EMPs to address issues raised in Public Hearing within 2 years with an allocated budget of Rs. 37.05 crore</p>	CEO & MD/Head HR
Ecology	Adverse effect on the ecology of the plant area not envisaged since there would be no removal of vegetation as plant premises already has built up areas	Development of peripheral 3 tier greenbelt and greenery of 40% of the plant area. Apart from this avenue plantation along connecting roads and NH would also be taken up in consultation with local authorities.	– Head Environment
Operation Phase			
Land environment	<ul style="list-style-type: none"> - No impact on the land environment in terms of loss of agricultural land or loss of vegetation - Potential negative impact due to temporary storage of raw materials and solid waste 	<ul style="list-style-type: none"> - All stockpiles would be on top of a concreted area to avoid leaching of materials during monsoon. - Maximum reuse/recycling of the solid wastes through practicable ventures. 100% of the pellet fines generated would be recycled in the process. Used oil would be handed over to authorized waste recyclers and STP sludge would be used as manure for greenery. 	Head-Environment



10 - Environmental Management Plan (EMP) (cont'd)

Discipline	Potential impacts	EMP	Administrative Authority
		<ul style="list-style-type: none"> - Monitoring of ground water quality to detect contamination due to leaching 	
Surface Water Resource & quality	<ul style="list-style-type: none"> - Marginal cumulative negative impact on surface water resource due to water requirement for proposed project - Plant designed on ZLD, no impact on surface water quality 	<ul style="list-style-type: none"> - Using recovered water from slurry dewatering and treated water as plant make up - Optimization of water requirement by recycling treated wastewater to the maximum extent and implementation of ZLD 	Head – Environment
Ground water	<ul style="list-style-type: none"> -No impact on resource as groundwater extraction not envisaged -Minimal impact on groundwater quality due to seepage and leaching 	<ul style="list-style-type: none"> - Concrete box drains to prevent seepage and ground water contamination. - Raw material and finished product storage yard to be covered and paved to avoid leaching through soil bed leading to contamination of ground water. 	Head – Environment
Air Environment	Adverse impacts on health & environment due to emission of PM, SO _x , NO _x (discussed in Ch-4)	<ul style="list-style-type: none"> - Selection & maintenance of APC equipments for fugitive & point source emissions. Point source emissions would be always kept less than 20 mg/Nm³ - Process optimization to control emission - Interlocking of APC equipments to send alert to operator if emission value exceeds 20 mg/Nm³ - Pneumatic or covered conveying of raw material - Transportation of finished pellets through covered conveyor to port and mechanized loading to ships - Maintenance of Plant roads and use of industrial vacuum cleaners & water sprinkling at regular intervals. - Operation & maintenance of tyre washing system at the exit side of material gate (Gate#2) 	Head – Environment
Noise	Detrimental impact on the health of working personnel in and around the plant premises.	<ul style="list-style-type: none"> - Noise levels for the new equipment and machineries to be fixed at 85 dB(A) Leq within 3 m distance from the noise prone equipment. - Highly noise prone equipment having Leq above 90 dB(A) would either be housed separately, or the attending personnel need to be housed in a noise-shielded cubicle. - Noise prone rotating/vibrating equipment provided with vibration dampening anchoring. - Use of appropriate PPEs 	– Head Environment

10 - Environmental Management Plan (EMP) (cont'd)

Discipline	Potential impacts	EMP	Administrative Authority
Socio-Economics	As mentioned above in the Construction phase		
Ecology	<p>Insignificant impact on ecology of the study area</p> <p>No adverse impact on aquatic ecology as plant is based on 'ZLD' concept</p>	<p>Development of 40% greenbelt within plant premises.</p> <p>Apart from this avenue plantation along connecting roads and NH would also be taken up in consultation with local authorities.</p>	Head Environment

Additionally the prescribed EMPs for projects to be located in SPA/CPA would also be complied since the proposed project falls under Paradeep SPA. The compliance to the conditions for SPA/CPA as per Ministry's OM vide F.No. 22-23/2018-IA.III (Pt) dated 31st October, 2019 in relation to compliance of Hon'ble NGT order dated 19.08.2019 (published on 23.08.2019) in O.A. No. 1038/2018 pertaining to formulation of a mechanism for environmental management of critically and severely polluted areas and consideration of activities/projects in such areas is shown below in Table 10-2.

TABLE 10-2 - COMPLIANCE TO CONDITIONS PRESCRIBED FOR PROJECT TO BE LOCATED IN SPA/CPA

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR - CR]
Air	i) Stack Emission levels should be stringent than the existing standards in terms of the identified critical pollutants	1. The first generation Pellet plants installed in India were with Multi Clones and stack emission levels were 100 mg/Nm ³ maximum. The second generation Pellet plants were installed with ESPs with stack emission limits 50 mg/ NM ³ maximum. The third generation Pellet plant have enough data for processing fragile iron ore of Odisha region. The dust collection system have undergone a major change to operate	With 20 mg/NM ³ emission from Stack, PM ₁₀ increase will be max 2.92 µg/m ³ at A4 located about 2.17 km NNE of the plant boundary. With 50 mg/NM ³ emission from Stack, PM ₁₀ increase will be 9.6 µg/m ³ at the same location.	130



10 - Environmental Management Plan (EMP) (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
		under challenging conditions. The Customised ESP technologies such as AIRTECH Compact Clean™ ESP with digitalised control known as PIAC DC 4 developed by established ESP manufacturer is installed in LKAB Sweden Pellet plant. Essar Minmet Ltd is planning to install similar ESP which will maintain stack emission level within 20 mg/NM ³ with N-1 fields. The ESP technology suppliers are committing to this emission standards. Hence, all our calculations are made with maximum emission level of 20 mg/NM ³ only from the outlet of ESP.		
	ii) CEMS may be installed in all large/medium red category industries (Air Polluting) and connected to SPCB and CPCB server	The main induration stacks will have online monitoring instrument which will be connected through IP to OSPCB and CPCB on continuous basis	Online stack monitoring values will be made available to OSPCB and CPCB..	
	iii) Effective Fugitive emission control measures should be imposed in the process/ transportation/ packing etc.	1. Process : Online monitoring and control through CCR will ensure all time performance to keep the fugitive emission under control.	1. Online CAAQMS with connectivity to OSPCB and CPCB will be provided	1
		2. Transportation: 2.a) All the trucks bringing other materials like Bentonite, Anthracite, Lime stone from port plot to plant (6 trucks/ hr) will be covered with Tarpaulin.	Better Ambient Air Quality for Control Fugitive Dust Emissions	
		2.b.) The trucks tyre washing system is incorporated in the plant layout to avoid fugitive dust emission.		0.75



10 - Environmental Management Plan (EMP) (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
		2.c) Water sprinkling at regular intervals will be done on all the roads.		0.30/annum
		2.d) Road Sweeper will be engaged		3.00
		2.e) Both sides of the Road will have green coverage		0.30
		2.f) Provision of modular metal cloth type wind curtain to reduce fugitive emissions		3.00
	iv) Transportation of materials by Rail/conveyor Belt, wherever feasible	1. Major Input Raw Material " Iron Ore Concentrate " 14.30 mmtpy is transported through a 250 km long slurry pipe line which is buried under ground	Zero Impact on Environment	Included in project Capex
		2. 14 mtpy product pellet is shipped through a mechanised loading system from plant to port through a closed conveyor.	Impact on Environment on insignificant	Included in Project capex
	v) Encourage Use of cleaner fuels(Pet coke/furnace oil/LSHS may be avoided)	Natural gas is the prime fuel. System will be designed to use Low Sulphur FO only during non-availability of Natural Gas. No Pet coke/high sulphur fuel oils are planned to be used	Low SOx Compared to FO	Included in Project Capex
	vi) Best Available Technology may be used. For example usage of EAF/SAF/IF in place of cupola furnace. Usage of super critical technology in place of sub critical technology.	EAF/SAF/IF/Critical Technology are not part of our plant process. Hence Not applicable		
	vii) Increase of green belt cover by 40% of the total land area beyond the permissible requirement of 33%, wherever feasible	The plant layout is developed for covering 40% of land as green belt.(40 acres)	Better green coverage and natural wind barrier as well as arresting fugitive dust generated within the plant.	3.3



10 - Environmental Management Plan (EMP) (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
	viii) Stipulation of green belt outside the project premises such as avenue plantation, plantation in vacant areas, social forestry etc.	Avenue plantation and plantation in vacant areas, social forestry will be undertaken with due approvals from local authorities.	Increase in green coverage and social forestry	1.00
	ix) Assessment of carrying capacity of transportation load on roads inside the industrial premises. If the roads to be widened, shall be prescribed as condition.	All the plant inside roads (4km) are considered to be concrete and included in the project capex. The roads will be designed as per relevant Standard Code.	Effective control of fugitive emissions	12
Water	i) Reuse/Recycle of treated waste water, wherever feasible	1. The water received through slurry transportation after meeting the requirement of pellet plant is returned through return water pipe line of 250 km in length to Beneficiation Plant for Reuse.	Saving of 34.5% of fresh water intake (380 cum/hr) equivalent to 3.63 cusecs	Additional 800 Cr in Capex
		2. Rain Water during monsoon is planned to transfer through return water pipe line to Beneficiation plant to the max extent possible. Clarifloculator of suitable capacity (150 cum) to be installed.	Further Reduction in fresh water intake during monsoon from River Baitarani	2
		3. CETP for treating blow down water and reuse in dust suppression and greenbelt	80 cum/hr of water saving by recycling	1.3
		4. STP - Sewage Treatment Plant	6 cum/hr is used for green belt	0.7



10 - Environmental Management Plan (EMP) (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
	ii) Continuous monitoring of effluent quality, quantity in large and medium Red Category industries (water polluting)	Periodical monitoring as part of Environmental Management Programme, the sample collection, testing and monitoring as per schedules both by in-house as well as reputed NABL Accredited third party agencies would be implemented	Ensures no impact on ground water quality in the near by areas	0.5 Cr / annum
	iii) A detailed water harvesting plan may be submitted by the project proponent	The storm water will be captured and utilised to send back through return water pipe line. A clarifloculator of 150 cum capacity included in the process to treat the rain water before leaving the plant boundary.	Conservation of Rain water and Reduction in fresh water intake	Capex included in (i.2)
	iv) Zero liquid discharge wherever techno-economically feasible	1. Process water is recycled through return water pipe line to Beneficiation plant 2. Rain water is also planned to be used through the return water pipe line	The scheme ensures zero discharge in the pellet complex	Included in Project Cost for return water pipeline.
	v) In case, domestic waste water generation is more than 10 KLD , the industry may install STP.	STP is incorporated in the plant layout	Recycle and Reuse of water	Included in Water (i.4)
Land	i) Increase of green belt cover by 40% of the total land area beyond the permissible requirement of 33% where feasible for new projects	Plant Layout has been prepared with 40% plant area reserved for green belt.	Better green coverage and natural wind barrier.	Included at Air (vii)
	ii) Stipulation of green belt outside the project premises such as avenue plantation, plantation in vacant areas and social forestry etc.,	Avenue plantation and plantation in vacant areas, social forestry will be undertaken with due approvals from local authorities.	Increase in green coverage and social forestry	Included in Air (viii)
	iii) Dumping of waste (fly ash/slag/red mud etc.) may be permitted at designated locations approved by SPCBs/PCCs	No solid waste such as fly ash/slag/red mud is generated in pellet making. Hence Not applicable	-	



10 - Environmental Management Plan (EMP) (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
	iv) More stringent norms for management of Hazardous waste. The waste generated should preferably be utilised in co-processing	1. Used Lubricants will be handed over to authorised recycler for further processing 2. STP sludge will be used as manure for green belt	Effective solid waste management -	0.1 Included in Water (i.4)
Other Conditions (Additional)	1. Monitoring of compliance of EC conditions may be submitted with third party audit every year	Annual Audit by reputed agencies will be carried out and the compliance will be submitted to OSPCB/CPCB/MOEFCC	-	
	2. The % of CER at at least 1.50 times the slabs given in the OM dated 01.05.2018 for SPA and 2 times for CPA in case of Environmental Clearance	The project location is coming under SPA, the CER amount is 1.50 times as compared NON SPA locations which amounts to Rs. 37.05 crores as against of Rs. 24.70 Crores	Better Social Governance	37.05

10.2 ADMINISTRATIVE HIERARCHY OF ENVIRONMENT AND SAFETY DEPARTMENTS

EML has constituted a Safety department and an Environment department under the administrative control of In-charge-Safety and In Charge Environment respectively. The aspect of occupational health of the employees is looked after by In-charge-Safety. The respective In Charge of Environment and Safety report directly to the CEO & MD who in turn report all environmental compliance related matters to the Board of Directors and stakeholders. The organizational Structure indicating the reporting structure of individual departments in matters relating to Environment, Health and Safety compliance is presented in Fig. 10-1.

