NOTARY
SUBHASH KRISHNA KANEKAR
SALCETE TALUKA
MARGAO-GOA
Regd.No.344/14
Exp.Dt:28/02/2027
GOVT. OF GOA (INDIA)

BEFORE THE NATIONAL GREEN TRIBUNAL

WESTERN ZONE BENCH AT PUNE

APPEAL NO. 146 OF 2024

Federation of Rainbow Warriors ... Appellant

Versus

Union of India and Ors. ... Respondents

AFFIDAVIT IN REJOINDER OF THE APPELLANT

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BEFORE THE NATIONAL GREEN TRIBUNAL

WESTERN ZONE BENCH AT PUNE

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Union of India and Ors. ... Respondents

AFFIDAVIT IN REJOINDER ON BEHALF OF THE APPELLANTS

I, Mr. Abhijit Prabhudesai, the General Secretary of the Appellant Society abovenamed, having its office at CSH-1, Block C-2, Leandra Heritage, Madel, Margao, Goa - 403601, do hereby state on solemn affirmation:

1. Vide the present Appeal, the Appellants are challenging the grant of the Environmental Clearance (EC) ("EC") bearing EC No. EC23A0000GA5507405N and file no. EC23A0000GA5507405N granted on 23.01.2024 (hereinafter referred to as the "impugned EC") by the Ministry of Environment, Forest and Climate Change to the Respondent No. 7 M/s Vedanta Limited for the proposed mining of Iron Ore with proposed production capacity of 3.0 MTPA, Waste: 25.162 MTPA (Total Excavation: 28.162 MTPA) along with crushing and screening plant capacity of 4.0 MTPA in the mine lease area of 478.5206 ha, located at Block 1 - Bicholim, Bordem, Lamgao, Mulgoa, Mayem & Sirigao Villages of Bicholim

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Taluka of North Goa District, Goa under the provisions of the Environmental Impact Assessment ("EIA") Notification 2006.

2. I say that I have read the present Appeal, as well as the Affidavit in Reply filed by the Respondent No. 7 ("Affidavit in Reply") and am familiar with its content, thus I am competent to depose in the present Affidavit in Rejoinder on behalf of the Appellants in the matter.

3. For the sake of brevity and cohesiveness, the Appellant is not submitting a para-wise response to the Affidavit in reply of the Respondent No. 7, as the Affidavit of the Reply of the Respondent No. 7 has mis-referenced or misnumbered the pleadings of the Appellant in Appeal No 146/2024.Therefore in order to avoid further confusion, I am countering the pleadings of the Appellant as per the averments raised in the Affidavit and not specifically as per paras. The Appellants crave leave to file further affidavits in Rejoinder if deemed to be necessary by this Hon'ble Tribunal. Nothing in the Affidavit in Reply of the Respondent No, 7 should be deemed to have been admitted by me for lack of specific denial unless the same is specifically admitted by me hereinafter.

AVERMENT REGARDING THRESHOLD FOR JUDICIAL REVIEW IN CHALLENGE TO EC

4. At the outset, I wish to address the submissions made by the Respondent No. 7 in relation to the judgment cited by the Respondent No. 7 ar para 2 of its Affidavit. It is pertinent to note that in its recent judgment dated 25.07.2024, the full bench of the Hon'ble Supreme Court of India held in the matter of *Santosh Kumar Singh v State Level Environmental Impact Assessment Authority* (Civil Appeal) No 4178/2023 that,



"In fact, looking at the challenge to the environmental clearance, it was the duty of the NGT to satisfy itself that all the conditions precedent for the grant of environmental clearance 1 were complied with. It is the duty of the NGT to ensure that the environmental clearance is lawfully granted. One of the duties of the NGT is to uphold and preserve the right to a healthy environment guaranteed under Article 21 of the Constitution. In this case, the NGT should have directed the fourth respondent to produce on record material to show whether compliance was made with clause 2(b) of the Revised Guidelines. The NGT has not examined the same.
"

"In our considered view, the NGT ought to have directed the fourth respondent to place on record the material to show that compliance was made with the requirements of clause 2(b) of the Revised Guidelines. Thereafter, the NGT could have gone into other issues, such as whether there is a power to relax the guidelines, the locus of the appellant, etc"

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I therefore say that the Hon'ble Supreme Court has made it clear that while considering a challenge to an Environmental Clearance, the Hon'ble NGT has to satisfy itself that:

a. that all the conditions precedent for the grant of environmental clearance were complied with.

b. that the environmental clearance is lawfully granted

c. That grant of the environmental clearance is consistent with the right of persons affected by the grant of the clearance to a healthy environment guaranteed under Article 21 of the Constitution

A copy of the order dated 25.07.2024 of the full bench of the Hon'ble Supreme Court of India held in the matter of S*antosh Kumar Singh v State Level Environmental Impact Assessment Authority (Civil Appeal)* No 4178/2023 has been annexed hereto and marked as **Annexure A-1**.

5. I further say that the reliance placed by the Respondent No. 4 on judgments such as those in the matter of Rajeev Suri v DDA (2022) 11 SCC 1 indicate that the Respondent no. 7 is attempting to argue that the challenge to the impugned EC should not be considered by this Hon'ble Tribunal. However, it is submitted that the illegalities and the irregularities behind the grant of the impugned EC are of such a nature that this Hon'ble Tribunal must exercise its jurisdiction to adjudicate, and set aside, the impugned EC.

6. It is submitted that the impugned EC should be set aside as per the standard of review/adjudication the Hon'ble Supreme Court of

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India put forth in the matter of in Rajeev Suri v DDA (2022) 11 SCC 1, as the non- application of mind of the EAC is self-evident from the record of the matter.

SUBMISSION OF WILDLIFE CONSERVATION PLAN

7. I say that at para 16-20 of the Affidavit of the Respondent No. 7 it is contended that the submission of the Wildlife Conservation Plan, no matter how inadequate, is sufficient for the Respondent No. 7 to satisfy the requirement under clause 4.2 of the TOR to submit proof of submission of a Wildlife Conservation Plan. It is submitted that since the project site and its proximity admittedly has at least 29 Schedule -I species of wildlife as per the Wildlife (Protection) Act, it is not at all an acceptable method for the Respondent No. 7 to claim to have addressed the impact of its project on wildlife, and most importantly, is not at all a sufficient parameter for the EAC to have addressed the issue of the impact of the project on wildlife. It is pertinent to note that the Respondent No. 7 has not stated in its affidavit that the Wildlife Conservation Plan effectively addresses the impact of its project on Wildlife, neither does it state whether Chief Wildlife Warden has approved the Wildlife Conservation Plan till date, despite admitting at para 17 that approval is required for its plan by the Chief Wildlife Warden. It is also pertinent to note that the Respondent No. 7 has claimed that the original Wildlife Conservation Plan which was submitted along with the EIA report at Annexure IV was "58 pages" long, and has admitted the revised

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Wildlife Conservation Plan, after accounting for an increased number of Schedule I species, is a singular page. While it is denied that either of the Wildlife Conservation Plans are at all adequate, the absurdity of preparing a less detailed Conservation Plan upon uncovering an increase in the number of Schedule-I species from 4 species to 29 species must be acknowledged by this Hon'ble Tribunal.

PUBLIC HEARING FOR THE IMPUGNED PROJECT

8. I categorically deny the submissions of the Respondent No. 7 at Para 2(a) and Para 64-66 of its Affidavit regarding the alleged adequacy of the Public Hearing.

9. I repeat and reiterate my submissions made in the pleadings of the present Appeal that the public hearing was conducted without obtaining the free, prior, and informed consent of the local communities, in violation of international commitments under various covenants, treaties, and the Constitution.

10. The Respondent project proponents and their consultants failed to consult any individuals from the six affected villages, including Panchayat members, farmer associations, agricultural tenants, and mine workers. This lack of engagement has resulted in a misleading EIA report that does not reflect the realities on the ground.

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11. Moreover, the public hearing for the project was held in the absence of the Consultant or their representative, leaving technical questions about the EIA study unanswered. This prevented participants from seeking necessary clarifications, effectively excluding them from meaningful participation. I say that it is pertinent to note that the same has not been denied by the Respondent No. 7 - who has merely claimed at para 64 of its affidavit that its "representatives" were present at the public hearing to make some presentation regarding the project. At para 65, it is even admitted by the Respondent No. 7 that the oral explanation made at the time of the public hearing by its representatives was "brief".

12. In the matter of the Lafarge Umiam Mining (P) Ltd v Union of India (2011) 7 SCC 338, the Hon'ble Supreme Court held that "The public consultation or public hearing as it is commonly known, is a mandatory requirement of the environment clearance process and provides an effective forum for any person aggrieved by any aspect of any project to register and seek redressal of his/her grievances;"

13. However, in contravention to the aforesaid finding of the Hon'ble Supreme Court, during the public hearing, the Chairperson limited each speaker to 10 minutes, contravening the provisions of the EIA Notification and further hindering the ability of attendees to express their concerns comprehensively. It is submitted that the said submission of the Appellant is not denied by the Respondent.

TRANSPORTATION SYSTEM OF IRON ORE

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14. The Appellant submits that its submissions regarding the transportation of Iron Ore by the Respondent No. 7 pertains to how the impugned EC was inexplicably granted by the EAC despite the Respondent Project Proponent refusing to comply with the suggestions and identified concerns of the EAC itself, particularly with regards to measures to curtail air pollution through the creation of an Over Land Belt Conveyor for material handling.

15. The Respondent No. 7 however has avoided addressing the said averment entirely by instead referring to the orders of the Hon'ble Bombay High Court regarding transportation of Iron Ore by road at para 21 -23 of its affidavit. I repeat and reiterate the manner in which the consideration of Over Land Belt Conveyor was abandoned by the Respondent No. 7 and the EAC falls short of the responsibility of the EAC to consider and address the pollution caused by the project of the Respondent No. 7.

16. I further deny that the orders of the Hon'ble Bombay High Court in any way preclude the consideration of this issue by this Hon'ble Tribunal, which is evident from a reading of the orders in question.

ALLEGED COMPLIANCE WITH CIRCULAR DATED 07.10.2014

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17. I deny the contention of the Respondent No. 7 at para 7-13 of its affidavit that the EAC did not contravene the directions of the Respondent MoEFCC in relation to the Circular dated 07.10.2014. I say that additional information regarding not only settling ponds, but the presence of forests, wildlife, transmission and material handling techniques and other issues were all requested by the EAC during the 20th meeting of the EAC as well as the sub-committee observations/recommendations. I say that the failure of the Respondent No. 7 to provide the said information on its own should have necessarily resulted in a rejection of the proposal of the Respondent No. 7 for the impugned EC.

DECISION MAKING OF EAC

18. I say that the decision making of the EAC in its 24th meeting shows, prima facie, the promptness and willingness of the EAC to ignore its own previous concerns about the operation of the iron ore mine in Block -I, Bicholim.

19. I say that the EAC has evidently not discharged its functions in a manner expected by it as per the standards enunciated by the Hon'ble Supreme Court of India in the matter of *Santosh Kumar Singh v State Level Environmental Impact Assessment Authority* (Civil Appeal) No 4178/2023.

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20. I say that there is clear non-application of mind by the EAC in the course of its 24th meeting on issues it had raised itself during previous meetings, which have been discussed in greater detail in the Appeal. I hereby repeat and reiterate the said submissions regarding the non-application of mind by the EAC to the relevant material and issues in relation to the present project. I say that the MoEFCC has not even filed an affidavit in the present matter to defend the manner in which the EAC has granted the impugned EC.

HYDROLOGY REPORT

21. I categorically deny the submissions of the Respondent No. 7 at para 51- 53 of its Affidavit. It is submitted that the hydrological study included in the EIA report is grossly inadequate. A proper assessment should have first examined the original groundwater resources of the study area and evaluated the impact of past mining activities, particularly by the Respondent Project Proponent within Block I, on these resources.

22. The hydrology report fails to consider both the ground reality, as well as previous studies of the severe damage to the water resources of this region by mining in the past. Pursuant to recommendation in PAC Report and Draft Goa Mining Policy 2012, a macro level EIA study was proposed by Respondent No 5. Accordingly, Respondent No 5 approached CSIR-NEERI, Nagpur to conduct a macro level environmental impact assessment study on effect of mining in Goa

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State. NEERI submitted the preliminary report in February 2014, which documents the severe damage to water resources in this region. Ignoring this expert report, other studies, the hydrology study presents baseless and arbitrary conclusions that directly contradict the ground reality and the experts' findings. Such oversight renders the report unreliable and warrants its rejection. A copy of the NEERI report has been annexed hereto and marked as **Annexure A-2.**

23. Additionally, the hydrology report overlooks the fact that water in the region is stored in unconfined aquifers within the laterite layer, which is slated for excavation and depletion. This lack of understanding risks catastrophic damage to the aquifers and groundwater resources. The report demonstrates a fundamental failure to grasp the nature of the aquifer system and the mechanisms by which groundwater is stored.

24. The large-scale destruction of groundwater resources caused by the Respondent Project Proponent and other mining lessees in the past is entirely concealed. The report falsely portrays the region's water security as intact, disregarding extensive scientific studies and High Court orders that document the depletion of original water resources across the mining belt, particularly in the lease area. The Appellant reserves the right to refer to and rely on these studies, reports and orders.

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25. Finally, the claim that waters from the Assonora River do not enter the mining pits is demonstrably false. Saline water from the Assonora and Bicholim rivers flows into the mining pits and subsequently seeps into farmers' fields, rendering the land uncultivable and the wells unusable. This misrepresentation further underscores the report's lack of credibility. It is also denied that the specific conditions of the impugned EC such as maintaining of 50 m buffer zone from the Assanora river will adequately mitigate or address the pollution of the river that will be caused by the operation of the mine at Block -I.

PAST MINING ACTIVITIES AND SUPPRESSION OF THE RESPONDENT

26. I say that at para 28 of its Affidavit, the Respondent No. 7 has sought to justify its patently false position that the Respondent No. 7 is a different entity than that of Sesa Sterlite Ltd. I say that the Respondent No. 7 has sought to justify the letter of the Respondent Director General of Mines dated 25.07.2023 by stating that the Respondent No. 7 has a distinct juristic entity from Sesa Sterlite Ltd.

27. It is submitted that Sesa Sterlite Ltd was the lead Respondent before the Hon'ble Supreme Court of India in the matter of the Goa Foundation v M/s Sesa Sterlite Ltd and Ors wherein the Sesa Sterlite had been held guilty of illegally operating its mining lease.

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It is pertinent to note that Sesa Goa is an intermediary of the Respondent No. 7, which can be evidenced from the letter head of the Respondent No. 7 in its letter responding to the EAC. The Respondent No. 7 had even filed a review against the judgment of the Hon'ble Supreme Court of India in the matter of *Goa Foundation v M/s Sesa Sterlite Ltd and Ors (2018) 4 SCC 218*, by filing Review Petition (Diary No) 18447 of 2020 . The said review petition was dismissed on 09.07.2021, vide an order of the Hon'ble Supreme Court of India annexed at Annexure "A-8" of the Appeal

28. It is therefore submitted that the Respondent No. 7 cannot be permitted to adopt the position that it can associate itself with Sesa Sterlite Ltd in legal proceedings, including in review petitions before the Hon'ble Supreme Court, only as per its convenience, but the said association would cease when inconvenient to the Respondent No. 7. I say that the Shah Commission report, the relevant extracts of which has been annexed hereto and marked as **Annexure A-3** to the present Affidavit, explains the past activities and antecedents of Sesa Sterlite Ltd and the Respondent No. 7.

LOCATION OF FOREST

29. I say that the proximity of forests to Bicholim Mineral Block-1 was admitted by the EAC in its 20th meeting, and then again by the sub-committee of the EAC. I repeat and reiterate the contents of

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paras 35-37 of the Affidavit of the Respondent No. 7. I say the letter of the Forest Department dated 12.04.2023 does nothing to dispute or negate the eco-sensitive nature of the project site and the fact that it literally shares a border with a forest and is in a 10 km proximity of three reserve forests and the Salim Ali Bird Sanctuary. I say that there has been no physical inspection of the distance between the project site and the Salim Ali Bird Sanctuary by any of the Respondent Authorities, despite the submissions of the Appellant, which was also made at the time of the public hearing for the project. I therefore deny the contents of para 37 of the Affidavit of the Respondent No. 7.

GREEN FIELD PROJECT

30. I categorically deny the submissions of the Respondent No. 7 at paras 33-36 and paras 39-50 of its Affidavit regarding past illegal mining activities on the site of the project and the justification of assessment of the project as a Greenfield Project.

31. It is submitted that the reliance placed by the Respondent No. 7 on Clause 2 of the EIA Notification of 2006 and the PIB note is incorrect and untenable in law, as the said clause does not exhaustively or even illustratively define the terms "greenfield" or "brownfield" project, but instead only clarifies which kind of projects require ECs. It is further submitted that a PIB note is only

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a press release, and does not muster the weight of being an interpretive circular or Office Memorandum issued by the Respondent MoEFCC. I say that the OM of 2011 cited by the Respondent MoEFCC in fact terms only abandoned mines or a sick project under revival as a greenfield project, which is not the case for the mine under consideration.

32. It is the submitted that the Appellant is aggrieved by the fact that the EIA report wrongly notes that the project is a greenfield mining project, because of the fact that the Block I mining lease issued to the Respondent No. 7 is identical to the earlier mining leases bearing TC Nos 11/41, 12/41, 13/41, 14/41 and 15/41 which were operated by the Respondent No. 7. The Respondent Project Proponent has grossly lied and concealed vital information to be furnished under specific TOR, serial no 20, which requires the Respondent Project Proponent to provide "Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994. The production details need to be submitted since inception of mine duly authenticated by the Department of Mines & Geology, State Government". The Respondent Project Proponent has wrongly stated against this column that the project is a "GREEN FIELD PROJECT", concealing the most vital information about past

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devastation. I say that the details sought in the ToR at serial no 20 were required to be considered by the EAC to understand the nature and scale of mining activities already undertaken at the site of Block I, Bicholim.

33. The Respondent Project Proponent has therefore concealed the past devastation of local environment and socio-economic resources, impacts on agriculture, water resources, fisheries and forests, the failure to restore past damage, the orders of the Hon'ble Supreme Court and the various illegalities pointed out in the Shah Commission Reports and by other studies.

CUMULATIVE IMPACT ASSESSMENT

34. I repeat and reiterate that the grant of lease of Block I was accompanied by grant of leases for new blocks, Block II and III, which are adjoining Block I. The Appellant submits that the TOR should have insisted on a cumulative study of all three blocks along with the past destruction in order to actually understand the impact of the proposed activity.

35. I say that it is pertinent to note that the Hon'ble Supreme Court has been pleased to hold that Segmenting of projects to avoid holistic environmental clearances is not permissible in its judgment in the

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matter *The National Highways Authority of India v Pandarinathan Govindarajuli and Anr* Civil Appeal No. 4035-4037/2020

36. It is denied that the EIA report and consequently the impugned EC provides for protections during natural disasters as claimed by the Respondent at para 62 and 63 of its affidavit.

37. I further deny that the socio-economic impact of the project was assessed by the EIA report as claimed by the Respondent No. 7 at para 56-61 of its affidavit.

38. Efforts to restore the khazan lands, fish-breeding and cultivating water bodies, paddy fields, cashew plantations, hills, forests, wildlife, and aquifers across Goa have yet to begin. Local communities, still bearing the brunt of environmental degradation, have little hope of seeing the restoration mandated by law. Furthermore, they face significant challenges in accessing or understanding the EIA study.

39. The restoration of land to its original state is impossible without an EIA study that accurately documents the land's original condition. Factors such as previously granted ECs, historical satellite imagery, the state of surrounding lands, records of tree felling by Respondent No. 7 and its predecessors since 1941, and all other relevant evidence of the land's original state must be taken into account.

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40. I say that the impugned EC therefore deserved to be quashed and set aside by this Hon'ble Tribunal and the prayers sought by the Appellant deserve to be made absolute.

Solemnly affirmed at Goa)
Dated this 21st day of January 2025)

Abhijit Desai

Appellant
(Mr. Abhijit Prabhudesai)

RONITA BHATTACHARYA
Advocate for the Appellants

BEFORE ME

Solemnly affiremed before me by
Shri/Smt. Abhijit Prabhudesai
Who is identified to me by —
Shri/Smt. —
Who is personally known to me
this 22nd day of Jan. 2025
Reg. No.

22/01/2025

SUBHASH KRISHNA KANEKAR
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STATE OF GOA (INDIA)

ANNEXURE A-1 2704

ITEM NO.120 COURT NO.6 SECTION XVII

S U P R E M E C O U R T O F I N D I A
RECORD OF PROCEEDINGS

CIVIL APPEAL NO(S). 4178/2023

SANTOSH KUMAR SINGH APPELLANT(S)

VERSUS

STATE LEVEL ENVIRONMENTAL IMPACT ASSESSMENT AUTHORITY & ORS. RESPONDENT(S)

(IA No. 124368/2023 - PERMISSION TO FILE ADDITIONAL DOCUMENTS/FACTS/ANNEXURES, IA No. 124369/2023 - STAY APPLICATION, IA No. 124370/2023 - EXEMPTION FROM FILING C/C OF THE IMPUGNED JUDGMENT, IA No. 167096/2023 - EXEMPTION FROM FILING O.T., IA No. 124372/2023 - EXEMPTION FROM FILING O.T. AND IA No. 259388/2023 - PERMISSION TO FILE ADDITIONAL DOCUMENTS/FACTS/ANNEXURES)

Date : 25-07-2024 This matter was called on for hearing today.

CORAM :
HON'BLE MR. JUSTICE ABHAY S. OKA
HON'BLE MR. JUSTICE PRASHANT KUMAR MISHRA
HON'BLE MR. JUSTICE AUGUSTINE GEORGE MASIH

For Appellant(s) Mr. Devashish Bharuka, Sr. Adv.
Mr. Yash Mishra, Adv.
Mr. Anuj Rathee, Adv.
Mr. Nirmal Goenka, AOR

For Respondent(s) Mr. Rajiv Yadav, AOR
Mr. Nishant Bhatia, Adv.
Mr. Rahul Bali, Adv.

Ms. Garima Prashad, Sr. A.A.G.
Mr. Sudeep Kumar, AOR
Ms. Manisha, Adv.

Mr. Pradeep Misra, AOR
Mr. Daleep Dhyani, Adv.
Mr. Manoj Kumar Sharma, Adv.
Mr. Suraj Singh, Adv.

Mr. Vikramjit Banerjee, A.S.G.
Mr. Gurmeet Singh Makker, AOR
Ms. Bansuri Swaraj, Adv.
Mr. Prahlad Singh, Adv.
Mr. Rohit Pandey, Adv.
Mr. Saransh Kumar, Adv.

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Ms. Sweksha, Adv.
Ms. Swarupama Chaturvedi, Adv.

UPON hearing the counsel the Court made the following

O R D E R

The Appeal is partly allowed in terms of the signed order.

Pending applications stand disposed of accordingly.

(ASHISH KONDLE)
COURT MASTER (SH)

(AVGV RAMU)
COURT MASTER (NSH)

[THE SIGNED ORDER IS PLACED ON THE FILE]



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2706

IN THE SUPREME COURT OF INDIA
CIVIL APPELLATE JURISDICTION

CIVIL APPEAL NO(S). 4178/2023

SANTOSH KUMAR SINGH — APPELLANT(S)

VERSUS

STATE LEVEL ENVIRONMENTAL IMPACT ASSESSMENT AUTHORITY & ORS. — RESPONDENT(S)

O R D E R

1. The appellant filed an Appeal before the National Green Tribunal (for short, "the NGT") established under the National Green Tribunal Act, 2010, for quashing an environmental clearance granted on 24th January 2023 by the State Level Environmental Impact Assessment Authority to the second respondent. One of the grounds of challenge was that it is not made clear whether the exercise required to be undertaken in terms of clause 2(b) of the Revised Guidelines for Common Bio-medical Waste Treatment Facilities (for short, "the Revised Guidelines") was in fact carried out by the State Pollution Control Board before the environmental clearance was granted. A notice was issued on the Appeal by the NGT to the respondents, including the fourth respondent, which is the State Pollution Control Board.

2. A perusal of the impugned order shows that an opportunity was not granted by the NGT to any of the respondents to file a counter affidavit. In fact, looking at the challenge to the environmental clearance, it was the duty of the NGT to satisfy itself that all the conditions precedent for the grant of environmental clearance

Signature Not Verified
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ASHISH KONKAL
Date: 2024.07.31
21:10:12 IST
Reason:

were complied with. It is the duty of the NGT to ensure that the environmental clearance is lawfully granted. One of the duties of the NGT is to uphold and preserve the right to a healthy environment guaranteed under Article 21 of the Constitution. In this case, the NGT should have directed the fourth respondent to produce on record material to show whether compliance was made with clause 2(b) of the Revised Guidelines. The NGT has not examined the same.

3. However, the NGT has interpreted clause 2(b) of the Revised Guidelines in a particular manner. Clause 2(b) reads thus:

> "2) Criteria for development of a new Common Bio-medical Waste Treatment and Disposal Facility for a locality or region.
> …
> b) SPCB/PCC is required to conduct gap analysis w.r.to coverage area of the bio-medical waste generation and also projected over a period of next ten years, adequacy of existing treatment capacity of the CBWTF in each coverage area of radius 75 KM, as given in Annexure-I"

4. The NGT, based on a view taken earlier, has virtually substituted the requirement of the coverage area of a radius of 75 KM by 40 KM. Clause 2(b) cannot be read in this fashion. The learned senior counsel appearing for the appellant relying upon a subsequent decision of the NGT dated 5th July, 2024 in Appeal No.04/2024 [Indotech Waste Solution vs. Uttar Pradesh State Impact Assessment Authority (UP SEIAA)] submitted that the NGT has now taken the view that the Guidelines including clause 2(b) have a statutory force.

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5. The learned counsel appearing for the second respondent seeks to contend that the requirements of clause 2(b) have been met. He objects to the appellant's locus.

6. The NGT has not rejected the Appeal filed by the appellant on the grounds of lack of locus, but the NGT has interpreted the requirement of clause 2(b) in a particular manner.

7. In our considered view, the NGT ought to have directed the fourth respondent to place on record the material to show that compliance was made with the requirements of clause 2(b) of the Revised Guidelines. Thereafter, the NGT could have gone into other issues, such as whether there is a power to relax the guidelines, the locus of the appellant, etc.

8. Hence, to enable the NGT to make an elaborate enquiry as warranted by law, we set aside the impugned order dated 13th April 2023 and restore Appeal No.05/2023 to its original number on the file of the National Green Tribunal, Principal Bench at New Delhi. We direct the NGT to decide the restored Appeal afresh after calling upon the fourth respondent to produce the material on record regarding compliance with clause 2(b) of the Revised Guidelines. The respondents shall be permitted to file counter. The restored Appeal shall be decided afresh in accordance with law.

9. The Registry of this Court shall forward a copy of this order to the Registrar of the National Green Tribunal, Principal Bench at New Delhi. The Registrar of the NGT will ensure that the restored Appeal is listed for directions on 9th September, 2024 at 10:30 a.m.

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All the parties which are before this Court shall appear before the NGT on that day.

10. The Appeal is, accordingly, partly allowed on the above terms.

11. All contentions of the parties are left open to be decided by the NGT.

.....J.
(ABHAY S. OKA)



.....J.
(PRASHANT KUMAR MISHRA)

.....J.
(AUGUSTINE GEORGE MASIH)

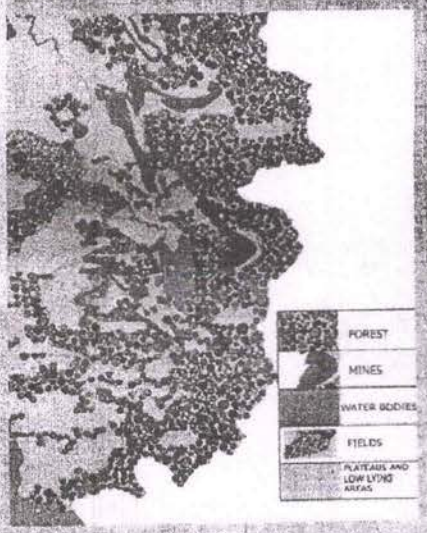
NEW DELHI;
JULY 25, 2024.

ANNEXURE A-2 2710

Preliminary Report

Macro Level EIA Study for Clusters of Iron Ore Mines in the State of Goa





Sponsor

Directorate of Mines and Geology, Goa

CSIR-National Environmental Engineering Research Institute
Nehru Marg, Nagpur 440 020

February 2014

NOTARY SUBHASH KRISHNA KANEKAR GOVT. OF GOA (INDIA) Exp. Dt: 26/02/2021

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Preliminary Report

Macro Level EIA Study for Clusters of Iron Ore Mines in the State of Goa

NOTARY SUBHASH KRISHNA KANEKAR SALCETE TALUKA MARGAO GOA Regd No. 2344 Exp. Dt: 28/02/2027 GOVT. OF GOA (INDIA)

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1.0 Introduction

1.1 General Status

Goa, India's smallest state is flanked to the east by forested, biodiversity rich Western Ghats and is adorned by nine rivers coursing through its hilly midlands, and coastal plains with mangrove fringed estuaries and brackish and sweet water paddy fields. The Western Ghats tracts are extensively protected by National Parks and Wildlife Sanctuaries. Goans cultivate rice, betel nut, coconut, cashew and mango, and enjoy rich river and coastal fisheries. The hilly tracts are rich in iron and manganese ore that has been tapped over last sixty years with a large number of small scale leases. Nearly half the iron ore exported from India comes from Goa, and the pace of its exploitation has increased dramatically in the last decade.

The exports have steadily increased from 0.436 million tonnes of iron ore in 1951 to 54.4 million tonnes in 2011. The iron ore has been exported to China, Japan, Taiwan, South Korea and Eastern European Countries.

The Iron ore deposits are distributed over the Northern, Southern and Central Blocks of Goa. The Northern Block deposits are richer both in terms of quality and quantity of the ore, as compared to the Southern and Central Blocks. The iron ore produced is mainly of lower grade with iron content between 55-58%, which can not be used by Indian steel producers due to technological limitation, therefore exported mainly to China. High-grade ore contains about 62-65% (or more) iron content.

The mining belt of Goa covers an area of approximately 700 sq. km and is mostly concentrated in 4 talukas namely Bicholim, Sattari, Sanguem and Quepem. Mining industry has been very important element in the economic history of Goa. It has provided a trigger to boost the economic growth not only in these talukas, but also for the whole State. Iron ore mining in Goa is completely in the private sector.

Mining in Goa is done by open cast method, which necessitated the removal of overburden overlying the iron ore formations. On an average 2.3 tonnes (or more) of mining waste has to be removed in order to produce a ton of iron ore. The average annual production of iron ore is of the order of 15-16 million tonnes and in this process about 40-50 million tonnes of mining waste is generated. Such a huge quality of mining waste not only created a problem for its storage but is also a source of environmental pollution. The total annual royalty collection on major minerals is to the tune of around Rs. 250 Crores.

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This mining activity has been the focus of public scrutiny in recent years as reflected in Justice Shah Commission's (2012) Report on Illegal Mining in Goa. Excessive and illegal mining in Goa has caused severe damage/loss to the ecology, environment, agriculture, ground water, natural streams, ponds, rivers, biodiversity, etc.

1.2 Recommendations of Public Account Committee

The Public Accounts Committee (PAC) Report prepared under the Chairmanship of present Chief Minister has recommended that:

- State Government should cap the total quantities of ore that the local area can take, by clustering the lease based on their Geographical locations and available transport network. The powers to do so are available to the State Government.
- Environmental Impact Assessment (EIA) Report of all the cases/mines, where the Environmental Clearance (EC) is granted, to be evaluated under the guidance of experts and report submitted to MoEF for review of Environmental Clearance Certificate, wherever required.
- Further, the MoEF should be informed that they should not grant or renew any EC unless impact of EC due to clusters of mines and local transport infrastructure is taken into consideration. As a result, due to irregularities in mining practices, the Govt. of Goa banned the mining activity in September 2012. This has not only affected the economic progress of the State, but also caused many workers, dependent on mining activities.

At the time of ban, out of 337 registered mines, 81 mines were reported to be in operation.

1.3 Salient Findings of Center for Environment Education Report

As a part of such public scrutiny, The Government of Goa assigned Centre for Environment Education (CEE), Goa State Office a two-year research project to assess the quality of the EIA report submitted, compliance with Environment Clearance (EC) conditions and the adequacy of the Environmental Management Plans (EMP) with respect to 105 mines in operation in Goa. The Department of Science, Technology and Environment, Government of Goa supported the study. The study was conducted in an open, transparent and participatory manner by organizing various workshops, and

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consultations with a wide range of stakeholders and field visits to the mining sites with the full cooperation of the mine management as well as the people of the state.

The salient observations/findings of the study conducted by CEE, Goa (as mentioned in the Oct 2013 report) are reproduced/summarized to properly understand the complex issues involved in mining and associated activities and how one can pave the way for sustainable development of the Goa State for the present as well as future generations. Salient findings of Study conducted by the CEE, Goa are:

- The study pointed out that the EIAs, ECs and EMPs were found to be highly deficient in information pertaining to major environmental parameters such as land use pattern, water resources, biodiversity, demographic profile, dependency of people on agriculture, air quality and impact of air pollution on the health of local people.
- It also highlighted that ECs were sanctioned to as many as 182 mining leases. The total production of these leases would amount to an annual removal of 70 million tonnes of ore. As the standard ore to waste/overburden is 1:3, this means the ECs sanctioned permitted in principle the removal of some 200 million tonnes of earth in the state of Goa every year. Obviously, it is necessary to consider the cumulative environmental impacts of such a huge turnover of soil in an ecologically sensitive area like the Western Ghats, with its forests protected under the Wildlife (Protection) Act, 1972, Indian Forest (Conservation) Act, 1980.
- The study further revealed lack of proper recognition of the impact of the large-scale mining activity on the water regime of the area under mining, which includes a substantial fraction of the water catchment areas of the State. The Ministry of Environment and Forests (MoEF), Govt. of India was advised by its Regional Office, Bangalore in the year 2005 not to grant environment clearances till a proper groundwater study and impact analysis was carried out. However, mines were permitted to continue their operations, subject to the study being done. The problem seems to have been resolved by inappropriately referring to the ground water utilisation of the entire taluka in which the mine was located instead of focusing on specific aquifers. Mining has

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been permitted even in the catchment of the largest water reservoir of south Goa, namely, Selaulim Dam.

- It further emphasized that the mining has substantial impacts that pervade through the entire state of Goa, impacting the Western Ghats, the midland plateaus and the coastal regions, the land and the waters, the forests, the agriculture and human settlements. These need to be viewed in a comprehensive and integrated manner if the environmental impact of mining is to be properly assessed and addressed through appropriate management measures. Such a holistic view has been lacking, and needs proper addressing of the following important issues, which have been neglected in micro level EIA studies.

Fig. 1.1 shows the location of mines near the water bodies, whereas **Fig. 1.2** shows the mining leases located near the protected areas.

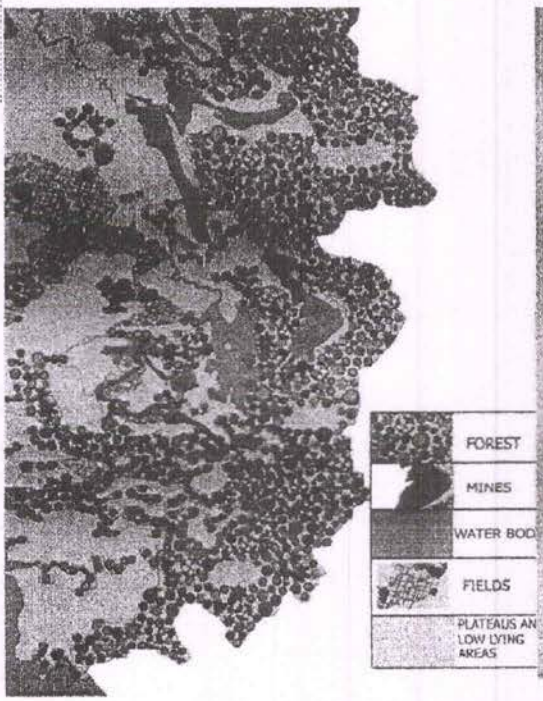


Fig. 1.1: Map Showing Location of mines near water bodies

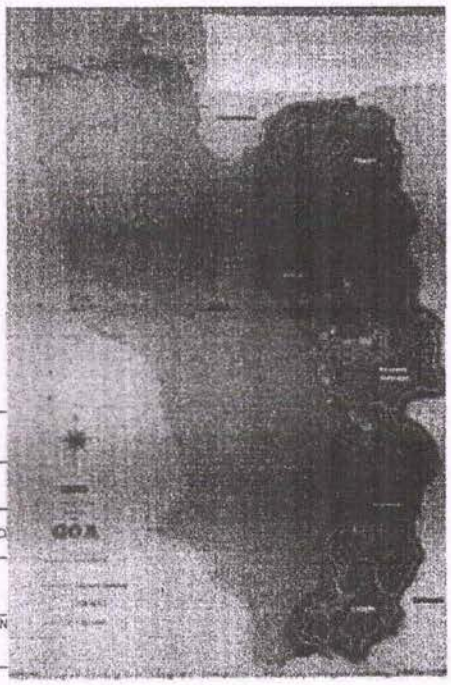


Fig. 1.2: Map Showing Mining leases Located near Protected Area

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Impacts of Mining

1. Loss of agricultural productivity due to [a] deposition of dust on the leaves, [b] depletion of ground water and water supply, [c] destruction of springs and other water sources, [d] siltation of agricultural land and orchards, [e] breaking of estuarine *Khazan* land bunds due to over barge traffic movement in rivers, [f] oil pollution of water and soil, and [g] excess iron and manganese content in water and soil
2. Destruction of grazing resources for livestock
3. Loss of fish and shellfish productivity due to [a] turbidity in water, [b] increased sedimentation [c] oil, iron and manganese pollution
4. Destruction of sacred groves
5. Destruction of special ecological habitats like hill plateaus *(sada)*, and hill streams
6. Depression of productivity of forest vegetation due to air pollution and deposition of dust layer on the leaves
7. Noise and vibrations leading to disturbance to wildlife and its movement
8. Impact on coastal fisheries due to increased riverine barge traffic, increased ore loading points, and barge and ship movement in the coastal and offshore waters
9. Reduction in availability of land based as well as aquatic food to people
10. Traffic congestion and road accidents
11. Impacts of air, water and noise pollution on health
12. Loss of employment in fisheries, agriculture, horticulture and forestry sector
13. Social conflicts resulting from unequal distribution of economic gains, influx of immigrants, and increased liquor sales

In order to address the above issues/concerns/impacts, individual studies have been conducted/ reported in different time periods/ magnitude, however, a holistic view for the entire mining activity in the State has been lacking. Therefore, the present study aims to address all the critical issues related to different components of the environment (air, water, soil, ecological, siltation, socio-economic etc.) to arrive at the sustainable level of fresh mining activity in the Goa State.

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1.4 Need for the Present Study

Recognizing the complexities associated with the mining and related activities, the Directorate of Mines & Geology, Govt. of Goa, prepared Mining Policy for the Major Minerals in Goa and the draft report emphasized need for a macro level EIA study on Goa to determine and recommend optimum level of fresh mining that can be undertaken in Goa in sustainable manner. Pending which it was proposed not to commence mining operations or submit fresh proposals. Though the individual mining leases in Goa have conducted EIA Study and prepared Environmental Management Plan for Mining of Minerals as per EIA Notification 2006 at micro level. However, no study was conducted at macro level taking into account contiguous locations of leases in clusters in the State of Goa.

Pursuant to recommendation in PAC Report and Draft Goa Mining Policy 2012, a macro level EIA study was proposed. Accordingly, Directorate of Mines & Geology, Govt. of Goa approached CSIR-NEERI, Nagpur to conduct a macro level environmental impact assessment study on effect of mining in Goa State.

Keeping in view the above, a macro level environmental assessment study due to mining activities in Goa was proposed with the following objective and scope of work.

1.5 Study Objectives

To carry out environmental impact assessment study with a view of having macro level impacts of mining in Goa on flora, fauna, the local inhabitant, Air, Water, Noise pollution and overall biological environment.

1.6 Study Area & Scope of Work

1. This project shall cover State of Goa more particularly Eastern part of Goa, comprising of talukas of Quepem, Sanguem, Dharbandora, Sattari and Bicholim, which forms the study area (**Fig. 1.3**)
2. There are Wild Life Sanctuaries like Netravali, Mhadei, Bhagwan Mahaveer Wild Life Sanctuary, Bondla, Salim Ali Bird Sanctuary located in vicinity of Mines so also rivers and other water bodies near the mining leases.
3. In Goa, all mines are open cast mining where mostly there are no blasting activities carried out. If at all necessary, the same are carried using latest

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technology which generate minimal sound/dust pollution during blasting activity

4. Environmental data needs to be collected and analyzed for the purpose of capping of fresh extraction in mines in Goa factoring intergenerational equity and sustainable development of the State in respect of

   a. Air Environment
   b. Water Environment
   c. Noise and Vibration
   d. Land Environment
   e. Biological Environment

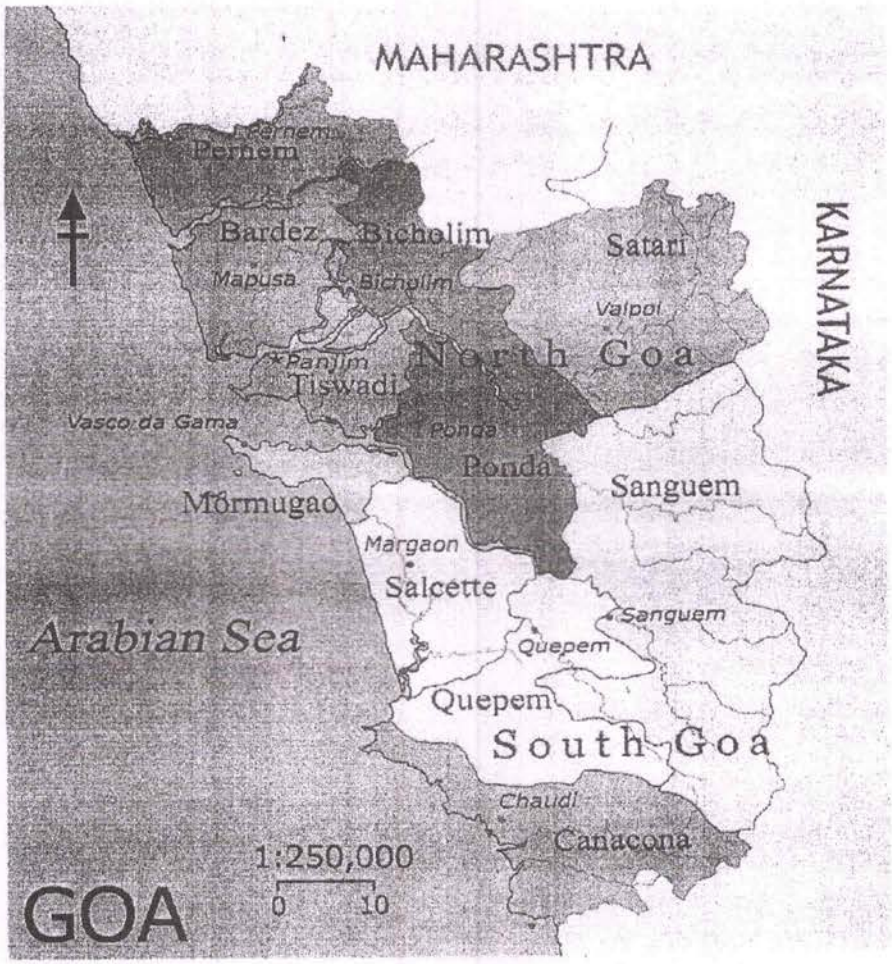


Fig. 1.3 : Administrative Map of Goa

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1.7 Component wise Scope of Work

Depending upon the availability of secondary data from different Govt. Departments/ Agencies, the report shall also contain the following information with respect to different components of the environment.

A. Air Environment

- Climate and meteorology (temperature (max. and min.), relative humidity, and rainfall) indicate the nearest IMD meteorological station from which climatological data have been obtained.
- Wind rose (wind directions and speeds, 24 hourly data)
- Analysis of long term Air quality data in respect of SPM, RSPM, SO2, NOx, CO, Heavy Metals in SPM (Mineralogical Fe, Mn, Pb, etc.), any other project specific pollutants, provided by the Sponsor/Goa PCB.

B. Water Environment

Sources of water (river, groundwater, mine water, other surface water), their requirement, and utilization for various operational need of the project, at different stages will be discussed.

Water balance with breakup of water requirement as per different activities in the mining operations.

Groundwater

Since the mining is excavation of the earth, the groundwater is affected to a great extent. The study shall include:

- Groundwater potential, recharge and budgeting
- Hydrogeology and aquifer characteristics of the area
- Groundwater quality, groundwater potential of the area and its availability, groundwater table (pre monsoon and post monsoon)
- The details of locations of groundwater observations wells with respect to core zone should be described
- Analysis of long term water quality data provided by the Sponsor/Goa PCB in the study area

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- Water bodies existing and water bodies likely to be created due to mining activities
- Water requirement and wastewater generation from various activities of mine, including township, beneficiation etc.
- Wastewater treatment, recycling and reuse

C. Noise Environment

- Locations of monitoring stations for noise measurements in accordance with the direction and distance from the sources and habitations
- Day-time and night-time noise level monitoring (leq)
- Vibration and air over pressure, caused due to blasting, transport and process equipments, wherever applicable

D. Biological Environment

Flora

- Detailed description of vegetation type in core and buffer zone
- Assessment of plant species with respect to their dominance, density, frequency, abundance, diversity index, similarity index, importance value index
- Quantitative estimation of forest and non-forest flora
- Type of forest in study area and its conservation status
- Information on the dependence of local people on minor forest products
- Location of National parks, Sanctuary

Fauna

- Assessment of fauna and avi-fauna
- List of endangered and endemic species as per the schedule of the Wildlife Protection Act, 1972
- Information on breeding and hibernating sites in core and buffer zone

E. Land Environment

- Landuse/land cover changes with respect to study area using GIS/Remote sensing

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- Analysis of soil quality data with respect to mining activities
- Geology, hydrogeology and hydrology of the study area

F. Social Aspects

- Demographic structure of the region
- Local inhabitants involved in mining activities
- Quality of life of the people in the study area

G. Working of mines near the Wild Life Sanctuaries/National parks

These are leases situated close to Wild Life Sanctuaries /National Parks and Government of Goa has proposed to have eco-sensitive zone of up to 1 km around such Wild Life Sanctuaries/National Parks. The study shall also cover issues concerning mining activities outside Wild Life Sanctuaries/National Parks in close proximity including permissible limits.