10 - Environmental Management Plan (EMP) (cont'd)

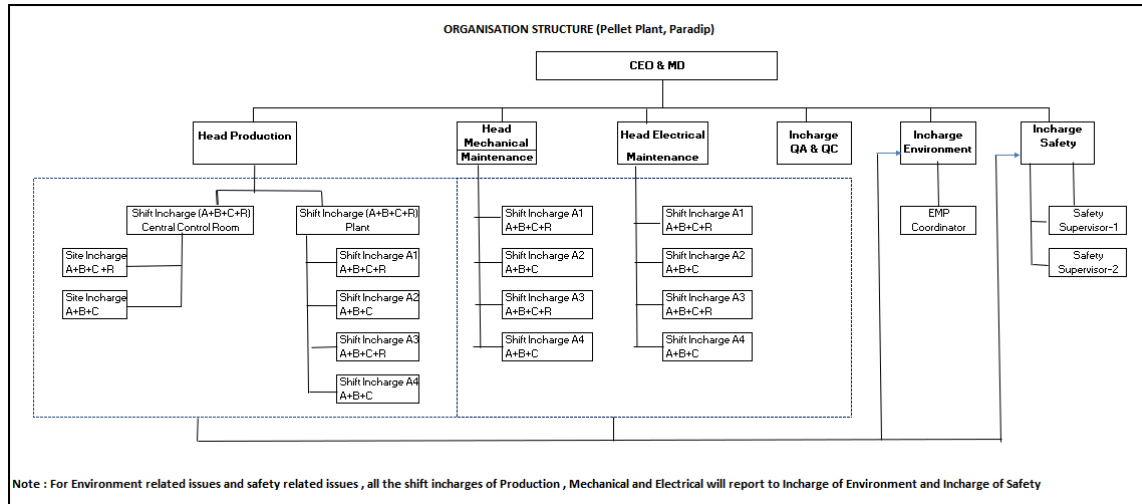


FIG. 10-1 - ORGANISATION STRUCTURE OF THE EHS DEPARTMENT

The main responsibilities of Environment and Safety dept. would cover the following:

- i) Supervising the environmental performance (EP) test of pollution control equipment/systems
- ii) Monitoring the EP of the pollution control equipment/systems on regular basis
- iii) Environmental data generation, compilation and monthly report preparation
- iv) Initiation and implementation of corrective measures as and when required in coordination with respective departments
- v) Interfacing with the stakeholders on the desired EP of the plant
- vi) Conducting environmental audit and check the legal compliance
- vii) Monitor the statutory compliance w.r.t. Green Belt development & facilitate the same
- viii) In charge Safety is responsible for Occupational health monitoring, implementation of occupational health care program and for maintaining health statistics of the employees



10 - Environmental Management Plan (EMP) (cont'd)

- ix) Safety officers & supervisors of the department are responsible for safety surveillance and safety audit
- x) Training of operation and maintenance personnel in EHS by expert EHS personnel for effective implementation of policy & guidelines are being carried out by the departmental officials.

10.2.1 Environmental Policy

EML has framed HSE Policy is committed to maintain environment friendly, safe, healthy and sustainable working condition in all its operations. The HSE policy is presented in Appendix 10-1 and this would be applicable for the proposed project.

Safety and Environment departments would be responsible for the compliance of the environmental conditions in adherence to the Environmental Laws and Regulations. Work instruction for reporting & addressing non-compliance related to EC/CTE/CTO conditions are laid down as a Standard Operating Procedure (SOP). Six monthly compliance reports with respect to the conditions stipulated by MoEFCC would be submitted regularly to the statutory agencies. In case of violation of any statutory conditions, the same is reported to In charge Environment and Safety within 2 hours of detection and appropriate corrective as well as preventive actions are taken. In charge Environment and Safety would also report the same to the CEO and MD within 12 hours. The action taken report would be communicated to all stakeholders through website notification.

10.3 OCCUPATIONAL HEALTH CARE AND SAFETY

Occupational health & safety aspects of the plant are overseen by In-charge-Safety.

The nature of health hazard associated with the operation and maintenance of the plant include hazards related to exposure to heat, noise, dust, acid & alkali fumes, fuel leaks, hazardous wastes etc.



10 - Environmental Management Plan (EMP) (cont'd)

The occupational health care issues look into reducing impacts of dust emissions, noise etc on employees, and also look into general health and issues associated with tobacco, alcohol and other intoxications.

The common causes of injury and illness are as follows:

- i) Slips, trips and falls on the same level; falls from height; unguarded machinery; falling objects
- ii) Engulfment; working in confined spaces; moving machinery, on-site transport, forklifts and cranes
- iii) Exposure to controlled and uncontrolled energy sources; exposure to mineral wools and fibres; inhalable agents (gases, vapours, dusts and fumes)
- iv) Skin contact with chemicals, contact with liquid steel & slag
- v) Fire and explosion; extreme temperatures; radiation (non-ionizing, ionizing)
- vi) Noise and vibration; burns and electric shock
- vii) Manual handling and repetitive work; failures due to automation; poor ergonomics
- viii) Lack of OHS training; poor work organization
- ix) Inadequate accident prevention and inspection; inadequate emergency first-aid and rescue facilities; lack of medical facilities and social protection

In the construction stage, there would be strict monitoring of Contractors' workers' health and safety. All the safety and health measures discussed above would be implemented for the construction workers including medical screening. Before commencing the work, the Contractors' workers' would be given awareness training on Safety procedures by EHS department of EML.

During the construction phase, casual labourers would be provided with toilet facility (both for male and female workers) with Septic tank and drinking water facility. Additionally rest shelters (with



10 - Environmental Management Plan (EMP) (cont'd)

proper ventilation and lighting facilities) at convenient locations, would be constructed and existing facilities will be used. These facilities related to infrastructure would also be extended to casual labourers and vehicle operators during the operation phase.

Health of workers would be evaluated by routine periodic medical examination. Emergency treatment would be carried out as per the prevailing practices. The schedule of medical check-up during operational phase is detailed below:

- i) Comprehensive Pre-employment medical check up for all employees
- ii) General check up of all employees once every year.
- iii) Executive health check up for employees in 30 to 40 years bracket: once every three years
- iv) Executive health check up for employees in above 40 years bracket: once every year
- v) Local hospitals and Govt. health monitoring system would be engaged.
- vi) Dispensary facility would be provided to all workers as applicable
- vii) All safety gears and Personal Protective Equipments (PPE) would be provided to workers and care would be taken by EHS department that these are used properly. All safety norms would be followed

PPEs provide supplementary protection against exposure to hazardous conditions where the safety of workers cannot be ensured by other means, such as eliminating the hazard, controlling the risk at source or minimizing the risk. PPEs provided would comply with the relevant national standards.



10 - Environmental Management Plan (EMP) (cont'd)

While selection of PPE, care is taken in assuring correctness & fit for the people who use it, the nature of the hazards the equipment is intended to protect against, comfort level, and the consequences of poor performance or equipment failure.

The common PPEs used are as follows:

- i) Head- Helmets
- ii) Face & Eye Protection - Face shields, Goggles
- iii) Feet - Safety Shoe
- iv) Respiratory Protective Equipment - Face mask
- v) Hearing Protection - Earplugs, Earmuffs
- vi) Radiation - Jackets, eye goggles
- vii) Heat - Fire retardant jackets
- viii) Protection from Falls- fall protection equipment, such as harnesses and lifelines.

Health education program would be conducted that would include occupational health, cardiac risk reduction, stress management, ergonomics, early diagnosis & treatment, burn safety & eye care, gas & heat hazards, occupational lung diseases, physical fitness, nutrition etc.

The health care surveillance of its employees for the proposed project would be carried out by audiometric examination & hearing conservation (especially for the employees exposed to high noise levels), statutory eye examination, x-ray investigation, blood examination, lung function test etc. Mandatory special medical check would be institutionalized for people working at height and enclosed area. The Safety Department would play a key role in maintaining the best safety practices to ensure zero accidents.

Routine safety surveillance would be carried out by the Safety Department. This would be in accordance with the plant safety manual for all primary and supporting production facilities. Fire Safety protection features like fire hydrants, sprinklers, extinguishers etc shall be routinely checked and mock drills of the same at periodic intervals



10 - Environmental Management Plan (EMP) (cont'd)

would be done to ensure functionality. The hazard potential of hazardous chemicals and fuels to be used in the plant would be informed to the concerned Personnel. They should also be made aware of the immediate first aid measures in the event of an accident. Maintenance work on all electrical installations shall have prior safety permit from the designated official of the Department. Safety permits for 'Hot work' and 'Work at Height' would be mandatory. The plant would have occupational health care manual and adopt international practice of occupational health care as required by the Regulations.

For accident prevention, the following measures would be undertaken:

- i) Fires & explosions resulting from ignition of volatile materials and fuels and electrical short circuits.
- ii) Operators would be trained in safe systems of work.
- iii) Risk assessments would be carried out to consider the potential dispersal of toxic chemicals & combustion products, and the potential impact of an explosion on the surrounding areas.
- iv) Regular safety audits would be undertaken to ensure that hazards are identified and risk-control measures maintained at an optimum level.

The proposed budget for Fire and OHS is furnished in Table 10-3.

TABLE 10-3 - OCCUPATION HEALTH AND SAFETY AND FIRE FIGHTING BUDGET ALLOCATION

Sl. No.	Categories	CAPEX (In Rs. Crores)	OPEX (per annum in Rs. Crores)
1	Fire	7.75	1.2
2	Occupational Health & Safety	4.5	3.55
	Total Budget	12.25	4.75



10 - Environmental Management Plan (EMP) (cont'd)

10.4 GREENBELT DEVELOPMENT PLAN

The green belts are acting as a natural barrier to noise and buffer of air pollutants that also boosts eco- restoration and aesthetics of the area. Leaves adsorb pollutants on their surface, especially near the tree crown thus effectively reducing pollutant concentration in the ambient air. Often the adsorbed pollutants are incorporated in the metabolic pathway and the air is purified. Apart from function as pollution sink, greenbelt would also provide suitable habitats for birds and other small animals. Checking soil erosion, restoring water balance and enhancing micro climatic conditions are some of the other objectives of greenbelt development.

10.5 DESIGN OF GREENBELT

Out of 100.13 acres of EML pellet plant area, 40 acres (40%) of land to be develops as a green belt and landscaping by special attention to the native plant species in the areas along the plant boundary, around the waste dump and between various facilities. A green belt of average 10- 100 m wide has been proposed all around the periphery of the plant. On an average 2,500 trees per hectare with local native species and other suitable species would be planted. However, the density of plantation would depend on factors such as the type of species and location factors. However, treated sewage water and treated water from CETP would be used for landscaping and green belt development purposes. 12.45 liter per tree per day would be reserved for the same.

10.6 GREENBELT DEVELOPMENT METHODOLOGY AND APPROACH

10.6.1 Preparation of Plantation Area

Plantation site would be cleared from all wild vegetation. Suitable soil and water conservation measures would be adopted. If planting area is large, it would be divided into blocks inter-linked by paths laid out in such a way that every tree is accessible for all post



10 - Environmental Management Plan (EMP) (cont'd)

plantation care. The planting arrangement and size would be based on the optimum use of the available land, quantum of irrigation water, purpose of plantation and the tree species.