1.8 Methodology/Approach to Study

- Review of documents/reports/information relating to status of mining activities existing in the study region (prior to ban)
- Review of micro level EIA studies of operational mines (***all mine owners to provide necessary inputs)***
- Geographical mapping of existing and proposed mines in the study area
- Assessment of baseline environmental quality with respect to different environmental components, viz. air, water, noise, land, biological and socio-economic aspects in the study region ***(based on secondary data, provided by the sponsor and also available on public domain)***
- Study of mining activity proposed in the region ***(as per Mining Policy, all mine owners to provide necessary inputs)***
- Identification and quantification of significant impacts of the proposed mining activity on different environmental components, considering future developmental/ growth scenarios in the mining sector
- Evaluation of impacts with and without environmental management plan
- Delineation of macro level environmental management plan for the region
- Review of completed mines in view of environmental restoration ***(concerned mine owners to provide necessary inputs)***

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- Determination of the permissible level of mining activity from environmental sustainability point of view
- Discussions with stakeholders to derive the best practicable strategy for environment friendly mining in the region
- Identification of critical environmental quality parameters/indicators for regular monitoring

1.9 Progress of the Study

Keeping in view the scope of work and study requirements, preliminary discussions were held with all the concerned agencies/organizations and stakeholders in Goa to assess the current scenario of the region with special focus on Mining Areas activities. The available secondary data was collected from all the concerned agencies and visits were also made to a few important areas in Goa by NEERI study team during January 2014. Based on the information collected and analysed, this preliminary report has been prepared and presented in the following chapters:

Chapter 2: Profile of Goa and Iron Ore Mining

Chapter 3: Air Environment

Chapter 4: Noise Environment

Chapter 5: Water Environment

Chapter 6: Hydrogeology

Chapter 7: Land Environment

Chapter 8: Biological Environment

Chapter 9: Socio-economic Environment

Chapter 10: Way Forward to Sustainable Mining

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2.0 Profile of Goa and Iron Ore Mining

2.1 Administrative Setting & Demographic Profile

Goa is India's smallest State in terms of land area and is located in the South-West part of the country. It is surrounded by Maharashtra in North, Karnataka in the East & South, whereas by Arabian Sea in the Western side.

As per 2011 Census data, the total population of the State is about 14.58 lakhs with a population density of 394 persons per sq.km. The State is divided into 2 districts; namely North Goa and South Goa. North Goa comprises of 6 Talukas (Tiswari, Bardez, Pernem, Bicholin, Sattari and Ponda) with a total area of 1,736 sq. km and its headquarters at Panaji, whereas South Goa comprise of 5 Taluikas (Sanguem, Canacona, Quepem, Salcete and Mrmugao) with a total area of 1,966 sq.km. and its headquarters at Margao (**Fig. 2.1**).

Topographically, Goa can be divided into three distinct sub-regions, namely the coastal plains, the intermediate or transitional sub mountainous region with undulating uplands and the interior hilly regions consisting of Western Ghat.

The coastal plain comprises the talukas of Bardez, Tiswadi, Mormugao and Salcete, which cover about 22% of the total geographical area. The intermediate or transitional sub mountainous region comprising the talukas of Pernem, Bicholim, Ponda and Quepem, with undulating uplands, covers about 35% of the area, whereas the interior hilly region of Sattari, Sanguem and Canacona talukas (vary from 300-800 m in height) make up the remaining 43% of the area.



Fig. 2.1: Administrative Setting of Goa

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The urban population of Goa is about 62.2%. Sex ratio of the State is 973 females per 1000 males. Overall literacy rate of males (91.7%) and females (81.6) is high as compared to the national average of male (75.9%) and female (54.2%) respectively. Infant mortality rate is 11 and life expectancy at birth is 68.5 years. Nearly 60 % of the total population resides in coastal talukas, whereas the hilly region has low density of population.

The State has 1 Municipal Corporation and 13 Municipalities (Mapusa, Pernem, Bicholin, Sanquelim, Valpoi, Ponda, Sanguem, Canacona, Quepem, Curchorem, Margao, Cuncolim, and Mormugao). Geographical and demographic details of North and South Goa districts are given in **Table 2.1**.

Table 2.1 : Geographical and Demographic Details

Sr. No.	Particular	Year	Unit	North Goa Statistics	South Goa Statistics	Total
1.	**Geographical features**					
1.1	Geographical Data					
	Latitude			15^0 16' 30" N & 15^0 48' 15" N	15^0 29' 32" N & 14^0 53' 57"N	
	Longitude			73^0 40' 30" E & 74^0 17' 15" E.	73^0 46' 21" E & 74^0 20' 11" E.	
	Geographical Area	2012	Km^2	1736	1996	3732
1.2	Administrative Units					
	Sub divisions	2012	Nos	04	03	7
	Talukas	2012	Nos	06	06	12
	Inhabited Villages	2010	Nos	213	347	560
	Municipal towns	2010	Nos	07	07	14
	Assembly Area	2011	Nos	01	01	2
2.	**Population**			817761	639962	817761
2.1	Sex-wise					
	Male	2011	Persons	417536	323175	740711
	Female	2011	Persons	400225	316787	717012
	Literates	2011	Persons	659812	492305	1152117
2.2	Rural Population	2011	Persons	325041	226373	551414

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2.1.1 Land use Pattern

Goa is a land of rich, natural assets. Besides the beaches which most people link it with, it also embraces rivers and lakes, hills and plateaus, pristine forests and fields. All packed by nature into one of India's smallest States. Out of the total geographical area of 3702 km^2, the State has about 37% area under forest cover (protected/reserved/ national park/wildlife sanctuaries/mangrove forests & private forests), followed by 22.8% orchards, 14.3% agricultural fields (paddy field/ Khazan land & cultivable land), 5.3% water bodies and nearly 14.2% settlement/built up area. Land use pattern of Goa is depicted in **Fig. 2.2.**

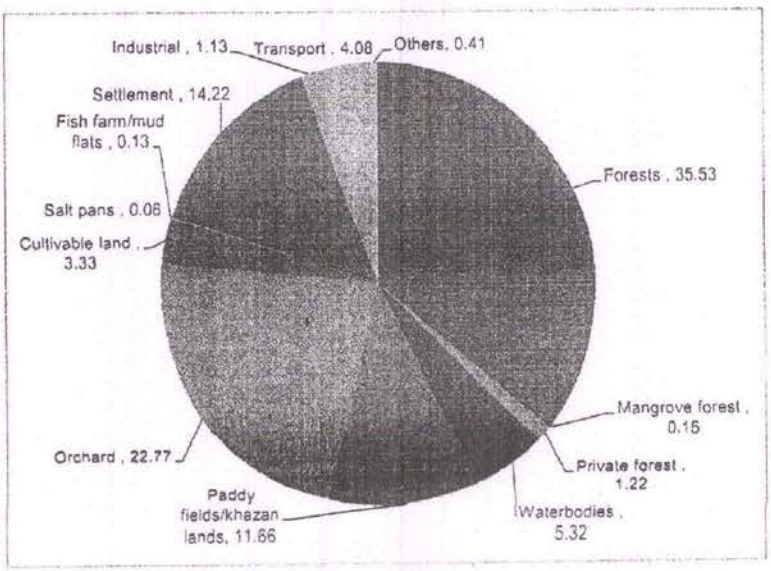


Fig. 2.2: Land use Pattern (in %) of Goa

2.1.2 Rivers

The Goa region is drained by nine major rivers, namely, Terekhol, Chapora, Baga, Mandovi, Zuari, Sal, Saleri, Galjibag and Talpona, which flow from the Western Ghat (East) to the Arabian Sea (West). The coastline runs to about 105 km from the North to South and the maximum width of the state is about 65 km from the East to West.

2.1.3 Land/Soil

The soils are predominantly of lateritic nature, which manifests the underlying geology of the area. The coastal tracts are, however, alluvial flats. The climate is pleasant and warm almost throughout the year and there are no remarkable changes in

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temperature. The rainy monsoon season runs from the month of June to September with an average annual rainfall of over 3000 mm. Agriculture is the predominant occupation of the people of the state followed by mining, fisheries and tourism.

2.1.4 Biological Resources/Forests

As per the State of Forest Report 1999 published by Forest Survey of India, the total forest cover in Goa was 1251 sq. km. i.e. 33.79 % the total geographical area, comprising 995 sq. km. dense forest , 251 sq. km. open forest and 5 sq.km. mangroves. A decrease of 1 sq.km. was reported in 1999 assessment as compared to 1997 assessment. As per the 2001 Report, the forest cover in Goa is 2095 sq. km. comprising 1785 sq. km. dense forest and 310 sq. km. open forest. The increase is due to the change in the methodology of the assessment which includes cashew, mango and other horticultural trees in the forest cover, and not the actual change.

Biological resources include 1 national park, 6 wildlife sanctuaries, several endangered species, 3 turtle nesting grounds, 1 coral reef, estuarine crocodiles at Cumharjua canal, mangrove areas, wetlands and 354.48 sq.km of reserved forest in North Goa and 869.98 sq.km in south Goa.

Ecologically Sensitive Areas

Environmentally sensitive areas are the areas that may be susceptible to negative impacts due to development activities such as industries and must be protected from industrial pollution. Hence, industrial activities cannot be allowed in these areas. These areas have been described in two categories:

Biological diversity: This include 1 national park, 6 wildlife sanctuaries, several endangered species, 3 turtle nesting grounds, 1 coral reef, estuarine crocodiles at Cumharjua canal, mangrove areas, wetlands and 354 sq.km of reserved forest in North Goa and 870 sq.km in south Goa.

Sensitivity / incompatible land use areas: This include public water supply areas from surface water bodies, world heritage sites, monuments of national significance, tourist places, pilgrim centres, agricultural research station, sacred graves, command areas of irrigation projects, airport and coastal regulatory zones.

Details of agriculture and forest are given in **Table 2.2**, *whereas details of livestock and* poultry in Goa are given in **Table 2.3.**

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Table 2.2 : Agriculture and Forest Details

Sr. No	Particular	Year	Unit	North Goa Statistics	South Goa Statistics	Total
1.	**Agriculture**					
1.1	Land utilization					
	Total Area	2011	km^2	173600	1966	175566
	Forest cover	2011	km^2	35448	870	36318
	Net Area Shown	2010	Ha	79908	51679	131587
	Area shown more than once	2010	Ha	19408	9325	28733
	Gross cropped area	2010	Ha	99316	61004	160320
2.	**Forest**					
	Forest	2011	km^2	35448	870	36318

Table 2.3 : Details of Livestock and Poultry in Goa

Sr. No.	Particular	Year	Unit	North Goa Statistics	South Goa Statistics	Total
1.	**Livestock & Poultry**					
1.1	**Cattle**					
	cattle	2007	Nos.	37412	33135	70547
	Buffaloes	2007	Nos.	21956	14160	36116
1.2	**Other livestock**					
	Goats	2007	Nos.	226350	4107	230457
	Pigs	2007	Nos.	13411	47261	60672
	Poultry (backyard)	2007	Nos.	71918	84793	156711
	Poultry (in farms)	2007	Nos.	226350	74714	70547

2.1.5 Industrial Base

The post-liberation era in the state of Goa has witnessed a tremendous boom in the industrial sector. This has resulted in the establishment of twenty industrial estates across the State, which is primarily located on plateau top areas. However, these industries are dependent on the power supply originating from the neighboring states of Karnataka and Maharashtra and allotted to Goa in the National Grid. Recently, M/s Reliance Salgaocar Co. has established, a private power-generating unit, which caters to some of the power demand. Agriculture, industry, trade, commerce, and tourism provide avenues of employment to a majority of the local population. In the occupational structure, agriculture, with about 40% of total workers, occupies the first

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position. Services with 34% and manufacturing with 23% are the other equally significant sources of employment. District-wise details of industries are given in **Table 2.4.**

Table 2.4 : Details of Industries in North and South Goa

Sr. No.	Head	Unit	North Goa Particulars	South Goa Particulars	Total
1	Registered Industrial Unit	No.	4595	2940	7535
2	Total Industrial Unit	No.			51,492*
3	Registered Medium & Large Unit	No.	60	75	135
4	Estimated Avg. No. Of Daily Worker Employed In Small Scale Industries	No.	7	7	14
5	Employment In Large And Medium Industries	No.	16,000	16268	32268
6	No. Of Industrial Area	No.	12	6	18
7	Turnover Of Small Scale Ind	In Lacs			464177**
8	Turnover Of Medium & Large Scale Industries	In Lacs	NA	NA	NA

* For the State of Goa as per IV Census of MSMEs
** at 2009-10 current prices

2.1.6 Urbanization, Transport and Communication

According to the Census of India 2001, there is 1 Class I city (Mormugao with a population of 1,04,758) and two Class II towns (Panaji and Margao) in the State of Goa. Also, there are 360 villages distributed evenly throughout the State. The State has developed 3 National Highways, 8 State Highways and 52 Major District Roads. Goa's Railway network comprises of Konakan Railway (105.961 km) and South Western Railway and 6 Railway Stations. Some rivers are also utilized for transportation. Dabolim Airport is the only Airport in Goa and handles both domestic and international flights. It is located at a distance of 25 km from the capital city of Panaji.

Goa has a good network for transport and communications. It is served by railways, roadways, inland waterways and airways. It has a natural harbor located at Marmugoa. The rivers of Mandovi and Zuari provide inland waterways and are extensively used to transport, minerals ores from the mines to the Port. *Of late, the entire old South Central* Railway network has been converted into a broad gauge and the Konkan Railway

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route has become operational. The details of transport and communication facilities are given in **Table 2.5**.

Table 2.5 : Transport and Communication Facilities

Particular	Year	Unit	North Goa Statistics	South Goa Statistics	Total
Railways					
Length of rail line	2010	Kms	60	100	160
Roads					
Surface Roads (Water Bound Macadem)	2010	Kms	336	257	593
Surface Roads (Black Topped)	2010	Kms	975	630	1605
Unsurfaced Road Cement Concrete	2010	Kms	11	1	12
Unsurfaced Road Motorable	2010	Kms	942	453	1395
Unsurfaced Road Motorable	2010	Kms	393	300	693
Communication					
Telephone connection	2009	Nos	95551	69815	165366
Post offices	2010-11	Nos	162	96	258
Telephone exchanges	2010-11	Nos	83	52	135
Density of Telephone	2010-11	Nos./1000 person	95	125	220
Density of Telephone	2010-11	No./Km	55	40	95
PCO Rural	2010-11	No.	4487	3229	7716
PCO STD	2010-11	No.			
Mobile (BSNL)	Up to Dec.2010	No.			179927

2.1.7 Cultural & Heritage Sites and Tourism

The state of Goa is a prime tourist spot of the world and is known for its beautiful beaches and landscapes. Apart from these, a world heritage site about 9 km east of Panjim, the capital city, lies in the erstwhile capital of the Portuguese rule in India that is old Goa or Velha Goa comprising of churches, convents etc. which have been declared by UNESCO in 1986 under world heritage category. A total of 21 monuments of national significance have been identified in the state of which most lie in Old Goa, followed by Candolim, Ponda, Arvalem, Tambdi, Surla and Chandor. The state of Goa caters more than 10 lakh tourists per year from around the world with the beauty of its 12 beaches which are located in Salcete, Bardez and Tiswadi talukas.

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Goa is famous as an international and national tourist destination center due to its rich natural and cultural heritage consisting of historical monuments, temples, churches, unique blend of cultural and pristine green cover of forests and agricultural patches. The state attracts a large number of domestic as well as foreign tourists who enjoy both the pristine natural environment and, traditional hospitability of the local population as well as the festivals spread through the year such as Shigmo, Carnival, feasts, jatras, etc.

During 2012, as many as 28 lakhs tourists visited Goa which included nearly 16% foreigners. Details of domestic and foreign tourists during 2002-2012 are presented in **Fig. 2.3.**

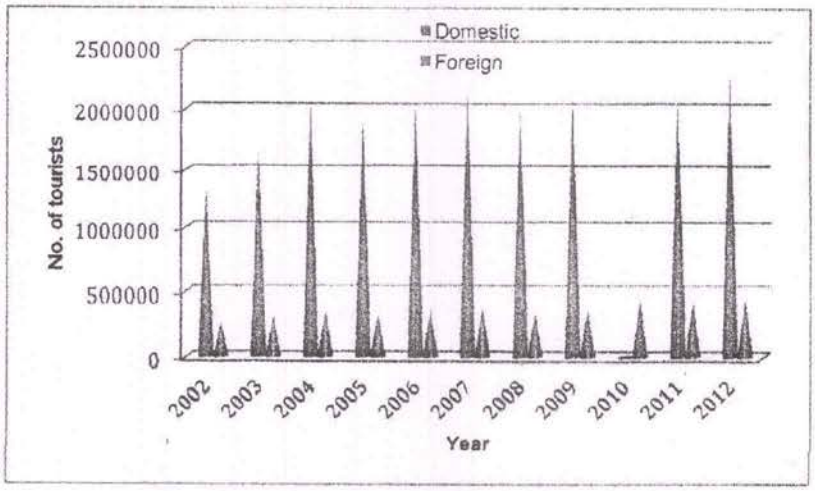


Fig. 2.3 : Tourist Flow in Goa during 2002-2012

2.1.8 Public Health, Education and Bank Facilities

Details of public health & education and bank facilities are given in **Table 2.6** and **2.7** respectively.

Table 2.6 : Public Health and Education

S.No	Particular	Year	Unit	North Goa Statistic	South Goa Statistic	Total
1.	**Public Health**					
	No. of Govt. Hospitals	2008-09	No.	5	8	13
	Beds Govt. Hospitals	2008-09	No.	1776	636	2412
	No. of Private	2008-09	No.	75	52	127

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S.No	Particular	Year	Unit	North Goa Statistic	South Goa Statistic	Total
	Hospitals					
	No. of Beds in Private Hospitals	2008-09	No.	1535	1181	2716
	Community health centers	2008-09	No.	3	2	5
	Primary health centers	2008-09	No.	11	120	131
	Dispensaries	2008-09	No.	19	9	28
2.	**Education**					
	Primary school		Nos.			1252
	Middle schools		Nos.			438
	Secondary & senior secondary schools		Nos.			375
	Colleges		Nos.			24
	Technical University		Nos.			-

Table 2.7 : Banking Details

Particular	Year	Unit	North Goa Statistics	South Goa Statistics	Total
Banking					
PSU Banks	2012	Nos.	267	149	416
Rural Bank Products	2012	Nos.	-	-	-
Co-Operative bank products	2012	Nos.	37	21	58
other Banks	2012	Nos.	49	36	85

2.1.9 Existing Status of Environment

There are 20 industrial estates with a total of 1773 industrial units in the State of Goa which are mainly responsible for the pollution load generation. Apart from these, 7 industries under special projects are also present in the region, which manufacture glass, coke, GRP pipe systems and tanks, pig iron, copper, nickel strips, and a distillery. Also there are 1835 Nos. of small scale industries which lie outside the industrial estates with majority of industries engaged in FMCG, food, household, bakery, agrochemical production.

In all, there are about 130 major industries already established in Goa. The State has over 6500 small scale units and about 147 large and medium scale industries employing over 60,000 people. Besides, there are 93 Nos. opencast mines & 426 Nos.

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of mines for minor minerals which are contributing to the total pollution level. Iron, manganese and bauxite are the major mines in Goa. The major environmental impact of mining operations are degradation of land, pollution of air, deforestation including loss of flora & fauna, rehabilitation of affected population including tribal and impact on historical monuments and religious places. There are 228 quarries in Goa, specially of latterite stone, which contribute to dust pollution.

A total of 13 settlements have been identified for generation of municipal solid waste in the region of north and south Goa. The solid waste constitutes wastes from households, municipal market, hotels and restaurants and commercial establishments, hospitals, tree trimmings, leaf liter and road sweepings.

The biomedical waste inventory shows 123 hospitals and nursing homes generating biomedical waste. The total hazardous waste generation from 93 units, as on 5th August 2005, is 9600.94 MT and 13,836 barrels. Total used oil generated is 702.62 MT and total waste oil/ residues containing oil generated is 30.32 MT. The hazardous waste generated is recycled/ stored in a TSDF or incinerated as per the nature of the waste. Domestic sewage is mostly discharged in to the rivers or sea. Class I towns use rivers for wastewater disposal whereas class II towns either use agricultural land or lakes/ponds and rivers for disposal of wastewater. There is only one class I city and two Class II towns in Goa, all of them have sewage treatment plants.

River Kalna, Assonora, Valvanti, Madei, Khandepar, Talpona and Salaulim reservoir (River Zuari) are the main sources of supply of drinking water in North and South Goa districts. Areas upto 2 kms u/s of public water supply abstraction points have been considered incompatible landuse area for protection. At present water quality of 11 rivers is monitored by the Board. The analytical results show that all the rivers satisfy the quality requirement of the designated best use. CPCB has now sanctioned 18 new stations in addition of 11 existing station, under the National Water Monitoring Programme (NWMP).

2.2 Iron Ore Mining in Goa

The State is rich in mineral deposits such as iron ore, manganese ore and bauxite. The open-cast mining operations in the state are mainly export-oriented. Ore is transported for short distances by dumpers (trucks) to the major river and from where loaded into barges for onward transportation to the harbour/port. Due to the open-cast method adopted for the extraction of these minerals, large reject dumps are generated, which

are prone to erosion during the heavy monsoon showers. The eroded material along with the turbid waters from beneficiation plants and mining pits are responsible for siltation / inundation and pollution of water bodies as also agricultural lands. Besides, mining involves removal of the green cover resulting in deforestation.

Taluka-wise reserves of iron ore are given in **Table 2.8**, which indicate major reserves lie in three talukas, namely Bicholim, Sanguem and Sattari, having a total share of about 96% of the total reserves of the state.

Table 2.8 Taluka Wise Ore Quantity In Mining Areas of Goa

Taluka	Ore Quantity (Million Tons)	% Share
Bicholim	209.547	33.09
Collem	4.061	0.64
Colombo	0.960	0.15
Cudnem	3.450	0.54
Maulingem	3.596	0.57
Pernem	0.600	0.09
Ponda	0.007	0.00
Quepem	9.011	1.42
Sanguem	309.027	48.80
Sattari	92.955	14.68
Total	633.216	100.00

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As on 2010-11, a total of 89 iron ore mines were in operation. Details of these mines are given in **Annexure I**. The mining areas in Goa are shown in **Fig. 2.4**. The total iron ore mine leases in the State were around 336. Details of these mine leases are given in **Annexure II**. Annual Ore export during 2002-2011 is presented in **Fig. 2.5**.

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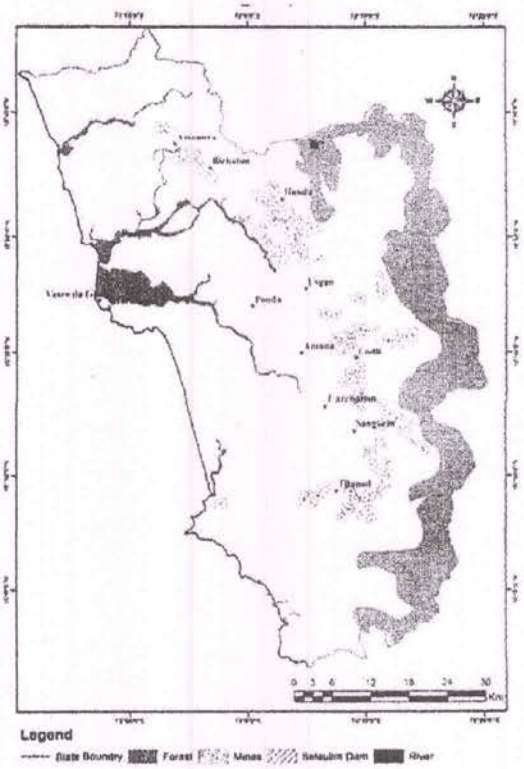


Fig. 2.4: Map Showing Mining Areas in Goa

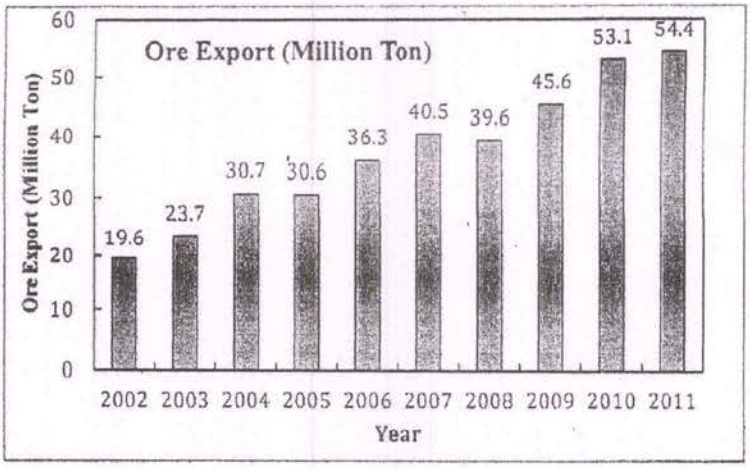


Fig. 2.5: Annual Ore Export during 2002-2011

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3.0 Air Environment

3.1 Air Quality Status

The secondary data on air quality and meteorology was collected from various sources. The data furnished by the following three departments were considered for evaluating the present status of the Ambient Air Quality (AAQ) of Goa.

- Goa State Pollution Control Board (GSPCB)
- Central Pollution Control Board (CPCB)
- Meteorological data from India Meteorological Department for various years

The air quality data of CPCB and GSPCB monitored at 13 locations within Goa is compiled. The monitoring stations are shown in the **Fig. 3.1** and the details of the monitoring duration at various stations are given in **Table 3.1**.

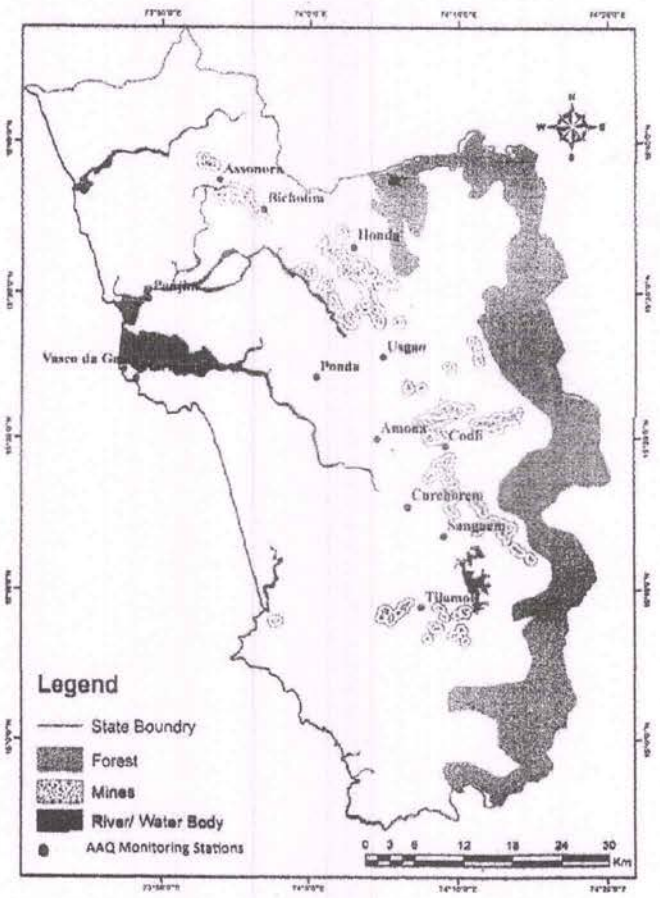


Fig. 3.1: Map of Mining Activity and AAQ Monitoring Stations in Goa

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Table 3.1: Details of Air Quality Stations in Goa

Monitoring Agency: SPCB, RO, Goa & CPCB

Parameters Monitored: PM_{10} & $PM_{2.5}$, SO_2, NO_2

Sr. No.	AQM Locations	Available Data Period
1.	Panaji	April 2010 to Feb 2012
2.	Murmagaon	April 2010 to Feb 2012
3.	Vasco de Gama	April 2010 to Feb 2012
4.	Assanora	Nov 2010 to Mar 2013
5.	Amona	Nov 2010 to Mar 2013
6.	Ponda	Dec 2011 to Mar 2013
7.	Bicholim	Nov 2010 to Mar 2013
8.	Codli	Nov 2010 to Mar 2013
9.	Honda	Dec 2010 to Mar 2013
10.	Usgaon	Nov 2010 to Mar 2013
11.	Curchorem	Nov 2010 to Mar 2013
12.	Sanguem	Feb 2012 to Mar 2013
13.	Tilamol	Dec 2011 to Mar 2013

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In order to have a general idea about the air quality of mining area and non-mining area based on available data, among all the locations; few sites located in the proximity of the mining areas were identified. The stations are Bicholim, Codli, Honda, Usgao, Curcorem, Sanguem and Tilamol located in Bicholim, Dharbondora, Sattari, Quepem and Sanguem taluks.

Analysis of Data

Variation in monthly mean values of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 during the whole period (April 2010- March 2013) is presented through **Fig. 3.2** through **Fig. 3.9** respectively. However, data of some monitoring sites was not available for few months. Monthly average values of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 at all the 13 locations (classified under proximity to mining and non-mining areas) are given in **Tables 3.2-3.9**. The data has been correlated with the ban on mining activity in October 2012.

PM10 Levels

Perusal of **Fig. 3.2** indicates in general; lower average values during monsoon months (June – September 2011) and highest levels during winter and summer months (from December 2011 – May 2012), which dropped down considerably from 100-250 µg/m^3 to 50-80 µg/m^3 during Jan-Feb 2013, reflecting the impact of ban mining activity on air quality at sites near mining areas. PM10 levels at monitoring sites away from the mining areas also showed similar trends of seasonal variation and impact of ban on mining. However, the concentrations levels were much lower than the levels observed near mining area sites (**Fig. 3.3**).

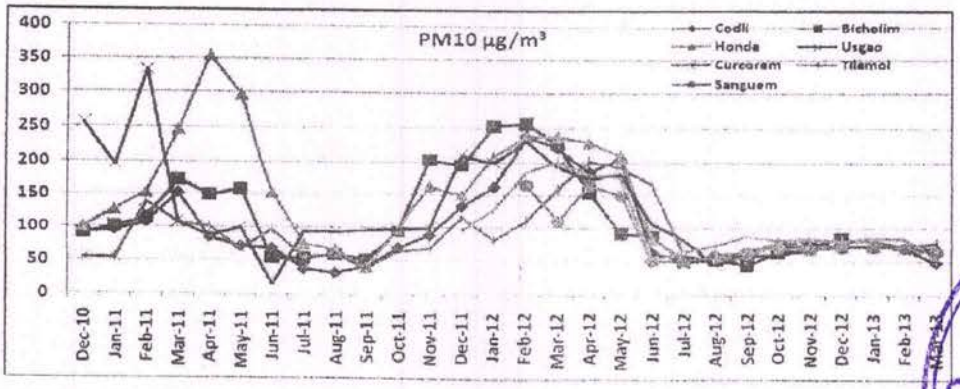


Fig. 3.2: Monthly Average PM_{10} Values at Stations Located near Mining Areas

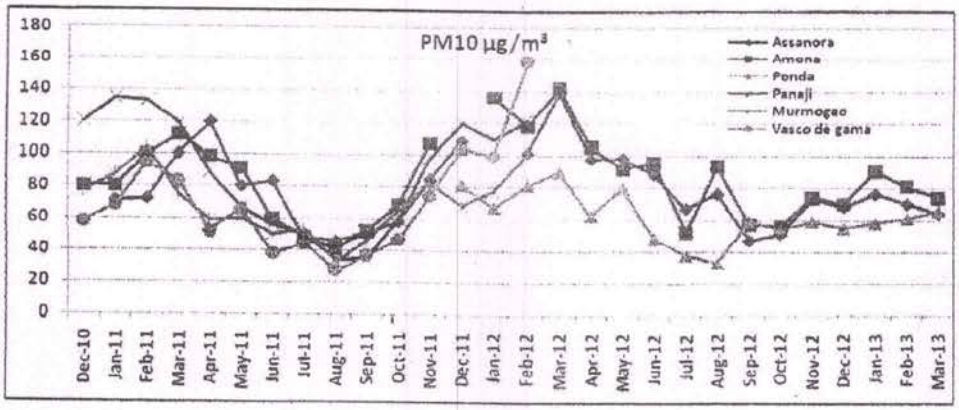


Fig. 3.3: Monthly Average PM_{10} Values at Stations Located away from Mining Areas

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PM2.5 Levels

Perusal of Fig. 3.4 indicates in general; lower average values during monsoon months (June – September 2011) and highest levels during winter months up to Jan-Feb 2012, which dropped down marginally during Jan-Feb 2013 after ban on mining activity, as compared to previous years observations during same months.PM2.5 levels at monitoring sites away from the mining areas also showed similar trend of seasonal variation, however, no significant impact of ban on mining activity was observed for this parameter (Fig. 3.5).

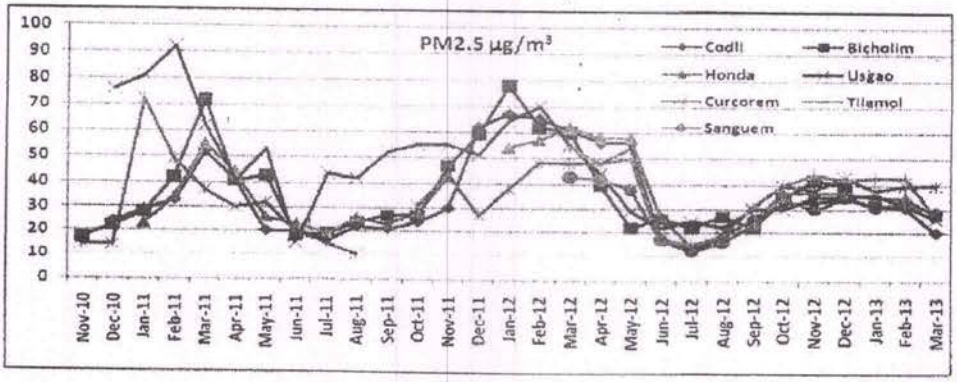


Fig. 3.4: Monthly Average $PM_{2.5}$ Values at Stations Located near Mining Areas

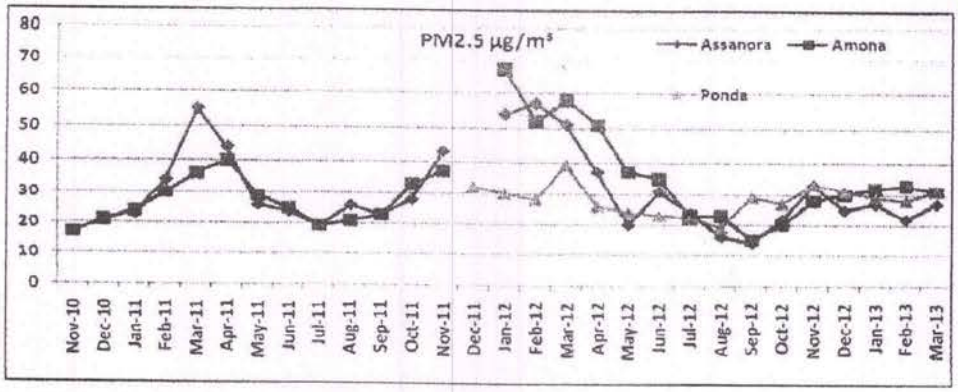


Fig. 3.5: Monthly Average $PM_{2.5}$ Values at Stations Located away from Mining Areas

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SO_2 Levels

Perusal of **Figs. 3.6 & 3.7** indicates that in general; presence of highest levels of SO_2 during winter months, followed by summer, and lowest during monsoon months at all the sites. SO_2 levels near the mining areas were found to be higher as compared to the sites away from the mining area. However, the SO_2 levels after ban on mining activities were found to be much below (less than 15 $\mu g/m^3$ near mining areas and less than 10 $\mu g/m^3$ away from the mining area sites).

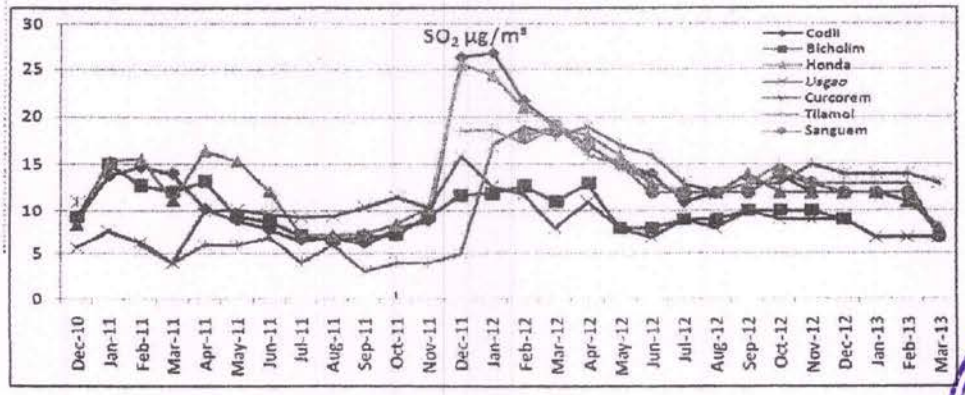


Fig. 3.6: Monthly Average SO_2 Values at Stations Located near Mining Areas

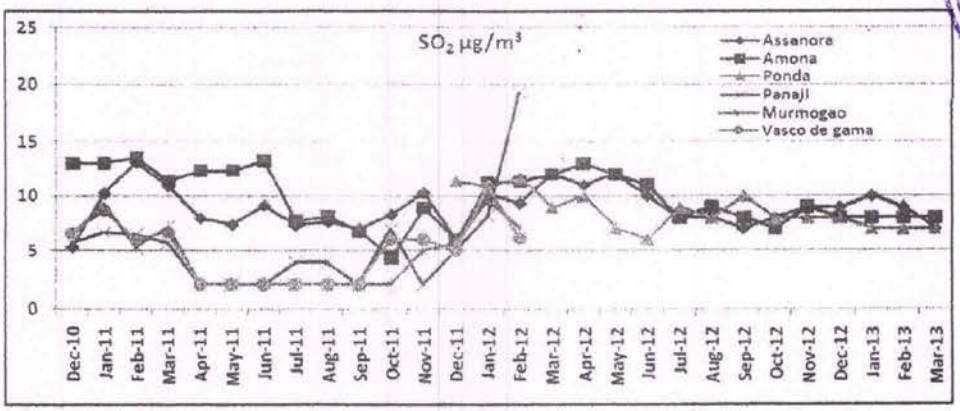


Fig. 3.7: Monthly Average SO_2 Values at Stations Located away from Mining Areas

NO_2 Levels

Perusal of **Figs. 3.8 & 3.9** indicates that in general highest levels of NO_2 during winter months, followed by summer, and lowest during monsoon months at all the sites. NO_2

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levels near the mining areas were found to be slightly higher as compared to the sites away from the mining area. NO_2 levels during winter months dropped down considerably (by about 50%) after the ban on mining activities in the winter months of 2012-13 at all the sites. This may be *attributed* to considerable reduction in truck movements carrying mined materials.

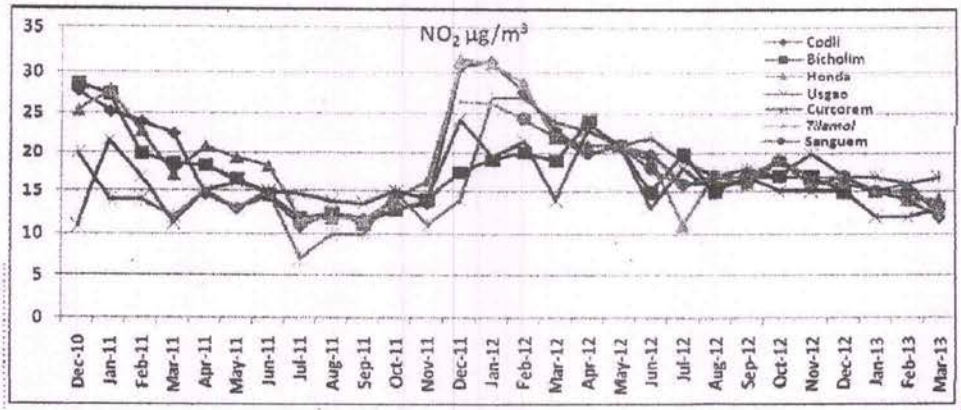


Fig. 3.8: Monthly Average NO_2 Values at Stations Located near Mining Areas

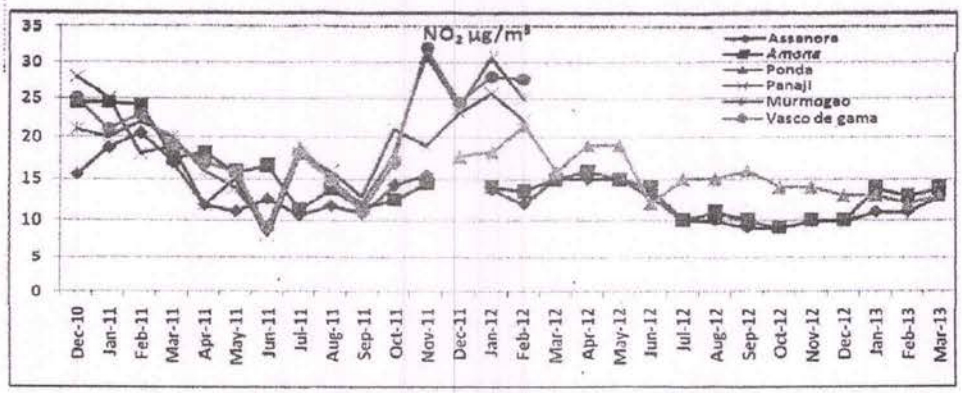


Fig. 3.9: Monthly Average NO_2 Values at Stations Located away from Mining Areas

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Table 3.2: Monthly Average PM10 Values at Monitoring Stations near Mining Areas

Monitoring Month & Year	PM10 Concentration Levels (µg/m³)						
	Bicholim	Codli	Honda	Usgao	Churchorem	Sanguem	Tilamol
Apr-10	--	--	--	--	--	--	--
May-10	--	--	--	--	--	--	--
Jun-10	--	--	--	--	--	--	--
Jul-10	--	--	--	--	--	--	--
Aug-10	--	--	--	--	--	--	--
Sep-10	--	--	--	--	--	--	--
Oct-10	--	--	--	--	--	--	--
Nov-10	85	--	--	--	55	--	--
Dec-10	91	90	100	257	55	--	--
Jan-11	101	95	126	197	138	--	--
Feb-11	114	107	153	333	107	--	--
Mar-11	172	152	248	108	101	--	--
Apr-11	149	85	355	87	68	--	--
May-11	158	71	297	100	96	--	--
Jun-11	55	69	153	15	56	--	--
Jul-11	54	37	75	94	58	--	--
Aug-11	60	31	67	94	39	--	--
Sep-11	52	41	40	96	65	--	--
Oct-11	94	70	98	98	68	--	--
Nov-11	204	88	163	100	116	--	--
Dec-11	196	132	150	212	81	--	94
Jan-12	253	162	210	201	111	--	126
Feb-12	257	239	240	233	159	165	185
Mar-12	228	223	240	195	203	109	202
Apr-12	154	186	231	175	193	166	182
May-12	92	207	211	183	166	149	178
Jun-12	88	64	84	107	60	51	53
Jul-12	51	52	56	83	52	51	64
Aug-12	54	57	57	46	59	59	74
Sep-12	45	61	65	60	77	64	87
Oct-12	64	73	79	61	84	72	81
Nov-12	73	71	74	69	80	68	85
Dec-12	85	71	74	72	82	72	81
Jan-13	--	72	73	75	72	72	85
Feb-13	--	70	73	68	78	70	84
Mar-13	--	48	69	69	64	63	57
Max	**257**	**239**	**355**	**333**	**203**	**166**	**202**
Min	**45**	**31**	**40**	**15**	**39**	**51**	**53**
SD	**66**	**58**	**85**	**75**	**43**	**42**	**50**
Average	**117**	**97**	**138**	**125**	**91**	**88**	**107**

-- Data not available

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Table 3.3: Monthly Average PM10 Values at Stations Located away from Mining Areas

Monitoring Month & Year	PM10 Concentration Levels (µg/m^3)					
	Panaji	Murmagao	Vasco de gama	Assanora	Amona	Ponda
Apr-10	74	50	61	--	--	--
May-10	69	46	61	--	--	--
Jun-10	57	46	44	--	--	--
Jul-10	63	75	44	--	--	--
Aug-10	71	33	44	--	--	--
Sep-10	45	42	43	--	--	--
Oct-10	60	51	44	--	--	--
Nov-10	66	58	55	--	--	--
Dec-10	120	77	58	--	80	--
Jan-11	135	87	68	71	80	--
Feb-11	133	104	94	72	99	--
Mar-11	119	75	83	100	112	--
Apr-11	88	59	52	120	98	--
May-11	67	60	66	80	91	--
Jun-11	56	50	38	83	60	--
Jul-11	50	53	44	48	48	--
Aug-11	34	33	27	46	41	--
Sep-11	35	46	37	51	52	--
Oct-11	60	66	47	58	69	--
Nov-11	97	82	74	84	107	--
Dec-11	120	68	103	108	--	81
Jan-12	109	77	99	--	136	67
Feb-12	122	101	159	101	118	81
Mar-12	--	--	--	139	142	89
Apr-12	--	--	--	97	105	62
May-12	--	--	--	98	91	79
Jun-12	--	--	--	88	95	48
Jul-12	--	--	--	67	52	38
Aug-12	--	--	--	76	93	33
Sep-12	--	--	--	47	57	59
Oct-12	--	--	--	51	56	54
Nov-12	--	--	--	73	74	59
Dec-12	--	--	--	68	70	55
Jan-13	--	--	--	76	90	58
Feb-13	--	--	--	70	81	61
Mar-13	--	--	--	64	74	66
Max	**135**	**104**	**159**	**139**	**142**	**89**
Min	**34**	**33**	**27**	**46**	**41**	**33**
SD	**32**	**20**	**29**	**23**	**26**	**15**
Average	**80**	**63**	**63**	**78**	**84**	**62**

-- Data not available

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Table 3.4: Monthly Average PM2.5 Values at Stations Located near Mining Areas

Monitoring Month & Year	PM2.5 Concentration Levels (µg/m^3)						
	Bicholim	Codli	Honda	Usgao	Churchorem	Sanguem	Tilamol
Apr-10	--	--	--	--	--	--	--
May-10	--	--	--	--	--	--	--
Jun-10	--	--	--	--	--	--	--
Jul-10	--	--	--	--	--	--	--
Aug-10	--	--	--	--	--	--	--
Sep-10	--	--	--	--	--	--	--
Oct-10	--	--	--	--	--	--	--
Nov-10	17	--	--	--	14	--	--
Dec-10	22	24		76	14	--	--
Jan-11	28	29	23	81	72	--	--
Feb-11	42	33	34	92	49	--	--
Mar-11	72	52	55	62	37	--	--
Apr-11	41	41	44	41	30	--	--
May-11	43	20	26	53	32	--	--
Jun-11	18	20	23	15	19	--	--
Jul-11	19	16	19	44	15	--	--
Aug-11	24	22	26	42	10	--	--
Sep-11	27	21	23	52		--	--
Oct-11	27	24	28	55	31	--	--
Nov-11	47	30	43	55	44	--	--
Dec-11	59	62		51	27	--	--
Jan-12	78	67	54	64	38	--	--
Feb-12	62	65	57	70	48	--	--
Mar-12	60	61	62	55	48	43	54
Apr-12	40	56	58	44	48	42	48
May-12	22	56	58	29	54	38	50
Jun-12	26	17	27	22	18	17	17
Jul-12	22	13	14	25	13	12	15
Aug-12	27	18	18	22	19	16	18
Sep-12	22	26	26	30	31	23	31
Oct-12	35	33	37	30	40	35	40
Nov-12	42	33	37	35	38	30	44
Dec-12	40	35	37	35	43	35	42
Jan-13	--	32	35	36	38	31	43
Feb-13	--	31	35	32	40	33	43
Mar-13	--	20	28	26	40	29	27
Max	78	67	62	92	76	43	54
Min	17	13	14	15	10	12	15
SD	17	17	14	19	17	10	13
Average	37	34	36	46	35	30	36

-- Data not available

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Table 3.5: Monthly Average PM2.5 Values at Stations Located away from Mining Areas

Monitoring Month & Year	PM2.5 Concentration Levels (µg/m³)					
	Panaji	Murmagao	Vasco de gama	Assanora	Amona	Ponda
Apr-10	--	--	--	--	--	--
May-10	--	--	--	--	--	--
Jun-10	--	--	--	--	--	--
Jul-10	--	--	--	--	--	--
Aug-10	--	--	--	--	--	--
Sep-10	--	--	--	--	--	--
Oct-10	--	--	--	--	--	--
Nov-10	--	--	--	--	17	--
Dec-10	--	--	--	--	21	--
Jan-11	--	--	--	23	24	--
Feb-11	--	--	--	34	30	--
Mar-11	--	--	--	55	36	--
Apr-11	--	--	--	44	40	--
May-11	--	--	--	26	29	--
Jun-11	--	--	--	24	25	--
Jul-11	--	--	--	19	19	--
Aug-11	--	--	--	26	21	--
Sep-11	--	--	--	23	23	--
Oct-11	--	--	--	28	33	--
Nov-11	--	--	--	43	37	--
Dec-11	--	--	--	--	--	32
Jan-12	--	--	--	54	67	30
Feb-12	--	--	--	57	52	28
Mar-12	--	--	--	51	58	39
Apr-12	--	--	--	37	51	26
May-12	--	--	--	20	37	24
Jun-12	--	--	--	31	35	23
Jul-12	--	--	--	24	23	22
Aug-12	--	--	--	16	23	19
Sep-12	--	--	--	14	15	29
Oct-12	--	--	--	22	20	27
Nov-12	--	--	--	33	28	33
Dec-12	--	--	--	25	30	31
Jan-13	--	--	--	27	32	29
Feb-13	--	--	--	22	33	28
Mar-13	--	--	--	27	31	31
Max	--	--	--	57	67	39
Min	--	--	--	14	15	19
SD	--	--	--	12	13	5
Average	--	--	--	31	32	28

-- Data not available

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Table 3.6: Monthly Average SO_2 Values at Stations Located near Mining Areas

Monitoring Month & Year	SO_2 Concentration Levels ($\mu g/m^3$)						
	Bicholim	Codli	Honda	Usgao	Churchorem	Sanguem	Tilamol
Apr-10	--	--	--	--	--	--	--
May-10	--	--	--	--	--	--	--
Jun-10	--	--	--	--	--	--	--
Jul-10	--	--	--	--	--	--	--
Aug-10	--	--	--	--	--	--	--
Sep-10	--	--	--	--	--	--	--
Oct-10	--	--	--	--	--	--	--
Nov-10	7	--	--	--	11	--	--
Dec-10	9	9	8	6	56	--	--
Jan-11	15	14	15	6	6	--	--
Feb-11	13	15	16	6	4	--	--
Mar-11	12	14	11	4	6	--	--
Apr-11	13	10	16	10	6	--	--
May-11	9	9	15	10	7	--	--
Jun-11	9	8	12	10	4	--	--
Jul-11	7	7	7	9	6	--	--
Aug-11	7	7	7	9	3	--	--
Sep-11	7	6	7	10	4	--	--
Oct-11	7	8	8	12	4	--	--
Nov-11	9	9	10	10	5	--	--
Dec-11	12	26	25	16	17	--	19
Jan-12	12	27	24	13	19	--	19
Feb-12	13	22	21	12	18	18	17
Mar-12	11	19	19	8	19	19	19
Apr-12	13	17	18	11	17	17	16
May-12	8	15	16	8	16	15	15
Jun-12	8	14	13	7	13	12	13
Jul-12	9	11	12	9	12	12	12
Aug-12	9	12	12	8	13	12	12
Sep-12	10	12	14	10	13	12	13
Oct-12	10	14	12	9	15	14	15
Nov-12	10	12	12	9	14	13	13
Dec-12	9	12	12	9	14	12	13
Jan-13	--	12	12	7	14	12	13
Feb-13	--	12	11	7	13	12	13
Mar-13	--	7	8	7	8	7	7
Max	15	27	25	16	56	19	19
Min	7	6	7	4	3	7	7
SD	2	5	5	2	10	3	3
Average	10	13	13	9	12	13	14

-- Data not available

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NOTARY
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Table 3.7: Monthly Average SO_2 Values at Stations Located away from Mining Areas

Monitoring Month & Year	SO_2 Concentration Levels (µg/m^3)					
	Panaji	Murmagao	Vasco de gama	Assanora	Amona	Ponda
Apr-10	BDL	5	6	--	--	--
May-10	BDL	BDL	BDL	--	--	--
Jun-10	5	8	8	--	--	--
Jul-10	7	7	7	--	--	--
Aug-10	7	8	8	--	--	--
Sep-10	BDL	BDL	4	--	--	--
Oct-10	BDL	10	BDL	--	--	--
Nov-10	BDL	5	BDL	--	--	--
Dec-10	6	7	7	5	13	--
Jan-11	7	9	9	10	13	--
Feb-11	7	5	6	13	14	--
Mar-11	6	7	7	11	11	--
Apr-11	BDL	BDL	BDL	8	12	--
May-11	BDL	BDL	BDL	7	12	--
Jun-11	BDL	BDL	BDL	9	13	--
Jul-11	4	BDL	BDL	7	8	--
Aug-11	4	BDL	BDL	8	8	--
Sep-11	BDL	BDL	BDL	7	7	--
Oct-11	7	BDL	6	8	4	--
Nov-11	BDL	5	6	10	9	--
Dec-11	5	6	5	6	6	11
Jan-12	8	10	11	10	11	11
Feb-12	19	7	6	9	11	12
Mar-12	--	--	--	12	12	9
Apr-12	--	--	--	11	13	10
May-12	--	--	--	12	12	7
Jun-12	--	--	--	10	11	6
Jul-12	--	--	--	8	8	9
Aug-12	--	--	--	8	9	8
Sep-12	--	--	--	7	8	10
Oct-12	--	--	--	8	7	8
Nov-12	--	--	--	9	9	8
Dec-12	--	--	--	9	8	8
Jan-13	--	--	--	10	8	7
Feb-13	--	--	--	9	8	7
Mar-13	--	--	--	7	8	7
Max	19	10	11	13	14	12
Min	BDL	BDL	BDL	5	4	6
SD	5	3	3	2	3	2
Average	5	5	5	9	10	9

-- Data not available

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Table 3.8: Monthly Average NO_2 Values at Stations Located near Mining Areas

Monitoring Month & Year	NO_2 Concentration Levels ($\mu g/m^3$)						
	Bicholim	Codli	Honda	Usgao	Churchorem	Sanguem	Tilamol
Apr-10	--	--	--	--	--	--	--
May-10	--	--	--	--	--	--	--
Jun-10	--	--	--	--	--	--	--
Jul-10	--	--	--	--	--	--	--
Aug-10	--	--	--	--	--	--	--
Sep-10	--	--	--	--	--	--	--
Oct-10	--	--	--	--	--	--	--
Nov-10	10	--	--	--	20	--	--
Dec-10	29	28	25	11	14	--	--
Jan-11	27	25	28	22	14	--	--
Feb-11	20	24	23	17	12	--	--
Mar-11	19	23	17	11	15	--	--
Apr-11	18	15	21	15	13	--	--
May-11	17	13	19	16	15	--	--
Jun-11	15	15	18	15	7	--	--
Jul-11	12	11	12	15	10	--	--
Aug-11	12	12	12	14	10	--	--
Sep-11	11	12	12	14	15	--	--
Oct-11	13	13	14	15	11	--	--
Nov-11	14	14	16	14	14	--	--
Dec-11	18	31	31	24	27	--	26
Jan-12	19	31	31	20	27	--	26
Feb-12	20	28	29	22	24	24	24
Mar-12	19	23	22	14	23	22	22
Apr-12	24	20	21	23	21	20	20
May-12	21	21	21	21	22	21	21
Jun-12	15	20	19	13	19	18	20
Jul-12	20	16	11	18	17	16	16
Aug-12	15	16	17	15	18	17	17
Sep-12	17	16	16	17	17	17	17
Oct-12	17	19	19	15	20	19	19
Nov-12	17	16	16	15	17	16	17
Dec-12	15	16	16	15	17	17	17
Jan-13	--	15	15	12	16	15	15
Feb-13	--	14	14	12	17	15	16
Mar-13	--	12	14	13	14	13	12
Max	29	31	31	24	27	24	26
Min	10	11	11	11	7	13	12
SD	4	6	6	4	5	3	4
Average	18	18	19	16	16	18	19

-- Data not available

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Table 3.9: Monthly Average NO_2 Values at Stations Located away from Mining Areas

Monitoring Month & Year	NO_2 Concentration Levels ($\mu g/m^3$)					
	Panaji	Murmagao	Vasco de gama	Assanora	Amona	Ponda
Apr-10	15	16	17	--	--	--
May-10	10	5	5	--	--	--
Jun-10	11	14	16	--	--	--
Jul-10	16	19	20	--	--	--
Aug-10	14	14	18	--	--	--
Sep-10	10	17	16	--	--	--
Oct-10	14	11	15	--	--	--
Nov-10	21	22	21	--	--	--
Dec-10	28	21	25	16	25	--
Jan-11	25	20	21	19	25	--
Feb-11	18	22	23	21	24	--
Mar-11	19	20	19	17	18	--
Apr-11	12	16	17	12	18	--
May-11	15	14	16	11	16	--
Jun-11	8	9	9	13	17	--
Jul-11	18	19	18	11	11	--
Aug-11	16	15	15	12	14	--
Sep-11	13	12	11	11	12	--
Oct-11	21	18	17	14	13	--
Nov-11	19	31	32	16	14	--
Dec-11	23	24	25	--	--	18
Jan-12	26	31	28	14	14	18
Feb-12	22	25	28	12	14	21
Mar-12	--	--	--	15	15	16
Apr-12	--	--	--	15	16	19
May-12	--	--	--	15	15	19
Jun-12	--	--	--	13	14	12
Jul-12	--	--	--	10	10	15
Aug-12	--	--	--	10	11	15
Sep-12	--	--	--	9	10	16
Oct-12	--	--	--	9	9	14
Nov-12	--	--	--	10	10	14
Dec-12	--	--	--	10	10	13
Jan-13	--	--	--	11	14	13
Feb-13	--	--	--	11	13	12
Mar-13	--	--	--	13	14	13
Max	28	31	32	21	25	21
Min	8	4.5	4.5	9	9	12
SD	6	7	7	3	4	3
Average	17	18	19	13	15	16

-- Data not available

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The CPCB standards for the above pollutants are given in Table 3.10.

Table 3.10 : National Ambient Air Quality Standards
[Central Pollution Control Board (CPCB) Notification: New Delhi, the 18th November 2009]

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial Residential, Rural and other area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulpur Dioxide (SO_2), $\mu g/m^3$	Annual*	50	20	- Improved West and Gaeke
		24 hours**	80	80	- Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 hours**	80	80	- Chemiluminescence
3	Particulate matter (size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual*	60	60	- Gravimetric - TOEM
		24 hours**	100	100	- Beta attenuation
4	Particulate matter (size less than 2.5 µm) or $PM_{2.5}$ $\mu g/m^3$	Annual*	40	40	- Gravimetric - TOEM
		24 hours**	60	60	- Beta attenuation

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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3.2 Climate and Meteorology

Long-term climatological data (1964-1990) for Goa, recorded by India Meteorological Department (IMD) is presented in **Table 3.11**. Monthly variations are depicted through **Figs. 3.10** to **3.12** respectively for temperature, rainfall and number of rainy days.

Table 3.11: Long-term Climatological Data of Goa (1964-1990)

Month	Mean Temperature (°C)		Mean Total Rainfall (mm)	Mean Number of Rainy Days	Mean Number of days with			
	Daily Minimum	Daily Maximum			HAIL	Thunder	FOG	SQUALL
Jan	19.8	31.9	0.0	0.0	0.0	0.0	1.0	0.0
Feb	20.6	31.7	0.1	0.0	0.0	0.0	1.4	0.0
Mar	23.2	32.1	0.6	0.0	0.0	0.4	0.9	0.0
Apr	25.5	33.0	7.2	0.6	0.0	1.6	0.0	0.0
May	26.4	33.3	97.1	3.3	0.0	3.3	0.0	0.0
Jun	24.7	30.4	861.5	22.1	0.0	5.0	0.4	0.1
Jul	24.3	29.0	899.8	22.1	0.0	1.0	0.0	0.1
Aug	24.0	28.8	591.6	23.9	0.0	0.5	0.1	0.0
Sep	23.9	29.7	256.3	13.3	0.0	3.0	0.1	0.0
Oct	23.8	31.7	116.5	5.6	0.0	5.0	0.0	0.0
Nov	22.2	32.9	33.9	2.6	0.0	2.3	0.0	0.0
Dec	20.9	32.6	16.2	0.5	0.0	0.1	0.6	0.0
Annual	23.3	31.4	2880.8	98.0	0.0	22.2	13.5	0.2

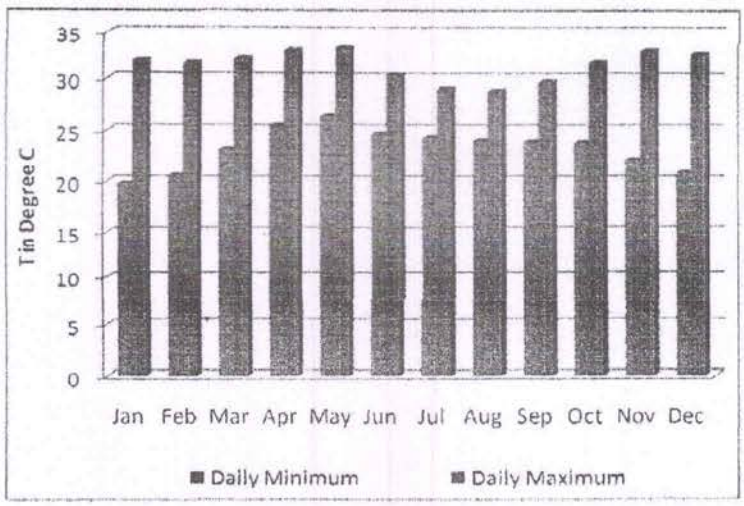


Fig. 3.10: Monthly Variation in Average Daily Minimum and Maximum Temperature of Goa

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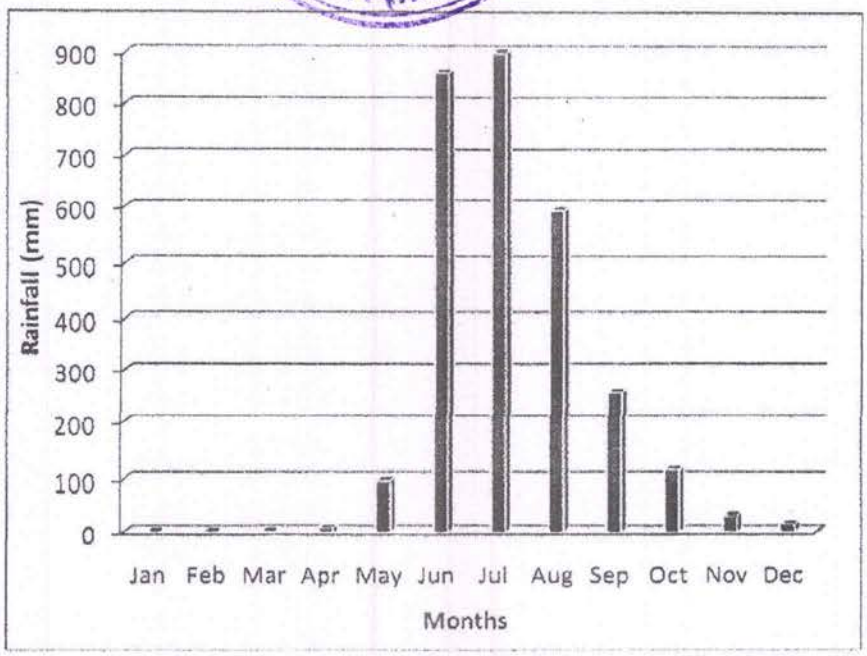


Fig. 3.11: Monthly Average Rainfall over Panaji, Goa (1964-1990)

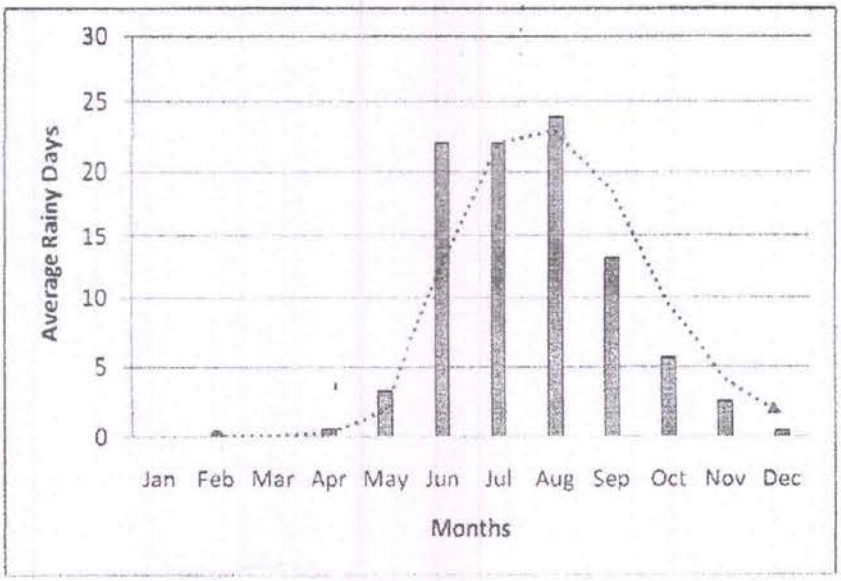


Fig. 3.12: Monthly Variation in Mean Number of Rainy days

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Wind Patterns over Panji (North Goa) and Murmugao (South Goa)

Annual average wind pattern observed at both the met stations are summarized in **Table 3.12** and presented through **Fig. 3.13**. Average annual wind activity over Panaji (or Panjim) (meteorological station at North Goa) shows mainly NE and E direction wind flow with speed varying 1 to 4.5 m/s. Although some high wind activity from SW and West directions are observed with speed 4.5 to 7 m/s mostly during active monsoon period.

Average annual wind activity over Mormugao (meteorological station at South Goa) shows generally NE and ENE direction wind flow with speed varying 1 to 4.5 m/s. Although some high wind activity from SW and WSW directions are observed with speed 7-9 m/s mostly during active monsoon period.

Table 3.12: Summary of Long Term Meteorological Data

Seasons	Wind Speed	Directions	Remarks
Panaji (North Goa)			
Winter (Dec, Jan, Feb)	0.5 to 4.5 m/s	NE, ENE, E	Predominately NE and E with wind speed 1.5 to 4.5 m/s
Summer (Mar, April, May)	0.5 to 4.5 m/s	NE, NNE, N, NW	Majorly N and NE direction with wind speed 1.5 to 4.5 m/s
Monsoon (Jun, Jul, Aug, Sept)	1.5 to 9 m/s	SW, W, WSW	Predominately W direction with Wind speed 7 to 9 m/s.
Post-monsoon (Oct, Nov)	0.5 to 4.5 m/s	E, ENE, NE	Varying from E to NE direction with speed 1.5 to 4.5 m/s
Murmugao (South Goa)			
Winter (Dec, Jan, Feb)	0.5 to 4.5 m/s	NE, ENE, E	Predominately NE and NNE with wind speed 1.5 to 4.5 m/s
Summer (Mar, April, May)	0.5 to 4.5 m/s	NE, NNE, N, NNW	Majorly N and NE direction with wind speed 1.5 to 4.5 m/s
Monsoon (Jun, Jul, Aug, Sept)	1.5 to 11 m/s	SW, W, WSW	Predominately SW direction with Wind speed 4.5 to 7 m/s.
Post-monsoon (Oct, Nov)	0.5 to 4.5 m/s	E, ENE, NE	Varying from E to NE direction with speed 1.5 to 4.5 m/s

Source: Wind atlas (1971-2000) by India Meteorological Department (IMD), Govt. of India.

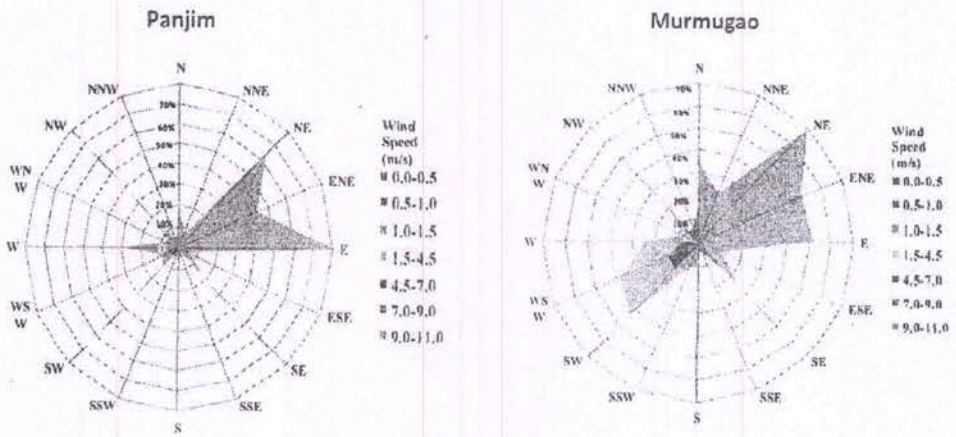


Fig. 3.13: Annual Average Wind Patterns at Panjin and Murmugao

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4.0 Noise Environment

Noise levels data was not available from SPCB. Noise data available from the earlier EIA study carried out by NEERI for M/s Zuari Industries Ltd., Goa has been presented here. Noise was measured at 14 residential locations, 4 commercial locations, 7 near the industries and 10 sensitive zone locations. Thus, in all noise levels were measured at 35 locations during daytime. The details of monitoring locations and measured noise levels are given in Table 4.1.

Table 4.1: Details of Ambient Noise Monitoring Locations with Measured Levels

Sr. No.	Monitoring location	Direction*	Approx. aerial distance* (km)	Measured Noise Level (dBA)
A.	**Residential Area**			
1.	Goa velha	N	7.5	66.6
2.	Sancoele	NNE	2.0	55.5
3.	Mercurium	NNE	7.5	43.2
4.	Zuarinagar	NE	1.0	68.8
5.	Cortalim	E	4.5	50.3
6.	Verna	ESE	8.0	65.5
7.	Cansaulim	SE	5.5	66.1
8.	Velsao	SE	3.0	60.1
9.	Majorda	SE	8.0	54.6
10.	Betalbatim	SSE	9.0	54.3
11.	Mormugao	WNW	6.5	61.6
12.	Vasco-Da-Gama	WNW	6.5	68.4
13.	Chicalim	NW	5.0	42.9
14.	Dabolim	NW	2.5	57.3
B.	**Commercial Area**			
15.	Market, Zuarinagar	NE	1.0	67.6
16.	Market, Cortalim	E	4.5	56.7
17.	Railway station, Cortalim	E	4.5	73.7
18.	Airport, Dabolim	NW	2.0	67.7
C.	**Industrial Area**			
19.	Main Gate, Meta Copper & Alloys Ltd, Zuari Nagar	NE	1.0	54.1
20.	Main Gate, Reliance Power Co. Ltd., Zuari Nagar	NE	1.0	62.0
21.	Main Gate, D-Link (India) Ltd., Verna	ESE	8.0	72.0
22.	Main Gate, Tulip Group Of Companies, Verna	ESE	8.0	57.4
23.	Main Gate, Duraline, Verna	ESE	8.0	62.6
24.	Main Gate, Finolex Cabels Ltd., Verna	ESE	8.0	54.3
25.	Main Gate, Cipla Ltd., Verna	ESE	8.0	68.6

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D.	Sensitive Area			
26.	Goa Medical College & Hospital, Bambolim	N	9.5	56.8
27.	Shanta Durga Higher Secondary School, Sancoale	NNE	2.0	58.9
28.	College Of Arts & Commerce, Zuarinagar	NE	1.0	62.7
29.	St. Lawrence High School, Agassaim	NE	6.5	59.9
30.	Public Health Centre, Cortalim	E	4.5	62.3
31.	Marina English High School, Verna	ESE	8.0	54.9
32.	St. Judes High School, Betalbatim	SSE	9.0	56.4
33.	Port Trust Hospital, Mormugao	WNW	6.5	54.8
34.	Municipal High School, Vasco-Da-Gama	WNW	6.5	62.9
35.	Cottage Hospital, Chicalim	NW	5.0	47.7

** with respect to Zuari Industries Limited.*

Source: EIRA Report of Zuari Industries Limited, Zuarinagar, Goa

The noise levels were found in the range of 42.9-68.8 dBA in the residential areas, 56.7-73.7 dBA in the commercial areas, 54.1-72 dBA in industrial areas and 47.7-62.9 in sensitive area. The noise levels were found to exceed CPCB limits in all the areas. Other than regular human activities, the traffic particularly of goods vehicles is the main contributor to noise in these areas.

Further, primary data collection with respect to specific noise sources will yield better understanding of noise pollution in the area.

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5.0 Water Environment

The state of Goa is divided into two distinct parts - North Goa District and South Goa District as shown in **Fig. 5.1.** The Geographical area of North Goa District is 1,736 sq. km. and South Goa District is 1,966 sq. Km. Administrative Units of North Goa District include 6 Talukas viz. Tiswadi, Bardez, Pernem, Bicholim, Satari, Ponda with average annual rainfall of 2932 mm. Principal rivers in North Goa are Zuari, Mandovi, Bicholim and Chapora. Administrative Division of South Goa District include 5 Talukas (Sanguem, Canacona, Quepem, Salcete, Marmugao) with average annual rainfall of 3110 mm. Principal rivers being Sal and Talpona.



Fig. 5.1: Administrative Units in the State of GOA

Secondary data on water quality of surface and ground water sources in the region was obtained from State Pollution Control Board, Goa and Monitoring of Indian Aquatic Resources (MINARS) for the period 2008-2013. This report presents the water quality scenario based on the recertt year data of 2012-2013.

The distribution of surface and ground water sources and water quality parameters considered in the present study are given in **Table 5.1.**

Table 5.1: Significant Water Bodies in Goa and Water Quality Parameters

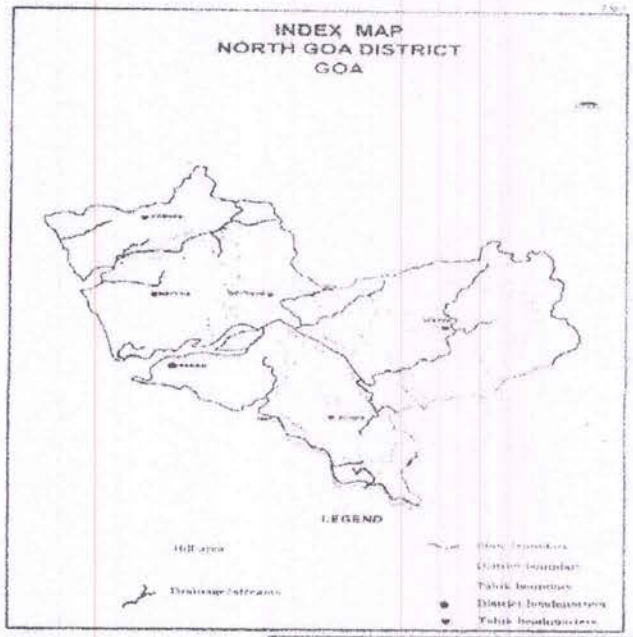
S. No.	Water Body	Numbers	Water Quality Parameters
1	Major Rivers	6	**Physico-chemical**: Temperature, pH, Conductivity, Turbidity, Chloride, Nitrite, Nitrate, Phosphate, Ammonia **Demand Parameters**: DO, BOD, COD **Bacteriological Parameters** :Total Coliform, Faecal Coliform **Metals**: Fe, Cr, Pb, Ni, Cu, Zn, Cd
2	Lakes/Reservoirs	5	
3	Canals	2	
4	Ground Water	9	

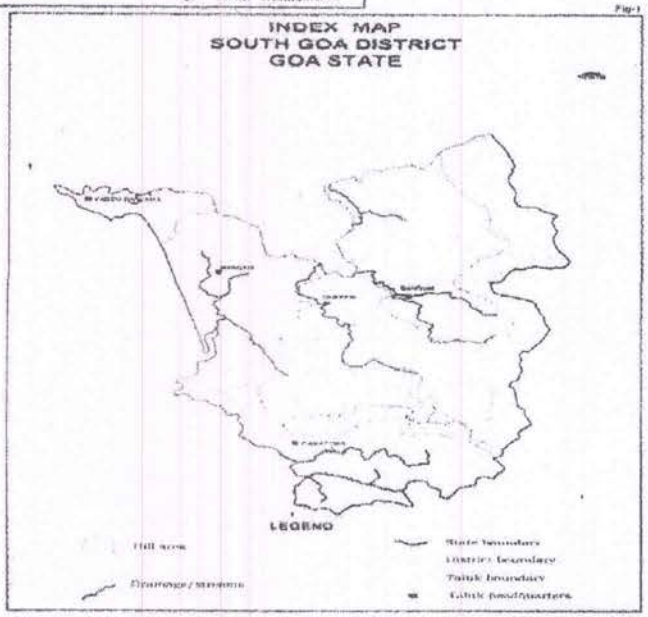
5.1 Surface Water Quality

5.1.1 Rivers

Index map showing rivers of North and South Goa is presented in **Fig. 5.2.** Summary of data availability for various monitoring stations along the river stretches is given in **Table 5.2.** Secondary data on physico-chemical parameters (pH, Turbidity, Conductivity and Chloride) and bacteriological parameters (TC and FC) along with heavy metals (Fe, Ni, Zn, Cr, Cu, Cd, and Pb) was analyzed to ascertain the baseline status of water environment for the year 2012-13.

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Fig. 5.2: Index Map Showing Rivers of North and South Goa

Table 5.2: Summary of Data Availability for Monitoring Stations in Rivers of North and South Goa (2012 - 2013)

Sr. No.	River	Monitoring Station	Data Availability	
			No of months	Months
1	Zuari	Cortalim	3	Apr-12, Feb-13, Mar-13
		Panchawadi	10	Apr-12, Jul-Dec-12, Jan-Mar-13
		Madkai jetty	9	Jul-Dec-12, Jan- Mar-13
		Borim bridge	9	Jul-Dec-12, Jan- Mar-13
2	Mandovi	Panaji	10	Apr-12, Jul-Dec-12, Jan-Mar-13
		Tonca Marcela	10	Apr-12, Jul-Dec-12, Jan-Mar-13
		Iffi Jetty	9	Jul-Dec-12, Jan- Mar-13
		Hotel Mariott	9	Jul-Dec-12, Jan- Mar-13
		Amona	9	Jul-Dec-12, Jan- Mar-13
3	Chapora	Near Alorna Fort, Pernem	12	Apr-Dec-12, Jan-Mar-13
		Near Siolim Bridge	9	Jul-Dec-12, Jan- Mar-13
4	Bicholim	Barazan Nagar, Bicholim	12	Apr-Dec-12, Jan-Mar-13
5	Sal	Mobor	12	Apr-Dec-12, Jan-Mar-13
		Pazorconi, Cuncolim	12	Apr-Dec-12, Jan-Mar-13
		Jackni Band, Navelim	8	Apr-Sep-12, Nov-Dec-12
		Khareband, Margao	11	Apr-Dec-12, Jan-Feb-13
		Orlim Bridge	12	Apr-Dec-12, Jan-Mar-13
		Rumder, Nuvem	12	Apr-Dec-12, Jan-Mar-13
		Mungul, Margao	8	Apr-Sep-12, Nov-Dec-12
6	Talpona	Canacona	10	Apr-12, Jul-Dec-12, Jan-Mar-13

River Zuari

The stretch of river Zuari in the present study covers 4 monitoring stations viz. Cortalim, Panchwadi, Madkai Jetty and Borim Bridge in Goa. The water quality data for the river is presented in **Table 5.3 (a to d)**. Along the stretch of river Zuari, the pH was observed to be in the range of 6.0-7.9, indicating slightly acidic nature of water intermittently. Turbidity was found to be ranging between 0.5 NTU and 90 NTU; maximum being at Madkai Jetty. Conductivity (max) values and Chloride concentrations were found to exceed the permissible limits of class D and E (Classification of Inland Surface Water) as per CPCB guidelines during pre monsoon and post monsoon period. Bacteriological contamination was evident along the stretch of the river.

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Table 5.3a : Water Quality of Zuari River at Cortalim (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	6.9	-	-	-	-	-	-	-	-	-	7.4	7.9	7.4	7.9	6.9	6.5 - 8.5
Temp °C	34	-	-	-	-	-	-	-	-	-	30	32	32	34	30	
Cond.µs/cm	59900	-	-	-	-	-	-	-	-	-	50080	50090	53357	59900	50080	
DO mg/l	6.5	-	-	-	-	-	-	-	-	-	5.4	5.5	5.8	6.5	5.4	4 mg/l or more
Turbd(NTU)	13.4	-	-	-	-	-	-	-	-	-	19.0	8.6	13.7	19.0	8.6	30 NTU
NH_3 mg/l	0.08	-	-	-	-	-	-	-	-	-	0.03	0.04	0.05	0.08	0.03	
N- NO_2 mg/l	0.03	-	-	-	-	-	-	-	-	-	0.01	0.01	0.02	0.03	0.01	
N-NO_3 mg/l	0.05	-	-	-	-	-	-	-	-	-	0.19	0.02	0.09	0.19	0.02	
PO_4 mg/l	0.04	-	-	-	-	-	-	-	-	-	0.03	0.03	0.03	0.04	0.03	
BOD mg/l	2.6	-	-	-	-	-	-	-	-	-	1.0	1.3	1.6	2.6	1.0	3 mg/l or less
COD mg/l	36	-	-	-	-	-	-	-	-	-	32	39	36	39	32	
Cl mg/l	17838	-	-	-	-	-	-	-	-	-	18065	17624	17842	18065	17624	
T.Coliform MPN/100ml	90	-	-	-	-	-	-	-	-	-	1100	780	657	1100	90	
F. Coliform MPN/100ml	NIL	-	-	-	-	-	-	-	-	-	780	450	615	780	450	100 or less MPN/100ml



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Table 5.3b : Water Quality of Zuari River at Panchawadi (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	6.1	-	-	6.0	6.5	7.4	7.0	6.9	6.6	6.7	7.2	6.9	6.7	7.4	6.0	6.5 - 8.5
Temp °C	32	-	-	29	29	30	31	30	28	29	31	33	30	33	28	
Cond. µs/cm	14480	-	-	75	72	285	62	14680	14000	19680	24590	19980	10790	24590	62	
DO mg/l	5.2	-	-	6.3	6.2	6.8	7.3	5.4	4.8	5.7	3.6	3.5	5.4	7.3	3.5	4 mg/l or more
Turbd(NTU)	5.5	-	-	11	14	3.6	3.5	8	21	3.8	4.4	4.6	8.0	21	3.5	30 NTU
NH_3 mg/l	0.02	-	-	0.19	0.07	0.08	0.09	0.03	0.02	0.02	0.03	0.01	0.06	0.19	0.01	
N- NO_2 mg/l	0.02	-	-	0.01	0.01	0.01	0.00	0.02	0.05	0.03	0.06	BDL	0.02	0.06	0.00	
N-NO_3 mg/l	0.08	-	-	0.14	0.08	0.01	0.70	0.06	0.12	0.04	0.10	1.05	0.24	1.05	0.01	
PO_4 mg/l	0.02	-	-	0.01	0.01	0.06	0.01	0.01	0.06	0.01	0.02	0.01	0.02	0.06	0.01	
BOD mg/l	1.9	-	-	0.4	0.6	1.3	1.7	1.8	1.0	1.4	0.2	0.8	1.1	1.9	0.2	3 mg/l or less
COD mg/l	27	-	-	6	1	2	3	16	18	13	24	23	13	27	1	
Cl mg/l	3134	-	-	3	13	64	9	4177	4607	6509	10608	6896	3602	10608	3	
T.Coliform MPN/100ml	155	-	-	4900	13000	2300	4600	1700	<1.8	180	930	780	3172	13000	155	
F. Coliform MPN/100ml	NIL	-	-	200	3300	NIL	1300	400	NIL	180	400	450	890	3300	180	100 or less MPN/100ml

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Table 5.3c : Water Quality of Zuari river at Madkai Jetty (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	-	-	-	6.4	6.4	7.7	7.8	7.6	7.5	7.5	7.5	7.6	7.3	7.8	6.4	6.5 - 8.5
Temp °C	-	-	-	28	29	31	25	31	29	29	31	30	29	31	25	
Cond. µs/cm	-	-	-	181	8520	37600	44000	46000	42900	47240	48900	49800	36127	49800	181	
DO mg/l	-	-	-	6.4	6.1	5.1	4.7	5.3	4.8	5.9	4.5	4.2	5:2	6.4	4.2	4 mg/l or more
Turbd(NTU)	-	-	-	90	11	8	8	18	16	23	15	14	23	90	8	30 NTU
NH_3 mg/l	-	-	-	0.44	0.64	0.07	0.08	0.03	0.04	0.03	0.07	0.05	0.16	0.64	0.03	
N- NO_2 mg/l	-	-	-	0.01	0.01	0.01	0.01	0.02	0.07	0.03	0.01	BDL	0.02	0.07	0.01	
N-NO_3 mg/l	-	-	-	0.02	0.12	0.02	0.02	0.09	0.05	0.04	0.10	0.19	0.07	0.19	0.02	
PO_4 mg/l	-	-	-	0.13	0.02	0.05	0.05	0.04	0.11	0.15	0.04	0.04	0.07	0.15	0.02	
BOD mg/l	-	-	-	0.8	1.5	1.6	1.0	1.3	2.6	1.3	1.0	1.2	1.4	2.6	0.8	3 mg/l or less
COD mg/l	-	-	-	7	8	19	12	22	21	25	34	31	19.9	34	7	
Cl mg/l	-	-	-	58	14	6636	16597	16610	16804	17887	49977	21855	16271	49977	14	
T.Coliform MPN/100ml	-	-	-	4900	7000	1300	450	200	<1.8	<1.8	450	200	2071	7000	200	
F. Coliform MPN/100ml	-	-	-	780	180	780	200	200	NIL	NIL	NIL	200	390	780	180	100 or less MPN/100ml



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Table 5.3d : Water Quality of Zuari river at Borim Bridge (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	-	-	-	6.3	6.8	6.9	7.0	7.3	7.1	7.1	7.3	7.5	7.0	7.5	6.3	6.5 - 8.5
Temp °C	-	-	-	29	29	32	31	31	29	29	31	32	30	32	29	
Cond. µs/cm	-	-	-	251	71	12970	463	29460	30500	32040	37800	38000	20173	38000	71	
DO mg/l	-	-	-	6.1	6.1	5.5	6.0	4.5	4.8	5.4	5.0	3.8	5.2	6.1	3.8	4 mg/l or more
Turbd(NTU)	-	-	-	11	14	11	0.5	19	22	9	5	5	11	22	0.5	30 NTU
NH_3 mg/l	-	-	-	0.13	0.03	0.07	0.04	0.06	0.04	0.03	0.04	0.03	0.05	0.13	0.03	
N- NO_2 mg/l	-	-	-	0.01	0.01	0.01	0.00	0.03	0.09	0.00	0.02	BDL	0.02	0.09	0.00	
N-NO_3 mg/l	-	-	-	0.14	0.07	0.01	0.01	0.08	0.10	0.12	0.03	0.47	0.11	0.47	0.01	
PO_4 mg/l	-	-	-	0.02	0.02	0.03	0.01	0.10	0.08	0.03	0.02	0.02	0.04	0.10	0.01	
BOD mg/l	-	-	-	0.6	0.7	1.3	2.1	1.4	1.6	2.0	1.2	1.0	1.3	2.1	0.6	3 mg/l or less
COD mg/l	-	-	-	6	1	11	15	30	23	24	26	25	18	30	1	
Cl mg/l	-	-	-	11	11	3917	2761	10733	12303	13065	37483	13356	10404	37483	11	
T.Coliform MPN/100ml	-	-	-	1700	12000	35000	780	17000	200	4800	450	1100	8114	35000	200	
F. Coliform MPN/100ml	-	-	-	450	4600	7900	450	11000	200	3400	200	780	3220	11000	200	100 or less MPN/100ml

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River Mandovi

The stretch of river Mandovi covers 5 monitoring stations namely Panaji, Tonca Marcela, Iffi Jetty, Near Hotel Mariott and Amona. The water quality data for the river is presented in **Table 5.4 (a to d).** Along the stretch of river Mandovi, the pH was observed to be in the range of **6.0 - 8.1**, indicating slightly acidic nature of water intermittently. Turbidity was found to be ranging between 2.2 NTU and 55 NTU. Conductivity (max) values and Chloride concentrations were found to exceed the permissible limits of class D and E (Classification of Inland Surface Water) as per CPCB guidelines, almost throughout the year. Bacteriological contamination was evident along the stretch of the river.

River Chapora

For river Chapora, data for two monitoring stations, near Alorna Fort, Pernem and near Siolim Bridge was available (**Table 5.5a & b).** In river Chapora, the pH was observed to be in the range of 6.3 – 8.0, indicating marginally acidic nature of water intermittently. Conductivity (max) values and Chloride concentrations were found to exceed the permissible limits of class D and E (Classification of Inland Surface Water) as per CPCB guidelines during monsoon months near Siolim Bridge while these were within limits for Alorna Fort. Rest of the months, both the stations exhibited high conductivity and chloride values. Bacteriological contamination was evident along the stretch of the river.

River Bicholim

For river Bicholim, data for only one monitoring station Barazan Nagar was available (**Table 5.6).** In river Bicholim, the pH was observed to be in the range of 5.8 -7.3, indicating acidic nature of water intermittently. Turbidity was found to be ranging between 2 NTU and 89 NTU. Conductivity and Chloride values were found to be within the permissible limits of class D and E (Classification of Inland Surface Water) as per CPCB guidelines. Bacteriological contamination was evident in the river.