10.6.2 Greenbelt Development Plan

Greenery would be developed along the periphery of the plant boundary, around the waste dumps and other vacant areas in various patches within the plant facilities and along the internal roads. The proposed greenbelt is shown in the plant general layout.

10.6.3 Location for proposed Greenery Development

The areas considered to special attention for plantation in the project area are

- i) Along the plant boundary
- ii) Around the waste dump
- iii) Around the administrative buildings
- iv) Patches between various shops
- v) Roadside plantation at approach road and internal roads

10.6.4 Selection of the Plant species for proposed Greenbelt

Selection of the plant species has been conducted reviewing, CPCB (March, 2000), Guidelines for developing green belts PROBES/75/1999-2000, Anticipated Performance Index (API) of plants against air pollution (International Research Journal of Plant Science (ISSN:2141-5447) Vol.2(4)PP.099-106, April-2011) and adhere to the following specific requirements, a list of selected trees and shrubs given in Table 10-4.

- i) Availability of seed material and resistance to specific air pollutants.

10 - Environmental Management Plan (EMP) (cont'd)

- ii) Tolerance to wide adaptability to eco-physiological conditions.
- iii) Fast growing, native and large canopy.
- iv) Extensive foliar area to provide maximum impinging surface for continued efficient adsorption & absorption of pollutants.
- v) Capacity to endure water stress and climatic extremes after initial establishment.
- vi) Differences in height, growth habits and bole shapes.

TABLE 10-4 - SELECTED TREES AND SHRUBS FOR GREENBELT

Greenbelt Layer	Common Name	Scientific Name
1st Layer (Curtain Belt)	Chakundi	<i>Cassia siamea</i>
	Debadaru	<i>Polyalthia longifolia</i>
	Dhala Siris	<i>Albizia procera</i>
	Jamun	<i>Syzygium cumini</i>
	Kala Siris	<i>Albizia lebbbeck</i>
	Karanja	<i>Pongamia glabra</i>
	Neem	<i>Azadirachta indica</i>
	Palas	<i>Butea monosperma</i>
	Sagun	<i>Tectona grandis</i>
	Sisoo	<i>Dalbergia sissoo</i>
2nd Layer (Middle Belt)	Aswatha	<i>Ficus religiosa</i>
	Bat	<i>Ficus benghalensis</i>
	Chakundi	<i>Cassia siamea</i>
	Jarul	<i>Lagerstroemia speciosa</i>
	Kadamba	<i>Anthocephalus cadamba</i>
	Kala Siris	<i>Albizia lebbbeck</i>
	Karanja	<i>Pongamia glabra</i>
	Neem	<i>Azadirachta indica</i>
	Tentul	<i>Tamarindus indica</i>
	Ashok	<i>Saraca indica</i>
3rd Layer (Inner Belt)	Babool	<i>Acacia arabica</i>
	Bougainvillea	<i>Bougainvillea spectabilis</i>
	Ber	<i>Zizyphus sp.</i>
	Duranta	<i>Duranta sp.</i>
	Karanja	<i>Pongamia glabra</i>
	Akashmoni	<i>Acacia auriculiformis</i>
Approach Roadside Plantation	Jamun	<i>Syzygium cumini</i>
	Kadamba	<i>Anthocephalus cadamba</i>
	Neem	<i>Azadirachta indica</i>
	Rain tree	<i>Samanea saman</i>
	Sagun	<i>Tectona grandis</i>
	Sisoo	<i>Dalbergia sissoo</i>
	Tentul	<i>Tamarindus indica</i>

10 - Environmental Management Plan (EMP) (cont'd)

Greenbelt Layer	Common Name	Scientific Name
Internal Roadside Plantation	Amaltas	<i>Cassia fistula</i>
	Bougainvillea	<i>Bougainvillea spectabilis</i>
	Cassia	<i>Cassia auriculata</i>
	Chakundi	<i>Cassia siamea</i>
	Debadaru	<i>Polyalthia longifolia</i>
	Gulmohar	<i>Delonix regia</i>
	Jarul	<i>Lagerstroemia speciosa</i>
	Java-ki-rani	<i>Cassia javanica</i>
	Kadamba	<i>Anthocephalus cadamba</i>
	Karabi	<i>Nerium indicum</i>
	Yellow Karabi	<i>Thevieta peruviana</i>
Around the shops, office buildings and other available stretches	Am	<i>Mangifera indica</i>
	Amla	<i>Phyllanthus emblica</i>
	Arjuna	<i>Terminalia arjuna</i>
	Bahada	<i>Terminalia bellirica</i>
	Bakul	<i>Mimusops elengi</i>
	Bhalia	<i>Semecarpus anacardium</i>
	Copperpod	<i>Peltophorum pterocarpum</i>
	Champa	<i>Michelia champaca</i>
	Chatim	<i>Alstonia scholaris</i>
	Daba baunsa	<i>Bambusa arundinacea</i>
	Gamhar	<i>Gmelina arborea</i>
	Guava	<i>Psidium guajava</i>
	Harida	<i>Terminalia chebula</i>
	Katha Champa	<i>Plumeria rubra</i>
	Kachnar	<i>Bauhinia variegata</i>
	Kurchi	<i>Holarrhena antidysenterica</i>
	Kusum	<i>Schleichera oleosa</i>
	Mahua	<i>Madhuca indica</i>
	Mahogini	<i>Sweitenia mahogini</i>
	Phasi	<i>Anogeissus acuminata</i>
	Rubber Fig	<i>Ficus elastica</i>
	Sal	<i>Shorea robusta</i>
	Sausage Tree	<i>Kigelia pinnata</i>
	Sidha	<i>Lagerstroemia parviflora</i>
	Simul	<i>Bombax ceiba</i>
	Weeping Fig	<i>Ficus benjamina</i>

10.6.5 Some Additional Information about Plantation

To undertake plantation on site for different purposes, following steps would be involved:

1. Raising seedlings in nursery
2. Preparation of pits and preparing them for transfer of seedlings
3. After-care i.e. nurturing the sapling for proper growth



10 - Environmental Management Plan (EMP) (cont'd)

Raising Seedlings in Nursery: Seedlings would be raised in nurseries. Adequate number of surplus seedlings should be available considering 10% mortality factor. Healthy seedlings should be ready for transfer to permanent location before rainy season.

Preparation of Pits for Transfer of Seedlings:

- i) Standard pit size would be 60 cm x 60 cm x 60 cm.
- ii) The distance between pits would vary depending on their location.
- iii) The pits should be filled using good soil (3 parts) and Farm yard manure (1 part).
- iv) Rhizobium commercial preparation (1 kg/1000 kg) v) BHC powder, if the soil inhabits white ants (Amount variable).
- v) The pits should be watered prior to plantation of seedlings

Plantation Work Plan and After Care: The detailed plantation work plan and final selection of species shall be finalized in consultation with the State Forest Department. Species and location wise plan of the plantation would be depicted on a general layout plan before the actual plantation work begins. The required seedling would be raised in the nursery established at the site for the purpose of plantation or would be procured from the local forest department/private nursery grower/agencies to meet the requirements of the plantation. Adequate arrangement for watering, particularly during early years, weeding and hoeing and replacing the dead saplings would be envisaged in the plan. The plantation pattern would be in three Tier systems as given in Table 10-5.

10 - Environmental Management Plan (EMP) (cont'd)

TABLE 10-5 - PLANTATION PATTERN FOR GREENBELT DEVELOPMENT

Tier	Habit	Height (m)
1st Tier (Towards boundary)	Trees	> 10
2nd Tier (Middle layer)	Small Trees	5-10
3rd Tier (Towards Plant)	Shrubs	≤ 5

Implementation Programme: The Greenbelt Development programme would be implemented within one year as shown in Table 10-6.

TABLE 10-6 - IMPLEMENTATION PROGRAMME FOR GREENBELT DEVELOPMENT

Plan period	Area (%)	Plantation Area	Tree Species
1st year	100	Along the periphery (1st Tire)	Chakundi, Debadaru, Dhala Siris, Jamun, Kala Siris, Karanja, Neem, Palas, Sagun, Sisoo
		Along the periphery (2nd Tire) and approach road	Akashmoni, Aswatha, Bat, Chakundi, Jamun, Jarul, Kadamba, Kala Siris, Karanja, Neem, Tentul,
		Along the periphery (3rd Tire) and internal road side within plant area	Amla, Ashok, Babool, Bougainvillea, Ber, Duranta, Guava, Karanja, Weeping Fig
		Along internal road side within plant area and available patches after establishment of all facilities	Am, Arjuna, Bahada, Bakul, Bhalia, Copperpod, Champa, Chatim, Daba baunsa, Gamhar, Harida, Katha Champa, Kachnar, Kurchi, Kusum, Mahu, Mahogini, Phasi, Rubber Fig, Sal, Sausage Tree, Sidha, Simul,

10.7 RAIN WATER HARVESTING (RWH)

The technique of collection and storage of rainwater for industrial use is now a successful concept, especially as it helps to preserve/recycle an important natural resource like water. Rain water



10 - Environmental Management Plan (EMP) (cont'd)

harvesting measures at plant site from roof-tops and storm water drains would be used for ground water recharge as well as for various secondary uses within the plant. Due to its high water table, ground water recharge is not feasible in Paradeep region. Therefore, during the monsoon season, surface runoff from the plant would be routed through storm water drains and get collected in settling catchpits. After settling of suspended solids and removal of Oil & Grease, the storm water would be recycled for in plant use and pumped back to the beneficiation plant to the maximum extent possible and the excess would be discharge outside plant boundary after treatment through clariflocculator of 150 m³/hr capacity.

10.8 ENERGY CONSERVATION MEASURES

Renewable energy is an energy that comes from resources which are naturally replenished on a human time scale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services. To promote use of Green Energy and to reduce dependency on Fossil Fuel Energy, CO₂ emission and mitigate climate change, solar energy would be promoted.

Energy conservation measures would be implemented to ensure that the use of non-renewable resources is optimized. A key component of achieving energy conservation would be the development of an Energy Management Action Plan. This plan would be included as part of the Construction and Operational EMPs. The Energy Management Action Plan would be consistent with the energy conservation measures during both construction and operation phase.



10 - Environmental Management Plan (EMP) (cont'd)

10.8.1 Energy Conservation during Construction Phase

The following mitigation measures would be undertaken during construction works.

- i) Efficient work scheduling and methods that minimise equipment idle time and double handling of material;
- ii) Throttling down and switching off construction equipment when not in use;
- iii) Switching off truck engines while they are waiting to access the site and while they are waiting to be loaded and unloaded;
- iv) Switching off site office equipment and lights and using optimum lighting intensity for security and safety purposes;
- v) Careful selection of road routes to reduce transportation distances for construction materials to site;
- vi) Regular maintenance of equipment to ensure optimum operations and fuel efficiency.

10.8.2 Energy Conservation during Operation Phase

The following mitigation measures would be implemented during plant operations.

- i) Waste gas recirculation in Induration furnace
- ii) Design of buildings and terminal layout would aim to achieve the following energy efficiencies:
 - a) Employing renewable energy sources such as day lighting and passive solar heating;
 - b) Designing internal roads and logistics to reduce transportation distances.



10 - Environmental Management Plan (EMP) (cont'd)

10.8.3 Energy Efficient Equipment

Large energy savings could be achieved in using energy efficient equipment. The following actions are examples of how energy savings could be achieved by the terminal operator(s):

- i) Using energy efficient electrical appliances like energy efficient LEDs and Inverter ACs;
- ii) Installing lighting control devices where appropriate and linking to photo-electric dimming; and
- iii) Providing sufficient energy metering and switching for energy management.
- iv) All street lights would be solar LED type

Energy would also be conserved through efficiency in work schedules and practices such as:

- i) Use of modern container yard management systems for the efficient stacking and retrieval of containers and to minimise vehicles waiting times;
- ii) Road transport scheduling to minimise energy use and wastage, e.g. increasing back loading and minimising waiting times;
- iii) Switching off truck engines while they are waiting to access the site and while these are waiting to be loaded and unloaded;
- iv) Regular maintenance of all powered equipment to ensure appropriate fuel consumption rates; and
- v) Communication and education of energy conservation measures to employees

The EMP matrix is shown in Table 10-7.