River Sal

The stretch of river Sal in the present study covers 7 monitoring stations viz. Mobor; Pazorconi, Cuncolim; Jackni Band, Navelim; Khareband, Margao; Orlim Bridge, Rumder, Nuvem and Mungul, Margao. The water quality data for the river is presented through **Table 5.7 (a to g).** Along the stretch of the river, the pH was observed to be in the range of 6.0 -8.0, indicating acidic nature of water intermittently. Conductivity

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Table 5.4a : Water Quality of Mandovi River at Panaji (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	6	-	-	7.3	7.1	7.6	7.4	7.7	8.0	7.9	7.7	7.8	7.4	8.0	6.0	6.5 - 8.5
Temp °C	27	-	-	28	31	31	30	29	29	30	30	27	29	31	27	
Cond. µs/cm	62700	-	-	10500	19380	14180	32500	38100	48100	42400	44760	49300	36192	62700	10500	
DO mg/l	4.6	-	-	6.8	6.0	6.3	5.0	6.0	5.0	6.1	5.4	6.0	5.7	6.8	4.6	4 mg/l or more
Turbd(NTU)	3.8	-	-	12	7	4.8	2.6	2.9	6.7	10.6	5.8	5.5	6.2	12	2.6	30 NTU
NH_3 mg/l	0.05	-	-	0.44	3.32	0.01	0.03	0.01	0.03	0.11	0.07	0.05	0.41	3.32	0.005	
N- NO_2 mg/l	0.02	-	-	0.00	0.02	0.00	0.01	0.01	0.02	0.01	0.03	0.01	0.01	0.03	0.003	
N-NO_3 mg/l	0.10	-	-	0.14	0.10	0.03	0.05	0.04	0.05	0.01	0.20	0.02	0.07	0.20	0.01	
PO_4 mg/l	0.11	-	-	0.04	0.02	0.05	0.02	0.02	0.01	0.04	0.01	0.02	0.03	0.11	0.01	
BOD mg/l	1.95	-	-	2.0	0.6	0.9	1.6	1.6	1.3	1.7	1.5	1.1	1.4	2.0	0.6	3 mg/l or less
COD mg/l	33	-	-	15	11	16	21.84	28.08	14	47	27	29	24.19	47	11	
Cl mg/l	21213	-	-	45	7430	4193	20579	15182	19476	12730	19405	19357	13961	21213	45	
T.Coliform MPN/100ml	145	-	-	13000	4900	680	3300	450	780	200	200	180	2384	13000	145	
F. Coliform MPN/100ml	4	-	-	3300	780	200	1300	200	200	200	NIL	NIL	773	3300	4	100 or less MPN/100ml

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Table 5.4b : Water Quality of Mandovi River at Tonca Marcela (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	6.3	-	-	6.2	6.2	6.8	7.0	7.4	7.1	6.9	6.9	7.2	6.8	7.4	6.2	6.5 - 8.5
Temp °C	28	-	-	27	26	30	30	31	28	29	31	31	29	31	26	
Cond. µs/cm	43400	-	-	235	83	512	4280	70870	25210	35020	37830	40890	25833	70870	83	
DO mg/l	5.20	-	-	6.5	7.0	6.1	5.9	5.3	5.5	5.1	4.2	4.1	5.5	7.0	4.1	4 mg/l or more
Turbd (NTU)	3.9	-	-	27	55	9.7	7.5	2.2	9.2	5.9	5.5	3.9	13	55	2.2	30 NTU
NH_3 mg/l	0.04	-	-	0.38	0.01	0.07	0.05	0.05	0.04	0.03	0.11	0.09	0.09	0.38	0.01	
N- NO_2 mg/l	0.00	-	-	0.03	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.03	0.00	
N-NO_3 mg/l	0.05	-	-	0.16	0.23	0.07	0.08	0.06	0.12	0.89	0.02	0.05	0.17	0.89	0.02	
PO_4 mg/l	0.03	-	-	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.03	0.01	
BOD mg/l	2.26	-	-	0.7	2.4	1.5	0.3	1.1	2.1	1.7	0.9	1.5	1.4	2.4	0.3	3 mg/l or less
COD mg/l	28.00	-	-	6	13	2	12	9	24	22	22	31	17	31	2	
Cl mg/l	12728	-	-	52	41	320	2149	6224	27063	12945	13791	5068	8038	27063	41	
T.Coliform MPN/100ml	4	-	-	4900	22000	7000	4900	1300	450	1300	1300	680	4383	22000	4	
F. Coliform MPN/100ml	NIL	-	-	1100	4700	1700	1100	780	450	450	450	450	1242	4700	450	100 or less MPN/100ml

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Table 5.4c : Water Quality of Mandovi River at IFFI Jetty (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	-	-	-	7.2	7.2	7.9	8.0	7.9	8.1	8.1	7.7	7.8	7.8	8.1	7.2	6.5 - 8.5
Temp °C	-	-	-	29	30	31	31	28	29	30	30	27	29	31	27	
Cond. µs/cm	-	-	-	20270	31100	30200	50800	47000	48600	49840	50480	52820	42346	52820	20270	
DO mg/l	-	-	-	6.8	6.2	6.2	6.0	5.3	6.4	5.7	5.6	5.2	5.9	6.8	5.2	4 mg/l or more
Turbd(NTU)	-	-	-	17	9.2	6.0	8.6	3.4	6.1	9.1	12.4	5.1	8.7	17	3.4	30 NTU
NH_3 mg/l	-	-	-	0.40	0.01	0.00	0.04	0.02	0.02	0.11	0.09	0.05	0.08	0.40	0.00	
N- NO_2 mg/l	-	-	-	0.01	0.03	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.03	0.00	
N-NO_3 mg/l	-	-	-	0.09	0.05	0.04	0.04	0.05	0.02	0.09	0.22	0.02	0.07	0.22	0.02	
PO_4 mg/l	-	-	-	0.04	0.03	0.08	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.08	0.01	
BOD mg/l	-	-	-	1.0	1.2	1.3	1.5	1.5	1.1	1.9	1.6	1.4	1.4	1.9	1.0	3 mg/l or less
COD mg/l	-	-	-	17	19	6	35	28	27	37	32	28	25	37	6	
Cl mg/l	-	-	-	9901	10774	22074	19690	16879	20370	16384	21334	20545	17550	22074	9901	
T.Coliform MPN/100ml	-	-	-	17000	2300	2300	200	1300	4000	1100	450	200	3206	17000	200	
F. Coliform MPN/100ml	-	-	-	2300	1100	NIL	200	780	2100	680	NIL	NIL	1193	2300	200	100 or less MPN/100ml



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Table 5.4d : Water Quality of Mandovi River Near Hotel Mariott (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	-	-	-	7.5	7.2	7.9	8.0	7.9	8.0	8.0	7.7	7.4	7.7	8.0	7.2	6.5 - 8.5
Temp °C	-	-	-	28	31	31	31	29	29	29	29	26	29	31	26	
Cond. µs/cm	-	-	-	24630	31600	32500	50800	47900	48400	42550	49880	52920	42353	52920	24630	
DO mg/l	-	-	-	6.8	6.6	6.3	5.9	5.6	5.5	5.7	5.5	5.5	5.9	6.8	5.5	4 mg/l or more
Turbd(NTU)	-	-	-	16	10	4.8	15	15	5.1	3.6	5.4	4.6	9.0	16	3.6	30 NTU
NH_3 mg/l	-	-	-	0.23	0.03	0.01	0.01	0.04	0.04	0.07	0.06	0.07	0.06	0.23	0.01	
N- NO_2 mg/l	-	-	-	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.01	
N-NO_3 mg/l	-	-	-	0.13	0.07	0.02	0.00	0.04	0.03	0.02	0.20	0.02	0.06	0.20	0.00	
PO_4 mg/l	-	-	-	0.08	0.02	0.10	0.07	0.04	0.02	0.03	0.01	0.03	0.04	0.10	0.01	
BOD mg/l	-	-	-	2.0	1.4	0.8	2.2	1.3	1.3	3.2	1.9	1.7	1.8	3.2	0.8	3 mg/l or less
COD mg/l	-	-	-	12	20	33	42	32	25	41	29	30	29	42	12	
Cl mg/l	-	-	-	3866	15789	10876	17879	20745	20852	18977	23624	21851	17162	23624	3866	
T.Coliform MPN/100ml	-	-	-	17000	3300	3300	<1.8	2300	3300	7900	1700	17000	6975	17000	1700	
F. Coliform MPN/100ml	-	-	-	1700	780	200	NIL	780	1700	3300	1300	11000	2595	11000	200	100 or less MPN/100ml

GOVT. OF GOA (INDIA) NOTARY SUBHASH KRISHNA KANEKAR Regd No. 9/2014 SALCETE (SALCAO) GOA Exp.Dt:28/02/2021

Table 5.4e : Water Quality of Mandovi River at Amona (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	-	-	-	6.3	6.9	7.5	7.0	7.4	7.2	7.7	7.0	6.8	7.1	7.7	6.3	6.5 - 8.5
Temp °C	-	-	-	28	31	29	25	28	28	29	30	27	28	31	25	
Cond. µs/cm	-	-	-	215	146	189	474	6500	19600	22170	27250	33400	12216	33400	146	
DO mg/l	-	-	-	6.6	6.8	6.8	6.6	6.2	5.2	6.7	6.1	5.5	6.3	6.8	5.2	4 mg/l or more
Turbd (NTU)	-	-	-	12	4.3	5.5	8.8	8.2	6.9	6.2	5.5	5.0	6.9	12	4.3	30 NTU
NH_3 mg/l	-	-	-	0.45	0.02	0.02	0.03	0.02	0.04	0.06	0.05	0.08	0.08	0.45	0.02	
N- NO_2 mg/l	-	-	-	0.02	0.00	0.00	0.01	0.01	0.04	0.02	0.06	0.01	0.02	0.06	0.00	
N-NO_3 mg/l	-	-	-	0.08	0.12	0.07	0.07	0.08	0.08	0.05	0.18	0.03	0.09	0.18	0.03	
PO_4 mg/l	-	-	-	0.02	0.01	0.02	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.04	0.01	
BOD mg/l	-	-	-	0.9	0.9	1.2	0.8	2.1	1.7	2.4	1.1	1.3	1.4	2.4	0.8	3 mg/l or less
COD mg/l	-	-	-	1	10	6	8	27	23	38	5	7	14	38	1	
Cl mg/l	-	-	-	6	27	35	283	1980	6935	6129	10365	12945	4301	12945	6	
T.Coliform MPN/100ml	-	-	-	4900	1300	7900	3400	680	<1.8	680	200	400	2433	7900	200	
F. Coliform MPN/100ml	-	-	-	780	200	780	1700	400	NIL	400	NIL	200	637	1700	200	100 or less MPN/100ml

GOVT. OF GOA (INDIA) NOTARY SUBHASH KRISHNA KANEKAR Exp. Dt-28/02/2021 SALCETE, PILUKA MARCELA-GOA Regd. No. 4/74

2778

Table 5.5a : Water Quality of Chapora river Near Alorna Fort, Pernem (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	6.3	7.0	6.9	7.0	6.5	6.4	7.0	7.1	7.0	7.6	7.8	6.7	6.9	7.8	6.3	6-9
Temp 'C	24	32	31	28	27	27	28	27	29	30	28	28	28	32	24	
Cond. µs/cm	6560	2315	70	71	52	56	54	67	5750	7020	109	6550	2389	7020	52	
DO mg/l	5.9	6.8	7.2	6.9	7.4	7.5	7.7	7.2	6.7	7.1	7.3	6.9	7.0	7.7	5.9	4 mg/l or more
Turbd(NTU)	3.1	2.9	6.8	18	13	8.7	2.1	0.7	2.7	2.7	8.01	2.5	6.0	18	0.71	
NH_3 mg/l	0.03	0.09	0.31	0.62	0.04	0.29	0.04	0.08	0.06	0.10	0.00	0.04	0.14	0.62	0.00	
N- NO_2 mg/l	0.03	0.00	0.00	0.01	0.00	0.10	0.00	0.00	0.02	0.00	0.01	0.02	0.02	0.10	0.00	
N-NO_3 mg/l	0.07	0.05	0.01	0.07	0.10	0.00	0.12	0.16	0.10	0.00	0.06	0.04	0.07	0.16	0.00	
PO_4 mg/l	0.05	0.00	0.01	0.01	0.02	0.02	0.04	0.02	0.00	0.07	0.01	BDL	0.02	0.07	0.00	
BOD mg/l	1.6	1.6	1.6	0.1	0.4	0.6	1.6	1.2	1.6	1.1	1.3	2.1	1.2	2.1	0.1	3 mg/l or less
COD mg/l	4	5	10	1	3	5	3	5	4	16	3	9	5.7	16	1	
Cl mg/l	1736	936	990	4	4	4	4	5	1900	1414	13	1378	699	1900	4	
T.Coliform MPN/100ml	165	160	210	7900	3300	1300	4600	1700	2300	2300	1700	2300	2328	7900	160	5000 or less MPN/100ml
F. Coliform MPN/100ml	NIL	7	11	1100	1700	200	2300	1100	1300	1300	780	1300	1009	2300	7	

GOVT. OF GOA NOTARY (INDIA) SUBHASH KRISHNA KANEKAR Regd.No.34/14 Exp.Dt:28/02/2021 MARGAO-GOA SALCETE TALUKA

2779

Table 5.5b : Water Quality of Chapora river Near Siolim Bridge (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	-	-	-	6.6	7.2	7.5	8.0	8.0	8.0	8.0	7.8	7.0	7.6	8.0	6.6	6-9
Temp °C	-	-	-	29	29	29	30	27	30	29	29	32	29	32	27	
Cond. µs/cm	-	-	-	4780	35900	11920	39500	46500	48300	37800	35320	41150	33463	48300	4780	
DO mg/l	-	-	-	6.7	7.0	6.8	5.3	6.7	5.3	5.9	6.4	5.3	6.2	7.0	5.3	4 mg/l or more
Turbd(NTU)	-	-	-	11	4.3	4.1	3.0	2.1	4.9	3.6	3.9	3.7	4.5	11	2.1	
NH_3 mg/l	-	-	-	0.28	0.04	0.08	0.02	0.01	0.02	0.03	0.20	0.07	0.08	0.28	0.01	
N- NO_2 mg/l	-	-	-	0.02	0.00	0.00	0.00	0.01	0.02	0.00	0.01	0.01	0.01	0.02	0.00	
N-NO_3 mg/l	-	-	-	0.11	0.04	0.03	0.02	0.03	0.05	0.01	0.01	0.01	0.03	0.11	0.01	
PO_4 mg/l	-	-	-	0.03	0.02	0.05	0.03	0.01	0.02	0.02	0.01	0.02	0.02	0.05	0.01	
BOD mg/l	-	-	-	1.1	1.6	1.5	1.9	2.2	1.4	1.3	1.9	1.3	1.6	2.2	1.1	3 mg/l or less
COD mg/l	-	-	-	1	20	18	32	29	26	28	29	29	24	32	1	
Cl mg/l	-	-	-	9995	13375	2452	14333	18152	19331	12376	11080	15205	12922	19331	2452	
T.Coliform MPN/100ml	-	-	-	7900	1300	13000	2300	450	1100	200	2200	780	3248	13000	200	5000 or less MPN/100 ml
F. Coliform MPN/100ml	-	-	-	780	NIL	4600	1300	200	450	200	1300	NIL	1261	4600	200	

GOVT. OF GOA (INDIA) NOTARY SUBHASH KRISHNA KANEKAR SALCETE MAJIRA MARGAO-GOA Regd.No. 3A/14 Exp.Dt:28/03/2021

2780

Table 5.6: Water Quality of Bicholim River at Barazan Nagar (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	6.5	7.0	6.5	5.8	6.0	6.1	6.5	7.1	7.0	7.3	7.1	6.9	6.6	7.3	5.8	6-9
Temp °C	34	33	26	28	29	28	29	31	31	28	30	30	30	34	26	
Cond. µs/cm	204	175	69	62	74	80	95	87	110	156	181	149	120	204	62	
DO mg/l	7.8	7.8	6.3	6.2	6.7	6.8	6.7	6.9	8.6	7.0	7.5	6.1	7.0	8.6	6.1	4 mg/l or more
Turbd(NTU)	7.6	5.4	88	76	9.5	5.4	4.7	1.9	3.1	5.8	3.3	3.2	18	88	1.9	
NH_3 mg/l	0.06	0.11	1.27	1.14	1.74	0.01	0.07	0.02	0.01	0.07	0.13	0.03	0.39	1.74	0.01	
N- NO_2 mg/l	0.01	0.01	0.04	0.02	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.04	0.00	
N-NO_3 mg/l	0.37	0.20	1.21	0.34	0.45	0.35	0.25	0.26	1.30	0.37	0.30	0.21	0.47	1.30	0.20	
PO_4 mg/l	0.05	0.15	0.15	0.14	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.05	0.15	0.00	
BOD mg/l	2.3	3.9	1.4	1.8	2.3	2.0	0.5	2.5	1.6	1.6	1.5	0.5	1.8	3.9	0.5	3 mg/l or less
COD mg/l	8	4	4	6	3	8	7	6	6	13	9	11	7.08	13	3	
Cl mg/l	11	8	8	4	6	3	7	7	11	10	20	4	8	20	3	
T.Coliform MPN/100ml	175	145	35000	22000	22000	35000	7900	15000	13000	21000	13000	1300	15460	35000	145	5000 or less MPN/100 ml
F. Coliform MPN/100ml	7	1	24000	11000	3300	2600	2300	1700	7900	14000	4900	7900	6634	24000	1	

GOVT. OF GOA (INDIA) NOTARY SUBHASH KRISHNA KANEKAR Exp.Dt:28/02/2021 Regd.No.3/14 MARGAO-GOA

2781

Table 5.7a : Water Quality of Sal River at Mobor (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	8.0	7.0	7.5	6.9	7.4	7.6	7.9	8.0	7.7	8.0	7.7	8.0	7.6	8.0	6.9	6.5 - 8.5
Temp °C	27	32	32	28	29	29	32	31	31	30	31	32	30	32	27	
Cond. µs/cm	62700	54000	42100	10870	27430	10510	31000	50600	41300	46800	46700	47740	39313	62700	10510	
DO mg/l	5.2	5.9	5.5	5.2	6.4	5.4	6.7	5.4	6.5	4.7	5.0	5.7	5.6	6.7	4.7	4 mg/l or more
Turbd(NTU)	3.1	8.1	17	110	11	7.0	2.2	1.8	3.0	21	98	2.7	23	110	1.8	30 NTU
NH_3 mg/l	0.05	0.04	1.01	1.89	0.02	0.12	0.04	0.05	0.02	0.19	0.18	0.02	0.30	1.89	0.02	
N- NO_2 mg/l	0.01	0.01	0.02	0.10	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.02	0.10	0.00	
N-NO_3 mg/l	0.10	0.00	0.05	0.08	0.31	0.26	0.03	0.08	0.04	0.04	0.03	0.04	0.09	0.31	0.00	
PO_4 mg/l	0.09	0.07	0.14	0.19	0.10	0.06	0.03	0.00	0.03	0.07	0.28	0.03	0.09	0.28	0.00	
BOD mg/l	1.9	1.8	1.5	0.9	1.5	1.4	1.2	1.6	1.8	3.4	2.6	0.8	1.7	3.4	0.8	3 mg/l or less
COD mg/l	63	18	23	9	22	9	24	38	14	19	22	36	25	63	9	
Cl mg/l	15910	19747	18859	3772	8406	3322	19481	20180	17916	18388	10137	15794	14326	20180	3322	
T.Coliform MPN/100ml	145	155	145	4900	4900	4900	3300	1100	1100	3900	13000	200	3145	13000	145	
F. Coliform MPN/100ml	4	4	4	3900	1700	1700	450	450	450	1400	7900	200	1514	7900	4	100 or less MPN/100 ml

GOVT. OF GOA (INDIA) NOTARY SUBHASH KRISHNA KANEKAR

2782

Table 5.7b : Water Quality of Sal River at Pazorconi, Cuncolim (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	7.8	6.5	6.5	5.9	6.9	7.0	6.8	6.9	7.4	6.8	6.9	7.1	6.9	7.8	5.9	6.5 - 8.5
Temp °C	24	30	31	26	29	29	30	29	29	26	29	29	28	31	24	
Cond. µs/cm	90	71	100	42	82	10540	75	60	70	88	94	64	948	10540	42	
DO mg/l	5.2	5.2	6.0	6.3	6.7	6.9	6.4	6.4	6.5	4.7	7.2	5.8	6.1	7.2	4.7	4 mg/l or more
Turbd(NTU)	7.3	10	18	41	8.2	6.8	10	4.7	12	9.3	9.1	7.2	12	41	4.7	30 NTU
NH_3 mg/l	0.03	0.04	0.56	0.57	0.03	0.03	0.05	0.02	0.05	0.04	0.06	0.03	0.12	0.57	0.02	
N- NO_2 mg/l	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.00	
N-NO_3 mg/l	0.09	0.03	0.17	0.16	0.34	0.27	0.19	0.25	0.23	0.20	0.14	0.08	0.18	0.34	0.03	
PO_4 mg/l	0.05	0.02	0.03	0.00	0.02	0.02	0.02	0.02	0.03	0.03	0.07	0.01	0.03	0.07	0.00	
BOD mg/l	2.9	1.8	1.4	0.9	0.5	0.8	2.3	0.5	2.3	2.8	2.8	1.3	1.7	2.9	0.5	3 mg/l or less
COD mg/l	22	2	6	14	3	1	4	9.4	11	8	12	4	8.0	22	1	
Cl mg/l	675	468	2735	3	7	47	8	8	9	9	8	6	332	2735	3	
T.Coliform MPN/100ml	160	165	210	7900	7900	1700	7900	4900	4600	1700	4900	6300	4028	7900	160	
F. Coliform MPN/100ml	4	4	9	1700	200	450	3300	2300	1700	680	2300	2300	1246	3300	4	100 or less MPN/100 ml

NOTARY GOVT. OF GOA (INDIA) SUBHASH KRISHNA KANEKAR SALCETE GOA-403 604 Exp. Dt: 28/02/2027

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Table 5.7c : Water Quality of Sal River at Jackni Band, Navelim (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	6.0	7.0	6.4	6.3	6.2	6.6	-	6.6	7.2	Not sampled	-	-	6.5	7.2	6.0	6.5 - 8.5
Temp °C	24	29	30	30	29	29	-	30	27		-	-	29	30	24	
Cond. µs/cm	888	1726	209	141	111	124	-	157	296		-	-	457	1726	111	
DO mg/l	0.7	0.7	2.0	5.2	5.7	5.7	-	3.1	4.2		-	-	3.4	5.7	0.7	4 mg/l or more
Turbd (NTU)	5.2	6.4	4.5	11	9.6	7.1	-	1.9	9.1		-	-	6.8	11	1.9	30 NTU
NH_3 mg/l	0.97	2.32	0.25	1.40	0.06	0.11	-	2.58	0.03		-	-	0.96	2.58	0.03	-
N- NO_2 mg/l	0.02	0.01	0.00	0.04	0.01	0.01	-	0.03	0.02		-	-	0.02	0.04	0.00	.
N-NO_3 mg/l	0.18	0.11	0.69	1.14	0.70	0.80	-	0.90	0.35		-	-	0.61	1.14	0.11	
PO_4 mg/l	0.03	0.06	0.02	0.06	0.03	0.04	-	0.01	0.04		-	-	0.04	0.06	0.01	
BOD mg/l	7.4	7.0	1.0	1.7	1.3	1.3	-	1.3	3.5		-	-	3.1	7.4	1.0	3 mg/l or less
COD mg/l	24	16	3	4	8	7	-	5	7		-	-	9.3	24	3	
Cl mg/l	337	47	943	15	11	14	-	21	25		-	-	177	943	11	
T.Coliform MPN/100ml	80	210	240	4900	11000	17000	-	13000	12000		-	-	7304	17000	80	
F. Coliform MPN/100ml	NIL	14	15	NIL	2200	780	-	3400	6300		-	-	2118	6300	14	100 or less MPN/100 ml

GOVT. OF GOA NOTARY SUBHASH KRISHNA KAMEKAR SALCETE TALUKA GOA (INDIA) Regd. No. 44/14 Exp. Dt: 28/02/2027

Table 5.7d : Water Quality of Sal River at Khareband, Margao (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	6.2	7.0	6.8	6.8	6.1	6.6	6.6	6.6	6.2	7.0	6.4	sample was not collected since the river had dried up and water was black in colour with foul smell .	6.6	7.0	6.1	6.5 - 8.5
Temp °C	26	31	30	30	30	29	31	31	29	27	29		29	31	26	
Cond. µs/cm	431	357	192	192	92	105	147	322	388	1067	1264		414	1264	92	
DO mg/l	0	0	0.8	2.7	4.6	4.5	2	0	0.5	0	0		1.4	4.6	0.0	4 mg/l or more
Turbd(NTU)	16	28	24	11	9.5	8.0	10	6.1	16	14	13		14	28	6.1	30 NTU
NH_3 mg/l	5.58	2.94	2.24	1.80	0.20	0.15	0.29	7.97	0.08	3.33	10.33		3.17	10.33	0.08	
$N\text{-}NO_2$ mg/l	0.01	0.02	0.04	2.20	0.03	0.12	0.03	0.01	0.01	0.00	0.02		0.23	2.20	0.00	
$N\text{-}NO_3$ mg/l	0.02	0.05	0.10	0.01	0.42	0.47	0.33	0.13	0.03	0.01	0.04		0.15	0.47	0.01	
PO_4 mg/l	1.86	0.89	0.14	0.08	0.09	0.04	0.89	0.09	0.35	0.64	0.59		0.51	1.86	0.04	
BOD mg/l	15.0	12.0	3.3	2.2	1.8	1.9	5.8	6.4	10.6	8.1	7.9		6.8	15.0	1.8	3 mg/l or less
COD mg/l	34	23	14	13	14	3	18	32	28	40	36		23.182	40	3	
Cl mg/l	96	94	2263	12	9	58	64	42	27	233	300		291	2263	9	
T.Coliform MPN/100ml	225	125	240	3300	13000	17000	22000	17000	13000	22000	22000		11808	22000	125	
F. Coliform MPN/100ml	12	NIL	15	NIL	2200	7900	14000	7900	7900	1700	17000		6514	17000	12	100 or less MPN/100 ml

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Table 5.7e : Water Quality of Sal River at Orlim Bridge (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	6.8	8.0	7.9	6.4	6.3	6.7	7.1	7.0	7.2	7.7	7.2	7.4	7.1	8.0	6.3	6.5 - 8.5
Temp °C	28	34	32	32	30	31	31	33	30	30	30	32	31	34	28	
Cond. µs/cm	43100	26400	17970	398	158.7	624	10020	17740	30900	38000	42580	36980	22073	43100	158.7	
DO mg/l	6.2	5.5	12.0	3.3	4.3	4.4	4.6	3.1	4.4	4.9	5.7	4.7	5.3	12.0	3.1	4 mg/l or more
Turbd(NTU)	4.8	12	12	11	8.6	7.6	5.6	0.9	5.2	4.5	5.6	4.8	7.0	12	0.9	30 NTU
NH_3 mg/l	0.05	3.90	0.23	0.87	0.19	0.09	0.18	0.12	0.09	0.07	0.03	0.14	0.50	3.90	0.03	
N- NO_2 mg/l	0.01	0.01	0.01	0.05	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.05	0.01	
N-NO_3 mg/l	0.04	0.07	0.03	0.34	0.41	0.38	0.18	0.33	0.25	0.04	0.17	0.04	0.19	0.41	0.03	
PO_4 mg/l	0.06	0.03	0.04	0.06	0.04	0.05	0.97	0.01	0.02	0.02	0.03	0.04	0.11	0.97	0.01	
BOD mg/l	2.0	2.2	6.2	2.4	1.0	1.6	2.3	3.1	2.5	12.0	2.4	2.6	3.4	12.0	1.0	3 mg/l or less
COD mg/l	45	13	26	7	10	20	12	21	21	31	35	42	24	45	7	
Cl mg/l	11378	468	9147	94	25	142	468	5894	7072	12872	14790	12208	6213	14790	25	
T.Coliform MPN/100ml	150	150	165	2100	3300	4900	1300	1400	680	200	<1.8	450	1345	4900	150	
F. Coliform MPN/100ml	4	7	7	180	1100	1100	1100	610	NIL	200	NIL	200	451	1100	4	100 or less MPN/100 ml

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Table 5.7f : Water Quality of Sal River at Rumder, Nuvem (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	6.1	7.0	6.3	6.6	6.1	6.5	6.5	6.6	6.7	7.4	7.2	6.9	6.7	7.4	6.1	6.5 - 8.5
Temp °C	28	34	31	30	29	29	30	32	30	29	30	32	30	34	28	
Cond. µs/cm	194	192	111	86	81	73	87	99	115	133	131	150	121	194	73	
DO mg/l	0	0	5.2	5.3	5.6	6.1	5.8	4.7	3.7	3	3.6	4.3	3.9	6.1	0	4 mg/l or more
Turbd(NTU)	16	29	41	13	11	13	19	0.8	20	15	10	4.9	16	41	0.8	30 NTU
NH_3 mg/l	1.51	0.09	0.98	0.90	0.08	0.06	0.04	0.10	0.06	0.86	0.08	0.50	0.44	1.51	0.04	
N- NO_2 mg/l	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.00	0.01	0.00	0.00	0.01	0.01	0.02	0.00	
N-NO_3 mg/l	0.01	0.00	0.26	0.51	0.51	0.42	0.02	0.01	0.01	0.00	0.06	0.02	0.15	0.51	0.00	
PO_4 mg/l	0.02	0.09	0.11	0.06	0.03	0.03	1.13	0.01	0.02	0.18	0.01	0.01	0.14	1.13	0.01	
BOD mg/l	30.0	22.0	2.9	1.2	1.7	1.3	2.8	3.4	3.2	1.9	2.7	2.5	6.3	30.0	1.2	3 mg/l or less
COD mg/l	70	48	10	18	4	5	9	15	15	30	25	39	24	70	4	
Cl mg/l	41	29	117	9	9	9	12	13	17	15	14	24	26	117	9	
T.Coliform MPN/100ml	210	175	240	9400	4900	17000	4900	4600	4900	1300	2300	450	4198	17000	175	
F. Coliform MPN/100ml	11	14	11	180	780	4600	3300	2300	1700	780	1300	450	1286	4600	11	100 or less MPN/100 ml

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Table 5.7g : Water Quality of Sal River at Mungul, Margao (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	8.0	7.0	6.0	6.2	6.1	6.5	-	6.6	6.9	Not sampled	-	-	6.4	8.0	6.0	6.5 - 8.5
Temp °C	29	34	30	30	30	29	-	31	28		-	-	30	34	28	
Cond. µs/cm	462	26400	221	120	83	86	-	274	269		-	-	3489	26400	83	
DO mg/l	0	0	1.6	4.3	5.2	5	-	1.9	1.7		-	-	2.5	5.2	0	4 mg/l or more
Turbd(NTU)	14	12	23	13	9.7	10	-	6.9	8.4		-	-	12	23	6.9	30 NTU
NH_3 mg/l	5.52	BDL	3.47	2.78	0.11	0.10	-	8.99	0.06		-	-	3.00	8.99	0.06	
N- NO_2 mg/l	0.01	0.01	0.08	0.06	0.02	0.01	-	0.01	0.02		-	-	0.03	0.08	0.01	
N-NO_3 mg/l	0.00	0.02	0.39	0.67	0.38	0.39	-	0.05	0.04		-	-	0.24	0.67	0.00	
PO_4 mg/l	0.22	0.01	0.13	0.08	0.08	0.04	-	0.12	0.17		-	-	0.11	0.22	0.01	
BOD mg/l	10.0	10.0	1.1	1.8	1.4	1.3	-	15.0	3.5		-	-	5.5	15.0	1.1	3 mg/l or less
COD mg/l	25	18	14	7	4	3	-	30	25		-	-	16	30	3	
Cl mg/l	48	374	943	12	9	11	-	31	36		-	-	183	943	9	
T.Coliform MPN/100ml	20	170	175	7900	11000	21000	-	21000	11000		-	-	9033	21000	20	
F. Coliform MPN/100ml	6	BDL	3	3	0	0	-	9	0		-	-	3	9	0	100 or less MPN/100 ml

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values were found to exceed the permissible limits of class D and E (Classification of Inland Surface Water) as per CPCB guidelines at stations Mobor and Orlim Bridge. Chloride concentrations were found to exceed the permissible limits at Mobor throughout the year. Bacteriological contamination was evident along the stretch of the river.

River Talpona

For river Talpona, data for only one monitoring station i.e. Canacona was available (**Table 5.8**). The pH was observed to be in the range of 6.1 -8.3, indicating acidic nature of water intermittently. Turbidity was found to be ranging between 0.24 NTU and 32 NTU. Bacteriological contamination was evident in the river intermittently.

Data for concentrations of metals for the above mentioned rivers during April 2012 is presented in **Table 5.9.** In rivers Zuari and Mandovi, Fe and Pb concentrations were found to exceed class A criteria (CPCB classification), whereas, either Fe or Pb concentrations were found to exceed class A criteria (CPCB classification) in rivers Chapora; Bicholim, Sal and Talpona.

Canals/Lakes/Reservoirs

Summary of data availability for various monitoring stations for Canals/Lakes/ Reservoirs is given in **Table 5.10.**

The water quality data of Canals/Lakes/Reservoirs is given in **Table 5.11.**

The pH at Cumbharjua canal at Corlim was found to range between 5.5 and 7.5, exhibits acidic nature of canal water during monsoon months. The values of conductivity were mostly found to exceed the permissible limits of class D and E (Classification of Inland Surface Water) as per CPCB guidelines in almost all the months except May and Aug-Oct. Chlorides concentrations were found to exceed the permissible limits except for the period July to October, 2012. Bacteriological contamination was evident in the canal.

The water quality data for upstream and downstream of agricultural canal at Cuncolim Industrial Estate (Table 5.11) is available only for four months. At the upstream of the canal pH was found to be in the range of 5.9-7.1, whereas it was found to range between 6.1 and 7.4 in the downstream of the canal. Bacteriological contamination was evident in the canal.

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Table 5.8a : Water Quality of Talpona River at Canacona (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	8.3	-	-	6.1	7.0	7.1	6.8	7.2	6.5	6.9	6.9	7.0	7.0	8.3	6.1	6-9
Temp °C	27	-	-	28	27	28	30	31	30	29	29	33	29	33	27	
Cond. µs/cm	93	-	-	48	50	46	45	40	43	57	63	73	56	93	40	-
DO mg/l	6.5	-	-	7.1	7.3	7.3	6.8	7.5	7.3	5.9	6.4	5.6	6.8	7.5	5.6	4 mg/l or more
Turbd(NTU)	3.3	-	-	32	15	5.5	1.4	0.2	1.3	2.8	2.5	2.8	6.7	32	0.2	
NH_3 mg/l	0.04	-	-	0.22	0.07	0.00	0.03	0.00	0.02	0.01	0.02	0.04	0.05	0.22	0.00	
N^-NO_2 mg/l	0.01	-	-	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	BDL	0.00	0.01	0.00	
$N\text{-}NO_3$ mg/l	0.07	-	-	0.25	0.25	0.09	0.85	0.02	0.01	0.03	0.34	0.01	0.19	0.85	0.01	
PO_4 mg/l	0.07	-	-	0.04	0.02	0.01	0.01	0.05	0.01	0.06	0.01	0.02	0.03	0.07	0.01	
BOD mg/l	2.3	-	-	0.6	0.8	0.9	0.3	0.2	0.8	0.6	1.0	1.4	0.9	2.3	0.2	3 mg/l or less
COD mg/l	8	-	-	1	12	4	2	9.4	5	7	4	13	6.5	13	1	
Cl mg/l	9	-	-	3	3	7	2	8	2	5	2	6	5	9	2	
T.Coliform MPN/100ml	185	-	-	7000	7000	4900	450	780	1100	680	450	180	2273	7000	180	5000 or less MPN/100ml
F. Coliform MPN/100ml	7	-	-	2300	780	780	200	200	400	450	200	NIL	591	2300	7	

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Table 5.9 : Metal Concentrations in Rivers (April 2012)

S.No.	River / Station	Concentration (mg/l)						
		Fe	Ni	Cu	Zn	Cd	Cr	Pb
1	**Zuari**							
	Cortalim	1.633	0.187	0.092	0.06	0.067	0.044	0.184
	Panchawadi	0.732	0.064	0.059	0.052	0.051	ND	0.047
2	**Mandovi**							
	Panaji	0.911	0.227	0.096	0.062	0.085	0.097	0.38
	Tonca Marcela	1.447	0.386	0.108	0.068	0.128	0.152	0.446
3	**Bicholim**							
	Barazan Nagar	2.7		0.04	0.23	0.03		
4	**Chapora**							
	Alorna Fort	0.241	0.061	0.044	0.023	0.033	ND	0.135
5	**Sal**							
	Mobor	0.809	0.329	0.191	0.052	0.101	0.166	0.267
	Pazorconi Cuncolim	2.813		0.124	0.172	0.027		
	Jakani Band	0.928	ND	0.045	0.073	0.038	ND	ND
	Khareband	1.514	ND	0.043	0.012	0.04	ND	ND
	Orlim	0.569	0.123	0.073	0.04	0.052	ND	ND
	Rumder Nuvem	5.527	ND	0.045	0.054	0.037	ND	ND
	Mungal	6.221	ND	0.042	0.079	ND	ND	ND
6	**Talpona**							
	Canacona	4.005		0.037	0.053	0.03		
CPCB Standards		**0.3**		**1.5**	**1.5**			**0.1**

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Table 5.10: Summary of Data Availability for Monitoring Stations of Canals/Lakes/Reservoirs of North and South Goa (2012 - 2013)

Sr. No.	Source	Monitoring Station	Data Availability	
			No of months	Months
1	Canal	Cumbharjua at Corlim	12	Apr-Dec-12, Jan-Mar-13
		Upstream of Cuncolim Industrial Estate	3	Apr-12, Jan-Feb-13
		Downstream of Cuncolim Industrial Estate	4	Apr-12, Oct-12, Jan-Feb-13
2	Lakes	Mayem	12	Apr-Dec-12, Jan-Mar-13
		Raia	9	Jul-Dec-12, Jan- Mar-13
		Saipem at Navelim	7	Jul-Dec-12, Jan-13
		Curtorim at Curtorim	9	Jul-Dec-12, Jan- Mar-13
3	Reservoir	Salaulim at Sanguem	12	Apr-Dec-12, Jan-Mar-13

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Table 5.11a : Water Quality of Canals, Lakes, Reservoirs - Cumbharjua Canal at Corlim (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	6.6	7.3	5.6	5.6	5.5	6.3	6.5	7.1	7.1	7.5	6.9	7.2	6.6	7.5	5.5	6.5 - 8.5
Temp °C	33	32	26	29	29	29	32	32	31	30	31	30	30	33	26	
Cond. µs/cm	54000	48	6200	1313	285	190	315	27690	32900	42600	42610	47400	21295	54000	48	
DO mg/l	5.5	5.6	5.4	5.9	5.4	5.2	6.7	3.5	3.3	4.7	4.5	5.0	5.1	6.7	3.3	4 mg/l or more
Turbd(NTU)	8.4	13.8	9.1	5.2	3.6	11.5	15.6	2.3	3.6	11.6	10.4	14.9	9.2	15.6	2.3	30 NTU
NH_3 mg/l	0.05	0.07	0.93	0.71	0.03	0.08	0.06	0.10	0.15	0.15	0.16	0.07	0.21	0.93	0.03	
N- NO_2 mg/l	0.04	0.01	0.02	0.00	0.00	0.01	0.01	0.09	0.03	0.00	0.02	0.01	0.02	0.09	0.00	
N-NO_3 mg/l	0.08	0.01	0.31	0.08	0.17	0.33	0.01	0.11	0.14	0.08	0.05	0.03	0.12	0.33	0.01	
PO_4 mg/l	0.06	0.05	0.02	0.01	0.01	0.04	0.03	0.01	0.03	0.07	0.04	0.05	0.03	0.07	0.01	
BOD mg/l	2.9	4.3	1.0	1.1	0.6	1.9	1.5	1.8	2.5	3.5	1.7	1.9	2.1	4.3	0.6	3 mg/l or less
COD mg/l	46.0	27.0	16.0	10.0	5.0	4.0	22.0	4.0	22.0	27.0	14.0	25.0	18.5	46.0	4.0	
Cl mg/l	18802	17080	6129	1.9	46	4.2	922	2593	13443	15182	15040	15438	8724	18802	1.9	
T.Coliform MPN/100ml	165	15	5400	1100	1700	13000	200	4900	4900	200	180	450	2684	13000	15	
F. Coliform MPN/100ml	4	NIL	2200	NIL	450	2600	NIL	930	1300	200	180	450	924	2600	4	100 or less MPN/100ml

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Table 5.11b : Water Quality of Canals, Lakes, Reservoirs - Agricultural Canal Upstream Of Cuncolim Industrial Estate (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	5.9	-	-	-	-	-	-	-	-	6.9	7.1	-	6.6	7.1	5.9	6.5 - 8.5
Temp °C	34	-	-	-	-	-	-	-	-	28	30	-	31	34	28	-
Cond. µs/cm	61	-	-	-	-	-	-	-	-	51	51	-	54	61	51	-
DO mg/l	7.5	-	-	-	-	-	-	-	-	6.2	7.5	-	7.1	7.5	6.2	-
Turbd(NTU)	1.9	-	-	-	-	-	-	-	-	1.3	1.9	-	1.7	1.9	1.3	-
NH_3 mg/l	0.00	-	-	-	-	-	-	-	-	0.02	0.11	-	0.04	0.11	0.00	-
N-NO_2 mg/l	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	0.00	0.00	0.00	-
N-NO_3 mg/l	0.05	-	-	-	-	-	-	-	-	0.08	0.01	-	0.05	0.08	0.01	-
PO_4 mg/l	0.01	-	-	-	-	-	-	-	-	0.05	0.01	-	0.02	0.05	0.01	-
BOD mg/l	1.6	-	-	-	-	-	-	-	-	1.0	0.9	-	1.2	1.6	0.9	-
COD mg/l	21.0	-	-	-	-	-	-	-	-	11.0	6.0	-	12.7	21.0	6.0	-
Cl mg/l	14	-	-	-	-	-	-	-	-	2	4	-	7	14	2	-
T.Coliform MPN/100ml	150	-	-	-	-	-	-	-	-	4600	3400	-	2717	4600	150	-
F. Coliform MPN/100ml	7	-	-	-	-	-	-	-	-	360	2200	-	856	2200	7	-



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Table 5.11c : Water Quality of Canals, Lakes, Reservoirs - Agricultural Canal Downstream Of Cuncolim Industrial Estate (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	6.1	-	-	-	-	-	6.5	-	-	7.1	7.4	-	6.8	7.4	6.1	6.5-8.5
Temp °C	34	-	-	-	-	-	29	-	-	29	30	-	31	34	29	
Cond. µs/cm	156	-	-	-	-	-	663	-	-	56	57	-	233	663	56	Max 2250 µs/cm
DO mg/l	8.1	-	-	-	-	-	5.0	-	-	7.1	7.2	-	6.9	8.1	5.0	
Turbd(NTU)	26.0	-	-	-	-	-	0.8	-	-	2.2	2.4	-	7.8	26.0	0.8	
NH_3 mg/l	0.48	-	-	-	-	-	0.31	-	-	0.01	0.11	-	0.23	0.48	0.01	
N- NO_2 mg/l	0.01	-	-	-	-	- -	0.00	-	-	0.00	0.00	-	0.01	0.01	0.00	
N-NO_3 mg/l	0.09	-	-	-	-	-	0.73	-	-	0.04	0.02	-	0.22	0.73	0.02	
PO_4 mg/l	0.02	-	-	-	-	-	0.03	-	-	0.10	0.02	-	0.04	0.10	0.02	
BOD mg/l	2.1	-	-	-	-	-	1.2	-	-	1.3	1.9	-	1.6	2.1	1.2	
COD mg/l	52.0	-	-	-	-	-	3.0	-	-	19.0	7.0	-	20.3	52.0	3.0	
Cl mg/l	28	-	-	-	-	-	47	-	-	2.4	6	-	21	47	2.4	
T.Coliform MPN/100ml	120	-	-	-	-	-	2	-	-	2300	7900	-	2581	7900	2	
F. Coliform MPN/100ml	NIL	-	-	-	-	-	NIL	-	-	1300	4900	-	3100	4900	1300	

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Table 5.11d : Water Quality of Canals, Lakes, Reservoirs at Mayem Lake (2012-13)

	2012									2013						
Parameters	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Avg**	**Max**	**Min**	**CPCB Stds**
pH	6.2	6.0	6.6	5.5	5.7	5.7	6.2	6.3	6.6	6.7	7.2	6.6	6.3	7.2	5.5	6.5 – 8.5
Temp °C	33	32	28	29	29	28	30	32	31	28	31	33	30	33	28	
Cond. µs/cm	57	62	38	36	38	39	34	59	32	40	42	92	47	92	32	
DO mg/l	7.2	6.8	6.6	6.9	7.4	6.9	6.1	6.7	6.4	6.9	7.7	6.8	6.9	7.7	6.1	4 mg/l or more
Turbd(NTU)	5.4	14.0	10.6	6.9	5.0	4.0	1.7	1.9	3.0	4.0	3.6	4.8	5.4	14.1	1.7	
NH_3 mg/l	BDL	0.03	0.30	0.60	0.01	0.01	0.04	0.02	0.01	0.03	0.12	0.03	0.11	0.60	0.01	
N- NO_2 mg/l	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	
N-NO_3 mg/l	0.08	0.02	0.13	0.09	0.09	0.07	0.02	0.07	0.98	0.01	0.01	0.02	0.13	0.98	0.01	
PO_4 mg/l	0.01	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.03	0.00	
BOD mg/l	2.3	1.9	1.1	1.6	1.6	2.5	1.1	1.7	1.2	1.3	1.1	1.3	1.6	2.5	1.1	3 mg/l or less
COD mg/l	20.0	16.0	7.0	3.0	4.0	6.0	6.0	5.0	10.0	17.0	7.0	15.0	9.7	20.0	3.0	
Cl mg/l	20	6	7	3	3	2	3	4	7	4	5	0.5	5	20	0.5	
T.Coliform MPN/100ml	125	145	5400	7900	2300	4900	370	3900	1700	13000	680	4900	3777	13000	125	5000 or less MPN/100ml
F. Coliform MPN/100ml	NIL	NIL	1100	780	200	450	180	1100	1100	7900	NIL	1700	1612	7900	180	

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Table 5.11e : Water Quality of Canals, Lakes, Reservoirs at Raia Lake (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	-	-	-	6.3	6.0	7.1	6.6	6.9	6.8	7.4	6.4	6.3	6.6	7.4	6.0	6.5 - 8.5
Temp °C	-	-	-	30	29	34	31	31	29	29	33	35	31	35	29	-
Cond. µs/cm	-	-	-	69	72	71	73	75	85	102	207	114	96	207	69	-
DO mg/l	-	-	-	6.5	4.9	4.4	3.6	5.8	5.3	6.1	7.0	6.1	5.5	7.0	3.6	-
Turbd(NTU)	-	-	-	3.3	4.3	2.4	2.7	1.8	6.3	8.5	25.4	26.3	9.0	26.3	1.8	-
NH_3 mg/l	-	-	-	1.18	0.13	0.01	0.05	0.02	0.02	0.03	0.06	0.40	0.21	1.18	0.01	-
N- NO_2 mg/l	-	-	-	0.29	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.04	0.29	0.00	-
N-NO_3 mg/l	-	-	-	0.02	0.17	0.00	0.00	0.01	0.01	0.02	0.56	0.01	0.09	0.56	0.00	-
PO_4 mg/l	-	-	-	0.02	0.01	0.00	0.02	0.01	0.02	0.01	0.23	0.06	0.04	0.23	0.00	-
BOD mg/l	-	-	-	2.0	2.4	1.6	2.0	1.5	2.1	2.7	3.2	4.9	2.5	4.9	1.5	-
COD mg/l	-	-	-	2.0	3.0	3.0	8.0	10.0	12.0	21.0	17.0	34.0	12.2	34.0	2.0	-
Cl mg/l	-	-	-	30	7	7	9	13	10	13	13	13	13	30	7	-
T.Coliform MPN/100ml	-	-	-	<1.8	200	1300	1300	3300	450	450	2300	3300	1575	3300	200	-
F. Coliform MPN/100ml	-	-	-	NIL	NIL	NIL	780	2100	200	200	NIL	780	812	2100	200	-

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Table 5.11f : Water Quality of Canals, Lakes, Reservoirs at Saipem Lake, Navelim (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	-	-	-	6.2	6.07	6.7	6.6	7.38	6.88	7.26	6.91	6.15	6.683	7.38	6.07	6.5 – 8.5
Temp °C	-	-	-	30	28	32	31	33	30	30	28	35	30.778	35	28	-
Cond. µs/cm	-	-	-	86	47.2	102.9	124.2	129.8	151.3	164.58	329.75	168.86	144.954	329.75	47.2	-
DO mg/l	-	-	-	5.2	6.4	2.9	2.7	3.8	2.5	4.8	6.1	5.9	4.478	6.4	2.5	-
Turbd (NTU)	-	-	-	34.6	6.79	13.4	12.6	5.64	20	7.32	8.21	13.66	13.580	34.6	5.64	-
NH_3 mg/l	-	-	-	0.983	0.033	0.025	0.116	0.023	0.027	0.039	0.063	0.07	0.153	0.983	0.023	-
N- NO_2 mg/l	-	-	-	0.037	0.004	0.006	0.011	0.005	0.006	0.005	0.0003	0.01	0.009	0.037	0.0003	-
N-NO_3 mg/l	-	-	-	0.091	0.25	0.018	0.033	0.007	0.009	BDL	0.088	0.01	0.063	0.25	0.007	-
PO_4 mg/l	-	-	-	0.04	0.01	0.021	0.097	0.117	0.015	0.019	0.001	0.02	0.038	0.117	0.001	-
BOD mg/l	-	-	-	2.9	1.7	2.2	16	8.8	16	2.5	2.9	3.4	6.267	16	1.7	-
COD mg/l	-	-	-	4	1	4	41	26	43	15	19	12	18.333	43	1	-
Cl mg/l	-	-	-	37.25	3.25	7.95	15.09	17.92	19	15.09	17.84	17.58	16.774	37.25	3.25	-
T.Coliform MPN/100ml	-	-	-	1400	4900	2200	4800	1100	14000	400	780	1300	3431.111	14000	400	-
F. Coliform MPN/100ml	-	-	-	NIL	180	680	2600	680	6300	200	NIL	780	1631.429	6300	180	-



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Table 5.11g : Water Quality of Canals, Lakes, Reservoirs at Selaulim Lake, Sanguem (2012-13)

	2012									2013						
Parameters	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Avg	Max	Min	CPCB Stds
pH	5.9	6.5	6.6	7.6	6.6	6.7	7.9	7.5	7.0	6.9	7.6	8.2	7.1	8.2	5.9	6.5 – 8.5
Temp °C	30	35	29	30	30	30	34	34	31	32	32	33	32	35	29	
Cond. µs/cm	63	52	46	48	44	39	40	43	36	51	48	24	44	63	24	
DO mg/l	7.5	7.8	6.4	7.6	7.8	7.8	7.8	7.5	7.2	6.7	7.3	7.9	7.4	7.9	6.4	4 mg/l or more
Turbd(NTU)	1.3	1.9	7.9	1.6	1.6	2.0	1.5	0.2	1.0	0.9	1.5	1.4	1.9	7.9	0.2	
NH_3 mg/l	0.06	0.10	0.52	0.79	0.66	0.08	0.03	0.09	0.02	0.03	0.04	0.02	0.20	0.79	0.02	
N- NO_2 mg/l	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	
N-NO_3 mg/l	0.07	0.00	0.11	0.43	0.06	0.00	0.00	0.09	0.01	0.00	0.05	0.01	0.07	0.43	0.00	
PO_4 mg/l	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.03	0.01	0.01	0.03	0.00	
BOD mg/l	-	-	0.20	0.60	1.10	1.20	0.40	1.40	0.60	0.90	1.10	1.90	0.94	1.90	0.20	3 mg/l or less
COD mg/l	14.00	9.00	5.00	1.00	2.00	2.00	6.48	4.00	3.00	6.00	2.00	2.08	4.71	14.00	1.00	
Cl mg/l	13.5	4.2	5.2	4.2	2.3	0.5	1.8	6.6	0.9	1.9	1.4	3.8	3.9	13.5	0.5	
T.Coliform MPN/100ml	10	150	35000	<1.8	<1.8	1700	<1.8	<1.8	<1.8	<1.8	400	<1.8	7452	35000	10	5000 or less MPN/100ml
F. Coliform MPN/100ml	NIL	11	7000	NIL	NIL	400	NIL	NIL	NIL	NIL	NIL	nil	2470	7000	11	

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Water quality of Mayem lake (**Table 5.11**) shows pH in the range of 5.5-7.2. Bacteriological contamination was evident in the canal.