10 - Environmental Management Plan (EMP) (cont'd)

TABLE 10-7 - EMP MATRIX

Discipline	Potential impacts	Mitigation measures
Construction Phase		
Air environment	Emission of dust due to construction activities leading to adverse health & environmental impacts	<ul style="list-style-type: none"> - Water sprinkling on roads to arrest fugitive dust emission. - Logistics would be designed to minimize movement of trucks transporting construction materials and optimize storage of construction materials at site
Water quality	Discharge of construction wastewater including sanitary and kitchen wastewater causing adverse health & ecological impacts	<ul style="list-style-type: none"> - Labour hutments would be provided with proper sanitation facilities - The stockpiles would be protected with toe wall of adequate height along with concrete garland drain & catch pits to prevent uncontrolled discharge of runoffs during monsoon.
Noise	Increase in noise level due to construction activities causing health hazards	<ul style="list-style-type: none"> - Provision of Personal Protective Equipment (PPE) like ear muffs, ear plugs etc. - Noise prone construction activities such as piling, drilling, excavation, cutting, etc. would be done during daytime only
Land environment	Adverse impact on land due to dumping of solid waste C & D waste,	<ul style="list-style-type: none"> - Development of 40% greenbelt within 1 year - Proper segregation of the wastes and use of recyclable materials within the plant/ sell to external agencies for secondary use - Handling & disposal of wastes by authorized agencies as per prevalent regulations
Socio-Economics	<ul style="list-style-type: none"> • Local employment opportunities, as per required skill set • Promotion and augmentation of ancillary & auxiliary establishments 	<ul style="list-style-type: none"> - Support towards vocational and industrial training of local population (having basic qualification) for skill upgradation
Ecology	<ul style="list-style-type: none"> • Loss of existing minor vegetation cover • Emission of dust causing adverse impact on terrestrial flora due to temporary reduction in photosynthesis rate 	<ul style="list-style-type: none"> - Plantation of diverse deep rooted native plant species - Temporary impact to be abated by measures like water sprinkling, paving of roads - Treatment of wastewater and reuse in dust suppression, landscaping, equipment washing etc. - Adoption of zero effluent discharge to mitigate impact on aquatic ecology
Operation Phase		
Land environment	Potential negative impact due to temporary storage of raw materials and finished pellets due to leaching of toxic components.	<ul style="list-style-type: none"> - All stockpiles would be on top of a concreted area to avoid leaching of materials during monsoon. - Abatement of dust emission through adoption of suggested measures including PTFE bag filters and limiting PM emission from stacks to 20 mg/Nm³
Surface Water Resource & quality	Potential cumulative Adverse impact due to withdrawal of surface water at beneficiation plant site	<ul style="list-style-type: none"> - Treatment of wastewater from units in CETP for recycle as fresh make-up water - Adoption of zero effluent discharge - Utilization of surface runoff to the maximum extent possible and discharge of excess storm water only

10 - Environmental Management Plan (EMP) (cont'd)

Discipline	Potential impacts	Mitigation measures
Ground water	<ul style="list-style-type: none"> No impact on resource as groundwater abstraction not envisaged Minimal impact on groundwater quality due to seepage and leaching 	<ul style="list-style-type: none"> Concrete box drains to prevent seepage and ground water contamination. Temporary solid wastes storage yard to be lined with suitable liner to avoid leaching through soil bed leading to contamination of ground water.
Air Environment	Adverse impacts on health & environment due to emission of PM, SOx, NOx	<ul style="list-style-type: none"> Selection & maintenance of APC equipments for fugitive & point source emissions Process optimization to control emission Interlocking of APC equipment to alert operator for controlled shut down of plant units in case of APC failure Pneumatic or covered conveying of raw material Maintenance of Plant roads and use of industrial vacuum cleaners & water sprinkling on product stockpile and roads at regular intervals. Operation & maintenance of tyre washing system at exit side of plant material gate (Gate #2)
Noise	Detrimental impact on the health of working personnel in and around the plant premises.	<ul style="list-style-type: none"> Noise levels for the new equipment and machineries to be fixed at 85 dB(A) Leq within 3 m distance from the noise prone equipment. Highly noise prone equipment having Leq above 90 dB(A) would either be housed separately or the attending personnel need to be housed in a noise-shielded cubicle. Noise prone rotating/vibrating equipment provided with vibration dampening anchoring. Use of appropriate PPEs
Socio-Economics	<ul style="list-style-type: none"> Local employment opportunities, as per required skill set Promotion and augmentation of ancillary & auxiliary establishments Potential hike in local purchasing power, land & property prices, rent scales and household income leading to a positive impact on the economic growth of the region 	<ul style="list-style-type: none"> Support towards vocational and industrial training of local population (having basic qualification) to be provided for up-gradation of skill Preference to locals for employment Implementation of Socio economic EMPs to be decided after conducting Public Hearing
Ecology	Potential adverse impact on terrestrial & marine ecology due to air pollution, generation of noise and release of untreated wastewater	<ul style="list-style-type: none"> Development of 40% greenery adsorbing dust & absorbing specific pollutants and maintaining overall ecological balance Adoption & adherence to the suggested Air pollution control measures, wastewater & solid waste management measures, noise pollution abatement measures

All EMPs would be implemented before commencement of operations and greenbelt would be developed within 1 year. Monitoring of all EMPs would be carried out by submission of compliance report to OSPCB on a six monthly basis.

10 - Environmental Management Plan (EMP) (cont'd)

10.9 ENVIRONMENTAL MITIGATION COST

For implementation of the proposed environmental mitigation measures, the estimated capital expenditure (CAPEX) would be of Rs. 63.95 crore and the estimated OPEX would be Rs. 1 crore per annum. The relative allocation of the CAPEX and OPEX would be as shown in Table 10-8 and the technological expenditure for pollution mitigation is shown in Table 10-9.

TABLE 10-8 - ENVIRONMENTAL MITIGATION COST

	Rs. in crore CAPEX	Rs. in crore OPEX
Water Conservation and Wastewater Treatment	2	0.1
Air Pollution Control Measure	10	0.2
Solid Waste management	0.1	0.1
Energy Conservation	0.5	-
Greenbelt Development	3.3	0.1
On-line Monitoring & Environmental Laboratory	11	0.5
Socio economic development activities	37.05	-
Total	63.95 (A)	1.0

During the interim period only one module will be in operation. Therefore the opex for EMP would be Rs. 0.5 crores.

TABLE 10-9 - TECHNOLOGICAL POLLUTION MITIGATION COST

Sl. No.	Mitigation measures	Budget in INR crore
1	ESP - 2 Nos. (Induration furnace)	90
2	ESP - 2 Nos. (Discharge end)	20
3	ESP - 2 Nos. (Hearth layer discharge)	20
4	Additive grinding building – Bag filters	5
5	Pneumatic conveying – Bag filters	2
6	Product stockpile – Garland drain	2
7	Covered storage for additives (Bentonite, limestone, coal) and filter cake with garland drain	10
8	RCC roads in place of bitumen roads (inside plant)	4
9	NG and FO dual firing boilers in induration furnace (Differential cost with respect to FO fired boilers)	20
Total		173 (B)
Total (A + B)		236.95



11 - SUMMARY AND CONCLUSION

i. Project Name and Location

M/s Essar Minmet Limited (EML) has proposed to setup a 14 MTPA (2 x 7 MTPA Greenfield Pellet Plant near Paradip in Kujanga Tehsil of Jagatisingpur District, Odisha.

ii. Project highlights, products and capacities

The proposed project would be designed to produce Total 14 MTPA Blast Furnace (BF) and Direct Reduction (DR) grade pellets in 2 modules (Module-I and Module-II, each of 7 MTPA capacity).

The production units and their capacities are given below.

Sl. No.	Name	Proposed Units	
		Configuration	Production, MTPA
1	Pellet Plant (Module-I and Module-II)	2 x 7 MTPA	14
2	Proportioning and mixing, green balling, induration (drying, pre-heating, firing, after firing and cooling) and product screening	-	Matching Capacity
3	Terminal facilities (slurry receiving and filtration) of iron ore slurry	-	Matching Capacity

iii Requirement of land, raw material, water, power, fuel with source of supply

- Land** .. The proposed Pellet Plant would be set up in a total area of 40.49 Hectare. The project site is tentatively bounded by 20°17'1" N to 20°17'25" N latitude and 86°37'54"E to 86°38'45"E longitude.
- Raw Material** .. The estimated consumption of raw materials like Iron ore concentrate, Bentonite, Limestone, Anthracite coal etc would be



11 - Summary and Conclusion (cont'd)

around 15.05 MTPA. These raw materials would be sourced indigenously or would be imported. The Iron Ore concentrate will be received through Slurry pipeline and the additives by sea and road. During the interim period when slurry pipeline and captive iron ore beneficiation facilities are not commissioned, only one 7 MTPA module shall be in operation and the iron ore concentrate shall be transported from Paradip Port through pipe conveyor envisaged for product pellet transport to Paradip port in normal direction.

Water	..	The estimated water requirement for the various activities of the proposed project is around 375 m ³ /hr and 214 m ³ /hr during interim period. This requirement will be met by the recovered water after dewatering/filtration of iron ore concentrate slurry and partly by recycling of treated water from CETP and STP.
Power	..	The tentative average power requirement of the proposed system is 69 MW and about 38 MW during the interim period. The required power will be received from state grid/private/Captive power producer.
Fuel	..	Natural Gas would be used as fuel for the pellet plant. In the event of unavailability of Natural Gas the fuel would be switched over to Furnace Oil till Natural Gas supply is restored. Term sheet has been signed with GAIL and IOCL for supply of Natural Gas

iv. **Process Description and review of pollution potential**

The basic process steps for production are:

- i) Iron ore concentrate, ground limestone, binder bentonite and coal would be fed into mixer.
- ii) The thoroughly mixed pre-wetted material shall be conveyed to DISC Pelletisers to produce Green pellets predominantly of 6 to 18 mm size.



11 - Summary and Conclusion (cont'd)

- iii) The single deck screen provided with each disc shall separate out the undersize and oversize fines which shall be recycled back to the mixed material bins through conveyor system.
- iv) The accepted size green balls shall then be charged onto the double deck roller screens for uniform screening of 6 to 18 mm green balls.
- v) The undersize (-) 6 mm and the oversize (+) 16 mm green balls shall be separated by the screen and re-circulated to the mixed material bins.
- vi) Heat treatment of green pellet shall be carried out in the induration furnace in stages comprising drying, pre-heating, firing, after firing and cooling of the green balls.
- vii) The indurated pellets duly cooled to ambient shall be discharged by the traveling grate at the tipping station and collected in a discharge bin for onward transportation to screening station.
- viii) The product pellet, thus screened out, shall then be transported for storage and dispatch to port through conveyor.

Various process operations would generate Particulate Matter (PM), oxides of sulphur and nitrogen and carbon dioxide to the environment. There would be fugitive dust emission as well.

Solid waste like excess concrete & cement, rejected components & materials, packing & shipping materials including waste plastics, hazardous wastes like paint containers and used oil & grease as well as Municipal Solid Waste (MSW) including kitchen waste, canteen waste, waste from landscaping & greenery development etc would be generated during construction phase. The principal solid wastes that would be generated from the production of pellet are fines during induration process.