Water quality for Raia, Saipem and Curtorim lakes is presented in **Table 5.11**. The quality of these sources was found to be within the CPCB guidelines, except for bacteriological contamination. Water quality of Salaulim reservoir at Sanguem as depicted in the table shows pH in the range of 5.9-8.2. Bacteriological contamination was evident.

Data for concentrations of metals for the above mentioned Canals/Lakes/Reservoirs during April 2012 is presented in **Table 5.12**. Based on the available data, it was observed that the Fe concentration exceeded the CPCB standards.

Table 5.12 : Metal Concentration in Canals/Lakes/Reservoirs (April 2012)

Sr. No.	Canals/Lakes/Reservoirs	Concentration (mg/l)						
		Fe	Ni	Cu	Zn	Cd	Cr	Pb
1	Cumbharjua Canal, Corlim	0.587	0.13	0.09	0.021	0.079	ND	ND
2	Mayem Lake	1.48	ND	0.038	0.05	0.04	ND	ND
3	Selaulim Lake	0.725	ND	0.045	0.052	0.035	ND	ND
4	Agricultural Canal Upstream of Cuncolim Industrial Estate	0.449	ND	0.042	0.075	0.037	ND	ND
5	Agricultural Canal Downstream of Cuncolim Industrial Estate	1.157	ND	0.049	0.086	0.034	ND	ND
CPCB Standards		**0.3**	**-**	**1.5**	**1.5**	**-**	**-**	**0.1**

5.2 Ground Water Quality

Summary of data availability for Bore Wells/Tube Wells/Open Wells is given in **Table 5.13.** Data for heavy metals in all the ground water sources under study is available only for the month of April 2012.

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Table 5.13 : Summary of Data Availability for Monitoring Stations for Bore well/Tube well/open well of North and South Goa (2012)

Sr. No.	Station Name	Data Availability	
		No of months	Months
1	Verna Industrial Estate	2	Apr-12, Oct-12.
2	Sancoale Industrial Estate	2	Apr-12, Nov-12
3	Zuari Industries Ltd, Zuarinagar	2	Apr-12, Oct-12
4	Kundaim Industrial Estate	2	Apr-12, Oct-12
5	Corlim Industrial Estate	2	Apr-12, Nov-12
6	Pilerne Industrial Estate	2	Apr-12, Nov-12
7	Cuncolim Industrial Estate	1	Oct-12
8	Bethora Industrial Estate	1	Oct-12
9	Madkai Industrial Estate	1	Oct-12

Ground water quality data for Bore Well/Tube Well/open well for physico-chemical and bacteriological parameters are presented in **Table 5.14** and for metal concentrations is presented in **Table 5.15**.

Ground Water quality at Verna Industrial Estate indicated that most of the physico-chemical and bacteriological parameters were within the acceptable limits of Drinking Water Standards (IS 10500:2012), except for low pH (6.4). Based on the available data, concentrations for the metals Fe and Cd were found to exceed the acceptable BIS limits.

Ground Water quality at Sancoale Industrial Estate indicated that most of the physico-chemical parameters were within the acceptable limits of Drinking Water Standards (IS 10500:2012), except low pH (6.1) and high turbidity (32 NTU). Bacteriological contamination was evident in the source, highest being in the month of November. Concentrations for Fe and Cd were found to exceed the acceptable BIS limits.

Ground water quality for Bore Well/Tube Well/open well at Zuari Industries Ltd, Zuarinagar shows low pH (6.1). It was observed that the physico-chemical and bacteriological parameters were within the acceptable limits of Drinking Water Standards (IS 10500:2012). Concentrations for Fe, Ni and Cd were found to exceed the acceptable BIS limits.

Ground water quality for Bore Well/Tube Well/open well at Kundaim Industrial Estate (**Table 5.14**) shows low pH (6.0). It was observed that the physico-chemical parameters were within the Drinking Water Standards (IS 10500:2012), except for turbidity in the month of April. Concentrations for Fe, Ni, Cu and Cd were found to exceed the acceptable BIS limits.

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Table 5.14 : Water Quality of Ground Water (Bore Well/ Tube Well/ Open Well) (2012)

Stations / Parameters	Verna Industrial Estate		Sancoale Industrial Estate		Zuari Industries Ltd, Zuarinagar		Kundaim Industrial Estate		
	Apr-12	Oct-12	Apr-12	Nov-12	Apr-12	Oct-12	Apr-12	Oct-12	BIS Specifications - IS10500: 2012
pH	6.4	6.9	6.1	6.7	6.1	6.9	6.0	6.0	6.5-8.5
Temp °C	29	33	28	31	29	33	31	32	
Cond. µs/cm	34	220	149	105	261	239	270	124	
DO mg/l	5.53	6	4.89	6.3	4.56	2	4.56	4.2	
Turbd(NTU)	0.5	0.4	0.2	33	3.6	0.6	57	5.2	
NH_3 mg/l	0.07	0.016	0.27	0.017	0.06	0.158	0.08	0.027	0.5 mg/l
N- NO_2 mg/l			0.002	0.01	0.001	0.005	0.002	0.001	
N-NO_3 mg/l	0.17	0.073	0.82	0.824	0.08	0.022	0.2	0.509	45 mg/l
PO_4 mg/l	0.02	0.014	0.01	0.069	0.04	0.004	4	0.036	
BOD mg/l	NIL	1	NIL	0.6	NIL	0.4	0.96	0.9	2 mg/l or less
COD mg/l	NIL	2	NIL	6	NIL	1	NIL	2	
Cl mg/l	20.7	9.8	21.2	10.7	27	9.8	23.1	5.5	250 mg/l
T. Coliform MPN/100 ml	65	<1.8	NIL	1700	4	<1.8	85	<1.8	
F. Coliform MPN/100 ml	NIL	NIL	NIL	450	NIL	NIL	NIL	NIL	

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	Corlim Industrial Estate		Pilerne Industrial Estate		Cuncolim Industrial Estate	Bethora Industrial Estate	Madkai Industrial Estate	
Parameters	Apr-12	Nov-12	Apr-12	Nov-12	Oct-12	Oct-12	Oct-12	BIS Specifications - IS10500: 2012
pH	5.0	5.0	6.3	6.8	7.0	6.5	6.1	6.5-8.5
Temp °C	29	31	33	34	28	32	30	
Cond. µs/cm	50.8	40.04	280.5	216.1	249.6	9000	52.3	
DO mg/l	5.85	5.1	6.83	6.9	6.4	6.7	4.9	
Turbd (NTU)	1.9	0.4	5.3	0.5	5.8	7.1	2.8	
NH_3 mg/l	0.03	0.031	0.03	0.007	0.06	0.005	0.1	0.5 mg/l
N- NO_2 mg/l	0.001	0.001	0.001	0.001	0	0.0004	BDL	
N-NO_3 mg/l	0.66	0.855	0.19	0.053	0.01	1.122	0.3	45 mg/l
PO_4 mg/l	NIL	0.013	0.07	0.062	0.02	0.012	0.01	
BOD mg/l	0.29	1	3.23	1.8	1	1	0.1	2 mg/l or less
COD mg/l	NIL	2	NIL	0.001	2	7	11	
Cl mg/l	19.2	11.0	14.4	4.1	6.9	280	12.2	250 mg/l
T. Coliform MPN/100 ml	4	<1.8	145	<1.8	<1.8	200	<1.8	
F. Coliform MPN/100 ml	NIL	NIL	4	NIL	NIL	NIL	NIL	

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Table 5.15: Metal Concentration in Ground Water (April 2012)

Sr. No.	Borewell/Tube well/ Open well	Concentration (mg/l)						
		Fe	Ni	Cu	Zn	Cd	Cr	Pb
1	Verna Industrial Estate	0.438	ND	0.042	0.076	0.04	ND	ND
2	Sancoale Industrial Estate	0.762	ND	0.041	0.071	0.058	ND	ND
3	Zuari Industries Ltd	1.321	0.06	0.042	0.032	0.037	ND	ND
4	Kundaim Industrial Estate	0.928	0.079	0.065	0.16	0.027	ND	ND
5	Corlim Industrial Estate	1.455	ND	0.063	0.166	0.053	ND	ND
6	Pilerne Industrial Estate	3.041	ND	0.047	0.246	0.039	ND	ND
BIS Standards		**0.3**	**0.02**	**0.05**	**5.0**	**0.003**	**0.05**	**0.01**

Ground water quality for Bore Well/Tube Well/open well at Corlim Industrial Estate (**Table 5.14**) shows low pH (5.0). It was observed that the physico-chemical parameters were within the Drinking Water Standards (IS 10500:2012). Concentrations for Fe, Cu and Cd were found to exceed the acceptable BIS limits.

Ground water quality for Bore Well/Tube Well/open well at Pilerne Industrial Estate (**Table 5.14**) shows low pH (6.3). It was observed that the physico-chemical parameters were within the Drinking Water Standards given by BIS (IS 10500:2012). Concentrations for Fe and Cd were found to exceed the acceptable BIS limits.

Water quality of Bore wells in Cuncolim, Bethora and Madkai Industrial Estates available only for the month of October is presented in **Table 5.14.**

5.2.1 Overall Water Quality Assessment

Physico-chemical parameters have been identified to establish trends in baseline quality status of surface water (rivers, canals, lakes and reservoirs) and ground water sources. Study of surface water bodies indicated higher values of mineral content as evident from high conductivity levels. Organic load in terms of BOD is not of much significance as the values were found to be well within the permissible limits. Bacteriological contamination was prominent in almost all the river stretches, canals and lakes. Most of the stations indicated high levels of heavy metals particularly, Fe and/ or Pb.

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In ground water sources, physico-chemical parameters indicated low levels of pH in almost all the locations, while turbidity levels were high at some places. Concentrations of Fe, Ni and Cd were found to exceed the acceptable BIS limits. Presence of TC and FC was rarely observed in the ground water sources.

5.2.2 Limitations & Assumptions

- The major limitation of data on surface water is non-availability of data on significant parameters i.e. data on suspended solids, the indicator of silt or erosion contribution from mining activities. Data on Heavy metals are available only for the month of April.
- Data on ground water quality is available only for two months viz. April and Oct/Nov

Following assumptions have been made while compiling the data:

- Data is compiled on the basis of minimum, maximum and average values recorded and reported in respect of surface water samples
- The sources have been classified as rivers, lakes/reservoirs/ponds, in case of surface water. No information whether bore wells /dug wells/ or tube well and/or hand pumps is available for ground water sources
- For prediction of impacts entire mining areas spread over the region/ state is considered as single unit

5.3 Impact on Water Quality

Based on secondary data for water quality received from Central/ State Govt. Authorities / Agencies, **prediction of impacts due to mining activities** in the region could be summarized as follows:

- Water quality due to presence of high conductivity (total dissolved solids) and chlorides due to surface runoffs/ intrusion of sea water as well as bacterial contamination may be attributed to human pressure and developmental activities including tourism
- Pollutional load due to BOD along the stretches of the rivers was mostly found to be minimal.
- The ground water sources in the study area were observed to be mainly associated with low pH and high concentrations of metals, particularly Fe, Ni and Cd. This may be attributed to runoffs and/ or leachates from mining activities in the vicinity of these sources.

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- The impacts of mining activities are reflected in the form of change in basic environmental quality of surface and ground water, aesthetic value of the water bodies and have affected the corresponding designated uses.

5.4 Environmental Management Plan

Based on the data on water quality received from identified secondary sources with given limitations of data, and assumptions required to encompass complete study area, it can be concluded that major impacts on water quality are due to the effect of change in the present topography by mining the iron ore and dumping of the over burdens nearby, thus changing the topography and drainage pattern and siltation / erosion. It is in this context, the mitigation measures given below need to be implemented, otherwise further deterioration of water quality as experienced today would surely continue vis-à-vis mining activities that would take place in future.

Mandatory Guidelines for Management and Control of Mining Activity

- If mining is continued to deeper levels i.e. below the groundwater level, the sources are likely to be affected, hence safe level of mining shall be quantitatively assessed after detailed study
- Exploitation of groundwater resources be planned based on water shed, drainage pattern, assessment of water requirement of particular region for the designated usages. In no case, groundwater should be used as sprinkling water for dust suppression but treated sewage, industrial wastewater or supernatant from tailing pond be used in place of fresh waters (groundwater / surface water)
- Measures such as construction of percolation tanks, creation of artificial water bodies in natural depressions, Check dams, Gully Checks for soil conservation need to be undertaken to serve arresting wash off solids and groundwater recharge (e.g. John Mines, be followed on priority basis in case of other mines)
- Identify appropriate locations for construction of diversion channels and protective earthen bunds to prevent entry of run off into the surface water bodies
- Construction of underground drainage (UGD) and STP be planned and implemented to protect water bodies getting bacterial as well as organic contamination through the runoffs/drains

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- Conservation of water through recycle/reuse shall be the practiced in all industries including mining industry and adopting wet process for dust control and for irrigating the plantation developed for slope stabilization of overburdens
- The major contribution of silt to surface waters and leachates to ground water is through erosion of particles from the overburdens dumped along the mines and hence engineering measures such as check dams, stone masonry check dam, dry stone masonry, earthen checkdam with other engineering slope stabilization methods such as,
  - Toe wall at bottom
  - RCC wall at bottom
  - UCE wall at bottom
  - PCE wall at bottom
  - Rock bolting and MS wire (at rock locations)
  - Gabion toe wall at bottom
  - Gabion & RCC toe wall along with road side with stable slope
  - RCC columns with boulder net at bottom
  - The Bio-engineering methods should be adopted for the stabilization, restoration and reclamation of the excavated areas after the mining

- RCC toe wall at bottom with soil bio engg. (Geomats) over the slope as well as bioengineering measures such as hydro seeding with geomats, mass plantation of local species be followed
- To examine the effectiveness of mitigation measures, post-project monitoring mechanism be strengthened further and made more stringent. The mining authorities (miners) should get involved in implementation of measures to be undertaken as suggested in their respective mines EIA studies
- The measures suggested are based on macro level study of the region, hence a complete integrated study to assess the carrying capacity of the region be initiated so that micro level action plans and mitigation measures could be suggested

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6.0 Hydrogeology

6.1 Introduction

Goa, one of the states of India, has a total surface area of 370,000 ha of which 65,400 ha (17.6%) has been leased for iron-ore mining, 18,300 ha (5%) being the area of actual mining operations (Chaulya et.al., 1999). As open cast mining is practiced and the water table is intersected at many mines, dewatering is adopted to continue with the mining activity. It is essential to have a sound management practice for the water resources in the mining areas. The groundwater potential of an area depends on the geological and geomorphologic setup, rainfall pattern, aquifer type, groundwater flow pattern, aquifer properties, etc. Systematic hydro-geological studies in Goa have been carried out since last three decades by various workers. However, most of these studies were carried out on a regional scale with administrative boundaries as study units. There have been limited attempts to study the mining operations vis-à-vis the groundwater scenario.

The Department of Water Resources (WRD), Government of Goa and Central Ground Water Board (CGWB), have assessed the net annual groundwater availability of the State of Goa at 132 million cubic meters (MCM) and the annual groundwater draft is 43 MCM as on March 2009 (Ibrampurkar and Chachadi, 2012). The stage of groundwater development is 33% and the entire state has been categorized as safe (WRD & CGWB, 2011). Micro-watershed level studies carried out by Chachadi and Lobo Ferriera (2001) in the coastal areas and Chachadi (2003) in the mining belt have indicated moderate to severe water stress conditions in majority of the sub-watersheds. There are quite a few reported examples where groundwater and surface water have been seriously contaminated due to industrial effluent disposals, urban sewage and solid waste disposals (Chachadi, 2009). The exploitation of groundwater resource has increased manifold recently in the urban areas with random sinking of bore wells (Ibrampurkar and Chachadi, 2012). The groundwater abstraction from shallow dug wells for irrigational purpose is also on rise in the rural areas.

The information collected from the Directorate of Geology & Mining, Govt. of Goa indicates that approximately 150 mines are operational in the state for which EC has been sanctioned. The open cast mining is practiced in all the working mines. The operational mines approximately cover an area of 14,110.59 ha (**Annexure III**). The open-pit mining has, in some places, extended below the groundwater table. The impact of mining may affect the availability of groundwater, and this has become a matter of concern because villages in the region suffer from water scarcity during dry periods. The lowering of the groundwater table, and thereby the depletion of

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groundwater is one of the concerns in the case of open-pit mining (Brawner 1986). However, these effects are mainly dependent on the regional geological formations, site specific conditions as well as the mining methods which are used (Karanth 1990; Aral 1995; Kresic 1997; Soliman and others 1997).

6.2 Physiography

Physiographically it can be broadly divided into four distinct morphological units (CGWB, 2010). The Coastal plain with marine land forms on the west stretches from west to east. Besides, there is vast stretch of plains adjoining the coastal plain, Low dissected denudational hills & tablelands towards the east, and deeply dissected high Western Ghats denudational hills along the eastern most part of the area.

6.2.1 Drainage

The drainage pattern of the study area is dendritic. It is very dense in most of the area.

North Goa: The principal perennial rivers draining through the district are, Terekhol, Chapora, Mandovi & Zuari and non – perennial (seasonal) river Baga. The river basin of all these westerly flowing short rivers originate from Western Ghats and drain in the Arabian Sea in the west under estuarine environment. Primarily the underlying rocks govern the drainage system in the area (**Fig. 6.1**). The major river Zuari follows the major NW synclinal axis. The river valleys are 'V' shaped in the western high hill ranges, but broaden in central midlands and become 'U' shaped in the low lands and coastal plains.

South Goa: The principal perennial River draining through the district is Galjibagh and non – perennial (seasonal) rivers are Sal, Saleri & Talpona. The river basin of westerly flowing Galjibagh river originates from Western Ghats and drain in the Arabian Sea in the west under estuarine environment. Primarily the underlying rocks govern the drainage system in the area (**Fig. 6.1**). The drainage pattern is generally dendritic type. The river valley is 'V' shaped in the western high hill ranges, but broadens in central midlands and become 'U' shaped in the low lands and coastal plains.

6.3 Geology

Geologically, it is dominantly covered by the formation of Goa Group belonging to Dharwar Super Group of Archean to Proterozoic age (CGWB, 2010). Deccan Trap of Upper Cretaceous occupies a narrow strip along the northeastern corner to Lower Eocene age. The Goa Group comprises of metamorphic rocks of green schist facies, and is divided into Barcem, Sanvordem, Bicholim and Vageri formation in the

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ascending order of superposition. The Goa Group of rocks has been intruded by granite gneiss, feldspathic gneiss, hornblende gneiss and porphyritic granite, followed by basic intrusive (**Fig. 6.2**). During the Sub – Recent and Recent times, the rocks have been subjected to lateritisation of varying thickness. Thus, laterite occurs extensively covering almost all the formations in North Goa district. Coastal alluvium occurring along the coastal plains consists of fine to coarse sands with intercalations of sandy loam, silt and clay.

6.4 Status of Groundwater Conditions

The occurrence and movement of ground water depends upon the type of rock formation, structure, topography, rainfall, recharge etc. Ground water in the North Goa occurs in rocks having primary porosity & permeability or in those having secondary porosity acquired due to weathering, leaking, tectonics, solutions etc. Ground water bearing formations in the area are laterite, alluvium, granite, granite gneiss, metavolcanics and metasedimentaries (CGWB, 2010). Dug wells are mainly the ground water abstraction structure in use for irrigation purposes in all the talukas. Shallow and deep tube wells are not much in use for irrigation purposes. Surface water irrigation is found to be extensively used in all the talukas of the state. Lift irrigation schemes are also being executed at selected areas.

Groundwater Level: Present Scenario

Monitoring stations for measuring the groundwater level have been established in the Hydrology project (Phase II). The observation network is in a regional set up. Groundwater levels had been compiled (**Table 6.2**) from the database of Hydrology project (HP-II) in the pre and post monsoon seasons of 2005 to 2010. During the project duration, observation well network has been established in North Goa (35 open wells and 34 piezometers) and South Goa (12 open wells and 23 piezometers) to collect seasonal groundwater levels as well as groundwater samples for chemical analysis. The temporal variation of the groundwater level in both the seasons is the difference between the post and pre monsoon water level data. The groundwater level (bgl) fluctuates from 1.56 m to 38.07 m in pre-monsoon and 1.48 m to 37.55 m in post-monsoon period in north Goa observation well net work (**Table 6.2**). In the case of south Goa, the ground water level (bgl) fluctuates from 1.28 m to 26.53 m in pre-monsoon and 1.00 m to 22.17 m in post-monsoon period (**Table 6.2**).

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The hydrogeological study carried out within the scope of the Micro EIA studies for different mines indicate that the water table with respect to the mine working level shows lot of variation. The summary compiled from the Environmental clearances indicate that the groundwater table is at a higher level as compared to the level of mining working level in 68 mine area and the groundwater table is at lower level as compared to the level of mining working level in 52 mines.

6.5 Data Gaps

Significant data exist on the hydrogeological characteristics in the study area. However, data relevant to assess the mining operations vis-á-vis the groundwater scenario are missing. Some of the data gaps are listed below:

6.5.1 Water Withdrawal from Mining

Data from the mining companies need to be procured pertaining to the withdrawal of water during mining in summer and post-monsoon seasons to understand the impact of mining operation on local groundwater regime. It is essential that the amount of dewatering in the mine pits during the dry season may be collected to know the impact of mining on the groundwater especially in situation wherein the mine working level has gone below the groundwater table.

6.5.2 Reduced Level Data of the Observation Wells

The study area has undulating topography with hilly terrain. In view of the change in topography due to the prevalent land use pattern, mining activities and irrigation practices, the procurement of reduced level (amsl) of existing observation wells under HP-II project is very important. Based on the reduced level measurements, contour maps of the study area will be generated for different seasons in order to decipher the groundwater flow direction in the study area.

In addition, the measurement of reduced levels near the water surface in the mining pit is very necessary, so that the present level of the pit with respect to aquifer can be established.

6.5.3 Habitations

It is essential to know the domestic draft of groundwater in the villages adjoining the mining areas. One needs to consider whether the dependence is only on shallow sources or deep wells.

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6.5.4 Piezometric Water Level

MoEF recommended to mining companies (143 No.) to implement the construction of piezometers in their mining premises while according environmental clearance (Annexure-I). As per MoEF instructions, the project authorities were directed to construct piezometers in their periphery of mining areas. It is necessary to procure the collected groundwater level data from constructed peizometers to understand the mining impact on local groundwater regime.

6.5.5 Groundwater Stage Development

Groundwater stage development is key factor to understand the status of aquifer regime in and around core/buffer zone of concerned mining operation. As per MoEF directives, about 72 mining companies have computed groundwater stage development and it appears that all are in safe zone (<70%) i.e. stage development in between 1% to 25% (15 No.), 26% to 50% (33No.) and 51%-70% (24 No.). It is necessary to provide the computed groundwater stage development values of remaining 78 mining companies for better understanding of local aquifer situation. However, the most recent studies need to be considered.

6.5.6 Soil & Water Conservation Structures

MoEF directed the implementation of soil and water conservation structures adjoining the mines for augmentation of groundwater resource and mitigate soil erosion. It is essential to know the status of compliance measures by the project authorities.

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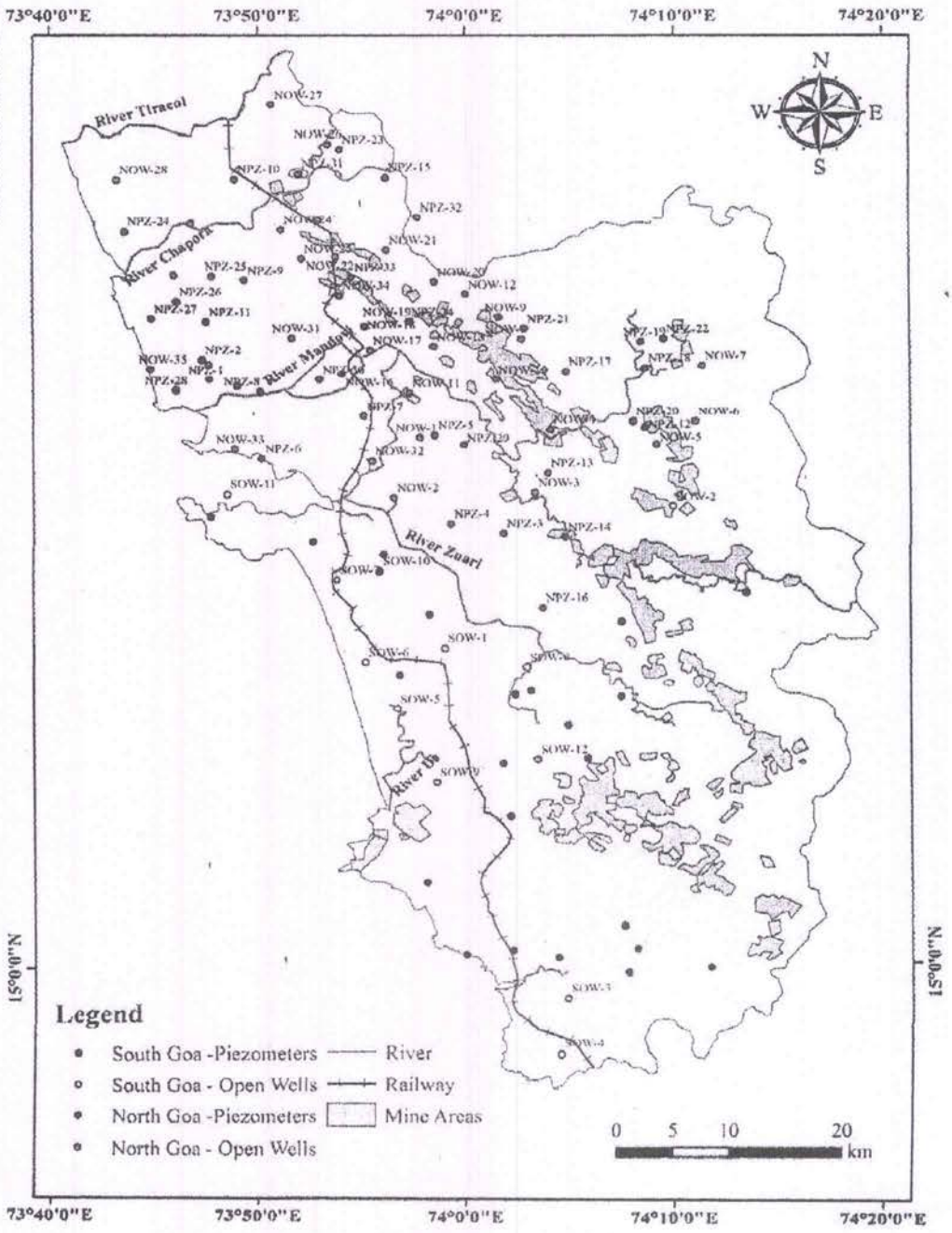


Fig. 6.1. Base Map of the Study Area
(Source : Directorate of Mines & Geology, Govt. of Goa)

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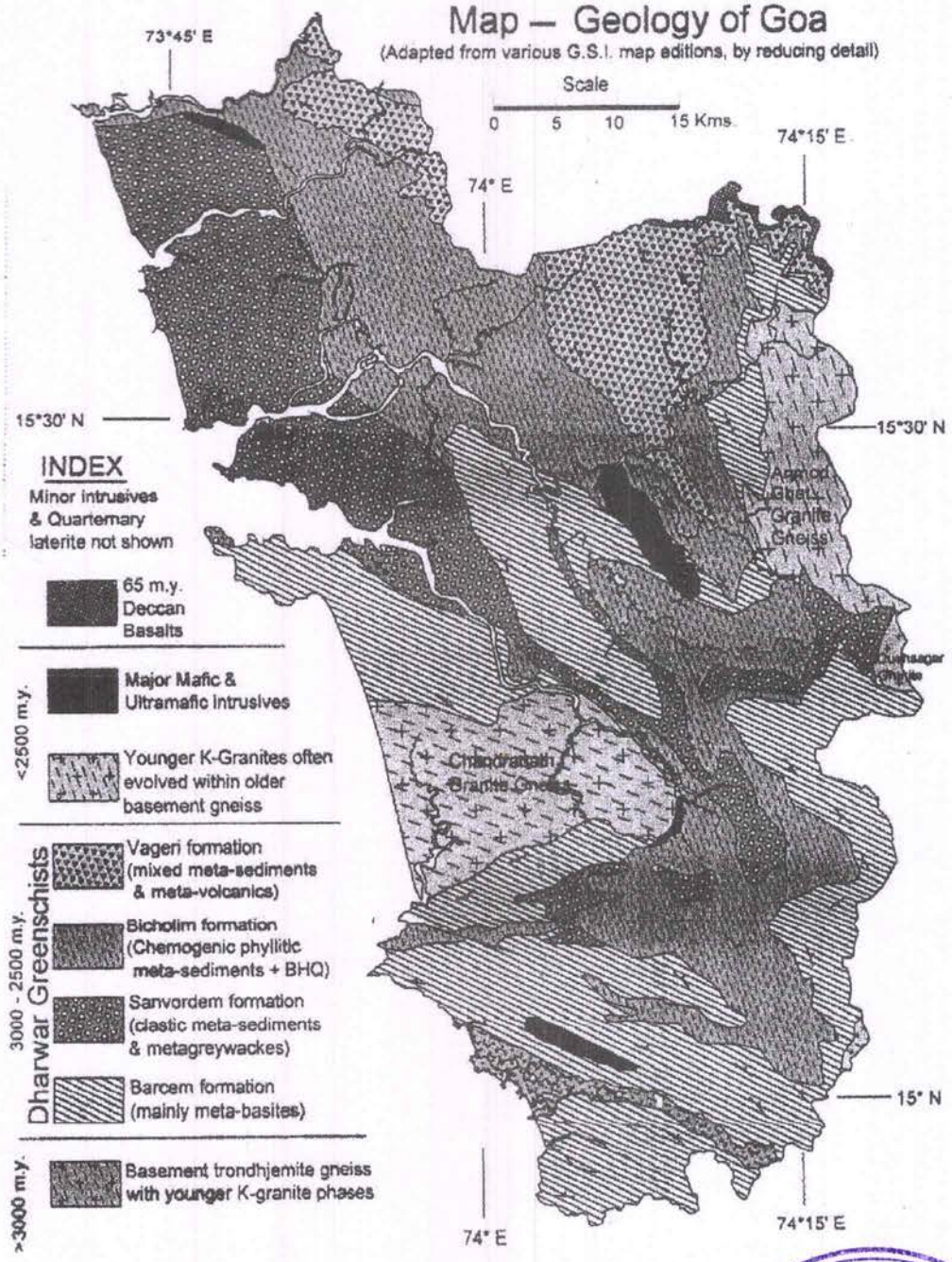


Fig. 6.2. Geology Map of the Study Area
(Source : Srinivasa,et.al, 2013)

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Table 6.1 : Ground Water Level in the Observation Stations (Piezometers & Open well) in North Goa District during 2008 to 2013

Well No	Taluka	Village/Waddo	Latitude (N)	Longitude (E)	Pre mon 2008	Post mon 2008	Pre mon 2009	Post mon 2009	Pre mon 2010	Post mon 2010	Pre mon 2011	Post mon 2011	Pre mon 2012	Post Mon 2012	Pre Mon 2013
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
OPEN WELLS															
OW-1	Ponda	Gauthanwada Bhoma	15.4740	73.9634	1.56	1.57	2.30	1.02	1.82	1.04	1.99	1.49	2.11	1.29	2.29
OW-2	Ponda	Madkai	15.4204	73.9418	2.75	2.49	2.62	2.26	2.60	2.21	2.54	2.36	2.61	2.36	2.61
OW-3	Ponda	Par-Usgao (Saptemol)	15.4244	74.0551	7.19	6.41	7.13	6.52	7.09	5.88	6.93	6.57	7.13	6.38	7.18
OW-4	Bicholim	Deulwada	15.4805	74.0678	5.88	5.91 ?	6.15	5.82 ?	6.12	6.10	6.29	6.52 ?	6.10	6.40 ?	6.40
OW-5	Sattari	Shellwada, Mainguinim	15.4667	74.1528	5.04	3.79	5.84	2.94	6.27	3.82	5.35	3.97	6.88	3.81	7.07
OW-6	Sattari	Sirsode	15.4870	74.1834	5.85	3.69	6.14	3.34	5.81	3.59	5.65	3.66	6.39	3.54	6.29
OW-7	Sattari	Sonalwada, Sonal	15.5387	74.1892	4.34	3.70	4.19	3.35	4.10	3.56	4.05	3.57	4.12	3.44	4.22
OW-8	Bicholim	Upper Harvalem	15.5645	74.0453	3.46	3.35	3.43	3.16	3.37	3.32	3.43	3.14	3.48	3.41	3.48
OW-9	Sattari	Majikwada	15.5848	74.0272	6.38	6.29	5.49	5.83	5.88	6.27	4.60	6.4	5.26	6.32	6.60
OW-10	Bicholim	Chikne	15.5269	74.0244	5.75	5.25	5.55	5.33	5.81	5.36	5.68	5.44	5.75	5.40	5.67
OW-11	Ponda	Chimbulwada Marcel	15.5148	73.9549	4.28	3.86	4.13	3.83	4.20	3.76	4.20	3.97	4.20	3.92	4.20
OW-12	Bicholim	Talewada, Kudchire	15.6061	74.0005	2.50	1.84	2.61	1.92	2.37	2.23	2.43	2.28	2.62	2.31	2.69
OW-13	Bicholim	Khotiwada, Karapur	15.5576	73.9746	3.28	2.87	3.16	2.21	2.96	2.76	3.00	3	3.26	2.87	3.65
OW-14	Bardez	Mainem	15.5226	73.8165	1.83	1.49	1.82	1.49	2.09	1.39	1.79	1.55	1.81	1.46	1.86
OW-15	Bardez	Donwada	15.5421	73.7941	6.74	4.45	7.10	4.10	7.23	3.85	6.07	3.99	6.20	3.89	6.40
OW-16	Tiswadi	Vinthojhe	15.5327	73.9009	2.75	2.28	3.00	2.24	3.10	2.07	3.01	2.38	3.05	2.27	3.00
OW-17	Bicholim	Marmowada	15.5545	73.9237	2.15	1.86	2.15	1.82	1.98	1.87	2.03	1.85	2.22	1.81	2.15
OW-18	Bicholim	Kumbarwada	15.5765	73.9193	4.23	3.66	4.09	3.75	4.20	3.67	4.18	3.87	4.36	3.75	4.32
OW-19	Bicholim	GIDC, Open Space	15.5811	73.9561	--	---	6.20	4.60	6.18	5.16	6.06	5.72	6.22	5.23	6.18
OW-20	Bicholim	Naikwada-Maulinguem	15.6172	73.9753	4.23	1.56	4.17	1.39	4.27	1.54	4.01	1.61	4.18	1.58	4.41

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Well No	Taluka	Village/Waddo	Latitude (N)	Longitude (E)	Pre mon 2008	Post mon 2008	Pre mon 2009	Post mon 2009	Pre mon 2010	Post mon 2010	Pre mon 2011	Post mon 2011	Pre mon 2012	Post Mon 2012	Pre Mon 2013
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
OW-21	Bicholim	Ambedkarwada, Kasarpal	15.6455	73.9372	2.43	2.71	2.51	3.36	3.63	3.14	2.92	2.94	2.56	3.16	2.70
OW-22	Bicholim	Gaonkarwada Advalpal	15.6399	73.8960	5.60	5.54	5.54	5.40	5.60	5.40	5.59	5.57	5.59	5.55	5.61
OW-23	Bardez	Tupalwada	15.6722	73.8825	5.67	3.58	5.79	3.42	5.71	3.29	5.41	3.75	5.67	3.47	5.45
OW-24	Bardez	Simulwada-Revora	15.6638	73.8527	2.27	1.74	2.56	1.98	2.17	1.89	2.27	1.98	2.50	1.96	2.31
OW-25	Bardez	Podwada ,Cansa	15.6379	73.8690	3.99	2.69	3.95	2.31	3.75	2.09	3.52	2.03	2.18	2.30	2.25
OW-26	Pernem	Chandel	15.7366	73.8904	2.92	1.30	2.91	1.16	3.49	1.39	2.89	1.48	3.08	1.38	3.05
OW-27	Pernem	Torse	15.7718	73.8448	3.50	1.52	3.56	1.43	3.21	1.78	3.32	1.86	4.25	1.80	4.28
OW-28	Pernem	Palye	15.7068	73.7208	3.98	2.75	4.30	2.48	4.15	2.49	3.57	2.78	3.98	2.53	4.05
OW-29	Pernem	Parse	15.6694	73.7802	2.78	2.07	2.86	2.09	2.94	2.08	2.60	2.24	2.88	2.20	2.84
OW-30	Bardez	Siolim	15.6236	73.7667	3.41	1.57	3.53	1.40	3.34	1.26	3.12	1.71	3.52	1.42	3.15
OW-31	Bardez	Pomburpa	15.5658	73.8609	2.82	1.95	2.66	2.10	2.50	2.10	2.19	2.07	2.86	2.10	3.06
OW-32	Tiswadi	Pelebhat wada Nevra	15.4534	73.9250	2.78	2.48	2.76	2.20	2.54	2.14	2.64	2.15	2.45	2.16	2.74
OW-33	Tiswadi	Nagaliwada	15.4647	73.8150	2.05	1.59	2.19	1.25	2.15	1.13	1.70	1.52	2.12	1.26	2.17
OW-34	Bardez	Paniwada	15.6052	73.8991	3.36	3.78	3.36	3.36	3.78	3.36	3.78	4.25	3.92	3.27	3.37
OW-35	Bardez	Tiwaiwada	15°32'17"	73°44'50"										5.89	9.02
PIEZOMETERS															
PZ-1	Bardez	G.P.School. Saligao	15.5286	73.7945			2.90	1.49	2.75	1.37	2.70	1.49	2.77	1.25	2.89
PZ-2	Bardez	GIDC Pilerne	15.5463	73.7887			35.42	34.55	31.50	31.25	31.80	32.35	32.68	32.53	32.70
PZ-3	Ponda	GIDC.Bethoda	15.3875	74.0299			4.85	3.09	4.46	2.98	4.44	3.39	4.72	3.41	4.52
PZ-4	Ponda	GTDC Kavle	15.3964	73.9875			4.10	4.22	4.23	2.59	4.86	4.54	4.09	4.38	4.57
PZ-5	Ponda	GIDC.Kundaim	15.4764	73.9751			12.25	12.00	12.42	11.90	12.64	12.91	12.86	12.21	12.77
PZ-6	Tiswadi	Goa University campus	15.4560	73.8362			22.20	20.50	22.85	18.87	21.42	19.52	21.47	19.50	22.05

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Well No	Taluka	Village/Waddo	Latitude (N)	Longitude (E)	Pre mon 2008	Post mon 2008	Pre mon 2009	Post mon 2009	Pre mon 2010	Post mon 2010	Pre mon 2011	Post mon 2011	Pre mon 2012	Post Mon 2012	Pre Mon 2013
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PZ-7	Tiswadi	Agr.farm-Ela	15.4937	73.9181			3.45	2.66	3.35	2.36	3.34	2.86	3.64	2.73	3.74
PZ-8	Bardez	H.P.lab. Porvorim	15.5172	73.8351					17.94	17.13	18.67	17.31	18.92	16.97	17.59
PZ-9	Bardez	GTIDC Colvale	15.6192	73.8231	--	--	6.30	4.05	6.25	3.20	6.27	5.45	6.29	4.62	6.05
PZ-10	Pernem	GTDC Vimora	15.7072	73.8154	--	--	12.55	9.73	12.42	9.43	12.23	10.72	12.59	10.18	12.67
PZ-11	Bardez	V.P. Verla	15.5813	73.7922	--	--	4.66	2.78	4.28	2.48	3.88	2.81	3.97	2.39	3.96
PZ-12	Sattari	V.P.Khotode	15.4823	74.1435	--	--	7.70	6.33	7.65	6.58	7.50	6.96	7.85	6.82	7.87
PZ-13	Ponda	V.P.Usgao Campus	15.4417	74.0657	--	--	16.20	14.65	16.39	14.81	16.38	15.35	16.59	15.08	16.67
PZ-14	Ponda	Agr.farm Kodar	15.3839	74.0791	--	--	11.60	10.64	11.46	9.49	11.06	10.65	11.29	10.66	11.31
PZ-15	Pernem	G.P.School.Ibrampur	15.7082	73.9367	--	--	7.27	7.20	6.35	7.95	7.52	8.16	8.33	7.90	9.29
PZ-16	Ponda	GPS.Torla, Shiroda	15.3212	74.0616	--	--	--	11.04	11.61	10.67	11.47	10.96	12.16	10.96	12.40
PZ-17	Bicholim	Nr GIDC G.L.Res	15.5341	74.0803	--	--	--	7.95	11.89	8.03	9.75	8.56	12.00	8.67	11.10
PZ-18	Sattari	Elect Dept.Veluz	15.5370	74.1437	--	--	--	13.02	14.35	13.24	13.84	13.44	14.35	13.30	14.17
PZ-19	Sattari	Govt.Cattle Breed Fm	15.5610	74.1407	--	--	--	4.42	6.16	4.82	5.76	5.18	6.11	4.61	6.72
PZ-20	Bardez	V.P. Campus	15.4877	74.1339	--	--	--	--	--		13.85	16.37	15.74	15.85	12.95
PZ-21	Sattri	Rehab Colony - morlem	15.5739	74.0475	--	--	--	--	--	9.96	10.55	10.05	10.67	9.83	10.63
PZ-22	Sattari	Health centre -Nagargao	15.5637	74.1585	--	--	--	--	--	7.96	11.64	8.89	12.14	8.26	12.14
PZ-23	Pernem	V.P. Assapur	15.7320	73.8996	--	--	--	--	--	7.04	7.60	7.68	7.79	7.51	8.19
PZ-24	Pernem	V.P.Mandre	15.6626	73.7270	--	--	--	--	--	4.54	5.85	5.23	6.30	5.07	6.74
PZ-25	Bardez	GPS, Sodiem	15.6227	73.7968	--	--	--	--	5.60	4.49	5.36	4.86	5.51	4.83	5.15
PZ-26	Bardez	V.P.Asagao	15.5998	73.7686	--	--	--	--	--	4.71	5.97	4.65	6.48	4.45	6.30
PZ-27	Bardez	GPS. Tembi,Anjuna	15.5843	73.7486	--	--	--	--	6.69	4.60	6.53	5.24	7.74	4.62	6.24

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Well No	Taluka	Village/Waddo	Latitude (N)	Longitude (E)	Pre mon 2008	Post mon 2008	Pre mon 2009	Post mon 2009	Pre mon 2010	Post mon 2010	Pre mon 2011	Post mon 2011	Pre mon 2012	Post Mon 2012	Pre Mon 2013
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PZ-28	Bardez	V.P.Candolim	15.5187	73.7676	--	--	--	--	9.80	5.67	----	----	----	----	----
PZ-29	Ponda	Vijayadurga Temple-Keri	15.4673	73.9986	--	--	--	--	--	15.00	18.82	15.08	18.45	19.65 ?	18.02
PZ-30	Tiswadi	Football ground Madel	15.5278	73.8825	--	--	--			7.32	8.29	6.82	8.32	6.54	8.33
PZ-31	Pernem	NrP.H.CentreKasarvarne	15.7117	73.8668	--	--	--	7.9	10.29	7.79	9.7	9.08	9.73	8.41	8.52
PZ-32	Bicholim	GTIDC.Dodamarg	15.6747	73.9621	--	--	--	9.78	9.95	9.90	9.39	10.57	8.91	10.20	9.07
PZ-33	Bicholim	GTIDC Mulgao	15.6215	73.9091	--	--	--	37.45	38.07	37.1	37.96	37.55	38.05	37.34	37.99
PZ-34	Bicholim	GIDC, Open Space	15.5808	73.9547	--	--	--	7.14	8.48	7.89	8.46	8.01	8.41	7.72	8.24

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Table 6.2 : Ground Water Level in the Observation Stations (Piezometers & Open well) in South Goa District during 2008 to 2013

Well No	Taluka	Village/ Waddo	Latitude (N)	Longitude (E)	Pre mon 2008	Post mon 2008	Pre mon 2009	Post mon 2009	Pre mon 2010	Post mon 2010	Pre mon 2011	Post mon 2011	Pre mon 2012	Post Mon 2012	Pre Mon 2013
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
OPEN WELLS															
OW- 1	Salcete	Gogal	15 17' 8.83"	73 58' 58.25"	6.600	6.6	6.68	6.5	6.7	6.3	6.3	7.31	7.4	7.15	7.45
OW - 2	Sanguem	Sacordem	1524'39.32"	7409'55.34"	8.330	8.33	8.7	8.25	8.57	8.18	8.52	6.52	7.52	8.84	6.47
OW- 3	Canacona	Peddem	1458' 14.99"	74 04' 46.78"	1.280	1.28	3.15	1.62	3.52	1.07	4.15	4.21	5.32	2.13	3.70
OW- 4	Canacona	Pollem	14 55' 24.53"	74 04' 29.24"	3.550	3.55	5.47	4.07	6.15	3.9	5.1	5.06	6.62	5.00	7.09
OW - 5	Salcete	Varca	15 13' 53.92"	73 56' 40.24"	1.650	1.65 ?	3.95	2.85	6.13	2.9	5.83	4.44	7.31	4.11	6.91
OW- 6	Salcete	Colva	15 16' 24.42"	73 55' 10.20"	3.350	3.35 ?	4.15	3.14	3.83	3.07	3.72	4.14	4.76	4.06	4.60
OW- 7	Marmogoa	Cansaulim	15 20' 48.48"	73 53' 48.54"	3.120	3.12	4.9	-0.07	4.65	2.97	4.56	3.86	5.64	3.82	5.63
OW- 8	Salcete	Guirdolim	1516'06"	7402'55.29"	5.910	5.91	9.55	4.87	5.18	4.53	5.05	5.48	5.92	5.41	5.93
OW - 9	Salcete	Velim	15 09' 57.20"	73 58' 32.68"	2.300	2.3	4.8	1.85	4.33	1.72	4.03	3.1	Dry	2.75	5.38
OW -10	Salcete	Verna	15° 21' 16"	73° 55' 52"	5.500	5.56 ?	5.3	4.78	5.95	5.2	–	6.29	6.66	6.06	—
OW - 11	Marmogoa	Vasco Baina	15 25' 28.15"	73 48' 30.42"	4.650	4.65 ?	5.1	4.45	4.9	4.45	4.88	5.37	5.72 ?	5.19	5.62
OW-12	Quepem	Ambaulim	15 11' 10"	73 03' 22"	6.650	6.65 ?	7.65	6.15	5.46	6.05	7.31	6.96	8.49	6.96	8.73
PIEZOMETERS															
PZ-1	Salcete	IDC Verna Ind. Est.	15° 22' 9"	73° 56 04"	--	13.75	15.07	11.4	15.02	11.75	13.06	13.28	13.88	12.72	–
PZ-2	Quepem	Quepem I.D Comp	1512 ' 58"	74 04' 53"	--	7.13	6.53	6.73	6.73	6.55	6.42	6.76	6.54	6.68	6.79
PZ-3	Quepem	Zambaulim GHS	15 11' 13"	74 05' 48"	--	11.65	11.9	11.6	11.92	11.59	11.7	11.64	12.07	11.71	12.08
PZ-4	Sanguem	Bandoli GPS	1518' 31"	74 07' 29"	--	4.47	5.22	5.03	5.12	4.3	4.98	4.41	5.94	4.45	5.98
PZ-5	Canacona	Murkud GPS	15 00' 36"	73 59' 55"	--	4.57	5.1	4.45	4.96	4.05	4.99	--	--	4.34	5.03
PZ-6	Canacona	Kumbegal GPS	14 59' 35"	74 07' 42"	--	12.1	12.8	11.95	12.67	11.84	12.59	12.13	12.82	11.92	12.77

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Well No	Taluka	Village/ Waddo	Latitude (N)	Longitude (E)	Pre mon 2008	Post mon 2008	Pre mon 2009	Post mon 2009	Pre mon 2010	Post mon 2010	Pre mon 2011	Post mon 2011	Pre mon 2012	Post Mon 2012	Pre Mon 2013
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PZ-7	Quepem	Barcem PHE Comp	15 84' 38"	74□ 02' 21"	--	7.2	9.2	7.29	8.82	7.15	8.34	7.36	9.32	7.09	9.06
PZ-8	Quepem	Kottombi GPS	15 14' 50"	74□ 03' 7"	--	2.77	3.27	2.13	3.7	2.35	3.01	1.90	3.31	2.63	3.54
PZ-9	Marmogoa	IDC Sancoale Ind. Est.	1522' 52"	73□ 52' 37"	--	18.2	20.66	14.85	18.15	13.9	15.32	1.98	15.3	14.03	12.27
PZ-10	Marmogoa	Sadda PHE O.V.tank	15□ 24' 13"	73□ 47' 42"	--	--	26.5	21.87	26.02	20.36	24.41	1.57	24.87	21.38	25.68
PZ-11	Salcete	Verna V P	15° 21□ 15"	73° 55□ 51"	--	--	10.98	10.26	10.98	10.27	10.79	9.93	10.37	9.76	
PZ-12	Salcete	Rawanpond Margao	15 15' 44"	73□ 56' 48"	--	--	4.1	3.23	4.1	3.29	4.07	4.67	3.73	5.44	4.29
PZ-13	Canacona	Char Rasta Canocona	15 00' 47"	74□ 02' 10"	--	--	6.35	4.19	8.2	4	6.92	3.94	6.29	3.64	7.29
PZ-14	Sanguem	Bendurdem	15 07' 58"	74□ 02' 5"	--	--	10.3	8.32	10.37	6.23	9.01	7.81	9.32	7.73	9.28
PZ-15	Canacona	WRD Godown Vodamol	15 00' 25"	74□ 04' 20"	--	--	15.55	14.41	14.63	14.59	14.58	14.07	14.79	14.11	14.81
PZ-16	Quepem	Cuncolim Ind. Est.	15 10' 57"	74□ 01' 47"	--	--	16.9	14.48	18.95	13.85	20.62	18.7	22.34	22.17	26.53
PZ-17	Quepem	Kakoda	15 14' 29"	74□ 07' 26"	--	--	--	3.96	5.34	4.5	5.08	3.92	4.02	4.05	5.16
PZ-18	Sanguem	Sigaon	15 19' 89"	74□ 13' 28"	--	--	--	5.63	7.5	5.51	7.66	5.82	7.42	5.55	7.34
PZ-19	Canacona	Khola	15 04' 21"	73□ 58' 3"	--	--	--	9.24	11.6	9	11	8.84	11.1	8.81	11.3
PZ-20	Canacona	Eda Kotigao	14 59' 49"	74□ 11' 39"	--	--	--	7.82	10.4	7.95	10.15	8.20	9.98	8.02	9.99
PZ-21	Salcete	Betalbatim (jude Church)	15° 18' 86"	73°58'15"	--	--	--	--	--	--	--	--	5.51	2.63	5.31
PZ-22	Canacona	Govt.High Sch Gaondongrim	15 02' 01.97"	74□ 07' 31"	--	--	--	--	--	15.5	15.8	15.12	16.35	13.98	16.1
PZ-23	Canacona	Near Road Side Saturli	1500' 49.52"	74□ 08' 09"	--	--	--	--	--	--	--	9.25	13.59	9.58	13.96

* Water level in m.b.g.l * Pre-monsoon water level May * Post monsoon water level November



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7.0 Land Environment

7.1 Baseline Status on Solid and Hazardous Wastes

The State of Goa is rich in iron ore, manganese, and bauxite minerals. Mineral production in Goa began in the late 1940s. In the initial years mineral production began for manganese and ferro-manganese. However during 1970s emphasis shifted to mining of iron ore. Iron Mining is currently the major extractive industry and is concentrated along the Ghat section in the east of Goa where a mining belt extends 65 km from southeast to northwest spanning some 700 km2. As per the available secondary data/information, there are total 336 mine leases allocated entirely to private parties. Out of these 336 mine leases, 133 leases have been recently declared as lapsed. In the last five years (2007 till September 2012), there were total 118 operational mines covering an area of 3067 hectares.