11 - Summary and Conclusion (cont'd)

Different sources of process wastewater would be cooling Tower blowdown, compressor cooling, process mixing, flushing water, Sewage Treatment Plant etc. Waste water would mainly contain suspended & dissolved solids.

v. Capital Cost and Estimated time of completion of the Project

The capital cost (Gross of GST) for the pellet plant is estimated at about Rs. 3,583 Crore and capital cost as Net of ITC is estimated at about Rs. 3,347 Crore considering GST credit amount as about Rs. 236 Crore. The project is envisaged to be implemented within a period of thirty (30) months after receipt of Environmental Clearance and Consent To Establish.

vi. Land use of the site

Presently the proposed land of 40.49 Hectare is in possession of Paradip Port Trust Authority. The land would be taken on long term lease basis for sixty (60) years from the Paradip Port Trust Authority. The present status of the land is industrial land.

vii. Baseline Environment

The average concentration (24 hrs) of PM₁₀ and PM_{2.5} are in the range of 80.6-130.3 µg/cu m and 42.7-70.0 µg/cu m respectively during summer season. The SO₂ and NO_x values are well within the permissible values for rural/industrial areas as set by NAAQS (2009). The CO and O₃ values are either below detection limit (bdl) or much below the approved values set by NAAQS.

The total hardness (TH) and total dissolved solids (TDS) content in ground water are found to be in the range of 505.63-605.59 mg/l and 1230-2154 mg/l respectively at the selected locations as against the allowable standards of 200 mg/l



11 - Summary and Conclusion (cont'd)

for TH and 500 mg/l for TDS. These high values indicate that the upper stratum of the ground water is saline due to coastal influence which is corroborated by high chloride level. Iron content lies within the range of 1.71-5.23 mg/l. Chromium, lead, arsenic, mercury, and other heavy metals are reported to below detection limit (bdl). It can be said that the ground water of the study area is suitable for human consumption except at Musadia village where the TDS level was found to be more than the permissible limit (2000 mg/l) of drinking water standards. The hardness is also found to be high at all locations in general. Therefore, treatment of the groundwater by softening is advisable before use, wherever possible. The average DO level for all surface streams ranges between 5.2-6.8 mg/l. Total dissolved solids (TDS) ranges from 9103.33 - 41333.67 mg/l. Total coliform count ranges from 1366 to 2366 CFU/100 ml. Presence of fecal coliform signifies that the water is not fit for human consumption without disinfection.

The soil is slightly reddish to greyish in colour and has a sandy loam texture having porosity in the range of 38.0 - 46%. The soil is slightly alkaline in nature with pH value ranging from 7.2 to 7.52. Availability of sufficient nutrients (N, P & K) is corroborated by the total organic carbon content of 6.2 gm/kg to 7.5 gm/kg and sufficient microbial population in the range of 6.9×10^4 to 7.2×10^4 CFU/ gm. The concentrations of heavy metals like lead, chromium are below detection limit (bdl).

The ambient noise levels Leq for one hour interval was recorded at eight different locations in four different zones, namely Commercial, Industrial, Residential & Silence zones once every monitoring season. The recorded noise levels are slightly higher than the stipulated norms at some locations.



11 - Summary and Conclusion (cont'd)

The study area is plain flat land and hardly shows any significant relief. Upper or the northern part of the study area is predominant by land surface whereas the southern part is mostly covered by sea. The general elevation of the study area varies from 0 m to about 10 m above mean sea level (amsl). The study area is drained by Mahanadi river. Nuna nadi and Kharinasi nadi joins Mahanadi from the north western side and north Eastern side respectively in the study area. The distributary of Mahanadi known as Santra nadi and Mahanga nadi flows through the western side of the study area. Many small river/streams are present in the study area. Taldanda canal flows through the northern side of the study area. All the coastal rivers and creeks including the Mahanadi river flow parallel to the coast for some distance before they meet the sea. The mouths of such creeks and rivers often shift along the coast and are constricted by subaqueous to sub-aerial bars. The drainage pattern is dendritic in study area with a significant meander in the streams. The depth to water level of the monitored sources ranges from 2.30 m to 4.80 m bgl during the month of April and from 0.68 m to 4.03 m bgl during the month of November as measured by CGWB.

The study area exhibits fertile cultivated alluvial plain lands formed by the deposits of river Mahanadi and its tributaries. There are strips of protected forest along the banks of Mahanadi river and coast line. There are also several low-lying areas with average elevation less than 1 m that have brackish water ecosystem as well as fresh water ecosystem. The study area is a part of the Coromandal Coast of Bay of Bengal that represents marine coastline ecosystem.



11 - Summary and Conclusion (cont'd)

The forest land in the study area can be considered as Beach Forest type under the sub division Littoral and Swamp Forests of Tropical Moist Forests. Vegetations in the forest area primarily comprises semi evergreen trees like Casuarina, Cashew, Akashmoni and Nilgari which are planted to stabilize the sand ridges.

In the non-forest area The most common trees are Akashmoni, Banyan, Cassia, Jamun, Mango, Neem, Nilgari, Pipal, Radhachura, Sajna, *Semal*, Siris, Sisoo and Teak.

The main agricultural crops in the study area are Rice, Maize, Wheat, Sesame, Black mustard seed, Sugarcane, Sunflower, Black and Green gram. Cashew and Pan are the main commercial horticultural crops found in the study area.

Among the recorded mangrove floral species, Hatal and Garana are assigned as Near Threatened (NT) category and rest of the floral species are considered as Least Concern (LC) or Not Assessed (NA) or Data Deficient (DD) in the IUCN Red List of Threatened Species, Version 2021-1. Among the recorded terrestrial faunal species, the terrestrial fauna Fishing Cat, Sambar, King Cobra are consider as Vulnerable (VU) and Indian Python consider as Endangered (EN). Among the reported aquatic faunal species Little Indian Porpoise and Asian Giant softshelled Turtle are consider as Vulnerable (VU), Indian darter is considered as Near Threatened (NT) and Irrawady Dolphin, Batagur Turtle, Green Sea Turtle, Hawksbill Sea Turtle, Indian Flapshell Turtle, Indian SoftShelled Turtles , North Indian Roofed Turtle, Leatherback Sea Turtle, Olive Ridley Sea Turtle, Peacock Eye Turtle, Salt water Crocodile, Indian Monitor Lizard , Water



11 - Summary and Conclusion (cont'd)

Monitor Lizard, Yellow Monitor Lizard are considered as Endangered (EN) and rest of the floral species are considered as Least Concern (LC) or Not Assessed (NA) or Data Deficient (DD) in the IUCN Red List of Threatened Species, Version 2021-1. The list of flora and fauna in the study area authenticated by DFO Rajnagar, Odisha has been enclosed in the EIA report. Eco-sensitive Zone of Bhitarkanika Wild Life Sanctuary and Gahirmatha Marine Wildlife Sanctuary falls within the study area and the project is located within Paradeep which is a severely polluted area. Apart from this, there are no Wildlife sanctuary, National Park, Protected Area, Biosphere reserve, Tiger reserve, Elephant reserves, Critically Polluted Area, Eco-sensitive area, Eco-sensitive Zone, State/UT Boundary, International Boundary, areas protected under international convention, national legislation, local legislation, cultural or other related value, wetlands, pilgrim areas, tourist areas, defense installations within 10 km from the project site.

Socioeconomic survey at 52 villages indicates that Schedule Caste population occupies the major part of the total population in this study area. They consist of 46% of the total population of the study area (as per the field study conducted in 2021) and has increased at a rate of 31% from 2011 (Census data) to 2021 (Field Survey). There are some villages which are inhabited completely by SC population. The sex ratio in the study area has increased from 786 to 852 in the past 10 years. Further, the literacy rate among males and females are 59% and 41% respectively.



11 - Summary and Conclusion (cont'd)

viii. Hazard Identification and Safety measures

The proposed facility would have installations, such as, storage and handling of fuel oil which would be under the purview of Manufacture, Storage, and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and its amendments thereof.

The types of possible disaster would be due to i) Disaster due to emergencies on account of fire, spillages, etc. ii) Disaster due to natural calamity on account of flood, earthquake, cyclone, storm, cloud burst, lightning and iii) Disaster due to external factors on account of food poisoning, sabotage etc.

Disaster management measures would include Design, manufacture, operation and maintenance of all plant machineries/structures as per applicable national and international standards as laid down by statutory authority, Preparation of layout to provide 'Assembly Point' and safe access way for personnel in case of a hazardous event/disaster, Proper Alarm system and training, Complete fire protection coverage for the entire plant as per regulatory stipulations, Creation and maintenance of Disaster Control Room (DCR) with adequately trained personnel who can handle all sorts of emergency situation, Provision of funds for prevention of disaster, mitigation, capacity-building and preparedness.

Monthly safety inspection shall be carried out by concerned officials as well as Safety department. Additionally, Safety Audit will be performed including all aspects of Occupational Health & Safety for all the areas.

11 - Summary and Conclusion (cont'd)

ix. Impact of the Project on Air, Water, land, flora-fauna & socio-economic status of the study area & Mitigation Measures

Discipline	Potential impacts	Mitigation measures
Construction Phase		
Air environment	Emission of dust due to construction activities leading to adverse health & environmental impacts	<ul style="list-style-type: none"> - Water sprinkling to arrest fugitive dust emission. - Logistics would be designed to minimize movement of trucks transporting construction materials and optimize storage of construction materials at site
Water quality	Discharge of construction wastewater including sanitary and kitchen wastewater causing adverse health & ecological impacts	<ul style="list-style-type: none"> - Labour hutments would be provided with proper sanitation facilities - The stockpiles would be protected with toe wall of adequate height along with concrete garland drain & catch pits to prevent uncontrolled discharge of runoffs during monsoon.
Noise	Increase in noise level due to construction activities causing health hazards	<ul style="list-style-type: none"> - Provision of Personal Protective Equipment (PPE) like ear muffs, ear plugs etc. - Noise prone construction activities such as piling, drilling, excavation, cutting, etc. would be done during daytime only
Land environment	Adverse impact on land due to dumping of solid waste C & D waste,	<ul style="list-style-type: none"> - Development of 40% greenbelt within 1 year - Proper segregation of the wastes and use of recyclable materials within the plant/ sell to external agencies for secondary use - Handling & disposal of wastes by authorized agencies as per prevalent regulations
Socio-Economics	<ul style="list-style-type: none"> • Local employment opportunities, as per required skill set • Promotion and augmentation of ancillary & auxiliary establishments 	<ul style="list-style-type: none"> - Support towards vocational and industrial training of local population (having basic qualification) for skill upgradation - Addressal of issues raised during Public Hearing in 2 years time with a budget of Rs. 37.05 crores
Ecology	<ul style="list-style-type: none"> • Loss of existing minor vegetation cover • Emission of dust causing adverse impact on terrestrial flora due to temporary reduction in photosynthesis rate 	<ul style="list-style-type: none"> - Plantation of diverse deep rooted native plant species - Temporary impact to be abated by measures like water sprinkling, paving of roads - Treatment of wastewater and reuse in dust suppression, landscaping, equipment washing etc. - Adoption of zero effluent discharge to mitigate impact on aquatic ecology
Operation Phase		



11 - Summary and Conclusion (cont'd)

Discipline	Potential impacts	Mitigation measures
Land environment	Ground water quality affecting	- All stockpiles would be on top of a hard surface area to avoid leaching of materials during monsoon.
Surface Water Resource & quality	Potential cumulative Adverse impact due to withdrawal of surface water at beneficiation plant site	- Treatment of wastewater from units in CETP for recycle as fresh make-up water - Adoption of zero effluent discharge - Utilization of surface runoff to the maximum extent possible and discharge of excess storm water only
Ground water	<ul style="list-style-type: none"> • No impact on resource as groundwater abstraction not envisaged • Minimal impact on groundwater quality due to seepage and leaching 	<ul style="list-style-type: none"> - Concrete box drains to prevent seepage and ground water contamination. - Temporary solid wastes storage yard to be lined with suitable liner to avoid leaching through soil bed leading to contamination of ground water.
Air Environ-ment	Adverse impacts on health & environment due to emission of PM, SOx, NOx	<ul style="list-style-type: none"> - Selection & maintenance of APC equipments for fugitive & point source emissions to maintain point source emission below 20 mg/Nm³ - Process optimization to control emission - Interlocking of APC equipment to alert operator for controlled shut down of plant units in case of APC failure - Pneumatic or covered conveying of raw material - Maintenance of Plant roads and use of industrial vacuum cleaners & water sprinkling on product stockpile and roads at regular intervals. - Operation & maintenance of tyre washing system at the exit side of plant material gate (Gate#2)
Noise	Detrimental impact on the health of working personnel in and around the plant premises.	<ul style="list-style-type: none"> - Noise levels for the new equipment and machineries to be fixed at 85 dB(A) Leq within 3 m distance from the noise prone equipment. - Highly noise prone equipment having Leq above 90 dB(A) would either be housed separately or the attending personnel need to be housed in a noise-shielded cubicle. - Noise prone rotating/vibrating equipment provided with vibration dampening anchoring. - Use of appropriate PPEs
Socio-Economics	<ul style="list-style-type: none"> • Local employment opportunities, as per required skill set • Promotion and augmentation of ancillary & auxiliary establishments • Potential hike in local purchasing power, land & 	<ul style="list-style-type: none"> - Support towards vocational and industrial training of local population (having basic qualification) to be provided for up-gradation of skill - Preference to locals for employment - Implementation of Socio economic EMPs to be decided after conducting Public Hearing