The typical solid wastes generated from the mining and associated operations include topsoil, over burden (waste rock), tailings from ore processing and miscellaneous wastes generated from the service facilities (maintenance and repair of vehicles/machineries). The past and present status of generation and management of these wastes as derived from available secondary data/information sources is presented in the following sections:

7.1.1 Top Soil

In the open cast mines, prior to the commencement of actual mining operations, the mine site is cleared of vegetation and top soil (generally up to 30 cm thickness) is generally stripped and stacked separately. The top usually soil contains plant nutrients, microbes and humus, and can be used for stabilization/rehabilitation of waste dumps and reclamation of mined out areas. The data/reports available from various mines in Goa however do not provide much information on quantum and handling details of top soil.

7.1.2 Overburden Waste

In mining operations, overburden is the material that lies above the ore body. Amongst all the wastes generated by mining sector, the most significant in terms of quantum is overburden waste. Since all the mines in Goa are open cast mines and considering the subsurface lithology of the area, the generation of overburden is very high as compared to iron ore mines in other parts of the country. It is estimated that nearly 2.5 to 3.5 metric tonnes of waste overburden is generated per tonne of ore extracted.

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Based on the data/information available from the 118 operational mines, a summary of Ore production and quantum of overburden generated/handled in last five years is compiled and presented in **Table 7.1**.

Table 7.1 : Ore Production and Quantum of Overburden Generated/Handled

Year	Run-of-Mine (ROM) (MT)	Processed Ore (MT)	Dump Working (MT)	Tailings/Concentrate (MT)	Dump Handled outside Mining Lease Area (MT)
2007-2008	30200781	26821227	1340201	1605076	6641951
2008-2009	31363342	30724304	1847676	1246538	4323231
2009-2010	33714546	35834656	3675572	1563314	8071008
2010-2011	32671933	34179342	2995385	930901	14567366
2011-2012	32614583	32420408	981125	554760	4099602

As per the specific conditions stipulated in the Environmental Clearances issued by Ministry of Environment and Forests (MoEF) the overburden generated by the mines is required to be stored/stacked temporarily in earmarked area. During temporary storage/stacking the dumps are required to be stabilized with proper height, slope, use of geotextiles, provision of catch drains and garland drains, and construction of retaining wall. The temporary dumps of overburden are finally required to be backfilled in the mined out areas.

At present, the overburden generated by the many of the mining industries is dumped in the earmarked areas within the lease boundary. However, a large quantum of overburden is also dumped haphazardly in the areas outside lease boundary. The details on physico-chemical characteristics and leaching potential of overburden wastes are not available readily. Parts of overburden are used by mining industries for stabilization/rehabilitation of old and abandoned mine benches, and construction of haul roads for working mine pits. However, except for few large scale mines, most of the mines have not initiated backfilling and final restoration/rehabilitation of mined out areas.

Although, the compliance reports submitted by individual mines indicate fulfillment of all the conditions stipulated by MoEF, a number of studies/investigations have reported violations of many of these conditions. There are several reported incidences of improper dump management. The poor dump management coupled with heavy

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monsoon in Goa has resulted into large scale erosion of soil and silt from these dumps, thereby substantially increasing the sediment load into the rivers/streams and nallahs.

7.1.3 Tailings from Ore Beneficiation Plants

The iron ore extracted from the mines are beneficiated to remove the gangue material and enrich Fe content. The separated gangue material is known as tailings and is required to be disposed of in the tailings pond for containment. The disposal of tailings is a major environmental problem, which is becoming more serious with increasing extraction of lower grade deposits. The tailings are usually transported and deposited as slurry of high water content into a massive pond for containment, which are generally called as tailing ponds / tailing dams.

The data/information available from various mining industries has been compiled and the tailing generated by the mining sector in Goa in last five years is listed in **Table 7.1**. Since data/information on ore beneficiation for many of the mining industries is not available, the quantities of tailing listed in **Table 7.1** may be substantially low as compared to the actual generation. Moreover the details on handling and disposal of are also not available extensively. On the other hands there are some reports available which indicate unscientific and illegal disposal of such tailing in river bodies.

7.1.4 Wastes from Service Facilities

The wastes generated from the service facilities (repairing and maintenance of vehicles and machineries) include metallic, non-metallic and oil contaminated wastes. The metallic wastes generated in the workshops include mainly iron & steel scrap. The nonmetallic wastes include tyres, tubes and plastics, the oil contaminated wastes include waste cotton, oily muck and oil filters. The metallic and non-metallic wastes are usually non-hazardous in nature and can be disposed-off through sale. The oily wastes fall under the category of Hazardous Wastes and are required to be manages as per Hazardous Waste (Management, Handling & Trans Boundary Movement) Rules, 2008.

The data information available from various mines do not provide much details about generation and management of these wastes.

7.2 Identification/Prediction of Impacts due to Solid and Hazardous Waste

As mentioned in the baselines status, adequate data/information on generation and management of solid and hazardous wastes generated by the mining industries, is not

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available. Moreover, the numbers of investigation reports/studies have indicated unscientific management of these wastes.

In general, the following environmental impacts are possible due to unscientific management of solid and hazardous wastes.

- Destabilization and collapsing of overburden dumps due to improper height and slopes resulting in to blockage/diversion of natural/artificial water bodies (streams/nallahs)
- Erosion of soil and silt from overburden dumps during monsoon season resulting into increase of sediment load in downstream water bodies and siltation of agriculture land.
- Release and deposition of tailings from ore beneficiation operations into the river/streams and nallahs resulting into increase in sediment load.
- Contamination of soil, groundwater and surface water due to unscientific management of oil bearing hazardous wastes.

7.3 Environmental Management Plan

The Government of India has taken a number of steps and equipped the concerned regulatory agencies and authorities for enforcement of the enactment and regulations related to the management of wastes generated from the mining sector. The Mineral Conservation & Development Rules (MCDR), 1988 stipulates the requirements for mining industry related to management of top soil and overburden. The salient features of these rules are as follows:

- All the mine lease holders are required to collect, store and utilize top soil for restoration/rehabilitation of mined out areas.
- Overburden, waste rock, rejects and fines generated during prospecting and mining operations as well as tailings, slimes and fines produced during sizing, storing and beneficiation operations are required to be stored in separate dumps.
- The site for such dumps should be as far as possible on an impervious ground to ensure minimum effects of leaching due to precipitation.
- These dumps shall be properly designed and managed to prevent escape of any material. The dumps should be suitably terraced and stabilized through vegetation and/or use of geotextile materials.

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- Overburden/waste rock etc. should be back-filled into main excavations to the maximum extent possible in order to restore the land to its original form and use as far as practicable. Such a practice will reduce the demand of land for storage and subsequent environmental degradation.
- The disposal of fines, rejects, tailings from beneficiation should be in properly designed tailing dam so as not to cause land degradation or damage to agricultural field, pollution of surface water bodies and ground water.

In addition to the above rules, Indian Bureau of Mines (IBM) has issued certain guidelines on dump management and rehabilitation. The salient features are given below:

- The design of the waste dump should accommodate progressive rehabilitation to ensure a minimum area of disturbance at any one time. The height, area and shapes of the waste dump should be designed having regard to the area of land available, the general topography of the area, nature of material being dumped and climatic conditions.
- All completed surfaces of the waste dump should be stable and able to resist long term erosion.
- Top soil should be scraped out from the dump site in advance and preserved in low height dumps, duly covered with grass and vegetal cover to increase its life.
- Previously stockpiled subsoil and top soil should be spread on all completed surfaces where practicable and re-vegetated with suitable vegetation.
- The design and construction of the waste dumps should be such that the completed out slopes do not exceed 20 degrees from the horizontal.
- Drainage should be constructed to handle heavy rainfall. Appropriate garland drains should be provided all around and specially to the ultimate boundary of the dump.

In addition to above Rules and Guidelines, the Central Pollution Control Board (CPCB) as proposed following guidelines for management of wastes generated from mining sector. The salient features of these guidelines are as follows:

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- The OB / IB/waste rock dumps shall be located away from the natural nallas, rivers of the area and on an impervious & non-mineralized area, to minimize the water pollution.
- Design and construction of the waste dumps shall be such that the completed out slopes do not exceed than 28 degrees from horizontal to avoid excessive erosion and easy vegetation.
- The OB/IB/waste rock dumps shall be properly dressed, benched, sloped at low angle with terracing and bamboo barricades in the slopes, making retaining walls/stone barriers at the toe of the dumps, gully plugging etc., to prevent the soil erosion during monsoon, besides establishing vegetation on dump top as well as its slope surface. In steep slopes, hydro-seeding technique or use of geo-textiles mat embedded with seeds shall be adopted.
- To prevent fine particles from OB/IB/waste rock dumps getting washed off due to rains, every year, before onset of monsoon, deep garland type trenches all around the waste dump shall be made to arrest the fine particles in the trenches. The accumulated water in the garland drains shall be passed through check dams/settling tanks to allow the silt to be settled before final discharge to surrounding environment. At the outlet of garland drains, proper de-silting arrangements shall be made before onset of monsoon.
- Oil contaminated wastes like oil filters, oily muck, cotton wastes etc. generated from workshops, garages and other areas shall be disposed in accordance with Hazardous Waste (Management Handling & Transboundary Movement), Rules 2008
- Tailing ponds shall be located on impervious areas with deep water table. The ground underlying the dam must be structurally sound and able to bear the weight of the impoundment. Wherever practicable, tailings shall be used for filling in the exhausted mine pits.
- Efforts shall be made for use of tailings generated from wet beneficiation plant for making value added products like ceramic floor tiles, wall tiles, bricks etc.
- The exposed tailing pond areas shall be properly covered with vegetation. The whole tailing pond area shall be covered through vegetation once the life of the pond is over.

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7.4 Conclusions

In view of the non-availability of sufficient data pertaining to the generation and management of various solid and hazardous wastes generated from the mining industries in Goa, a detailed study would be required to quantify and characterize these wastes and to assess the past as well as present management practices. The study would also include generation of primary data for various environmental components to assess the adverse impact if any. The specific environmental management plan vis-à-vis past and present waste management practice can be delineated after the detailed study.

7.5 Future Work-Plan

Due to non-availability of sufficient data/information on various aspects of solid and hazardous wastes management by the individual mining industry in Goa and also due practical limitation of data collection each mine. The individual mine owners are requested to provide necessary inputs for their mines as per the attached questionnaire.

The relevant data information on solid and hazardous waste management will be reviewed and compiled from the questionnaire. The representative samples of the waste generated by the mining industries will be collected from the selected industries for detailed characterizations. Based on the data/information complied through questionnaire and the characteristics of various waste generated by the mining industry, a critical assessment of environmental impact and delineation of comprehensive environmental management plant would be possible.

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8.0 Biological Environment

Under the terrestrial ecology, the following aspects are covered with respect to the whole of the Goa State:

- Forest cover
- Wild Life Sanctuaries and National Park
- Flora
- Fauna
- Avifauna

8.1 Forest Cover

Goa, the popular tourist destination in the country, has a luxuriant and flourishing biodiversity. It is a tiny state with a geographical area of 3,702 km^2 constituting 0.11% of total area of the country. The recorded government forest area in the state is 1,224 km^2, which is 33.06% of the geographical area. Of this, the Reserved Forests constitute 20.67%, Protected Forests 69.04% and Unclassified Forests 10.29% of the total forest area. The state has one National park (Mollem) and 6 wildlife sanctuaries covering an area of 107 km^2 and 648 km^2 respectively. Thus, a total of 755 km^2 area constituting 61.68% of the recorded Forest Area and 20.4% of the geographical area of the state is under protected area network. Besides, nearly 200 km^2 area is under private forest. Thus, the total forest cover becomes 1424 km^2, which is 38.47% of the geographical area of the State. Forest map of Goa is shown in **Fig. 8.1**.

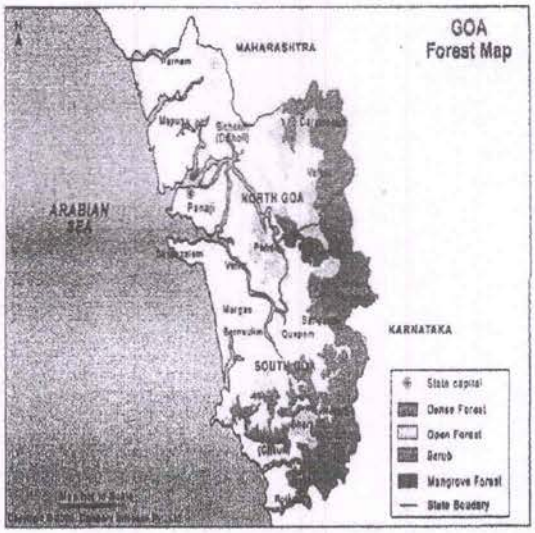


Fig. 8.1: Forest Map of Goa
(Source: http://www.mapsofindia.com/)

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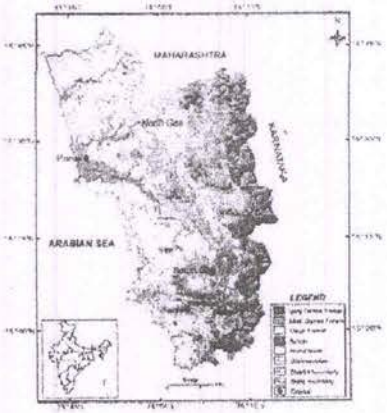
Out of the total 1224 km^2 government forest area, about 354 km^2 lies in North Goa district and remaining 870 km^2 in South Goa district. Taluka-wise distribution of the forest cover of the State is given in the **Table 8.1**.

Table 8.1: District & Taluka-wise Distribution of Forest Cover in Goa State

Sr. No.	District & Taluka	Geographical Area (km^2)	Forest Area (km^2)
A.	**North Goa**	**1674.40**	**354.40**
	Bardez	264.80	--
	Bicholim	236.33	8.08
	Pernem	242.00	13.43
	Ponda	252.28	50.12
	Satari	512.84	280.99
	Tiswadi	166.12	1.78
B.	**South Goa**	**2026.8**	**870.05**
	Canacona	347.36	185.82
	Mumugao	78.31	--
	Salcete	277.19	0.08
	Sanguem	886.60	569.25
	Quepem	437.36	114.90

Forest Cover (based on Feb. 2009 Satellite Data)

Based on the interpretation of satellite data of February 2009, the forest cover in the State is 2,219 km^2, which is 59.94% of the State's geographical area. In terms of forest canopy density classes, the state has 543 km^2 area under very dense forest, 585 km^2 area under moderately dense forests and 1,091 km^2 area under open forests. Forest cover map of Goa is depicted in **Fig. 8.2.**



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Fig. 8.2: Forest Cover Map of Goa
(Indian State of Forest Report, 2011)

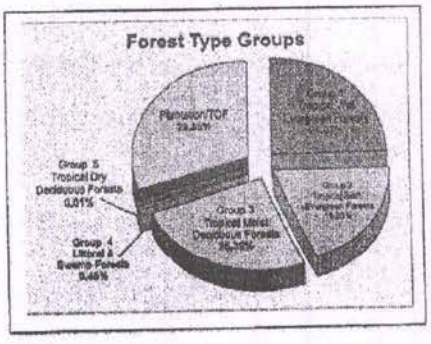
The forests of Goa are typical of the Western Ghats (Southern Maharashtra and Karnataka). There is diversity in the forests due to the variation in altitude, aspect, soil

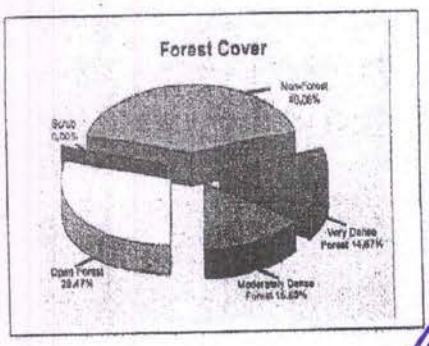
characters, slope etc. As per Champion and Seth (1968) Classification of Forest types of India, the forests of Goa fall in the following types:-

A. Estuarine vegetation consisting of mangrove species along narrow muddy banks of rivers [4 B/TS1 and 4B/TS2]
B. Strand vegetation along the coastal belts
C. Plateau vegetation confined especially to the low altitude
    a. Open scrub jungle (5.E7)
    b. Moist mixed deciduous forests [3B/C2]
    c. Secondary moist mixed deciduous forests [3B/C2/2SI)
    d. Sub-tropical Hill forests [8A/C2]
D. Semi-evergreen and evergreen forest limited to patches along the high altitude
    a. Semi-evergreen forests [2A/C2]
    b. Lateritic Semi-evergreen forests [2 E4]
    c. Evergreen forests [1A/C4]

While, according to the forest type mapping done by the Forest Survey of India, the State has five forest types, which belong to five forest groups, viz. a) Tropical Wet Evergreen, b) Tropical Semi Evergreen, c) Tropical Moist Deciduous, d) Littoral and Swamp and e) Tropical Dry Deciduous forests.

Further, based on the tree inventory collected over a period of 6 years during 2004-2010, tree cover outside the forest (TOF) area was estimated to be 286 km^2, (7.73% of the geographical area of the State). Thus, the total forest cover including tree outside forests becomes 2505 km^2, which is nearly 2/3rd of the total geographical area of the State. The forest type and forest cover-wise distribution is shown in **Fig. 8.3** and **Fig. 8.4**, respectively *(Source: Indian State of Forest Report 2011)*.





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Fig. 8.3: Forest types in Goa Fig. 8.4: Forest cover in Goa

8.2 Wild Life Sanctuaries and National Park

The State has six Wild Life Sanctuaries (WLS) and one National Park (NP), which are depicted in Fig. 8.5.

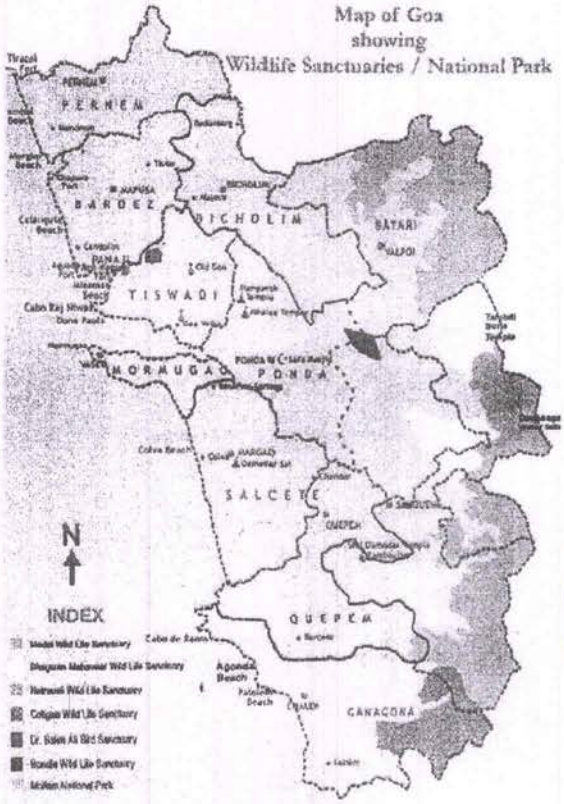




Fig. 8.5: Wildlife Sanctuaries and National Park in Goa
(Source: http://www.planet-goa.com/images/goa-map.jpg

The total area covered under these wildlife sanctuaries and national park is bout 755 km^2, which is about 20.4% of the total geographical area of the State. Details of each Sanctuary and National Park are given in Table 8.2.

Table 8.2: Wild Life Sanctuaries and National Park in Goa

Sr. No.	Name	Geographical Area (km^2)	% of Area	Location (Taluka)	Year of Creation
1.	Madei WLS	208.48	27.60	Satari	1999
2.	Bhagwan Mahaveer WLS	133.00	17.61	Sanguem	1967
3.	Netravali WLS	211.05	27.94	Sanguem	1999
4.	Cotigao WLS	86.00	11.39	Canacona	1969
5.	Dr. Salim Ali Bird	1.80	0.24	Tiswadi	1988

	Sanctuary				
6.	Bondla WLS	8.00	1.06	Ponda	1969
7.	Mollem National Park	107.00	14.17	Sanguem	1978
	Total	**755.33**	**100.00**		

Boundaries of Wildlife Sanctuaries with Eco-sensitive Zone Markings

As per 2013 ESZ Notification, The Ministry of Environment & Forests, New Delhi has declared all the Wild Life Sanctuaries and National Park as eco-sensitive. The extent of Eco Sensitive Zone is 1 km uniformly all along the periphery of the boundary of Wildlife Sanctuary within the State of Goa.

Mining is not allowed around the eco-sensitive zone (ESZ) of these wildlife sanctuaries and national park in Goa and the Centre has also constituted a state-level ESZ Monitoring Committee (SESZMC) under Section 3 of the Environment (Protection) Act, 1986, to see that the ESZ notification for the state is complied with.

The ministry has prohibited all new and existing mining of minor and major minerals, stone quarrying and crushing units with immediate effect in all the six sanctuaries. However, in case of Bhagwan Mahaveer and Netravali Wildlife Sanctuaries, the existing mining would be phased out based on the state government's plans. Eco-sensitive Zone boundary details for each Wildlife Sanctuary and National Park are given here.

A. Madei Wildlife Sanctuary with Eco-sensitive Zone, North Goa

The Eco-sensitive Zone is bounded on the North by Maharashtra State boundary, on the South by the boundary of Bhagwan Mahaveer WLS, on the East by the villages of Karnataka State and on the West by the Anjunem reservoir and its canals and areas of the villages of Sattari Taluka. The Mahadei river, a tributary of Madei River is joining the ESZ on East and passing along the Eco Sensitive Zone boundary from East towards West at few places. The Anjunem reservoir is within the ESZ towards West. Boundaries of Madei Wildlife Sanctuary along with its Eco-sensitive Zone markings are depicted in **Fig. 8.6**.

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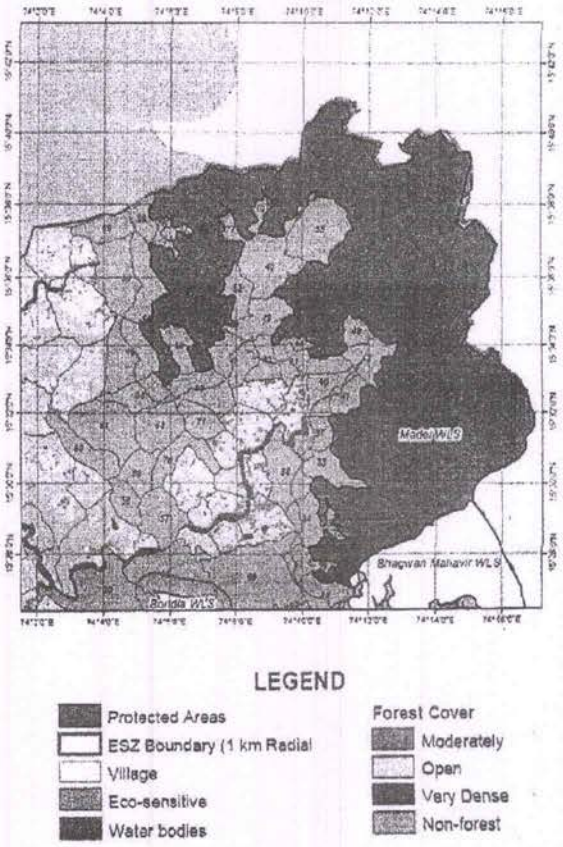


Fig. 8.6: Map of the Madei WLS with Eco-sensitive Zone Boundary

B. Bhagwan Mahaveer WLS & National Park Eco-sensitive Zone, North Goa

Bhagwan Mahaveer Wildlife Sanctuary & National Park within the State of Goa is bounded on the North by the boundary of Madei WLS, on the South by the boundary of Netravali WLS, on the East by the boundary of Bhagwan Mahaveer WLS & National Park and on the West by areas of the villages of Dharbandora Taluka, Sattari Taluka and Sanguem Taluka. The Dudhsagar (is a water fall of headwaters of Mandovi river forming a foaming torrent that splits into three streams to cascade down a near-vertical cliff face into a deep green pool.), originating from the Bhagwan Mahaveer National Park passes through the ESZ towards West and also passing along the Eco Sensitive Zone boundary and Bhagwan Mahavir Sanctuary boundary towards West. Boundaries of Bhagwan Mahaveer WLS and National Park along with its Eco-sensitive Zone markings are depicted in **Fig. 8.7**.

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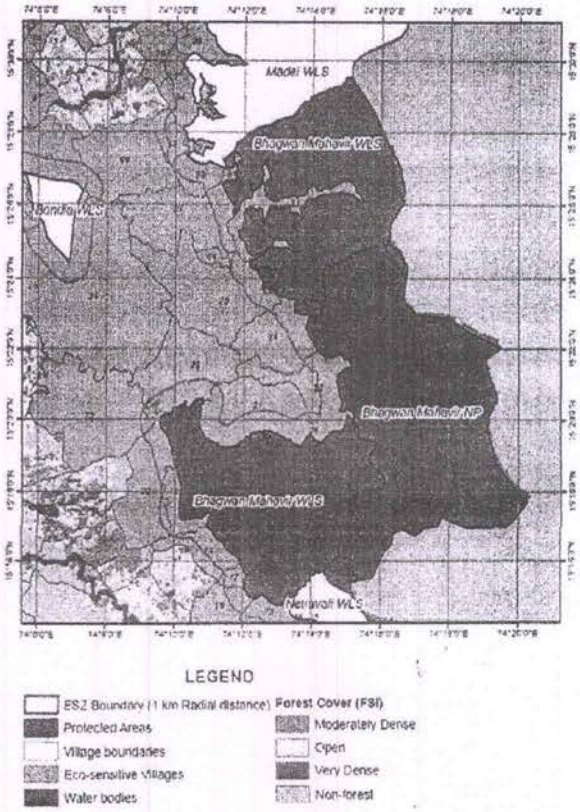


Fig. 8.7: Map of Bhagwan Mahaveer WLS & National Park with Eco-sensitive Zone Boundary

C. Netravali Wild Life Sanctuary Eco-sensitive Zone, South Goa

The Netravali WLS is bounded on the North by the boundary of Bhagwan Mahaveer WLS, on the south by the boundary of Cotigao WLS, on the East by the boundary of Netravali WLS and on the West by Salaulim reservoir and the balance areas of villages of Sanguem Taluka. Boundaries of Netravali WLS along with its Eco-sensitive Zone marking are depicted in **Fig. 8.8.**

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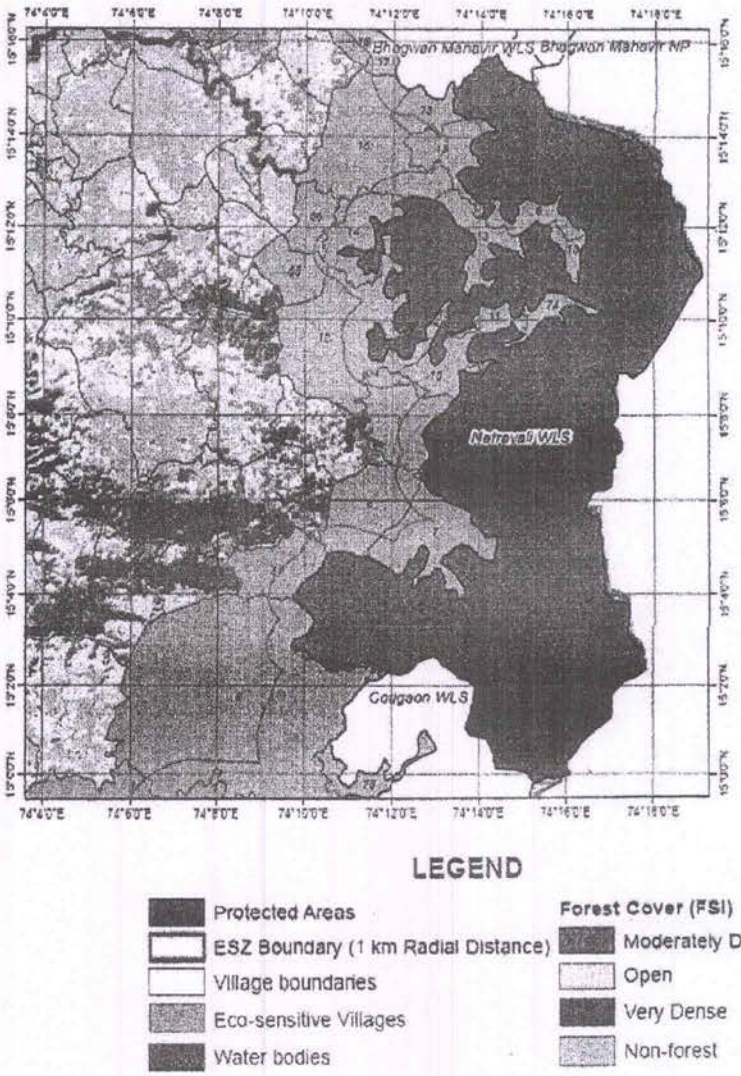


Fig. 8.8: Map of Netravali WLS with Eco-sensitive Zone Boundary

D. Cotigao Wild Life Sanctuary Eco-sensitive Zone, South Goa

The extent of Eco Sensitive Zone is 3 km uniformly all along the periphery of the boundary of the Cotigao WLS within the State of Goa. The Eco-sensitive Zone is bounded on the North by Netravali WLS, on the South by Karnataka State, on the East by the Cotigao WLS and on the West by remaining part of Cotigao, Poinguinim and Gaodongrem villages. Boundaries of Cotigao WLS along with its Eco-sensitive Zone markings are depicted in Fig. 8.9.

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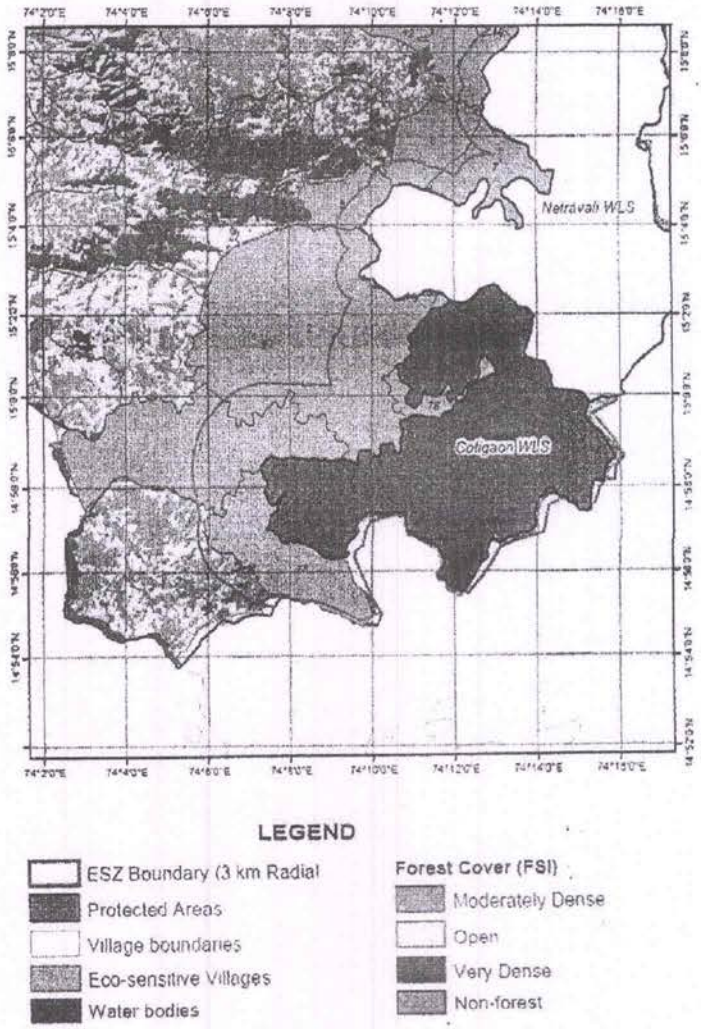


Fig. 8.9: Map of Cotigaon WLS with Eco-sensitive Zone Boundary

E. Dr. Salim Ali Bird Sanctuary Eco-sensitive Zone, North Goa

The extent of Eco Sensitive Zone is 1 km uniformly all along the periphery of the boundary of the Dr. Salim Ali Bird Sanctuary within the State of Goa. The Eco-sensitive Zone is bounded on the three sides i.e, North, West and South by the Mapusa River and the Mandovi river and the village Chorao of Tiswadi Taluka is located towards the Eastern side. Boundaries of Dr. Salim Ali Bird Sanctuary along with its Eco-sensitive Zone markings are depicted in **Fig. 8.10.**

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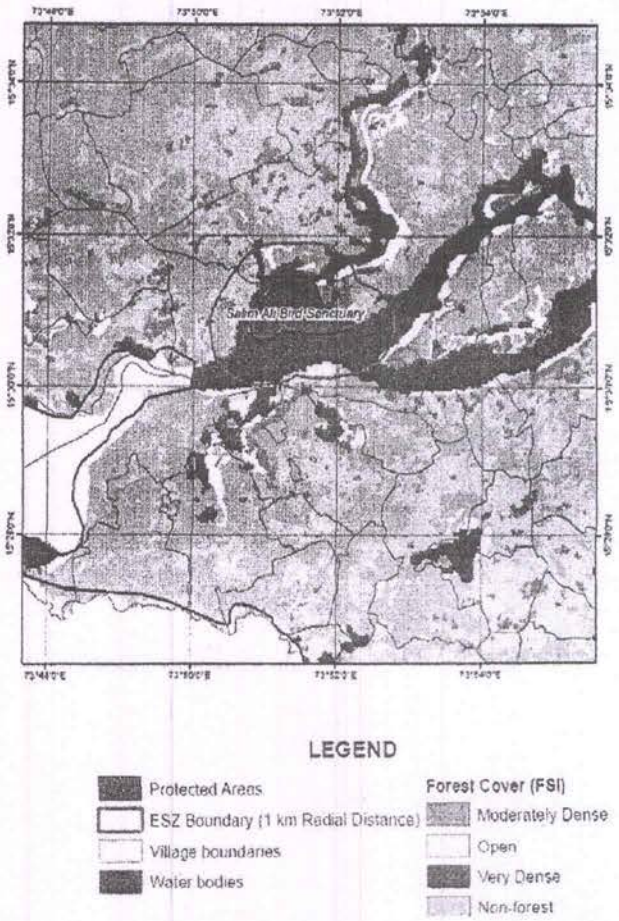


Fig. 8.10: Map of Dr. Salim Ali Bird Sanctuary with Eco-sensitive Zone Boundary

F. Bondla Wildlife Sanctuary Eco-sensitive Zone, North Goa, Goa

The Eco-sensitive Zone, 1 km around the Bondla Wildlife Sanctuary within the State of Goa is bounded on the North by areas of the villages Gangem, Conquirem and Melauli, on the South and West by the areas of the villages Dharbandora, Piliem and Usgaon, on the East by areas of the Villages Dharbandora and Melauli. The Ragada Nadi, a tributary of Madei River is entering inside the ESZ on East and passing along the Eco Sensitive Zone boundary from East towards North at few places. Boundaries of Bondla WLS along with its Eco-sensitive Zone markings are depicted in **Fig. 8.11**.

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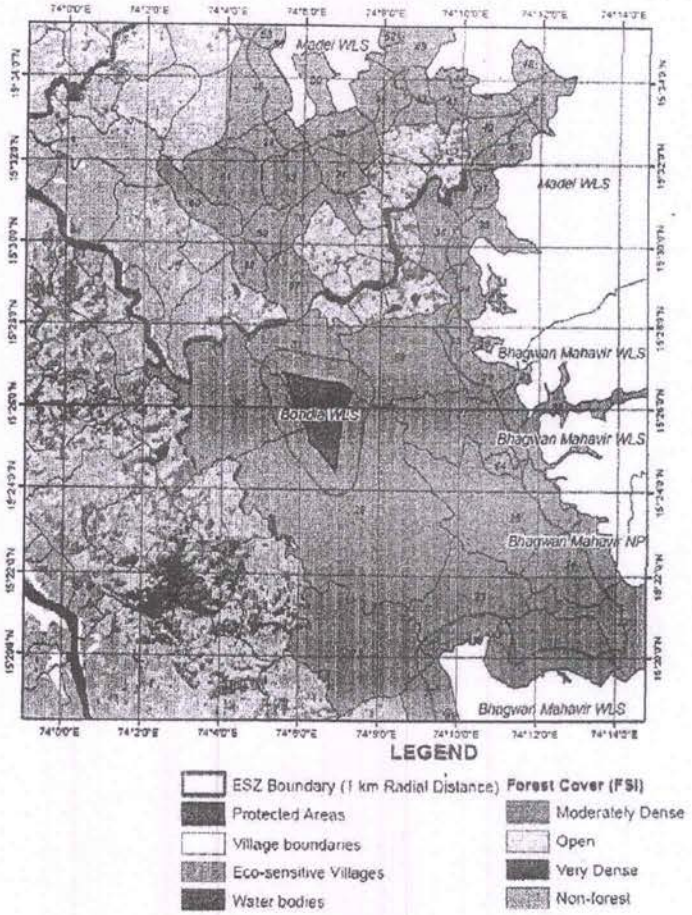


Fig. 8.11: Map of Bondla Wildlife Sanctuary with Eco-sensitive Zone Boundary

8.3 Flora of Goa

The State of Goa is the smallest of all the States in the country yet, it shows an astonishing diversity of endemic species, habitats and ecosystems. The smallest state of India is situated on the western shores of the country in the Konkan territory. Goa is under the influence of two global biomes - the marine biome of the Arabian Sea and the terrestrial forest biome of the Western Ghats. Within this geographical canvas, there is a wide range of ecosystems and *habitats* e.g. forests, Ghats, alluvial plains, coasts, rivers, estuaries, mangroves, wetlands, etc. The Western Ghats have the greatest divert of plant life, including areas of jungle (which can be seen around Dudhsagar Falls and Bhagwan Mahavir Wildlife Sanctuary), The vegetation here is, for

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the most part, tropical evergreen, although there evergreen although there are large areas of cane & bamboo and semi-evergreen trees. The eco-physiology of the habitats is governed by complex ecological and meteorological conditions. There are normal habitats and extreme habitats (like the rock pools and the salt pans). The status of biodiversity in each of these habitats varies. depending naturally on a variety of genetic and environmental factors. On the lower slopes of the Ghats, thinner, dry soil supports lateritic semi-evergreen forests. In many places (for example, Cotigao wildlife Sanctuary) the arid nature of the leads to savanna likes vegetation. In the less dry patches of the lower slopes, imbers such as teak are grown.

Goa's wildlife sanctuaries boast 1512 species of plants. The region shelters over 275 species of birds, 60 genera of reptiles found in the pristine forest of Goa, 14 Mangrove tree species are found mainly on the west coast.

The state of Goa is home to abundant woodlands, encompassing more than 1,424 km^2. The major forest products in the state of Goa are Maratha barks, Bamboo sticks, Bhirand and Chillar barks. In this state, coconut trees are seen everywhere other than the places with higher altitude. A big variety of broad-leafed plants such as sal (*Shorea robusta*), teak (*Tectona grandis*), mango (*Mangifera indica*) trees, and cashew (*Anacardium occidentale*) is seen. Popular fruits found in this area are, Mango, Jackfruit, Black-berry, also known as podkoam in Konkani language and Pineapples. The jungles of the state are full of herbs and medicinal trees. The state tree of Goa is the Asan. Goa's wet evergreen forests generally occupy about 250 km^2 which are found in different areas in deep ravines and steep hills. These forests are mainly on the eastern border of Goa, close to the steep, rocky slopes of the Western Ghats. With these regions receiving heavy rainfall, the soils are shallow since they tend to be easily eroded. During the pre Liberation period, the Portuguese kept these forests as 'A' class classified ones for purposes of soil conservation and regulation of water flows. Also, these areas being somewhat inaccessible and coupled with high elevation and rocky territory, the wet evergreen forests had low value timber content. Among these Goan wet evergreens, only two really could be termed as 'gregarious species' viz. *Syzgium cumini* (Jamun) and *Mimusops elegy* (Maulshree). In their virgin state, Goa's moist deciduous forests include leaf-shedding species, teak and bamboos, the latter being an excellent source of long-fibre material for pulp. Essentially, these forests can be classified into four categories *viz.*

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(1) High value

(2) Medium value

(3) Average value and

(4) Low value timber

During the time of the Portuguese rule, 400 forest out of a total of nearly 800 km^2. Of moist deciduous forest had been classified as teak-bearing areas and treated as being available for commercial timber sales. However, despite the absence of user-rights, considerable illegal, unsupervised over-cutting took place resulting in considerable damage to these forests, leaving behind stumps and malformed trees. Added to this, were the dumping of mining waste which contributed to the degradation of these forests.

List of Flora of Goa in given in **Table 8.3**. Medicinal plants along with their uses are listed in **Table 8.4**.