11 - Summary and Conclusion (cont'd)

Discipline	Potential impacts	Mitigation measures
	property prices, rent scales and household income leading to a positive impact on the economic growth of the region	
Ecology	Potential adverse impact on terrestrial & marine ecology due to air pollution, generation of noise and release of untreated wastewater	<ul style="list-style-type: none"> - Development of 40% greenbelt adsorbing dust & absorbing specific pollutants and maintaining overall ecological balance - Adoption & adherence to the suggested Air pollution control measures, wastewater & solid waste management measures, noise pollution abatement measures

Additionally the prescribed EMPs for projects to be located in SPA/CPA would also be complied since the proposed project falls under Paradeep SPA. The compliance to the conditions for SPA/CPA as per Ministry's OM vide F.No. 22-23/2018-IA.III (Pt) dated 31st October, 2019 in relation to compliance of Hon'ble NGT order dated 19.08.2019 (published on 23.08.2019) in O.A. No. 1038/2018 pertaining to formulation of a mechanism for environmental management of critically and severely polluted areas and consideration of activities/projects in such areas is shown below.

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR - CR]
Air	i) Stack Emission levels should be stringent than the existing standards in terms of the identified critical pollutants	1. The first generation Pellet plants installed in India were with Multi Clones and stack emission levels were 100 mg/Nm ³ maximum. The second generation Pellet plants were installed with ESPs with stack emission limits 50 mg/NM ³ maximum. The third generation Pellet plant have enough data for processing fragile iron ore of Odisha region. The dust collection system have undergone a major change to operate under challenging	With 20 mg/NM ³ emission from Stack, PM ₁₀ increase will be max 2.92 µg/m ³ at A4 located about 2.17 km NNE of the plant boundary. With 50 mg/NM ³ emission from Stack, PM ₁₀ increase will be 9.6 µg/m ³ at the same location.	130



11 - Summary and Conclusion (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
		conditions. The Customised ESP technologies such as AIRTECH Compact Clean™ ESP with digitalised control known as PIAC DC 4 developed by established ESP manufacturer is installed in LKAB Sweden Pellet plant. Essar Minmet Ltd is planning to install similar ESP which will maintain stack emission level within 20 mg/NM ³ with N-1 fields. The ESP technology suppliers are committing to this emission standards. Hence, all our calculations are made with maximum emission level of 20 mg/NM ³ only from the outlet of ESP.		
	ii) CEMS may be installed in all large/medium red category industries(Air Polluting) and connected to SPCB and CPCB server	The main induration stacks will have online monitoring instrument which will be connected through IP to OSPCB and CPCB on continuous basis	Online stack monitoring values will be made available to OSPCB and CPCB..	
	iii) Effective Fugitive emission control measures should be imposed in the process/ transportation/packaging etc.	1. Process : Online monitoring and control through CCR will ensure all time performance to keep the fugitive emission under control.	1. Online CAAQMS with connectivity to OSPCB and CPCB will be provided	1
		2. Transportation: 2.a) All the trucks bringing other materials like Bentonite, Anthracite, Lime stone from port plot to plant (6 trucks/hr) will be covered with Tarpaulin.	Better Ambient Air Quality for Control Fugitive Dust Emissions	
		2.b) The trucks tyre washing system is incorporated in the plant layout to avoid fugitive dust		0.75



11 - Summary and Conclusion (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
		emission.		
		2.c) Water sprinkling at regular intervals will be done on all the roads.		0.30/annum
		2.d) Road Sweeper will be engaged		3.00
		2.e) Both sides of the Road will have green coverage		0.30
		2.f) Provision of modular metal cloth type wind curtain to reduce fugitive emissions		3.00
	iv) Transportation of materials by Rail/conveyor Belt, wherever feasible	1. Major Input Raw Material " Iron Ore Concentrate " 14.30 mmtpy is transported through a 250 km long slurry pipe line which is buried under ground. During interim period iron ore would be transported by pipe conveyor	Zero Impact on Environment	Included in project Capex
		2. 14 mtpy product pellet is shipped through a mechanised loading system from plant to port through a closed conveyor.	Impact on Environment on insignificant	Included in Project capex
	v) Encourage Use of cleaner fuels(Pet coke/furnace oil/LSHS may be avoided)	Natural gas is the prime fuel. System will be designed to use Low Sulphur FO only during non-availability of Natural Gas. No Pet coke/high sulphur fuel oils are planned to be used	Low SOx Compared to FO	Included in Project Capex
	vi) Best Available Technology may be used. For example usage of EAF/SAF/IF in place of cupola furnace. Usage of super critical technology in place of sub critical technology.	EAF/SAF/IF/Critical Technology are not part of our plant process. Hence Not applicable		



11 - Summary and Conclusion (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
	vii) Increase of green belt cover by 40% of the total land area beyond the permissible requirement of 33%, wherever feasible	The plant layout is developed for covering 40% of land as green belt.(40 acres)	Better green coverage and natural wind barrier as well as arresting fugitive dust generated within the plant.	3.3
	viii) Stipulation of green belt outside the project premises such as avenue plantation, plantation in vacant areas, social forestry etc.	Avenue plantation and plantation in vacant areas, social forestry will be undertaken with due approvals from local authorities.	Increase in green coverage and social forestry	1.00
	ix) Assessment of carrying capacity of transportation load on roads inside the industrial premises. If the roads to be widened , shall be prescribed as condition.	All the plant inside roads (4 km) are considered to be concrete and included in the project capex. The roads will be designed as per relevant Standard Code.	Effective control of fugitive emissions	12
Water	i) Reuse/Recycle of treated waste water, wherever feasible	1. The water received through slurry transportation after meeting the requirement of pellet plant is returned through return water pipe line of 250 km in length to Beneficia-tion Plant for Reuse Only during the interim period the process water is recycled through CETP and reused. The consumption would be 214 m3/hr	Saving of 34.5% of fresh water intake (380 cum/hr)equivalent to 3.63 cusecs	Additional 800 Cr in Capex



11 - Summary and Conclusion (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
		2. Rain Water during monsoon is planned to transfer through return water pipe line to Beneficiation plant to the max extent possible. Clarifloculator of suitable capacity (150 cum) to be installed.	Further Reduction in fresh water intake during monsoon from River Baitarani	2
		3. During the interim period the storm water would be collected in the raw water reservoir to the extent possible and reused		
		3. CETP for treating blow down water and reuse in dust suppression and greenbelt	80 cum/hr of water saving by recycling	1.3
		4. STP - Sewage Treatment Plant	6 cum/hr is used for green belt	0.7
	ii) Continuous monitoring of effluent quality, quantity in large and medium Red Category industries (water polluting)	Periodical monitoring as part of Environmental Management Programme, the sample collection, testing and monitoring as per schedules both by in-house as well as reputed NABL Accredited third party agencies would be implemented	Ensures no impact on ground water quality in the near by areas	0.5 Cr / annum
	iii) A detailed water harvesting plan may be submitted by the project proponent	The storm water will be captured and utilised to send back through return water pipe line. A clarifloculator of 150 cum capacity included in the process to treat the rain water before leaving the plant boundary.	Conservation of Rain water and Reduction in fresh water intake	Capex included in (i.2)
	iv) Zero liquid discharge wherever techno-economically feasible	1. Process water is recycled through return water pipe line to Beneficiation plant	The scheme ensures zero discharge in the pellet complex	Included in Project Cost for return water pipeline.
		2. Rain water is also planned to be used through the return water pipe line		
	v) In case, domestic waste water generation is more than 10 KLD , the	STP is incorporated in the plant layout	Recycle and Reuse of water	Included in Water (i.4)



11 - Summary and Conclusion (cont'd)

Environment	Condition Stipulated	Compliance	Impact	Budget allocated [INR – CR]
	industry may install STP.			
Land	i) Increase of green belt cover by 40% of the total land area beyond the permissible requirement of 33% where feasible for new projects	Plant Layout has been prepared with 40% plant area reserved for green belt.	Better green coverage and natural wind barrier.	Included at Air (vii)
	ii) Stipulation of green belt outside the project premises such as avenue plantation, plantation in vacant areas and social forestry etc.,	Avenue plantation and plantation in vacant areas, social forestry will be undertaken with due approvals from local authorities.	Increase in green coverage and social forestry	Included in Air (viii)
	iii) Dumping of waste (fly ash/slag/red mud etc.) may be permitted at designated locations approved by SPCBs/PCCs	No solid waste such as fly ash/slag/red mud is generated in pellet making. Hence Not applicable	-	
	iv) More stringent norms for management of Hazardous waste. The waste generated should preferably be utilised in co-processing	1. Used Lubricants will be handed over to authorised recycler for further processing	Effective solid waste management	0.1
		2. STP sludge will be used as manure for green belt	-	Included in Water (i.4)
Other Conditions (Additional)	1. Monitoring of compliance of EC conditions may be submitted with third party audit every year	Annual Audit by reputed agencies will be carried out and the compliance will be submitted to OSPCB/CPCB/MOEFCC	-	
	2. The % of CER at at least 1.50 times the slabs given in the OM dated 1.5.2018 for SPA and 2 times for CPA in case of Environmental Clearance	The project location is coming under SPA, the CER amount is 1.50 times as compared NON SPA locations which amounts to Rs. 37.05 crores as against of Rs. 24.70 Crores	Better Social Governance	37.05



11 - Summary and Conclusion (cont'd)

For implementation of the proposed environmental mitigation measures, the estimated capital expenditure (CAPEX) would be around Rs. 63.95 crore and Rs. 236.95 crore including technological measures for pollution mitigation. Estimated OPEX would be Rs. 1 crore per annum at 14 MTPA stage and Rs. 0.5 crore during the interim period.

x. Emergency Preparedness Plan

EML would implement an On-site Emergency plan approved by Director (Factories and Boiler), Bhubaneswar. Head-Plant would be designated as Works Main Controller (WMC) who assumes overall responsibility for implementation of emergency planning at the time of crisis on the site. He is assisted at next level by Head EHS who acts as Site Incident Controller (SIC), who coordinates with Combat Team Leader (CTL), Rescue Team Leader (RTL) and Auxiliary Team Leader (ATL) to mitigate the emergency situation.

The emergency control center would be located strategically in an area of minimum risk with easy access to concerned personnel.

The implementing authority of the off-site plan is the local authority and not the plant authority. ED in consultation with the Safety, Admin & other concerned department will be coordinating with the district administration/ local authority for safeguarding nearby settlements during off-site emergency.

xi. Public Hearing and Socio-economic Upliftment Activities

Public hearing was held on 5th January 2022 and based on the issues raised a plan for addressing the issues was chalked out in the form of Socio economic EMPs. Implementation of these socio economic EMPs would commence from the initiation of



11 - Summary and Conclusion (cont'd)

construction activities and be completed within 2 years. Since the project is located in a Severely Polluted Area, the budget allocated is 1.5 times the prescribed budget (INR Rs. 37.05 crore) as per CER Notification (May 2018). The summary of the action plan is as follows:

Description	Year 1	Year 2	Total (in Rs. Lakhs)
Area Development			
Development of village roads	Balijhara village 2km in length. Paradipgarh village -2km Bijaychandrapur village- 2km Udaybhat village – 2 km Allocation of fund to Paradip Municipality for repairing of damaged road. The agreement with Paradip Municipality will be intimated to MoEFCC during six(6) monthly compliance		550
Improvement of drainage condition of Bauriapalanda & Balijhara villages - total 8km	Construction of drain (total 8 km length) in Bauriapalanda & Balijhara villages and connection to existing drainage network of Paradip Municipality		205
Health care facilities	Strengthening of primary health care unit in Nuagarh & Biswali villages. The need will be assessed in consultation with local administration and will be informed to MoEFCC during 6 monthly compliance. The EML will provide funds to local administration for development of hospital and the scheme will be informed to MoEFCC through six(6) monthly compliance.	Procurement of mobile health care unit for conducting medical campaign in Bhutmundai, Paradipgarh , Nuagarh & Biswali villages.	750
Establishment of library infrastructure facilities with 500 books, 10 bookshelves and 4 numbers of computers with internet facilities in villages	Bijaychandrapur & Bhutmundai	Nuagarh, Balidia, Chakradharpur & Paradipgarh	200
Skill development training on welding, electrician course, machinery, carpentry etc. and livelihood program	200 persons	400 persons	300



11 - Summary and Conclusion (cont'd)

Description	Year 1	Year 2	Total (in Rs. Lakhs)
Local students training through ITI list – 2 ITIs in Paradipgarh, 1 ITI in Nuagarh, and 1 ITI in Mangraipur.	40 students	20 students	60
Strengthening of school library & up gradation of existing village schools by providing Chair, table & books & 4 Nos of computers with internet to each library	Three schools 1. Pipal UP School 2. Govindchandra High school Nuagarh 3. Balidia Nodal UP School	Five schools 1. Paradip Port High school Bhutmundai 2. Nabjyoti Girls' High school Biswali 3. Chakradharpur High School 4. Srimaa Aurobindo School Paradipgarh 5. Bijaychandrapur UP School	240
Infrastructure improvement of Bauriapalanda Basti	Rehabilitation of Basti will be taken up with District Administration and Paradip Port Trust & the development plan will be intimated to MoEFCC	Continued in 2 nd year	600
Provision of drinking water through pipelines & installation of portable RO in peripheral villages or contribution to government fund for the same	Six villages 1. Balijhara 2. Musadia 3. Bauriapalanda 4. Bijaychandrapur 5. Bhutmundai 6. Nuagarh	Two villages 1. Balidiha 2. Chakradharpur	500
Vocational training on tailoring, farming, poultry for skill development of women. Selection of villages will be decided in discussion with Local administration	300 women	600 women	300
Total (in INR lakhs)	2185	1520	3705

EML would adopt two villages, Nuagarh (population: 2561 as per 2011 census) and Balidia (population: 1972 as per 2011 census) for development under their CSR plan.

The model villages will be developed within a span of 10 years.



11 - Summary and Conclusion (cont'd)

xii. Project Benefits

1. The employment generation from the project would be as follows:

Manpower	Construction Phase	Operation Phase	Interim period – Operation phase
Permanent	50	149	110
Contractual	700	450	250

2. The project is expected to improve the physical infrastructure in the study area by developing transport facilities, communication facilities, installation of street lights, installation/repair of hand pumps and bore wells, de-siltation and deepening of dug wells, recreational spaces such as parks, play grounds, community halls etc.
3. The project would improve hospitality services such as hotels, lodgings houses, restaurants, fast food centers, transport services, shopping, hospitals, nursing homes as well as education facilities in the region.
4. The project benefits also entail revenue earnings to the district and state through road tax, income by registration of trucks & trailers, income tax, corporate tax etc.

xiii. Occupational Health measures

Occupational health & safety aspects of the plant are overseen by in charge-Safety. In the construction stage, there would be strict monitoring of Contractors' workers' health and safety. Various measures would be adopted for safety and health of the construction workers including medical screening. Before commencing the work, the Contractors, workers would be given awareness training on Safety procedures by EHS department of EML.

During the construction phase, casual labourers would be provided with toilet facility (both for male and female workers) with Septic tank and drinking water facility. Additionally rest



11 - Summary and Conclusion (cont'd)

shelters (with proper ventilation and lighting facilities) at convenient locations would be constructed. These facilities related to infrastructure would also be extended to casual labourers and vehicle operators during the operation phase.

Routine medical check-up would evaluate the health of workers. Dispensary facility would be provided to all workers as applicable. Emergency treatment would be carried out as per the standard practices. All safety gears and Personal Protective Equipments (PPE) would be provided to workers and care would be taken by EHS department that these are used properly. All safety norms would be followed.

Health education program would be conducted that would include occupational health, cardiac risk reduction, stress management, ergonomics, early diagnosis & treatment, burn safety & eye care, gas & heat hazards, occupational lung diseases, physical fitness, nutrition etc.

The health care surveillance of its employees for the proposed project would be carried out by audiometric examination & hearing conservation (especially for the employees exposed to high noise levels), statutory eye examination, x-ray investigation, blood examination, lung function test etc. Mandatory special medical check would be institutionalized for people working at height and enclosed area. The Safety Department would play a key role in maintaining the best safety practices so as to ensure zero accidents.

Routine safety surveillance would be carried out by the Safety Department. This would be in accordance with the plant safety manual for all primary and supporting production facilities. Fire Safety protection features like fire hydrants, sprinklers,



11 - Summary and Conclusion (cont'd)

extinguishers etc shall be routinely checked and mock drills of the same at periodic intervals would be done to ensure functionality. The plant would have occupational health care manual and adopt international practice of occupational health care as required by the Regulations.

xiv. Post Project Monitoring Plan

The environmental monitoring plan for various parameters of air, water, soil, etc. would be as follows:

Sl. No.	Parameter	Location	Schedule of monitoring
1.	Meteorology: Dry bulb temp, wet bulb temp, relative humidity, wind speed, wind direction and rainfall	Meteorology data would be recorded at one (1) permanent station which will be installed in the plant premises at the roof top of Env. Engg. Department inside the plant.	Online continuous monitoring
2.	Air Quality Monitoring Parameters: PM2.5, PM10, SO ₂ , NO _x , CO, NH ₃ & O ₃	Four (4) monitoring stations will be installed by EML at following locations i) Near Personnel Entry Gate (Gate No-1) (South) ii) Towards Paradip Port Trust Water Reservoir (North) iii) Location near Additive grinding building	Continuous Ambient Air Quality Monitoring Stations (CAAQMS)
3	Stack Emission Monitoring: PM, SO ₂ , NO _x , CO	All major stacks For DE stacks only PM will be monitored Additive grinding stack would be monitored weekly for PM	Online continuous monitoring system as per OSPCB's guidance
4	Fugitive dust emission and work zone dust monitoring	Near stock yard	Monthly once through labs recognized under E(P) Act, 1986.



11 - Summary and Conclusion (cont'd)

Sl. No.	Parameter	Location	Schedule of monitoring
5	Water Quality - effluents water quality, surface and ground as per CPCB standard.	Ground water - Two (2) locations i) Near raw material storage yard ii) Near Pellet stockpile iii) Surface water - Two (2) locations iv) Storm water outlet from the plant at NW end v) Storm water drain at SE end Waste water - Inlet and Outlet of ETP	Ground water quality analysis- twice in a year Surface water quality - Monthly once Surface & ground water - in pre & post monsoon Waste water - All parameters monthly once and weekly monitoring of common parameters
6	Ambient noise level	Noise levels will be monitored at the following locations: i) Process Fan area ii) Office Building	Monthly once for each location
	Work zone noise level	Following locations of work zone noise monitoring will be monitored. i) Process fan area ii) Filtration Building iii) Additives Grinding Building	Monthly once for each location
7	Soil quality	Two (2) locations within the plant (raw material storage area, solid waste storage area) and two (2) from outside plant area.	As per nutrient cycle by NABL/MoEFCC approved agency
8	TCLP test for solid wastes	One (1) location for hazardous waste storage	Once in a six (6) month or as directed by OSPCB
9	Inventory of solid waste	Within plant premises	Monthly or as directed by OSPCB
10	Water Consumption	Water meter at the intake pump house	Continuous
11	Energy Consumption	All consumer points through energy meter	Continuous

Conclusion: The assessment of impacts due to the proposed project has been conducted with respect to various parameters as outlined in the preceding chapters and adequate mitigation measures have been suggested. The project would also lead to holistic socio-economic development of the region. Hence, the project may be deemed as environmentally feasible.



12 - DISCLOSURE OF CONSULTANT ENGAGED

JSL has appointed M. N. Dastur & Company (P) Ltd, Consulting Engineers, Kolkata, to undertake EIA Study and prepare EIA Report in accordance with the approved ToR of MoEFCC.

12.1 ABOUT THE CONSULTANCY COMPANY

M. N. Dastur & Company (P) Limited was founded in 1955 by Dr. Minu Nariman Dastur, the pioneer in providing consulting engineering services in India. The company offers integrated design and engineering consultancy services, from concept to commissioning, for a wide range of projects related to metallurgical, mining, chemical, oil & gas, cement, power, environment, infrastructure and other allied industries. DASTUR specializes in project planning and appraisal, economic evaluation, design and detailed engineering, procurement assistance services, supervision of construction and erection, environmental engineering and pollution control, energy management and optimization, human resources development, and management consultancy. DASTUR has a dedicated team for Project Management services and to implement sound project management practices in the organization by providing professional training and PMP certification to large group of employees and thus becoming a constructive partner of Project Management community. We are approved as a Registered Education Provider (R.E.P) by the Project Management Institute (PMI), USA.

Dastur Business & Technology Consulting (DBTC) a division of DASTUR, offers specialized and end-to-end expertise to enable clients meet the needs of a rapidly changing global business and technological environment.



12 - Disclosure of Consultant Engaged (cont'd)

Dastur Innovation Labs (DIL), headquartered in Toronto, is a part of Dastur - the global metals, mining and energy consulting firm. DIL carries out cutting-edge applied research, process and operations modelling, and design, to solve difficult challenges faced by our customers. Our work spans the areas of quality, yield, throughput, logistics and metallurgical process improvements across ferrous and non-ferrous industries.

Over the years, DASTUR has built up a multidisciplinary team of over 700 professionals and technical staff with varied experience, fully abreast of the 'state-of-the-art' technologies, with intimate understanding of the latest trends, combining creativity with initiative. DASTUR provides a unique blend of experience and talent, catering to the specific requirements of each project.

DASTUR is internationally recognised as one of the largest independent consulting engineering organisations in the world. DASTUR is headquartered in Kolkata with offices in Chennai, Mumbai, Bengaluru, New Delhi, Bhubaneswar, and Hyderabad. International operations are based out of Düsseldorf in Germany, Tokyo in Japan, Abu Dhabi in UAE, Manama in Bahrain and New Jersey in USA.

DASTUR has earned global appreciation for its dedication and teamwork. Today, DASTUR is synonymous with excellence in engineering consultancy and business & technology consulting services.

12.2 ACCREDITATIONS

1. ISO 9001-2008 - Management System certified organization.
2. ISO 27001:2013 - Information Security Management System certified organization.



12 - Disclosure of Consultant Engaged (cont'd)

3. Environmental Engg. Dept. accredited under NABET (National Accreditation Board of Education & Training).
4. ISO 14001:2015 & BS OHSAS 18001:2007 - Environmental and Occupational Health & Safety Management System certified organization
5. ISO 17020:2012-Accredited Inspection Body

12.3 CONSULTANCY FOR ENVIRONMENTAL ENGINEERING/ MANAGEMENT SERVICES

For the Environmental Management Services, Dastur has dedicated environmental engineering department consisting of QCI-NABET Accredited Professionals for the following approved sectors:

- Mining of Minerals (Sector-1)
- Thermal Power Plants (Sector- 4)
- Coal Washeries (Sector-6)
- Mineral Beneficiation (Sector -7)
- Metallurgical Industries (Sector 8)
- Coke oven plants (Sector-11)
- Ports, harbours, break waters & dredging (Sector-33)

12.4 RANGE OF SERVICES

M N Dastur offers diverse services ranging from integrated engineering, management consultancy to various studies as listed below.