Table 8.3: List of Flora of Goa

Sr. No.	Name in Konkani	Botanical Name	Name in English	Name in Hindi
1	Ambo	*Mangifera indica*	Mango	Aam
2	Ambado	*Spondia mangifera*	Hogplum	Jangali Aam
3	Ananas	*Ananas comosus*	Pine Apple	Ananas
4	Apto	*Bahuhinia racemosa*	Bidi Leaf Tree	Kathmuli
5	Asoka	*Saraca indica*	Sorrow less tree	Ashok
6	Assan	*Pterocarpus marsupium*	Indian Kino	Vijaysar
7	Awala	*Embilica officinalis*	Indian Gooseberry	Amla
8	Bayo	*Cassia fistula*	Indian Laburnum	Amaltas
9	Bavalgi	*Vitex altissima*	Five-leaved chaste tree; Horseshoe vitex	Sambhalu
10	Bibba	*Semicarpus anacardium*	Indian marking nut tree	Bhilawa
11	Bhedas	*Syzgium caryophyllatum*	Wild black plum	Jangli jamun
12	Bhendi	*Thespecia populinea*	Cork tree, false rosewood	Rakta Kambal
13	Bhiran	*Garcinia indica*	Indian Tallow tree	kokum
14	Billemad	*Caryota urens*	Indian sago palm	Tody palm
15	Boke	*Bischofia javanica*	Bishop wood	Kein
16	Boram	*Zizuphus mauritiana*	Indian Plum	Ber
17	Brev-Damar	*Canarium strictum*	black dammar tree	Kala Dammar
18	Caju	*Anacardium occidentale*	Cashew	kaju
19	Chandole	*Macaranga peltata*	Macaranga	chandada

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Sr. No.	Name in Konkani	Botanical Name	Name in English	Name in Hindi
20	Char	*Buchanania lanzan*	cuddapa almond	Chironji
21	Datura	*Datura stramonium*	Jimson weed	Dhatura
22	Dhamen	*Grewia tiliaefolia*	common Indian linden	Dhamani
23	Elamb	*Machilus macrantha/ Persea macrantha*	Persea	Golum
24	Goinda	*Diospyros motana*	Bombay ebony	Bistendu
25	Goting	*Terminalia bellerica*	Beleric Myrobalan	Bahera
26	Gunj	*Adenanthera pavonina*	Red Sandalwood	Rattan Gunj
27	Gulmohar	*Delonix regia*	Flame Tree	Gulmohar
28	Hedu	*Adina cordifolia/ Haldinia cordifolia*	Haldinia	Kadamba
29	Hirda	*Terminalia chebula*	Yellow Myrobalan	Harad
30	Irai	*Calophyllum wightianum*	Indian Laurel tree	Undi
31	Jagan	*Falcouria latifolia*	Wild flower	Jagan
32	Jamun	*Syzygium cumini*	Java Plum	Jamun
33	Karmal	*Dillenia pentagyna*	Dog Teak	Karmal
34	Katekawach	*Bridelia retusa*	Spinous Kino Tree	Khaja
35	Kadam	*Anthocephalus envamba*	Anthocephalus	Kadamb
36	Kalamb	*Mytragyna parviflora*	Mitragyna	Kaim
37	Kaidol	*Sterculia urens*	Indian-tragacanth	Kulu
38	Kala Siras	*Albizzia odoratissima*	Ceylon rosewood	Kala Siris
39	Karanji	*Pongamia pinnata*	Indian Beech Tree	Karanj
40	Karamb	*Olea diocia*	Rose Sandalwood	Karamb
41	Kadu Khajur	*Melia composita*	Plywood tree	Kadu
42	Kakad	*Garunga pinnata*	Grey Downy Balsam	Kharpaat
43	Kalakundo	*Wrightia tinctoria*	Pala indigo plant	Stree Kutaja
44	Kamdel	*Carallia brachiata*	Freshwater Mangrove	Kierpa
45	Kamdeli	*Rhizophora mucoronata*	Asiatic Mangrove	Kala Lakri
46	Karo	*Strychonos nux-vomica*	Strychnine tree	Kucchla
47	Keli	*Musa paradisiaca*	Banana	Kela
48	Khair	*Acacia catechu*	Cutch Tree	Dant Dhawan
49	Kharvat	*Ficus asperrima*	Bengal Fig	Bargad
50	Kindal	*Terminalia paniculata*	Flowering Murdah or Kindel Tree	Asvakarna
51	Kumbiyo	*Careya arborea*	Wild Guava	Kumbhi
52	Kudo	*Hollarhena antidysentric*	Indrajao	Kadvi
53	Kusum	*Schleichera Oleosa*	Lac Tree	Kusum
54	Lavang	*Cinamomum zylariccum*	Clove	Laung
55	Matti	*Terminalia tomentosa / crenulata*	Indian Laurel	Saaj
56	Moi	*Lannea grandis*	Ash Tree	Mohin
57	Naal	*Cocos nucifera*	Coconut	Nariyal

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Sr. No.	Name in Konkani	Botanical Name	Name in English	Name in Hindi
58	Nano	*Lagerstroemia lanceolata*	Egyptian Privet Irula	Henna/Mehendi
59	Nagin	*Sterculia foetida*	Wild Indian Almond	Jangali Badam
60	Onwal	*Mimusops elengi*	Spanish Cherry	Maulshri
61	Oondi	*Calophyllum inophyllum*	Alexandrian laurel	Sultan Champa
62	Otomb	*Artocarpus lakoocha*	Monkey Jack	Badhal
63	Palas	*Butea monosperma*	Flame of the forest	Palash
64	Padval	*Stereospernum personatum*	Trumpet Flower	Patiri
65	Pal Phanas	*Artocarpus hirsuta*	Jackfruit	Kathal
66	Papaya	*Carica papaya*	Papaya	Papita
67	Pave	*Hopea wightiarius*	Wild flower	Pave
68	Phanas	*Artocarpus heterophyllus*	Jackfruit	Kathal
69	Pipal	*Ficus religiosa*	Sacred Fig	Pipal
70	Pongaro	*Erythrina indica*	India Coral Tree	Pangari
71	Ranjaiphal	*Myristica malabarica*	Malabar Nutmeg	Bombay Jaiphal
72	Ran Bhendi	*Thespesia lampas*	Common Mallow	Ban Kapas
73	Rinte	*Sapindus emarginatus*	Notched Leaf Soapnut	Reetha
74	Saguvan	*Tectona grandis*	Teak	Sagvan
75	Salai	*Aparora lindhyana*	Wild Flower	Salai
76	Savai Matti	*Terminalia arjuna*	Arjun Tree	Arjun
77	Saton	*Alstonia scholarias*	Blackboard Tree	Shaitan ki Jhar
78	Sawar	*Bombax malabaricum*	Red Silk Cotton Tree	Semal
79	Semdri	*Mallotus phillipinensis*	Monkey face tree	Kamala
80	Siras	*Albizia lebbeck*	Woman's tongue, Tibet lebbeck, singer-tree	Shirish
81	Shivan	*Gmelina arborea*	White Teak	Gambhari
82	Sissum	*Dalbergia latifolia*	Bombay Blackwood, East Indian Rosewood	Sesum
83	Taman	*Lagerstroemia speciosa*	Giant Crape-myrtle	*Jarul*
84	Tetu	*Oroxylum indicum*	Midnight horror	Bhoot Vriksh
85	Vad	*Ficus bengalensis*	Indian Banyan	Bargad
86	Vavalo	*Holoptelea integrifolia*	Indian Elm	Chilbil
87	Zamba	*Xylia xylocarpa*	Burma Ironwood	Jambu

Source: Goa central.com

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Table 8.4: Medicinal Plants in Goa and their Uses

Sr. No.	Botanical Name	Name in Konkani, English & Hindi	*Useful for treatment of*
1.	*Alstonia scholaris*	Saton, Blackboard Tree, Shaitan ka jhar	Ulcers, dyspepsia, skin diseases, liver problems.
2.	*Cassia fistula*	Bayo, Indian Laburnum, Amaltas	Paralysis, rheumatism, skin diseases, diabetes, "Black water" fever.
3.	*Ficus religiosa*	Pipal, Sacred Fig, Pipal	scabies, cracked /inflammed soles of feet.
4.	*Magnifera indica*	Ambo, Mango, Aam	Bleeding piles, diptheria, skin disease.
5.	*Mimosa pudica*	Lajwanti, Touch-me-not, Chui-Mui	Kidney disorders, piles, fistular sores, urinary diseases, abscesses.
6.	*Piper nigrum*	Miire, Black Pepper, Kali Mirch	Dyspepsia, vertigo, coma, sore throat parapytic affection, alopacia and urticaria.
7.	*Tectona grandis*	Saguvan, Teak, Sagvan	Dyspepsia, heartburn, headache, diuresis skin itch.
8.	*Terminalia chebula*	Ordo, Hirida, Yellow Myrobalan, Harad	Mild laxative, enlarged spleen, urinary disorders, intestinal worms.
9.	*Tinospora cordifolia*	Nimgilo, Indian Tinospora, Giloy	Rheumatism, biliousness, spermatorrhoea, jaundice, bone fractures.
10.	*Zizyphus jujuba*	Ranbor, Red Date, Ber	Boils, abscesses, inflammation of gums, mild laxative, expectorant.
11.	*Vitex negundo*	Nigund, Chaste Tree, Nigundi	Catarrhal fever, rheumatism, enlarged spleen, sprains, inflammatory swellings of joints, cholera and hemorrhages.
12.	*Acacia arabica*	Khair, Black Catechu, Khair	Treatment of gonorrhea, vaginal diseases, dysentery, bleeding from bites of leeches; and also as an expectorant.
13.	*Strychnos nux vomica*	Kajra, Snake wood, Bailewa	Debility, worms, hysteria, mental emotions, insomnia, spasmodic diseases, sexual impotence and bronchitis.
14.	*Erythrina indica*	Pangara, Coral Tree, Pangar	Round worms, tape worms, thread worms, toothache, rheumatic pains, eye diseases.

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Dependence of Local People on Minor Forest Products

The forest of Goa yields products like timber, firewood, poles canes, *shikakai* pods, oil, fibers and grasses. The coastal mangrove forests also serve as breeding grounds for marine fishes. This natural vegetation helps in the conservation of the soil resources, regulation of the climate, and the surface flow of this state. The *Casuarina equisetifolia* plantations, for example, help to protect the coast against soil erosion and also serve as a shelter for the agricultural fields located in the interior. Economically important plants of Goa are listed in **Table 8.5**, whereas threatened plants are listed in **Table 8.6.**

Table 8.5: Economically Important Plants of Goa

Sr. No.	Name of the Plantation	Economic use
1.	Cashew	One of the largest plantation crops in Goa. About 10 lakh litres of cashew feni are produced annually which fetches the State of Goa around Rs. 80 - 90 lakhs / year.
2.	Coconut	Second major plantation crop in Goa. – Staple diet of Goans being Fish Curry & Rice, coconut curries are an essential ingredient of the daily diet. – The other element of the coconut tree is that the toddy is used in the production of jaggery and vinegar as well as in the manufacture of feni, another variety of liquor. – Besides oil and oilcakes, which are fed to the animals, the trees produce fibres for ropes and matting. Coconut tree trunk is used to make rafters for roofs. Leaves both dry and green are used for making baskets and thatches to protect Goan homes, particularly windows and balcaos during heavy monsoon. The ribs of the leaves are used to produce brooms.
3.	Toddy tappers	The toddy tapping community is one of the major occupational groups in Goa. It secures its livelihood by tapping toddy from coconut trees, distilling into liquor known as feni and selling it to the public. The toddy is collected twice or thrice daily from the tree and is distilled later. Distilling involves a shed on distillery locally known as 'batti' using certain typical vessels for distilling.
4.	Kumeri cultivation	In Goa, shifting cultivation is locally known as 'Kumeri' and it is this form of agriculture that is largely responsible for producing Goa's output of nachne, other millets and pulses.
5.	Bhirand/Kokum	Bhirand / kokum is also an important plantation crop which forms a part of daily diet. It is used as a garnish to give an acidic taste to curries and vegetable as well as in the preparation of cooling kokum syrup during the hot summer months.

Source: ENVIS Centre on Floral Diversity. Botanical Survey of India, Ministry of Environment and Forests, Government of India

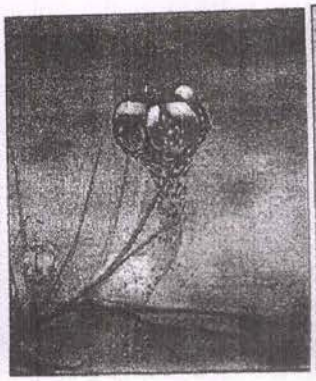
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Table 8.6 : Threatened Plants of Goa

Sr. No.	Family/ Scientific Name	Family	Red Data Book Status
1.	*Weisneria triandra*	Poaceae	Rare
2.	*Ceropegia fantastica*	Asclepiadaceae	*Extinct in Wild (Ex-Situ conservation in Shivaji University Kolhapur)*
3.	*Indigofera constricta*	Fabaceae	Rare
4.	*Aglaia talbotii*	Meliaceae	Vulnerable
5.	*Dimeria woodrowii* *Glyphochloa talbotii*	Poaceae Poaceae	Rare Vulnerable
	Source: *Red Data Book Plants of India (Nayar & Sastry 1987-88)*		
6.	*Ceropegia fantastica*	Asclepiadaceae	Endangered
7.	*Dimeria woodrowii*	Poaceae	Rare
8.	*Glyphochloa talbotii*	Poaceae	Vulnerable
9.	*Wisneria triandra*	Poaceae	Rare
10.	*Wrightia dolichocarpa*	Apocynaceae	Indeterminate
	Source: *ENVIS Centre on Floral Diversity. Botanical Survey of India, Ministry of Environment and Forests, Government of India.*		



Weisneria triandra



Ceropegia fantastica



Indigofera constricta



Aglaia talbotii



Dimeria woodrowii

Threatened Plants of Goa

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8.4 Fauna of Goa

Goa has plenty of wild animals in forests and these include: Monkeys, hares, tigers, antelopes, leopards, sambars, mongoose, barking deer, jackals, wild boar, otter, pangolin, fulvous fruit bat, flying foxes, stripped palm squirrels, Indian field mouse, bandicoot, Indian porcupine etc.

In addition to these wild animals, there are the well known domestic animals (dogs, cats), and livestock (cattle, goats, horses, donkeys, pigs, sheep,) and poultry (hens, cocks, ducks and drakes). Faunal diversity of Goa is presented in **Table 8.7**. Common Fauna of Goa is listed in **Table 8.8**.

Table 8.7: Faunal Diversity of Goa

Group	Order	Family	Subfamily	Genera	Species
Parasitic Protozoa	3	8	-	11	103
Mollusca (Land and Fresh Water)	6	12	6	15	25
Chilopoda (Centipede)	1	1	2	4	8
Cladocera	1	6	3	29	44
Isopoda (Land and Marine)	1	2	-	3	7
Crabs (Marine and Estuarine)	1	9	15	33	47
Anomuran Crabs	1	3	-	4	11
Crustacea	1	2	-	2	5
Odonata 1	8	12	24	39	-
Mantodea	1	4	7	8	9
Lepidoptera	1	5	18	141	251
Arachnida	5	16	-	33	50
Pisces (Fresh water)	8	20	-	31	58
Amphibia	2	5	-	17	28
Reptilia	3	20	-	57	100
Aves	20	71	9	238	458
Mammalia	12	31	25	57	83
Total	**68**	**223**	**97**	**707**	**1326**

Source: Zoological Survey of India, 2012

Table 8.8: List of Common Fauna of Goa

Sr.	Local name in Konkani	Botanical Name	Common English Name	Common Hindi Name
1	Van Mannus	Loris tardigradus	Slender Loris	Vangu
2	Makad	Macaca radiata	Bonnet Macaque	Bandar
3	Vandor	Presbytis entellus	Langur	Langur
4	Vag	Panthera tigris	Tiger	Bagh
5	Bibtto Vag	Panthera pardus	Leopard	Tendua
6	Ran Manzor	Paradoxurus herma phroditus	Toddy Cat	Tody
7	Baul Manzor	Felis chaus	Jungle Cat	Billi

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Sr.	Local name in Konkani	Botanical Name	Common English Name	Common Hindi Name
8	Vagati	Felis bengalensis	Leopard Cat	Tendua Billi
9	Katanoor	Viverricula indica	Small Indian Civet	Civet
10	Mongus	Herpestes edwardsi	Common Mongoose	Nevla
11	Bhalu	Melursus ursinus	Sloth Bear	Bhalu
12	Colo	Canisaureus	Jackal	Gidhar
13	Yeul	Hyena hyena	Striped Hyena	Bhediya
14	Deucolo	Cuon alpinus	Wild Dog	Dhol
15	Uldh	Lutra lutra	Common Otter	Udbilao
16	Uldh	Lutra perspicillata	Smooth Indian Otter	Udbilao
17	Vagul	Rousettus leshenaulti	Fulvous Fruit Bat	Chamgadad
18	Vagul	Rhinophus rouxi	Rufus Horse Shoe Bat	Chamgadad
19	Pako	Pteropus giganteus	Indian Flying Fox	Chamgadad
20	Shenkaro	Ratufa Indica	Indian Giant Squirrel	Gilehri
21	Khadi Khar	Funambulus palmarum	Three Striped Palm Squirrel	Gilehri
22	Channi	Funambulus pennant	Five Striped Palm Squirrel	Gilehri
23	Pak Mazor	Petaurista petaurista	Common Giant Flying Squirrel	Gilehri
24	Undir	Mus booduga	Indian Field Mouse	Chuha
25	Undir	Rattus rattus	Common House Rat	Chuha
26	Koli Undir	Bandicot Indica	Bandicoot	Kukur jihwa
27	Chueha	Rattus blanford	Blanford's Rat	Chuha
28	Sal	Hystrix indica	Common Indian porcupine	Syahi
29	Soso	Lepus nigricollis	Hare	Khargosh
30	Govo Redo	Bos gaurus	Indian Bison	Gaur
31	Sambhar	Cervus unicolor	Sambhar Antelope	Sambhar
32	Chital	Axix axis	Cheetal	Chital
33	Bhenkaro	Muntiacus muntjack	Barking Deer	Kakhad
34	Pisoi	Tragulus meminna	Mouse Deer	Hiran
35	Kuring	Axix porcinus	Hog Deer	Hiran
36	Ran Dukar	Sus scrofa	Wild Boar	Jangali Suar
37	Tiryo	Manis crassicaudata	Pangolin	Sechi
38	Dugong	Dygong dugon	Sea Cow	Samudri Gai

Source: Goa central.com

8.5 Avifauna of Goa

Goa also hosts a large number of different types of birds, which includes: Egrets, kingfishers, eagles, bee eaters, vultures, blue throated-barbets, pheasants, shallow, jungle, fowls quails, shrikes, white breasted-water hens, oriole, pigeons,

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drongos, parrots and parakeets, mynas, cuckoos, bul buls, owls, babblers, flycatchers, tai lor birds, magpie-robin, wagtails, house sparrow and weaver birds. This wildlife sanctuary is also home to around 200 avian species. Some of the popular bird species here are Paradise flycatcher, Indian great black woodpecker, Emerald dove, Malabar pied hornbill, Great Indian hornbill, Grey jungle fowl, Fairy bluebird, Drongo, Wag tails, Shrikes, Barbets, Kingfishers etc. Some of the threatened bird species of Goa are listed in **Table 8.9**.

Table 8.9: Some of the Threatened Birds of Goa

Sr. No.	Common Name	Scientific Name	Status (IUCN)
1	White backed Vulture	Gyps bengalensis	Critically Endangered
2	Long-billed Vulture	Gyps indicus	Critically Endangered
3	Nilgiri Wood Pigeon	Columba elphinstonii	Vulnerable
4	Lesser Adjutant	Leptoptilos javanicus	Vulnerable
5	Greater Spotted Eagle	Aquila clanga	Vulnerable
6	Indian Skimmer	Rynchops albicollis	Vulnerable
7	Darter	Anhinga melanogaster	Vulnerable
8	White Ibis	Threskiornis melanocephalus	Vulnerable
9	Malabar Pied Hornbill	Anthracoceros coronatus	Near Threatened
10	Great Pied Hornbill	Buceros bicornis	Near Threatened

Source: ENVIS Centre on Floral Diversity. Botanical Survey of India, MoEF, New Delhi

8.6 Impact of Mining

Mining for iron ore production has been the most important economic activity contributing significantly to the State revenue of Goa. However, mining and associated activities over a sizable area has had considerable adverse impacts on environment and natural resources. Terrestial ecology is greatly affected by mining activity. Open pit mining operations have left an indelible mark on the region: hills have been flattened, forests razed, and fields blanketed in silt run-off from waste sites and processing plants.

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Damage to the environment is mainly done by the reject dumps, pumping out of muddy waters from the working pits including those where the mining operations have gone below the water table, and slimes from the beneficiation plant. The damage is more evidenced during mohsoon where the rain water carries the washed out material from the waste dumps to the adjoining low-lying agricultural fields and water streams.

Lamgaon is one of the many villages which have been affected in the name of development. Many villages like Pissurlem, Bicholim and Sulcorna etc have been affected heavily. Villagers now have to cut live trees for firewood instead of the normal dead trees. In Colamb, Sanguem (South Goa) lush green forests have been slashed down to clear the way for mining. The Kushavati River faces a dangerous situation due to mining which includes killing of the aquatic life. The mountains, especially in the south, are mineral-rich. Therefore, mining is a potential future threat that should be addressed with preemptive measures in this area.

Diversion of Forest Areas for Mining Activity

More than 40 mining leases operated in forested areas of the State. They require the destruction of forests on private properties or government-owned forests. Most mining operations are within the Western Ghats. Talukas like Sanguem in which many mining leases have been approved are thickly forested. Majority of the government forests allowed for mining have in fact already been notified as - Reserve Forests, to bring them within the protection of the Indian Forest Act, 1927. That protection, however, has not been a bar to their destruction at the hands of the mining industry and the government. The maximum area under mining is in Sanguem Taluka followed by Bicholim, Sattari and Quepem. Some 400 mining leases had been granted in Goa till 2002-03, covering approximately 303 sq. km. -- this works out to almost 8% of the total geographic area of the state. Number of mines increased every year. The estimated area of forests affected due to mining in Goa is about 20 sq.km.

According to this secondary data, in addition to the effects of mining in forest areas, floral diversity, discontinuity of distribution and patches of vegetation, leaf coloration and wilting effects are also reported.

In view of various and diversified impacts, further detailed analysis of secondary as well as primary data is necessary in consonance with the proposed mining activities to assess the safe limit of mining and related activities to ensuring from maintenance of terrestrial ecology of the State.

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Determination of various parameters/indices such as species frequency distribution, density, dominance, abundance, importance value index, stomata studies, leaf injury analysis, metal deposition, air pollution tolerance index, Simpson index, Shannon & Weiner Index, Whitford's index etc. with respect to flora and fauna will be studied to arrive at a safe limit for mining from terrestrial ecology point of view.

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9.0 Socio-economic Environment

Impacts of Interim Ban on Mining in Goa

Goa's mining operations were suspended first by the Goa Government on 10.09.2012 after the Justice M. B Shah Commission Report was tabled in the Parliament three days earlier. Then, 139 Environmental Clearances were suspended by the Ministry of Environment and Forests on 14.09.2012, followed by the Supreme Court order for ban on mining operations in the State on 5.10.2012, in the context of the Goa Foundation petition 435/2012. The Justice M.B Shah Commission and the Central Empowered Committee have investigated and reported several illegalities concerning the mining industry in Goa.

9.1 People's Perception

In order to understand and summarize the Environmental & Socio-Economic impacts of ban on the mining activity of Goa, the salient findings of the study conducted by EIA Resource and Response Centre (ERC), Goa, October 2013 Report was referred. **The rapid survey carried out by the ERC, Goa brought out people's perception on the changes with the suspension of mining in Goa, by way of reviewing print media and conducting a primary survey.** Mining is an industry mainly for economic benefits. People feel that the ban on mining should not hinder the process of reclamation in order to prevent any further damage to the State's environment, social well-being and traditional occupations.

The post ban environmental, social and economic scenario largely indicates that the State on the whole could make a successful recovery from about 60 *years of continued* mining operations. Each scenario is briefly summarized here..

9.1.1 Environmental Scenario

Despite Goa receiving about 120 inches of rainfall every year, it has to 'rely on the Tillari Project for water. While some rivers are flowing, there are some water bodies still reeling from the impact of mining. The impacts that occurred due to mining largely include:

(a) Air pollution due to suspended particles, vehicular exhaust and 'coating of roadside vegetation with dust

(b) Loss of wildlife habitat

(c) 'Water pollution' in streams, rivers, wells and wetlands affecting fish population and fishermen, dairy and 'silting of agricultural area and plantations'

(d) Noise pollution affecting houses and institutions like schools on road sides as well as wildlife around mines

The ban on mining has allowed for rejuvenation of the environment. Presently;

(a) The air is devoid of dust

(b) Springs, which were dry, have "begun to flow gradually"

(c) The 'decrease in noise pollution' has come as sigh of relief. Sacred groves have begun to echo with the sounds of various bird species

(d) Fishermen along the Mandovi and Zuari have noticed a rise in the amount of fish in the rivers since the movement of barges has reduced

(e) 'Rare orchids are blooming' and a 'tailing pond is slowly sprouting green'

(f) The number of wildlife sightings 'has increased' on the whole and 'the chirping of birds has replaced the roar of trucks.'

On the whole the environmental condition is on a road to recovery and any further mining operation without scientific study could seriously impair Goa's natural resources and environment.

9.1.2 Social Scenario

There were protests largely by truck owners, demanding the resumption of mining. The social parameters that emerged during this study include:

(a) Impacts of mining on culture and traditions
(b) Respite to schools
(c) Improvement in health conditions in mining areas
(d) Improved traffic conditions in mining areas
(e) Unrest and protests, truckers threatening activists and media
(f) Corruption in the Goa mining industry

The ban on mining has allowed for a number of changes in the social sphere and has brought some amount of respite to people e.g.

(a) There has been change in the demographics with 'the presence of the migrant workforce dwindling.

(b) In schools, teachers and students report a 'better teaching and learning experience as there is less amount of noise from mining trucks.'

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(c) Health conditions in mining areas have improved as "no new cases of skin problems, kidney problems or T.B. have been reported after the ban."

(d) Traveling has become 'convenient, safer and less time consuming.'

(e) Youth who were "reluctant to take up agriculture and were protesting for the ban on mining to be lifted have gradually begun returning back to the fields."

The cultural scenario had been impacted by way of, 'lack of water for celebrating traditional festivals', piling of a 'reject dump at a crematorium plot', 'mining leases in sacred groves' and 'youth being steered away from traditional occupations'.

Although the cultural scenario does not show significant positive change, if the ban on mining continues and economic alternatives are explored sincerely by people and government, the social scenario on the whole could make a successful recovery.

9.1.3 Economic Scenario

Residents from villages around the mines at Netravali, Sanguem, Goa, which were shut in the year 2003 have indicated positive results due to the stoppage of mining in the area by reporting, "...huge improvement in the quality of stream water and yield of local produce." Their comments come 9 years after the mines shut down. Hence if the ban on mining continues, one could surely expect other such positive changes in future.

VV Interesting comA Documentary Be Made??

Even though 'mining dependants' are claiming loss of income due to stoppage of mining, 'there is a section of the public benefitting economically by way of agriculture and exploring new options.' The ban has forced people to re-think and venture into different occupations.

Currently;

(a) Cultivators say, that their 'chilies and cashew produce has increased and they explain how earlier the dust would coat the plants and rot the flowers.'

(b) Traditional fishing communities have noticed 'a rise in the 'mendios' (Window Pane Oysters)' in Chicalim, along the bank of River Zuari (through which transportation of ore by barges and hence water pollution was taking place prior to the ban).

(c) Some truck drivers have agreed that 'agriculture will help clear their loans from the banks and sustain them.'

(d) A truck driver, with the closure of mines in Sirigao, Bicholim, 'has managed to bounce back as a motorcycle pilot.'

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In terms of people's views, while some seek 'controlled' and 'organized' mining, this seems difficult to implement with the infamous environmental track record of mining companies in the state and the obvious lack of compliance to environmental laws. There are some who believe that 'all the stakeholders of mining should come to terms that mining is not a sustainable business model and think of diversifying the local economy to make it less dependent on mining.' The pertinent questions arising due to limited natural resources of the state are, 'What after mining?' What after water resources are depleted?

9.2 Impact on Mining Dependents (Study of Barge Operators)

9.2.1 Mining Related Activities and Dependence

A large number of activities as well as communities/people are associated directly and/or indirectly with mining operations. Some of them are listed in **Table 9.1**, who are affected due to the proposed ban on mining.

Table 9.1 : Identified activity in the mining and transport route.

No.	Activity	Community / people involved
1.	Overburden removal and storage	- Nearby village residents, - Flora and fauna due to air pollution, - Agricultural land, forest land due to dumping
2.	Ore Extraction	Manual Labour
3.	Reject storage	- Flora and fauna due to air pollution, - Agricultural land, forest land due to dumping
4.	JCB Machine / Crane operation for loading of material	Machine Operators, mechanic
5.	Trucks for transport of material up to Barge	Driver, cleaner / conductor Trucks- 20,000; Workers- 40,000
6.	Eateries, repair shops along the road	Technicians, hoteliers
7.	JCB / Machine for transfer of material from unloading point to Barge	Machine Operators, mechanic
8.	Water way transport of Iron Ore by Barge	Machine Operators, mechanic
9.	Logistic providers for Barge operation	
10.	Unloading of Iron Ore near the port using Machine for onward shipment	Machine Operators, mechanic
11.	Loading of Iron Ore onto the ship using Machine for export	Machine Operators, mechanic
12.	Logistic providers	- Ship Chandlers - Stevedore

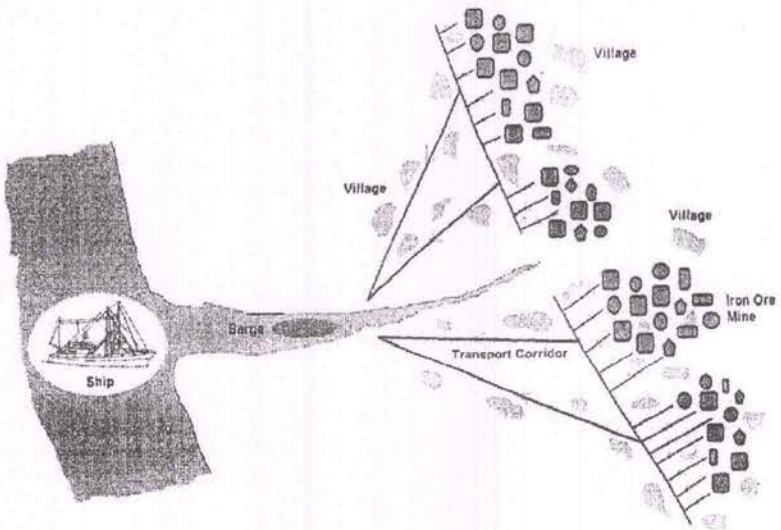
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No.	Activity	Community / people involved
		- Vessel owners agents - Charters Agent - Owners Agent - Custom House Agent

Though each of the above activity and community needs to be studied in detail, a brief assessment on 'Ore Transport using Barge' is presented here.

9.2.2 Transport of Iron Ore using Barge through River Waterways

Barges are the lifeline of the Ports of Mormugao and Panaji as the entire cargo for exports is transported by barges to the Ports. Goa is endowed with a large network of navigable rivers; The Mandovi and Zuari linked by the Cumbarjua Canal and the Mapusa River. These rivers have played an important role in the economy of the mining industry in Goa by providing a cheap, efficient and environmental friendly mode of ore transport which is unique to Goa. Schematic diagram of iron ore movement from mine to the ship is depicted in Fig. 9.1.



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Fig. 9.1 : Schematic Diagram of Overall Iron Ore Movement

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9.2.3 Impact on Barge Operators due to Ban on Iron Export

The entire quantity of ore for exports is transported by barges to the Ports of Mormugao and Panaji. Taking cognizance of the illegal Iron ore mining via a Public Interest Litigation, the Honorable Supreme Court of India put restriction on Iron ore export on 5th October 2012. This brought an abrupt halt in the operation of all the societies, stakeholders associated with Iron Ore mining. Barges operators are also one of those affected by the ban on Ore Export. The impact on the Barge operator due to ban is as follows:

Goa is a mono-cargo Port i.e., only Iron ore is exported from Goa and no other material is exported for which these Barges can be used as an alternative option. Goa carried 85% of India's Inland Water Transport. There is no other state in India which can absorb these large-size Barges that too large in number. Goan Barges were built for carriage of heavier cargoes like Iron Ore and are not suitable because of less cubic capacity to carry coal and are therefore not found economically viable to operate in other States like Gujarat and West Bengal, where coal is the predominant cargo imported. The entire Barge Fleet is idle and the condition of Barges is deteriorating day by day as barges are expensive to maintain. The total investment of approx. 1500 crores in barges is now a Dead Investment.

9.2.4 Financial Liability

Barge Owners of Goa have liability to the tune of Rs. 364 crores to Banks and Financial Institution by way of loans taken to purchase barges (**Table 9.2**). As barges are floating objects, in almost all cases "Homes of the Barge Owners" have been kept as collateral by the Banks. Because of non-operation, Barge owners do not have any income to meet the commitments of interest and loan installments. Thus all loans have become non-performing asset (NPA) and banks have commenced taking action against defaulting Barge owners. Banks do not want to seize the barges of the loaner as they would have to provide crew and maintain the barge. These barges cannot be kept in OFF mode instead its engine should continue to be in ON mode. This requires maintaining crew members on board thus incurring expenditure towards their salary and maintenance. Due to these operating conditions, the Banks do not keep the floating object as collateral. Banks have preferred the houses, most of which are in the names of the spouses of the Barge Owners. Due to NPA, the banks are now after the

homes of Barge owners who are worried that they may be pushed on the streets by the Bankers.

Table 9.2 : Loan Provided by Different Banks to Barge Owners

Sr. No.	Name of Bank	Loan Amount (Rs.)
2	State Bank of India	519873041
3	Bank of India	419047195
4	Corporation Bank	351159510
5	Bank of Maharashtra	293338463
6	Syndicate Bank	159756424
7	Bank of Baroda	101759596
8	Punjab National Bank	86217927
9	Saraswat Co-op Bank	89229994
10	Canara Bank	84292971
11	Indian Overseas Bank	59823602
12	IDBI Bank	55848132
13	Central Bank of India	49565244
14	HDFC Bank	40170530
15	United Co-op Bank	1947000
	Total	**2312029629**
16	Goa Urban Co-op Bank	750578821
17	Madgaon Urban Co-op Bank	119790700
18	EDC	102301331
19	Bicholim Urban Co-op Bank	35989001
20	Goa State Co-op Bank	24815387
21	Citizen Co-op Bank	5182968
	Total	**1038658208**
22	Sreia Finance	141574730
23	L & T Finance	130321619
24	Tata Cap Finance	13813284
	Total	**285709633**
	Grand TOTAL	**3636397470**

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9.2.5 Effects on Employment of Workers

Over 6000 crew members are directly employed on barges and another 30000 persons are employed in ancillaries like ports, workshops, jetties, trucks, services, offices, etc. Stoppage of work has led to large scale retrenchment of workmen. It has affected their families and children education. Large scale retrenchment of workers would have an adverse impact on the fragile economy and on the social fabric of Goa.

9.2.6 Effects of Capping on Iron Ore at Unsustainable Levels

As per an estimate provided by Barge owners, the Barge Industry requires at least 50 million tonnes of cargo in order to survive. If the permissible level of export is reduced below 50 million tonnes per year, the number of trips per Barge would not be sufficient for self-sustenance. These issues need to be confirmed by detailed study including the carrying capacity of water body that can carry these numbers of Barges. This can also be one of the approaches for finding the limit of ore export. The barge freight which is fixed by the GBOA and the Goa Mineral Ore Exporters Association (currently Rs.89.90 per ton) is based on 123 trips.

At the time of the ban in October 2012, there were 305 barges owned by private entrepreneurs (all members of GBOA). Besides this, exporters have 62 barges for captive transportation. These Barges can carry a significant part of the Ore and therefore the private entrepreneur will be left with small amount of cargo to be transported thereby making their operation unviable if the export quantity is limited to very low levels. Thus an evaluation needs to be done on the fraction of cargo that should be permitted to be carried by the captive Barges. List of captive Barge owners is as follows:

Mining Company	Number of Barges
M/s. Sesa Goa Ltd.	37
M/s. V.M. Salgaocar (group)	12
M/s. Timblo Private Ltd.	6
M/s. Salgaocar Mining	7
Total	62

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Barge owners have opted to enter into this business due to encouragement by the Goa State Government from time to time. The desire for increased Iron ore export that may help the State's economy has led to the construction of large size Barges. In the year 2002, the average size of unit Barge was 1300 Ton, where as in 2012 it was 1800 Ton. The increase in size was also approved by different agencies involved in granting permission.

Barges grew in number as the exports increased in 2010, the GBOA made efforts to curb the number of barges on account of congestion of the rivers, increase in number of accidents and shortage of statutory crew like Captain (Masters) & Drivers. The Captain of Ports issued Circular No. 11039/5260 dated 16 December 2010 to temporarily stop the Registration of new barges in Goa. The erstwhile Government withdrew the circular stating that exports would grow to 70 million tonnes. Entrepreneurs invested in 'Barges accordingly and today an abrupt Ban on exports is hitting them very badly. Any fall in the quantum of exports would spell the death knell of the Barge Industry. It is necessary that exports are maintained at levels sufficient to sustain the infrastructure created. An exit policy for barges would have to be formulated while deciding the Iron ore export limit, keeping in view the Bank Liabilities and liabilities to crew, creditors etc., besides their basic livelihood.

The above analysis presents qualitative/ observational/situation analysis as a whole, however in order to arrive at sustainable level of mining, it is necessary to assess and quantify the impacts of the proposed level of mining and related activities in the State of Goa.

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10.0 Way Forward to Sustainable Mining

10.1 Summary of Secondary Data Analysis

The preliminary report on assessment of baseline environmental quality and its interpretation with respect to different environmental components, viz. air, water, noise, land, biological and socio-economic aspects in the study region is based on the limited data/information/reports available from various government agencies, internet and also interaction with the stakeholders during preliminary visit in January 2014. The data gaps on environmental quality data have been identified in respective chapters and are briefly summarized here.

Information Available	Information Required
Air Environment	
Partial AAQ data for Goa State from 2010-2013	Pollutant wise long term spatial & temporal data Spatial & temporal data of entire study area with core/buffer zone Fugitive emission data of various activities
AAQ data for only 4 pollutants with limited period	More AAQ data as per CPCB regulation/other relevant parameters
Limited Met data available for West Goa only	Met data near mining sites
	Transport & base mining emission data Data near mining site with core & buffer zone
Noise Environment	
Noise AAQ data is limited	Data near to mining site core and buffer zone Source noise level data
Water Environment	
Limited Piezometer study data and WQ data available	Data near mining sites
Land Environment	
Limited land use data	Detailed data of all mines with mine closure and restoration plans
Low resolution data of partial area of Goa 2012 Limited data on SW/Ore dumps available	High resolution imageries of entire Goa. For change detection of temporal data for past year Toposheets of Survey of India is requested. Scaled map indicating location of mines & its core & buffer area in it.
Biological Environment	
Limited data on flora/fauna	Mine specific data
Socio-economic	
Limited data available on social component of mining operation	Activity specific data of individual mines and its associated activities on socio-economic parameters



Analysis of available data with respect to different environmental components indicates data gaps and thus it needs to be assessed/ confirmed through micro level study of mines to obtain a credible database.

10.2 Holistic Approach to Sustainable Mining

Mining/exploration activities have the potential to adversely impact on the environment, if they are not managed appropriately. The issues that require management include:

- Clearing of vegetation and other types of disturbance to fauna during mining
- Soil erosion and stream sedimentation
- Spreading of weeds
- Noise, light and dust level pollution monitoring
- Disturbance to culturally significant sites
- Disruption to other land users, such as farmers and the local community
- Contamination of soil and water, and
- Injury to, or detrimental effects on the health and wellbeing of employees, other persons at work and the public.

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The application of high standard environmental management practices in mining/ exploration is essential to ensure that such activities are properly controlled with the protection of environmentally sensitive areas and community concerns are effectively addressed. A number of guidelines are available to assist mining exploration company personnel to achieve leading practice. In the present study, approach proposed in the handbook/guide (July 2011) on "Leading Practice Sustainable Development in Mining" is considered appropriate to address the issues relevant for iron ore mining in Goa.

The handbooks of the "Leading Practice Sustainable Development in Mining' series integrate environmental, economic and social aspects through all phases of mineral production from exploration through construction, operation and mine-site closure. The concept of leading practice is simply the best possible way of conducting activities for a given site. As new challenges emerge and new solutions are developed, or better solutions are devised for existing issues, it is important that leading practice be flexible and innovative in developing solutions that match

site- specific requirements. Although there are underpinning principles, leading practice is as much about approach and attitude as it is about a fixed set of practices or a particular technology.

10.3 Future Work Plan

To address/analyze various issues related to iron ore mining and associated activities, detailed information for each individual mine (including dependent activities), proposed to be made operational in the Goa is required (**Annexure IV**). After the receipt of all the mine specific information/data the following tasks shall be performed to arrive at sustainable level of mining activity in the State of Goa.

- Geographical mapping of existing and proposed mines using GIS/ remote sensing data
- Identification and quantification of significant impacts of the proposed mining activity on different environmental components, considering future developmental/ growth scenarios in the mining sector.
- Discussions with stakeholders to derive the best practicable strategy for environment friendly mining in the region
- Study of completed mines in view of environmental restoration
- Determination of the permissible level of mining activity from environmental sustainability point of view
- Evaluation of impacts with and without environmental management plan
- Delineation of micro and macro level environmental management plan for the mines and region as a whole
- Identification of critical environmental quality parameters/indicators for regular monitoring to ensure effective implementation of various control measures/management plans

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DETAILS OF OPERATIONAL MINES FOR THE PERIOD 2010-2011

SR. NO.	T.C. NO.	NAME OF LESSEE	VILLAGE	TALUKA
1	7/41	M/S EMCO GOA PVT. LTD.	SIGAO	SANGUEM
2	23/53	M/S EMCO GOA PVT. LTD.	COLLEM, MOLLEM / SIGAO	SANGUEM
3	4/49	M/S RAJARAM BANDEKAR (S) MINES PVT. LTD.	SIRIGAO	BICHOLIM
4	16/51	SHRI V. D. CHOWGULE (LATE)	DUDAL	SANGUEM
5	40/50	SHRI V. D. CHOWGULE (LATE)	SANTONA	SANGUEM
6	2/51	M/S M. S TALAULIKAR & SONS.	SANCORDEM	SANGUEM
7	44/51	M/S SHANTILAL KUSHALDAS & BROS. PVT. LTD.	MAINA	QUEPEM
8	62/51	M/S MINEIRA NATIONAL LTD.	SANTONA /KIRLAPAL	SANGUEM
9	28/52	M/S SHANTILAL KUSHALDAS & BROS. PVT. LTD.	RIVONA	SANGUEM
10	62A/52	SMT. SUNANDA D. BANDODKAR (LATE)	VELGUEM	BICHOLIM
11	84/52	M/S BANDEKAR BROS. PVT. LTD.	PALE	BICHOLIM
12	89/52	M/S LITHOFERRO	ADVALPALE	BICHOLIM
13	45/54	M/S SOVA (BALKRISHNA AVDE)	SANGOD	SANGUEM
14	4/55	M/S MARZOOK & CADAR LTD.	DHARBANDORA	SANGUEM
15	34/55	M/S ZARAPCAR & PARCAR	DABAL	SANGUEM
16	41/55	M/S. V. M. SALGAOCAR & BRO. LTD.(SMI)	TIVIM / PIRNA	BARDEZ
17	7/58	SHRI CIPRIANO D'SOUZA (LATE)	SANGOD	SANGUEM
18	86/53	V. M. SALGAOCAR & BRO.(SALLITHO ORES PVT LTD)	PALE	BICHOLIM
19	8/61	M/S MADACHEM BAT MINES PVT LTD	PALE	BICHOLIM
20	31/55	M/S CHOWGULE & CO. LTD.	XELPO CURADO, GAVANEM & AMBELIM	SATTARI
21	05/49	M/S CHOWGULE & CO. LTD.	SIRIGAO / MAYEM	BICHOLIM
22	13/49	M/S CHOWGULE & CO. LTD.	MAYEM	BICHOLIM
23	22/50	M/S CHOWGULE & CO. LTD.	COSTI	SANGUEM
24	98/52	M/S CHOWGULE & CO. LTD.	ONDA & CUDNEM	SATTARI
25	31/53	M/S CHOWGULE & CO. LTD.	PALE / PONOCEM	BICHOLIM
26	41/56	M/S CHOWGULE & CO. LTD.	PONOCEM	SATTARI
27	11/41	M/S DEMPO MINING CORP. PVT. LTD.	BICHOLIM, MAYEM & LAMGAO	BICHOLIM
28	6/55	M/S SESA GOA LTD.	HONDA	SATTARI
29	28/51	M/S SESA GOA LTD.	PISSURLEM	SATTARI
30	70/52	M/S SESA GOA LTD.	CODLI	SANGUEM
31	10/49	M/S SESA GOA LTD.	MAULINGUEM	BICHOLIM
32	76/52	M/S SESA GOA LTD.	ADVALPALE	BICHOLIM
33	126/53	M/S SESA GOA LTD.	CODLI	SANGUEM
34	61/53	M/S SOC. TIMBLO IRMAOS LTDA. (P.T.I.)	CODLI	SANGUEM
35	87/53	M/S SOC. TIMBLO IRMAOS LTDA. (P.T.I.)	SIGAO	SANGUEM
36	143/53	M/S SOC. TIMBLO IRMAOS LTDA. (P.T.I.)	SANGOD	SANGUEM
37	88/52	M/S SOC. TIMBLO IRMAOS LTDA. (S.F.I.)	SIGAO	SANGUEM
38	45/52	M/S SOC. TIMBLO IRMAOS LTDA. (S.F.I.)	CUDNEM	BICHOLIM
39	92/52	M/S SOC. TIMBLO IRMAOS LTDA. (T.P.L.)	CUDNEM	BICHOLIM
40	13/55	M/S V. M. SALGAOCAR & BRO. PVT. LTD.	SIGAO	SANGUEM
41	83/52	M/S V. M. SALGAOCAR & BRO. PVT. LTD.	SURLA	BICHOLIM
42	29/54	M/S V. M. SALGAOCAR & BRO. PVT. LTD.	SURLA	BICHOLIM

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43	50/55	M/S V. M. SALGAOCAR & BRO. PVT. LTD.	SIGAO	SANGUEM
44	05/54	M/S V. S. DEMPO & CO. PVT. LTD.	SONUS VONVOLIEM	SATTARI
45	35/52	M/S V. S. DEMPO & CO. PVT. LTD.	RIVONA	SANGUEM
46	3/51	M/S V. S. DEMPO & CO. PVT. LTD.	CURPEM / SULCORNA	SANGUEM / QUEPEM
47	21/54	M/S V. S. DEMPO & CO. PVT. LTD.	SURLA / CUDNEM	BICHOLIM
48	35/55	M/S SOC. TIMBLO IRMAOS LTDA. (P.T.I.)	PALE	BICHOLIM
49	14/58	M/S SOC. TIMBLO IRMAOS LTDA. (T.P.I.)	CODLI	SANGUEM
50	14/53	M/S SOC. TIMBLO IRMAOS LTDA. (S.F.I.)	CUDNEM	BICHOLIM
51	1/55	M/S DAMODAR MANGALJI & CO. LTD.	SURLA	BICHOLIM
52	33/53	M/S DAMODAR MANGALJI & CO. LTD.	SURLA	BICHOLIM
53	95/52	M/S DAMODAR MANGALJI & CO. LTD.	PISSURLEM	SATTARI
54	12/41	M/S DEMPO MINING CORP. PVT. LTD.	BICHOLIM, MAYEM & LAMGAO	BICHOLIM
55	13/41	M/S DEMPO MINING CORP. PVT. LTD.	BORDEM, MAYEM & LAMGAO	BICHOLIM
56	14/41	M/S DEMPO MINING CORP. PVT. LTD.	MULGAO	BICHOLIM
57	15/41	M/S DEMPO MINING CORP. PVT. LTD.	MULGAO, SHIRIGAO & MAYEM	BICHOLIM
58	01/Fe Mn/78	SHRI GAJANAN PODIYAR	MOLCORNEM	QUEPEM
59	4/NSD /BAUX /68	SHRI PRAVIN KUMAR GOSALIA	QUITOL,NAQUERIM,MORPIRLA,FATORPA,VELIM	QUEPEM/SALCETE
60	8/41	SHRI G. N. AGRAWAL	SIGAO / COLLEM	SANGUEM
61	6/49	SHRI HIRALAL KHODIDAS (LATE)	COLOMBA	SANGUEM
62	17/49	SHRI ATMARAM PALONDICAR (LATE)	CURPEM / NAVELIM	SANGUEM
63	30/50	SHRI PRAFULLA HEDE	COLLEM	SANGUEM
64	10/51	SHRI HAIDER KASSIM KHAN (LATE)	SULCORNA / VICHUNDREM	QUEPEM
65	55/51	SMT. GEETABALA M. PARULEKAR	PISSURLEM	SATTARI
66	59/51	SHRI ZOIRAM NEOGUI (LATE)	CAVREM / MAINA	SANGUEM / QUEPEM
67	63/51	SHRI CANDRAKANT F. NAIK (LATE) / SHRI RAJESH TIMBLO	CURPEM	SANGUEM
68	65/51	SMT. AMALIA RODRIGUES FIQUEREIDO (LATE)	CURPEM	SANGUEM
69	70/51	M/S R.S SHETYE & BROS.	PISSURLEM	SATTARI
70	40/51	SHRI N.S.NARVEKAR (LATE)	SANTONA / QUIRLA PALE	SANGUEM
71	12/52	SHRI N.S.NARVEKAR (LATE)	SANTONA/ QUIRLA PALE	SANGUEM
72	14/52	M/S BADRUDDIN HUSSAINBHAI MAVANI	COLOMBA / SULCORNA	SANGUEM
73	51/52	SMT. KUNDA GHARSE	CUDNEM	BICHOLIM
74	75/52	SHRI VOICUNTA CANECAR (KADNEKAR) (LATE)	COLOMBA / RIVONA	SANGUEM
75	5/53	SHRI ALEIXO MANUEL DA COSTA	TUDOU / PATIEM	SANGUEM
76	12/53	SHRI VOICUNTA CANECAR (KADNEKAR) (LATE)	MAINA	QUEPEM
77	39/53	SHRI LEKHRAJ NATHURMAL (LATE)	ARVALEM	BICHOLIM
78	110/53	M/S COSME COSTA & SONS	PISSURLEM	SATTARI
79	41/54	SMT. AHILIABAI SARDESSAI (LATE)	CORMONEM / BANDOLI	SANGUEM