12 - Disclosure of Consultant Engaged (cont'd)

RANGE OF SERVICES		
Studies	Integrated Engineering Services	Management Consultancy
<ul style="list-style-type: none"> • Concept Note • Market Surveys • Site selection studies • Master Plan studies • Feasibility Report • Techno-Economic Feasibility studies • Basic Engineering Report • Detailed Project Report • Productivity Review • Due Diligence studies • Energy Audit • Technology Evaluation 	<ul style="list-style-type: none"> • Basic Engineering • Shop and Plant General Layout • Vendor Drawing Scrutiny • Bulk Material Handling • Architecture • Civil Engineering • Structural Steelwork • Electric Power Systems • Automation and Computerisation • Instrumentation and Control Systems • Piping Systems • Environmental Control Systems • Heating, Ventilation, Air-Conditioning Systems • Communication Systems • Roads, Drainage and Sewerage Systems 	<ul style="list-style-type: none"> • Corporate Planning • Manpower Planning • Market Studies • Recruitment and Human Resource Development • Financial Assessment • Organisation & Methods, and Management Information Systems • Valuation of Assets • Lender's Engineering
Environment Management Services	Project Management	Inspection & Quality Assurance
<ul style="list-style-type: none"> • Environmental Impact Assessment • Locational Evaluation • Environment Audit & Compliance • Social Environmental impact Assessment (SEIA) • Environment Management Planning • Risk Assessment & Disaster Management Plans • Environmental Pollution Control Measures • Rain water harvesting • Greenbelt Development Planning and Landscaping • Evaluation of Pollution Standards • Strategic Environment Assessment • Hydro-geological study • Social Cost Benefit Studies • Other Environmental Management services 	<ul style="list-style-type: none"> • Project Governance • Procurement Management Services • Planning, Monitoring and Control • Construction Management • Project Risk Management • Cost Monitoring and Reporting • Contract Management • Management Information System • Project Closure 	<ul style="list-style-type: none"> • Inspection of plant and equipment of different industries • Inspection of technological, flyover and building structures • Inspection of Power Distribution, Shop Electrics, Instrumentation, Automation, Power Electronics and tele-communication items • Inspection of Spares and Consumables • Inspection of Refractory Materials • Inspection of Pipelines • Vendor Assessment • Approval of welding electrodes • Inspection of unfired pressure vessels under SMPV rule • Inspection of IBR valves, pipes and pipe fittings • Expediting and follow up services
Site Services <ul style="list-style-type: none"> • Construction Planning • Planning of Construction facilities • Constructability Study • Construction Supervision • Quality Audit • Safety Audit • Bill Certification • Assistance during Commissioning and Performance Guarantee Tests • Assistance and Support during 'Ramp-up' 		



12 - Disclosure of Consultant Engaged (cont'd)

- Contract administration and Claim Settlement
- Safety Surveillance
- Implementation of database management system on safety observations and Safety management system
- Material management
- Implementation of Material indenting system (for Free-issue items)

12.5 CLIENTELE

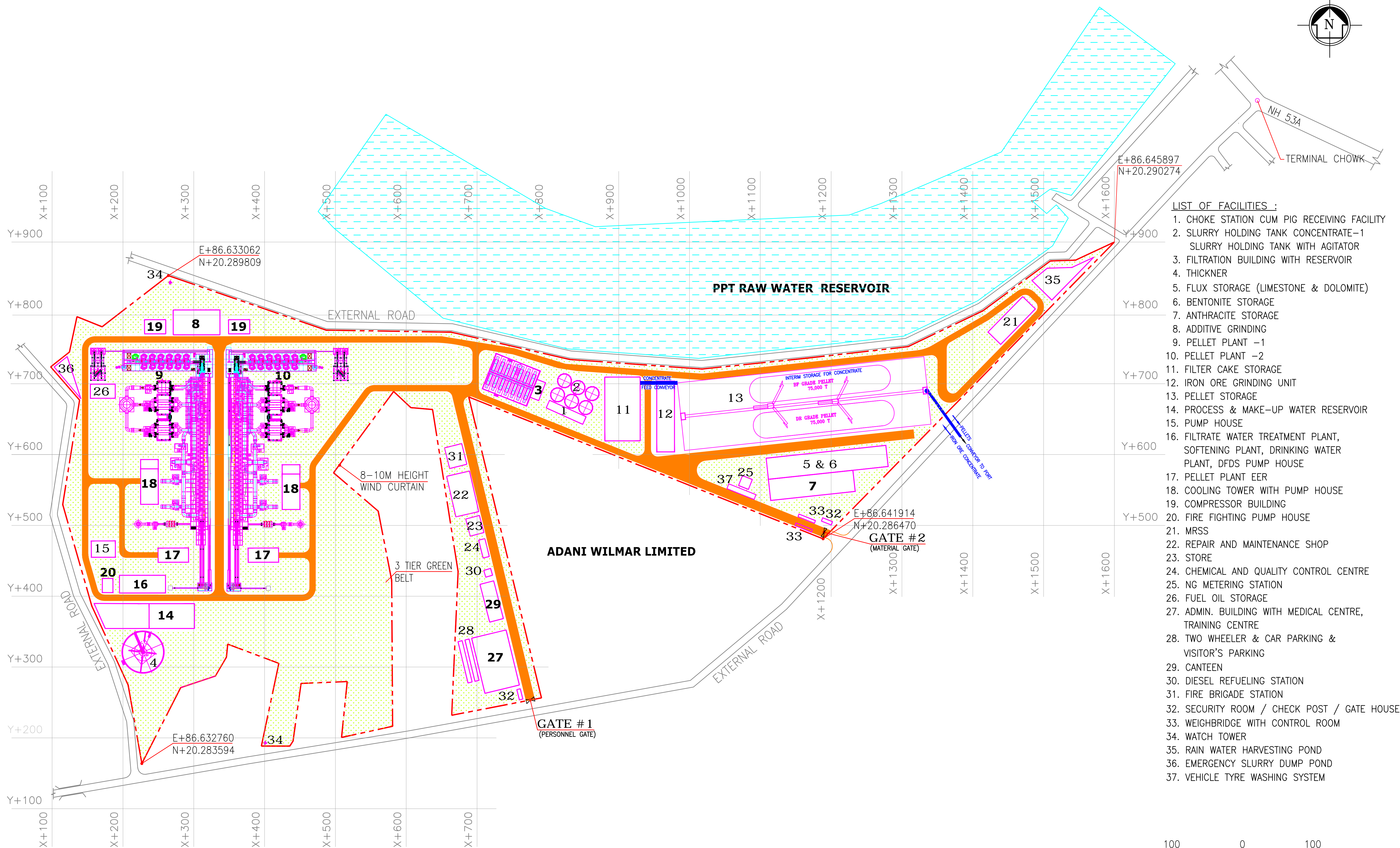
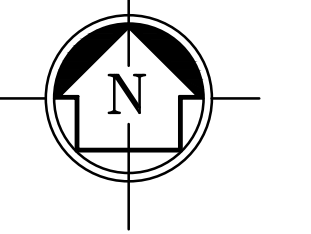
With core competencies spanning technology, engineering, operations, economics, cost, finance, and data science, Dastur is equipped to serve clients in a broad range of industry verticals. Its major clients include global organizations, government and the state enterprises. Some of our key clients over the years include:

- Aditya Birla
- Arcelor Mittal
- Bhushan Power & Steel Limited
- Bhushan Steel Limited
- BUA International
- ESSAR
- Garmco
- GPH Ispat Ltd
- Hindalco
- Imerys Steelcasting India Pvt. Ltd
- Indian Oil Corporation Limited
- Jindal Coke Limited
- Jindal Steel & Power Limited
- Jindal Stainless Limited
- Jindal United Steel Limited
- JSW Steel
- JSW Utkal Steel Limited
- Kalyani Steels Limited
- Libya Iron and Steel Company
- Mitsui & Co. Steel Ltd.
- Nalco
- Nova Iron & Steel Limited
- Omzest
- Orissa Alloy Steel Pvt. Ltd.
- Orissa Metaliks Private Limited
- POSCO India
- Rashtriya Ispat Nigam Limited
- Rio - Tinto
- Qatar Steel
- SAIL
- SENNAT
- Spintech Tubes Private Limited
- Tata Steel Limited
- Tata Steel Kalinganagar



12 - Disclosure of Consultant Engaged (cont'd)

- Tata Metaliks Limited
- Vedanta
- Welspun Steel Limited
- West Bengal Power Development Corporation Limite



- LIST OF FACILITIES :**
1. CHOKE STATION CUM PIG RECEIVING FACILITY
 2. SLURRY HOLDING TANK CONCENTRATE-1
SLURRY HOLDING TANK WITH AGITATOR
 3. FILTRATION BUILDING WITH RESERVOIR
 4. THICKNER
 5. FLUX STORAGE (LIMESTONE & DOLOMITE)
 6. BENTONITE STORAGE
 7. ANTHRACITE STORAGE
 8. ADDITIVE GRINDING
 9. PELLET PLANT -1
 10. PELLET PLANT -2
 11. FILTER CAKE STORAGE
 12. IRON ORE GRINDING UNIT
 13. PELLET STORAGE
 14. PROCESS & MAKE-UP WATER RESERVOIR
 15. PUMP HOUSE
 16. FILTRATE WATER TREATMENT PLANT,
SOFTENING PLANT, DRINKING WATER
PLANT, DFDS PUMP HOUSE
 17. PELLET PLANT EER
 18. COOLING TOWER WITH PUMP HOUSE
 19. COMPRESSOR BUILDING
 20. FIRE FIGHTING PUMP HOUSE
 21. MRSS
 22. REPAIR AND MAINTENANCE SHOP
 23. STORE
 24. CHEMICAL AND QUALITY CONTROL CENTRE
 25. NG METERING STATION
 26. FUEL OIL STORAGE
 27. ADMIN. BUILDING WITH MEDICAL CENTRE,
TRAINING CENTRE
 28. TWO WHEELER & CAR PARKING &
VISITOR'S PARKING
 29. CANTEEN
 30. DIESEL REFUELING STATION
 31. FIRE BRIGADE STATION
 32. SECURITY ROOM / CHECK POST / GATE HOUSE
 33. WEIGHBRIDGE WITH CONTROL ROOM
 34. WATCH TOWER
 35. RAIN WATER HARVESTING POND
 36. EMERGENCY SLURRY DUMP POND
 37. VEHICLE TYRE WASHING SYSTEM

NOTE :-

1. LOAD BLOCK SUB-STATION (LBSS) FOR FILTRATION PLANT AND FAN ELECTRIC SUBSTATION ALONG WITH ALL ELECTRICAL EQUIPMENT AND CONTROL ROOM FOR PELLET PLANT PLANNED TO BE HOUSED WITHIN THE BALLING BUILDINGS AND ADDITIVE GRINDING BUILDING OF THE TWO PELLET PLANTS.

2. LBSS FOR RMHS PLANNED TO BE LOCATED WITHIN THE IRON ORE GRINDING UNIT.

AREA STATEMENT			
	AREA IN Ha	AREA IN ACRE	% OF TOTAL AREA
PLANT AREA	20.03	49.50	49.50%
ROAD	4.17	10.30	10.30%
PARKING	0.08	0.20	0.20%
GREENBELT	16.19	40.00	40%
TOTAL	40.47	100	100%

LEGEND :-	
PROPOSED FACILITIES SHOWN THUS	1
SPACE FOR IN-PLANT ROAD, DRAIN SHOWN THUS	
LAND BOUNDARY SHOWN THUS.....	
GREEN BELT SHOWN THUS.....	