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80	16/55	SHRI V.G.QUENIM (LATE)	SONUS VONVOLIEM	SATTARI
81	42/56	SMT. KUNDA GHARSE	TUDOU	SANGUEM
82	2/57	SHRI MAHABALESHWAR GARCO (LATE)	MUGULI / COSTI	SANGUEM
83	19/54	SMT. KUNDA GHARSE	TUDOU	SANGUEM
84	3/57	SMT. KUNDA GHARSE	PATIEM / TUDOU	SANGUEM
85	33/57	SMT. KUNDA GHARSE	PATIEM / TUDOU	SANGUEM
86	24/57	SHRI RAMACANT VELINGKAR	DHARBANDORA	SANGUEM
87	6/61	SHRI GANGADHAR NARSINGDAS AGRAWAL	MAINA	QUEPEM
88	1/51	SHRI SHAIKH MOHAMAD ISSAC(LATE)	CAVREM	QUEPEM
89	53/51	SHRI X.A.X.A. AZIZ S. A.GOFUR(LATE)	CURPEM	SANGUEM

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Annexure II

LIST OF MINING LEASES IN THE STATE

No.	T. C. No.	NAME OF LEASE HOLDER / APPLICANT	VILLAGE	TALUKA
1		3	5	
1	41/54	SHRI AJIT SARDESAI & SHRI GHANASHYAM SARDESAI LEGAL HEIR OF LATE SMT AHILIABAI SARDESSAI, SF-1, Navelkar Arcade, Dr. A. Borkar Road, Panaji Goa. 403001	CORMONEM / BANDOLI	SANGUEM
2	5/53	Shri Aleixo Manuel C. P. Da Costa, H. No. 1560, Argicol, P. O. Curtorim, Salcete Goa.	TUDOU / PATIEM	SANGUEM
3	65/51	Mrs. Maria de Lourdes Filomena Figueiredo de Albuquerque, C/o. Imran Traders, Having office at 514, 515, 5th Floor, Lake Plaza Building, Fatorda Margao Goa.	CURPEM	SANGUEM
4	29/55	Shri Atchuta V. S. Velingkar, Veling, Mardol, Ponda - Goa.	AGLOTE	SANGUEM
5	67/52		VICHUNDREM / NETORLIM	SANGUEM
6	14/52	M/s Baddrudin Hussainbhai Mavani P. O. Box No. 34, Kadar Manzil, Margao - Goa.	COLOMBA / SULCORNA	SANGUEM
7	7/58	Shri Ralph D'Souza, Legal Heir of Late Shri Cipriano D'Souza, Salgaocar Chambers, P. O. Box No.35, Margao - Goa	SANGOD	SANGUEM
8	1/56		NIRANCAL	PONDA
9	110/53	M/s Cosme Costa & Sons, Mine Owner, Altinho, Mapusa - Goa.	PISSURLEM	SATTARI
10	29/51	Shri Prashant D. Naique, Legal Heir of Late Shri Damu S. Naique, G-28, Phoenix Estate, Gogal, Margao - Goa	SULCORNA / VICHUNDREM	QUEPEM / SANGUEM
11	10/55	1) Shri Dioago J. X. Sequeira 2) Smt Dorothy J. X. Sequeira Legal Heir of Late Shri Dioago J. X. Sequeira, 141, Municipal Market, Mapusa - Goa.	MALPONA	SATTARI
12	6/61	Shri Gangadhar N. Agrawal, Anand Bhavan, Old Station Road, Margao - Goa.	MAINA	QUEPEM
13	7/61		MAINA / RIVONA	QUEPEM / SANGUEM
14	35/50		NETORLIM	SANGUEM
15	8/52		MAINA	QUEPEM
16	8/41	Shri Gangadhar N. Agrawal, Anand Bhavan, Old Station Road, Margao - Goa.	SIGAO / COLLEM	SANGUEM
17	18/54		BORDEM	BICHOLIM
18	18/58		ARVALEM	BICHOLIM
19	8/55		KALAY	SANGUEM
20	55/51	Smt Geetabala Monohar Naik Parulekar, Altinho, Mapusa, Bardez - Goa. 403507	PISSURLEM	SATTARI
21	39/50		DARGALIM	PERNEM

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22	11/56	Shri Shripad G. Gharse, Legal Heir of Late Shri Gopinath S. Garco FO-32/35, 1st Floor, B Block, Baboy Commerce Centre, Martires Dias Road, Margao - Goa	UNDORNA	QUEPEM
23	6/49	1) Dr. Nilin H. Gosalia 2) Shri Uday H. Gosalia for Self and as the constituted Attorney of all the other Legal Heir of Late Shri Hiralal Khodidas (Mine Owner). Curchorem - Goa, 403 706	COLOMBA	SANGUEM
24	1/47	1) Shri Bombo Alias Ramdas Hiru Gauns, 2) Smt Vijaya Ramdas Gauns, 3) Shri Nakul Alias Gurudas Hiru Gauns & 4) Smt Sulochana Hiru Gauns All Legal Heir of Late Shri Hiru Bombo Gauns P. O. Box No.257, Old Station Road, Margao-Goa.	VICHUNDREM	SANGUEM
25	38/52		VICHUNDREM	SANGUEM
26	42/56	Smt Kunda Raghuvir Gharse Legal Heir of Late Shri Raghuvir Sinai Gharse, P. O. Box No. 204, Near Municipality Bldg. Margao - Goa.	TUDOU	SANGUEM
27	3/57	Smt Kunda Raghuvir Gharse Legal Heir of Late Shri Raghuvir Sinai Gharse, P. O. Box No. 204, Near Municipality Bldg. Margao - Goa.	PATIEM / TUDOU	SANGUEM
28	33/57		PATIEM / TUDOU	SANGUEM
29	19/54		TUDOU	SANGUEM
30	51/52		CUDNEM	BICHOLIM
31	22/51		SALGINIM / VERLEM	SANGUEM
32	40/52		SALGINIM / VERLEM	SANGUEM
33	82/52		COLOMBA	SANGUEM
34	7/49	Virginia Maria Simoes, Legal Heir of Late Smt Lidia B. Simoes, H. No. 241, Gotnamordi, Tilamol Quepem, South - Goa. 403 601.	COLOMBA	SANGUEM
35	17/55		CODLI	SANGUEM
36	71/59	Virginia Maria Simoes, Legal Heir of Late Smt Lidia B. Simoes, H. No. 241, Gotnamordi, Tilamol Quepem, South - Goa. 403 601.	NETORLIM	SANGUEM
37	10/53		PIRLA	QUEPEM
38	77/59		MAINA	QUEPEM
39	42/50		RIVONA	SANGUEM
40	60/51	Shri Francis Minguel Mascarenhas Legal Heir of Late Shri Minguel Mascarenhas, H. No. 98, Devrem Vichundrem, Netravalim, Sanguem – Goa.	VICHUNDREM	SANGUEM
41	2/49	Mr. Rajiv M. Shinkre, Managing Director of M/s National Agency, P. O. Box No.270, Margao - Goa	VERLEM	SANGUEM
42	6/41	M/s Raphael Mines, C/o. Balkrishna Narahar Thakur, P. O. Box No. 52, Ormuz Road, Panaji - Goa.	CALEM	SANGUEM
43	70/51	M/s R. S. Shetye & Bros., Trionora Appts, 14, 1st Floor, Near Municipal Market, Panaji - Goa	PISSURLEM	SATTARI
44	41/51	Smt Shakuntala R. Paingankar Legal Heir of Late Shri Raghuvir R. Paingankar, E-3, Sanchayani Ananth Vishwa Row House, Opp. Borkar Supper Market, Vidya Nagar, Margao - Goa	CUDNEM	BICHOLIM

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45	52/51	Late Shri Raghuvir R. Poinguinkar, through his Legal Heir of Shri Rajendra R. Poinguinkar in representation of the estate of Late Shri Raghuvir R. Poinguinkar, Shri Damodar Co-Operative Housing Society Limited, Aquem-Alto, Margao - Goa	DHARBANDORA	SANGUEM
		Smt Shakuntala R. Paingankar Legal Gheir of Late Shri Raghuvir R. Paingankar, E-3, Sanchayani Ananth Vishwa Row House, Opp. Borkar Supper Market, Vidya Nagar, Margao - Goa		
46	45/54	M/s Sova, Salgaocar Chambers, P. O. Box No. 114, Margao - Goa.	SANGOD	SANGUEM
47	62A/52	Smt Shashikala Kakodkar & Others, C/o M/s D. B. Bandodkar & Sons Pvt. Ltd., 2nd Floor, Atmaram Commercial Complex, Dr. Atmaram Borker Rd., P. O. Box No.271, Panaji - Goa.	VELGUEM	BICHOLIM
48	53/52	M/S Sarda Energy & Minerals Ltd., Industrial Growth Centre, Siltara, Raipur (C.G) 493 111.	CURPEM	SANGUEM
49	100/53	M/S Sarda Energy & Minerals Ltd., Industrial Growth Centre, Siltara, Raipur (C.G) 493 111.	COLOMBA / CURPEM	SANGUEM
50	21/59	Smt Usha Kare Legal Heir of Late Shri Pandurango Sinai Garco, C/o. Dinar Tarcar, Minescape Minerals Pvt. Ltd., The Scape Groups, campal, Panaji - Goa	CONQUIREM	SATTARI
51	46/51	Shri Deepak G. Mehta, Power of attorney of all Legal Heir of Late Shri V. G. Mehta, G-28, Phoenix Estate, Gogal, Margao - Goa	COLOMBA	SANGUEM
52	41/53		COLOMBA	SANGUEM
53	16/55	Shri Prasad V. Quenim, Legal Heir of Late Shri V. G. Quenim, 1ST Floor, Keni Building, Dr Dada Vaidya Road, Panaji - Goa	SONUS VONVOLIEM	SATTARI
54	68/53	Smt Ana Berta Do Rego E Fernandes & Mrs. Maria Auxiladure Do Rego E FernandesH. No. 9, Bhuttem Bhat, Merces, Panaji - Goa	UGUEM	SANGUEM
55	1/58		DHAVEM	SATTARI
56	12/53	Shri Ajit Vaicunth M. Kadnekar Son of Late Shri Vaicunth Kadnekar Mine Owner, 75, Francisco – de Loyala Road, Margao - Goa. 403 601	MAINA	QUEPEM
57	075/52		COLOMBA / RIVONA	SANGUEM
58	001/51	Shri Shaikh Salim Legal Heir of Late Shri Xec Mohamed Issac, G-28, Phoenix Estate, Gogal, Margao - Goa	CAUREM	QUEPEM
59	55/53	Shri Roy antao & Sane Antao Joint Legal Heir of Late Shri Zacarias Antao, H. No.282, Betalbatim, Salcete - Goa	POTREM	SANGUEM
60	21/51	Sri Dinar Tarcar, Attorny for all Legal heirs of Late Shri Zairam B. Neogui, C/O Mines scape Minerals Pvt Ltd. Campal Panaji Goa.	CAVREM	QUEPEM
61	6/50	Shri Anup A. Mahatme, P. A. Holder of all the Legal Heirs of Late Shri Zairam B. Neogui,Ivory Towers, Ground Floor, St. Mary's colony, Miramar, Panaji - Goa	COLOMBA	SANGUEM
62	3/52		COLOMBA	SANGUEM

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63	20/50	Smt Padma P. Bhandari P. A. Holder of Legal Heir of Late Shri Zairam B. Neogul, Jaswand, Bepkegal, Curçhorem - Goa	COLOMBA	SANGUEM
64	4/51	Sri Dinar Tarcar, Attorny for all Legal heirs of Late Shri Zairam B. Neogui, C/O Mines scape Minérais Pvt Ltd. Campal Panaji Goa.	MOLCORNEM	QUEPEM
65	59/51		CAVREM / MAINA	SANGUEM / QUEPEM
66	34/55	M/s. Soc. Zarapkar & Parkar Constituted Attorney Shri Jayprakash G. Parkar, Vaishya Bhavan, Bldg No. 3, Mapusa - Goa.	DABAL	SANGUEM
		M/s Zarapkar & Parkar, Salgaocar Chambers, P.O. Box No. 35, Margao - Goa.	DABAL	
67	006/63	M/s Companhia Mineira Progresso Ltd., F-1 Bhaurao Dalal Commercial Complex, 4th Floor, Near Hari Mandir, Margao - Goa	VICHUNDREM	SANGUEM
68	001/37	M/s Elray Minerals & Co., Meleguides Building, F. L. Gomes Road, Vasco-da-Gama - Goa	SANCORDEM	SANGUEM
69	082/53	M/s Gasa Goa Ltd., Salgaocar Chambers, P. O. Box No. 35, Margao - Goa.	SANGOD	SANGUEM
70	017/50	Smt Radha S. Timblo Legal Heir of Late Shri Gurudas Timblo, Kadar Manzil, P. O. Box No.34, Margao - Goa.	PALE	BICHOLIM
71	008/51		PIRLA	QUEPEM
72	051/51		VERLEM	SANGUEM
73	092/53	M/s Lima Leitao & Co. Pvt. Ltd., 3rd Floor Lima Arcade, Block No.1, New Vaddem, Vaso-da-Gama - Goa	XELPI	SATARI
74	089/52	M/s Lithoferro, Khalap Chambers, Market Road, Mapusa-Goa.	ADVALPALE	BICHOLIM
75	019/56		SANGOD	SANGUEM
76	027/50	M/s Socledade Sri Mahalaximi Companhia Mineira Ltd., F-1 Bhaurao Dalal Commercial Complex, 4th Floor, Near Hari Mandir, Margao - Goa	NETORLIM	SANGUEM
77	013/58	Shri Manharlal D. Rajani, P. O. Box No.99, 2nd Floor, Entrance III, Sesa Ghor, Patto Plaza, Panaji - Goa.	LADPEM	BICHOLIM
78	018/56	M/s Marzook & Cadar Pvt. Ltd., Salgaocar Chambers, P. O. Box No. 114, Margao - Goa.	COLOMBA	SANGUEM
79	004/58		SONAL	SATARI
80	004/55		DHARBANDORA	SANGUEM
81	015/53	M/s Orient Goa Pvt. Ltd., 2nd Floor, Atmaram Commercial Complex, Dr. A. B. Road, Panaji - Goa.	NETORLIM	SANGUEM
82	141/53		NANUZ/USGAO	PONDA
83	016/49	M/s S. Kantilal & Co. Pvt. Ltd., Salgaocar Chambers, P. O. Box No.114, Margao - Goa.	SANCORDEM	SANGUEM
84	005/50		VILLIENA	SANGUEM
85	017/51		NETORLIM	SANGUEM
86	017/52		VILLIENA	SANGUEM
87	018/52		BATI	SANGUEM
88	060/52		CURDI	SANGUEM
89	061/52		BATI	SANGUEM

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90	096/52		VILLIENA	SANGUEM
91	035/53		VADEM	SANGUEM
92	070/53		NETORLIM	SANGUEM
93	028/55		SANCORDEM	SANGUEM
94	029/56A		BATI	SANGUEM
95	030/56		BATI	SANGUEM
96	036/56		BATI	SANGUEM
97	049/56		BATI	SANGUEM
98	031/57		CUMBARI	SANGUEM
99	032/57		BATI	SANGUEM
100	049/58		BATI	SANGUEM
101	029/59		CALEM	SANGUEM
102	068/59		CUNBARI	SANGUEM
103	020/60	M/s S. Kantilal & Co. Pvt. Ltd., Salgaocar Chambers, P. O. Box No.114 Margao-Goa.	BATI	SANGUEM
104	50/52		NAIQUIRIM	SANGUEM
105	50/57		BATI	SANGUEM
106	67/51		NETORLIM	SANGUEM
107	5/56		BATI	SANGUEM
108	1/52		MOLCORNEM	QUEPEM
109	12/56		NAIQUINIM	SANGUEM
110	66/51		COLEM	SANGUEM
111	44/54		NANORA	BICHOLIM
112	044/51	M/s Shantilal Khushaldas & Bros. Pvt. Ltd., Salgaocar Chambers, P. O. Box No.114, Margao - Goa	MAINA	QUEPEM
113	028/52		RIVONA	SANGUEM
114	009/53		MAINA	QUEPEM
115	060/53		MOLCORNEM	QUEPEM
116	081/53		VELGUEM	BICHOLIM
117	004/56		CARMONEM	SANGUEM
118	007/54		NUNDEM	SANGUEM
119	028/54		AGLOTE	SANGUEM
120	034/57		POTREM	SANGUEM
121	037/57		PISSURLEM	SATARI
122	039/54		SANCORDEM	SANGUEM
123	001/61		CURPEM	SANGUEM
124	55/52		CURDI	SANGUEM
125	90/52		LATAMBARCEM	BICHOLIM
126	42/51		NETORLIM	SANGUEM
127	76/58		ARVALEM	BICHOLIM
128	38/59		ANTORIEM	SANGUEM
129	27/58		CANANGUINIM	QUEPEM
130	24/60		QUIRLAPALE	SANGUEM
131	33/58		UGUEM	SANGUEM
132	9/56		ARVALEM	BICHOLIM
133	061/57	M/s Tisa Moraes Mining Industries, C/o. Dr. S. S. Moraes, Bella Vista Appts., Near Salgaocar Chambers, Margao - Goa	CURDI	SANGUEM
134	3/FE & MN/70	M/S A. H. JAFFAR & SONS, Hotel Republica Near Old Secretariat, Panaji Goa	CARAPUR	BICHOLIM

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135	6/FEMN/69	M/S VAGHA MINERALS PVT. LTD., Plot, B-2,b-3, phase -1A, Verna industrial Estate Verna -Goa 403722	COLOMBA	SANGUEM
136	1/NSD/B AUX/85	M/S BHUMIPURUSH MINERALS PVT. LTD., Rep. by Shri Rajesh Timblo-Constituted Attorney P.O.Boc\x No. 785, Felicinta Complex, Near Clock Tower, Gogal, Margao Goa.	NAQUERIM	QUEPEM
137	2/FEMN/79	SHRI ANTONIO DAVID SOUSA, B1-B2, P.O.Boc\x No. 785, Felicinta Complex, Near Clock Tower, Gogal, Margao Goa.	SULCORNA	QUEPEM
138	9/FE/78	M/S D. B. BANDODKAR & SONS, 2ND FLOOR, Atmaram Commercial Complex, Dr. Atmaram Borker Road, P.O.Box No. 271, Panaji Goa.	VELGUEM	BICHOLIM
139	7/FE/78	M/S EMCO GOA PVT. LTD., Desai Bros Bldg., Old Station Road, Margao Goa	VICHUNDREM	SANGUEM
140	1/FEMN/78	SHRI GAJANAN PODIYAR, H. No. 121, Paroda, Quepem Goa.	MOLCORNEM	QUEPEM
141	1/FEMN/77	SMT JAI KISHORI SAHIB, Shri Prakash K. Joshi Power of Attorney holder for Smt. Jai Kishori Sahib, Dempo House, Panaji Goa.	SULCORNA	QUEPEM
142	2/FEMN/74	Shri K. N. ShariffOpp. Bansai Plaza, Housing Complex, P.O.Box No. 35, Curchorem Goa.	SULCORNA	QUEPEM
143	2/FE/71	M/S DAMODAR MANGALJI & CO. PVT. LTD., Damodar Niwas, M.G.Road, P.O. Box No. 22, Panaji Goa.	PISSURLEM	SATTARI
144	3/FEMN/79	SHRI NARAINA S. QUIRTONIM (LATE), Mathura, H. NO. 1153, Near Apna Bazar, Aquem, Alto, Margao Goa.	CAUREM	QUEPEM
145	5/NSD/B AUX/68	SHRI PRAVIN KUMAR S. GOSALIA, Garden view, Phase II, 3RD Floor, Margao Goa 403 601	CABO DE RAMA, NUVEM & CANANGUINIM	CANACONA & QUEPEM
146	4/NSD/B AUX/68	SHRI PRAVIN KUMAR S. GOSALI, AGarden view, Phase II, 3RD Floor, Margao Goa 403 601	QUITOL, NAQUERIM, MORPILA, FATORPA & VELIM	QUEPEM & SALCETE
147	17/49	SHRI ATMARAM PALONDIKAR (LATE), Represented by 1) Shri Shanu A. Poi Panandikar & Others, Margao - Goa. 2) Shri Shambhu Palondikar, C/o Subhash D. Prabhudessai, G-5, Shalimar Apts; ground floor, Nr. Hindu Cremetorium, Pajifond, Margao-Goa. No. 4, Aditya Apts. Glate Bogmalo Road, Dabolim Goa.	CURPEM /NAVELIM	SANGUEM
148	31/58	SHRI BABAL S. N. TARI (LATE)Representated by his Power of Attorney Shri Eknath Babal Naik Tari H. No. 112, Near Post office, P. O. Sanguem Goa 403704.	BATI	SANGUEM
149	9/51	SHRI BHANUDAS KOSSAMBE (LATE), Representated by Prasad B. S. Kossambe, F/1, Sanchayani Anant Vishwa, Margao Goa 403601	CURPEM/VICHUNDREM	SANGUEM

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150	48/58	SHRI KASHINATH . D. S. TALAULIKAR(LATE) Girijhabai Kashinath Sawant Talualikar, Legal Heir of Late Kashinath D. S. Talaulikar, C/o Shri Santosh T. Bhangui claiming Power of Attorney Holder for Legal Representative of Late Kashinath D. S. Talualikar, Shiv-Shail Karai, Shiroda Ponda - Goa.	CUDNEM	BICHOLIM
151	63/51	RAJESH TIMBLO, B1/B2, Felecinta Complex, near Clock Tower, Gogol,P.O.Box No. 785, Margao Goa	CURPEM	SANGUEM
152	6/53	SHRI CRISNA M. CAMOTIM (LATE), Represented by Shri. Umacanta K.Kamat and Shri. Balaji K.Kamat,C/o. Hotel Rukrish, Margao Goa	NETORLIM /VICHUNDRE M/MANGAL	SANGUEM
153	22/53	SHRI DAMODAR J. AMONCAR (LATE), Represented by Shri Jairam Amoncar, Minescape Minerals Pvt. Ltd., The Scape Group, Campal, panaji Goa	SANCORDEM	SANGUEM
154	5/51	SHRI DINANATH CUVELKAR (LATE), Represented by his legal heir Shri Anant D. Cuvelkar, C/o Dr. Mahatme Nursing Home, Bicholim - Goa	COLOMBA	SANGUEM
155	2/29	Shri Domnic Fernandes, Represented by Smt Radha S. Timblo, Power of Attorney holder, P.O. Box No. 34, Kadar, Manzil, Margao Goa	VADEM	SANGUEM
156	30/50	DR. P. R. HEDE, Durga Bhavan, Hede Centre, Tonca, Miramar, Panaji - Goa	COLLEM	SANGUEM
157	73/53	SHRI ERASMO V. SEQUEIRA (LATE),Represented by his Legal Heirs, Smt.Maureen De Sequeira,Amita De Sequeira, Anil De Sequeira,Aisha De Sequeira, H. No. 164, Campal Panaji Goa	COTOREM	SATARI
158	10/52	SHRI ESVONTA D. SADEKAR, (late) represented by Shri Dattatria E. Sadeker P. O. Box 99, 2 nd Floor, Entrance III Sesa Ghor, Patto Plaza, Panaji Goa	RIVONA	SANGUEM
159	36/53	SMT MUCTABAI MOHAN alias MANMOHAN POI RAITURKAR, sole legal heir of SHRI. ANAND MOHAN POI RAITURKAR, sole legal heir of MANMOHAN ESVONTA POI RAITURKAR, sole legal heir of ESVONTA VISNU POI RAITURKAR, B-G-1, Shubham Apts, Aquem, Alto, Margao - Goa.	NETORLIM	SANGUEM
160	35/51	SHRI GAJANAN P. N. KARMALI (LATE), C/o. Dinar Tarcar, Sea View, Campal, Panaji Goa	RIVONA	SANGUEM
161	10/51	SHRI HAIDER KASSIM KHAN (LATE), Represented by his legal heir, SHRI SHABBAR HAIDER KHAN & OTHERS, Govt. Hospital Road, Kakoda, Curchorem - Goa	SULCORNA / VICHUNDREM	QUEPEM/ SANGUEM
162	80/59	SHRI JAISING MANGANLAL, Maganlal Sadan, D.V. Road, Panaji Goa	PIRLA	QUEPEM

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163	54/51	SHRI JOSE AZAVEDO DUARTE, Near Delmon Hotel, Cantano Albuaquerque Road, Panaji - Goa	VERLEM	SANGUEM
164	39/53	SHRI LEKHRAJ NETHURMAL (LATE), Represented by SHRI HARISH MELWANI & KANTA MELWANI, 3rd Floor, Rizvi Chambers, Caetano Albuquerque Road, Panaji - Goa	ARVALEM	BICHOLIM
165	2/57	SHRI MAHABLESHWAR GARCO (LATE) Represented by his legal heir & POA. Holder of all other legal heirs SHRI DEEPAK GHAESE, F-23/24, Block A/3 Jairam Comples, Panaji Goa.	MUGULI / COSTI	SANGUEM
166	7/59	SMT MANIKBAI POI VERNEKAR, C/o. Mr. Dinar Tarcar, Minescape Minerals Pvt. Ltd., Campal, Panaji Goa	DHARBANDORA	SANGUEM
167	95/53	SHRI MOTIRAM GOUNDALCAR (Late), Representated by Mrs. Gauri Sudinkumar N. Gaunkar, Mrs Madhavi Hemant Parodkar, Mrs Sudha Gaundolkar,Bhurao Dalal Commercial Complex, 4th Floor, Near Hari Mandir, Margao Goa	NIRANCAL	PONDA
168	10/50	SHRI MUHAMED USMAN MUHAMAD, Repesented by his POA, Smt Radha Timblo, Kadar Manzil, P.O. Box No. 34, Margao Goa	CURPEM	SANGUEM
169	27/57	SHRI MUSSA XEC USMAN (Late), Represented by his legal heirs Noor Mohammad Shaik Mussa, Nafis Shaik Noor, Filomena Shaik Usman Usmania House, Ponda Goa	KALAY	SANGUEM
170	40/51	SHRI N. S. NARVEKAR (LATE) , Repesented by his constituted Attorney Shri S. T. Pokle Opp. Fatima Convent, Bombi Niwas, Margao Goa	SANTONA / QUIRLA PALE	SANGUEM
171	31/59	SHRI N. S. NARVEKAR (LATE) , Repesented by his constituted Attorney Shri S. T. Pokle Opp. Fatima Convent, Bombi Niwas, Margao Goa	SANTONA / RUMBREM	SANGUEM
172	32/53	SHRI N. S. NARVEKAR (LATE) , Repesented by his constituted Attorney Shri S. T. Pokle Opp. Fatima Convent, Bombi Niwas, Margao Goa	CURDI	SANGUEM
173	12/52	SHRI N. S. NARVEKAR (LATE) , Repesented by his constituted Attorney Shri S. T. Pokle Opp. Fatima Convent, Bombi Niwas, Margao Goa	SANTONA/ QUIRLA PALE	SANGUEM
174	43/53	SHRI NOOR M. A. KARIM (LATE), Represented by Timblo Minerals Pvt. Ltd., P. O. Box No.34, Kadar Manzil, Margao - Goa	CURDI	SANGUEM
175	25/52	Smt PATRICIA BARNETO, Legal heir of late Roque Santana Barneto, C/o. Mr. Dinar Tarcar, Minesscape Minerals Pvt. Ltd., Campal, Panaji Goa	RIVONA	SANGUEM
176	48/54	SHRI PETER F. E. FERNANDES, Repesented by Shri Rajesh Timblo, POA Holder of all legal heirs of Late Shri Salvador Fernandes, B1 - B2, Felecnta Complex, Near Clock Tower, Gogal, Margao - Goa	CURPEM	SANGUEM

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177	59/52	Shri Prabhakar Cunde Legal heir of shri quexova s. cundo , Vissu Virginkar bldg., 1st Floor, Near Cine Lata, Jose Inacio de Loyala Road, Margao Goa	COLOMBA	SANGUEM
178	8/50	SHRI RAJARAM POIGUINKAR (LATE), Represented by Shri Raju R. Poinguinkar, Legal Heir & P.A. Holder of all other Legal Heirs of Late Shri Rajaram Poiguinkar, B-2, Virginkar Classic, Near Maruti Temple, Davorlim, Margao Goa	PATIEM / UGUEM	SANGUEM
179	3/59	SHRI RAMACANT POIGUINKAR, (late) represented by Shri Raju Poiginkar Damodar co-op, housing Society, Mine Owner, Aquem, Margao Goa	SANVORDEM	SATARI
180	24/57	SHRI RAMACANT VELINGKAR, Velinga, Mardol Goa	DHARBANDORA	SANGUEM
181	47/51	SHRI RAMAKRISHNA D. P. LOUNDO (LATE), Repesented by his legal heirs Shri Pradeep R. Lawande & Shri Gajanan R. Lawande, H. No.1155, Upper Harvalem, P. O.: Pratap Nagar, Sanquelim - Goa.	NAVELIM	BICHOLIM
182	22/59	SHRI RAVINDRA T. DEULKAR, Sesa Ghor, 2nd Floor, Entrance III, P.O. Box No. 99, Patto Plaza, Panaji Goa	MAULINGUEM	SANGUEM
183	20/51	SHRI RAVINDRA T. DEULKAR, Sesa Ghor, 2nd Floor, Entrance III, P.O. Box No. 99, Patto Plaza, Panaji Goa	MAULINGUEM	SANGUEM
184	15/50	SHRI ROGHUVIR R. LOTLIKAR (Late),Repesented by his Legal Heir Shri Sadanand Lotlikar, H. No.12, opp. Chamundi & Alankar Bldg, Pajifond, P. O. Box No. 25, Margao Goa	VERLEM	SANGUEM
185	21/56	SHRI ROGHUVIR R. LOTLIKAR (Late),Repesented by his Legal Heir Shri Sadanand Lotlikar, H. No.12, opp. Chamundi & Alankar Bldg, Pajifond, P. O. Box No. 25, Margao Goa	MAINA	QUEPEM
186	103/52	SHRI ROGHUVIR R. LOTLIKAR (Late),Repesented by his Legal Heir Shri Sadanand Lotlikar, H. No.12, opp. Chamundi & Alankar Bldg, Pajifond, P. O. Box No. 25, Margao Goa	NETORLIM	SANGUEM
187	23/56	SHRI ROGHUVIR R. LOTLIKAR (Late),Repesented by his Legal Heir Shri Sadanand Lotlikar, H. No.12, opp. Chamundi & Alankar Bldg, Pajifond, P. O. Box No. 25, Margao Goa	KARAPUR	BICHOLIM
188	22/56	SHRI ROGHUVIR R. LOTLIKAR (Late),Repesented by his Legal Heir Shri Sadanand Lotlikar, H. No.12, opp. Chamundi & Alankar Bldg, Pajifond, P. O. Box No. 25, Margao Goa	GANGEM	SATARI

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189	16/50	SHRI ROGHUVIR R. LOTLIKAR (Late),Repesented by his Legal Heir Shri Sadanand Lotlikar, H. No.12, opp. Chamundi & Alankar Bldg, Pajifond, P. O. Box No. 25, Margao Goa	VERLEM	SANGUEM
190	81/59	SHRI ROGHUVIR R. LOTLIKAR (Late),Repesented by his Legal Heir Shri Sadanand Lotlikar, H. No.12, opp. Chamundi & Alankar Bldg, Pajifond, P. O. Box No. 25, Margao Goa	PILIEM	SANGUEM
191	50/58	MANOHARLAL REGE(Late) Representated by his legal heir SMT SHAKUNTALABAI M. REGE, Mohankrupa, 1st Floor, Deulmol, Quepem Goa 403 705	COLEM	SANGUEM
192	1/42	SHRI V. P. S. SUQUERKAR, 362, Aquem, Alto, Margao Goa	MELAVLI	SATARI
193	39/52	SHRI VAMAN JOSHI (LATE), Represented by SHRI MUKUND VAMAN JOSHI, Oxel Vagalim, Siolim, Bardez Goa	OZORIM	PERNEM
194	31/56	SHRI VINAYAK NAIK (LATE), Repesented by his legal heir SMT NALINI VINAYAK NAIK, Salgaocar Chambers, P. O. Box No.35, Margao - Goa	SIGAO	SANGUEM
195	53/51	SHRI XEC ABDUL GOFUR XEC ABDUL AZIZ (late), Represented by his legal heir Shri Shaikh Abdul Kudoos, H. No.218, Gofur Manzil, Curchorem - Goa	CURPEM	SANGUEM
196	34/51	SHRI XEC A. ABUBAKAR (LATE), Represented by his legal heir Smt Khatiza Bi Xec Adam, C/o RAJESH TIMBLO, B//B2, Felecinta Complex, Near Clock Tower, Goagal P.O.Box No 785, Margao Goa	COLOMBA	SANGUEM
197	37/51	SHRI XEC ABDUL GOFUR XEC ABDUL AZIZ (late), Represented by his legal heir Smt Shaikh Aminabi Gofur, H. No.218, Gofur Manzil, Curchorem - Goa	CURPEM	SANGUEM
198	12/50	SHRI XEC ABDUL KADAR (LATE), Repesented by his Legal Heir Shri Shaikh Abdul Shakoor, Kadar, P. O. Box No.34, Kadar Manzil, Margao - Goa	NETORLIM	SANGUEM
199	3/41	SHRI XEC HASAN XEC ABDUL KADAR (LATE), Represented by his Legal Heir Shri Shaikh Iqbal, Bansai, Kakoda, Curchorem - Goa. 403 706	BATI	SANGUEM
200	74/59	SMT LIDIA B. SIMOES (LATE) Virginia Maria Simoes, Legal Heir of Late Smt Lidia B. Simoes, H. No. 241, Gotnamordi, Tilamol Quepem, South - Goa.	CAUREM	QUEPEM
201	120/53	SHRI XEC CADAR X. USMAN (Late), Repesented by Shri Xec Mustafa Kadar, Salgaocar Chambers, P. O. Box No. 35, Margao - Goa	VICHUNDREM	SANGUEM
202	25/56	SHRI XEC CADAR X. USMAN (Late), Repesented by Shri Xec Mustafa Kadar, Salgaocar Chambers, P. O. Box No. 35, Margao - Goa	CODLI	SANGUEM

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203	84/52	M/S BANDEKAR BROS. PVT. LTD. P. O. Box No.11, Suvarna Bandekar Bldg, Vasco-da-Gama - Goa	PALE	BICHOLIM
204	21/50	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	VICHUNDREM	SANGUEM
205	31/55	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	XELPO CURADO, GAVANEM & AMBELIM	SATTARI
206	05/49	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	SIRIGAO / MAYEM	BICHOLIM
207	13/49	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	MAYEM	BICHOLIM
208	30/54	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	NADORA	BARDEZ
209	93/52	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	RIVONA	SANGUEM
210	4/50	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	MAULINGUEM	BICHOLIM
211	12/57	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	COSTI	SANGUEM
212	42/57	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	TUDOU	SANGUEM
213	38/51	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	COSTI	SANGUEM
214	22/50	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	COSTI	SANGUEM
215	57/53	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	SULCORNA, CURPEM & VICHUNDREM	QUEPEM & SANGUEM
216	40/57	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	TUDOU	SANGUEM
217	52/58	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	AMONA & NAVELIM	BICHOLIM
218	98/52	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	ONDA & CUDNEM	SATTARI
219	26/57	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	XELPO CURADO	SATTARI
220	31/53	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	PALE / PONOCEM	BICHOLIM

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221	41/56	M/S CHOWGULE & CO. LTD. Chowgule House, Mormugao Harbour, Mormugao - Goa.	PONOCEM	SATTARI
222	15/60	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	CORMONEM	SANGUEM
223	33/56	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	ARVALEM / PORIEM	BICHOLIM / SATTARI
224	33/53	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	SURLA	BICHOLIM
225	26/60	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	CODLI	SANGUEM
226	11/50	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	COSTI	SANGUEM
227	42/53	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	MOICALEM	SANGUEM
228	34/56	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	SIGAO	SANGUEM
229	1/55	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	SURLA	BICHOLIM
230	46/56	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	DABAL	SANGUEM
231	18/53	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	CONQUIREM	SATTARI
232	84/53	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	COLOMBA	SANGUEM
233	95/52	M/S DAMODAR MANGALJI & CO. LTD. Damodar Niwas, M. G. Road, P. O. Box No.32, Panaji - Goa.	PISSURLEM	SATTARI
234	13/41	M/S DEMPO MINING CORP. PVT. LTD./ SESA MINING CORP. LTD. Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa.	BORDEM, MAYEM & LAMGAO	BICHOLIM
235	14/41	M/S DEMPO MINING CORP. PVT. LTD./ SESA MINING CORP. LTD. Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa.	BORDEM,MUL GAO & MAYEM	BICHOLIM
236	15/41	M/S DEMPO MINING CORP. PVT. LTD./ SESA MINING CORP. LTD. Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa.	MULGAO, SHIRIGAO & MAYEM	BICHOLIM
237	12/41	M/S DEMPO MINING CORP. PVT. LTD./ SESA MINING CORP. LTD. Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa.	BICHOLIM, MAYEM & LAMGAO	BICHOLIM
238	11/41	M/S DEMPO MINING CORP. PVT. LTD./ SESA MINING CORP. LTD. Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa.	BICHOLIM, MAYEM & LAMGAO	BICHOLIM
239	11/52	M/S DEMPO MINING CORP. PVT. LTD./ SESA MINING CORP. LTD. Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa.	BICHOLIM	BICHOLIM

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240	23/53	M/S EMCO GOA PVT. LTD Shri Damodar Krupa Prasad, 1st Floor, Rawandfond - Mandopa Road, Aquem Baixo, Margao - Goa.	COLLEM, MOLLEM / SIGAO	SANGUEM
241	7/41	M/S EMCO GOA PVT. LTD Shri Damodar Krupa Prasad, 1st Floor, Rawandfond - Mandopa Road, Aquem Baixo, Margao - Goa.	SIGAO	SANGUEM
242	43/58	M/s. V.M. SALGAOCAR & BRO. PVT. LTD (M/S GOA MINERALS (P) LTD). Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SIGAO	SANGUEM
243	115/53	M/S GOA MINERALS (P) LTD. Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	MELAULIM	SATTARI
244	2/51	M/S M.S.TALAULIKAR & SONS PVT. LTD Villa Flores Da Silva, Erasmo Carvalho Street, Margao - Goa.	SANCORDEM	SANGUEM
245	8/61	M/S MADACHEM BAT MINES PVT. LTD Suvarna Bandekar Bldg, P.O.Box No. 11, Vasco-da-gama - Goa	PALE	BICHOLIM
246	62/51	M/S MINEIRA NACIONAL LTDA.P. O. Box No.114, Salgaocar Chambers, Margao - Goa. M/S HARDESH ORES PVT. LTD.Vila Flores da Silva, Erasmo Carvalho Street, Margao – 403601, Goa, India.	SANTONA /K IRLA PAL	SANGUEM
247	37/50	M/S PANDURANG TIMBLO IND. (LATE) P. O. Box No. 242, Subhas Timblo Bhavan, Margao - Goa.	BATTI / CUMBARI	SANGUEM
248	29/52	M/S PANDURANG TIMBLO IND. (LATE) P. O. Box No. 242, Subhas Timblo Bhavan, Margao - Goa.	RIVONA	SANGUEM
249	54/52	M/S PANDURANG TIMBLO IND. (LATE) P. O. Box No. 242, Subhas Timblo Bhavan, Margao - Goa.	BATTI / CUMBARI	SANGUEM
250	4/49	M/S RAJARAM BANDEKAR (SIRIGAO) MINES PVT. LTD. 601,6th floor, Dr. Ozier Forum Nr. St.Andreus Church, P. O. Box No.31, Vasco-da-Gama - Goa	SIRIGAO	BICHOLIM
251	9/49	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	MAULINGUEM	BICHOLIM
252	32/55	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	PIRNA	BARDEZ
253	69/51	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	CODLI	SANGUEM
254	76/52	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	ADVALPALE	BICHOLIM
255	26/55	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	SACORDEM	SANGUEM
256	38/55	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	DHARBANDORA	SANGUEM
257	6/55	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	HONDA	SATTARI
258	03/54	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	MAULINGUEM	BICHOLIM
259	28/51	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	PISSURLEM	SATTARI

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260	70/52	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	CODLI	SANGUEM
261	39/55	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	DHARBANDORA	SANGUEM
262	10/49	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	MAULINGUEM	BICHOLIM
263	126/53	M/S SESA GOA LTD .Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	CODLI	SANGUEM
264	61/53	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	CODLI	SANGUEM
265	87/53	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	SIGAO	SANGUEM
266	143/53	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	SANGOD	SANGUEM
267	34/50	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	RIVONA	SANGUEM
268	73/52	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Timblo Pvt. Ltd., P.O. Box No. 34, Kadar Manzil, Margao Goa	AGLOTE	SANGUEM
269	92/52	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Timblo Pvt. Ltd., P.O. Box No. 34, Kadar Manzil, Margao Goa	CUDNEM	BICHOLIM
270	22/55	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Timblo Pvt. Ltd., P.O. Box No. 34, Kadar Manzil, Margao Goa	QUIRLAPALE	SANGUEM
271	90/53	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Timblo Pvt. Ltd., P.O. Box No. 34, Kadar Manzil, Margao Goa	SALGINIM	SANGUEM
272	96/53	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Timblo Pvt. Ltd., P.O. Box No. 34, Kadar Manzil, Margao Goa	RIVONA	SANGUEM
273	14/58	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Timblo Pvt. Ltd., P.O. Box No. 34, Kadar Manzil, Margao Goa	CODLI	SANGUEM
274	139/53	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	MELAULIM	SATTARI
275	20/57	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	KIRLAPALE	SANGUEM
276	81/52	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	NETORLIM	SANGUEM
277	35/55	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	PALE	BICHOLIM
278	1/41	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	VERLEM	SANGUEM
279	16/52	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	SALGINIM / VERLEM	SANGUEM

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SALCETE TALUKA
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280	137/53	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	VERLEM	SANGUEM
281	42/54	M/S SOC. TIMBLO IRMAOS LTDA. Represented by M/s Panduronga Timblo Industrias, P. O. Box No.242, Subhas Timblo Bhavan, Margao - Goa.	SALGINIM / VERLEM	SANGUEM
282	88/52	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	SIGAO	SANGUEM
283	45/52	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	CUDNEM	BICHOLIM
284	14/53	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	CUDNEM	BICHOLIM
285	21/57	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	BATI	SANGUEM
286	31/50	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	RIVONA	SANGUEM
287	44/52	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	SALGINIM	SANGUEM
288	19/55	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	MOLLEM	SANGUEM
289	88/53	M/S SOC. TIMBLO IRMAOS LTDA. Rep. by Sociedade de Fomento Industrial Pvt. Ltd., P.O. Box No. 31, Villa Flores Da Silva, Eramos Carvalho Street, Margao Goa	COLOMBA	SANGUEM
290	107/53	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	SURLA	BICHOLIM
291	40/50	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	SANTONA	SANGUEM
292	16/51	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	DUDAL	SANGUEM
293	14/51	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	COLOMBA	SANGUEM
294	001/53	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	AGLOTE	SANGUEM
295	59/53	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	GAVANEM	SATTARI
296	31/54	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	SANCORDEM	SANGUEM
297	46/54	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	PIRNA	BARDEZ

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SUBHASH KRISHNA KANEKAR
SALCETE TALUKA
MARGAO-GOA
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GOVT. OF GOA (INDIA)

2882

298	15/51	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	MOLEM	SANGUEM
299	2/53	Legal Heir of Shri V.D. Chdwgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	CANDOLA	PONDA
300	93/53	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	VAGURIEM	SATTARI
301	106/53	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	SURLA	BICHOLIM
302	58/52	Legal Heir of Shri V.D. Chowgule (L), Chowgule House, Mormugoa Harbour, Mormugoa	SALGINIM	SANGUEM
303	13/55	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SIGAO	SANGUEM
304	39/56	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	MALPONA	SATTARI
305	47/54	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SIGAO	SANGUEM
306	44/56	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SURLA / AGLOTE	SANGUEM
307	27/53	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	AGLOTE	SANGUEM
308	83/52	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SURLA	BICHOLIM
309	29/54	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SURLA	BICHOLIM
310	19/58	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SONUS VOLVOLIEM	SATTARI
311	25/54	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	VANTEM	SATTARI
312	62B/52	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	VELGUEM	BICHOLIM
313	71/51	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	VANTEM	SATTARI
314	50/53	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	SIGAO	SANGUEM
315	19/52	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	AGLOTE	SANGUEM
316	18/55	M/S V. M. SALGAOCAR & BRO. PVT. LTD .Salgaocar House, P. O. BOX No.14, Fiancisco Luis Gomes Road, Vasco-da-Gama – Goa.	MALPONA	SATTARI
317	49/54	V. M. SALGAOCAR (LATE) (SMI) Salgaocar Chambers, P. O. Box No. 35, Margao - Goa	ADVAPALE	BICHOLIM
318	24/50	V. M. SALGAOCAR (LATE) (SMI) Salgaocar Chambers, P. O. Box No. 35, Margao - Goa	DUDAL	SANGUEM

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319	4/53	V. M. SALGAOCAR (LATE) (SMI) Salgaocar Chambers, P. O. Box No. 35, Margao - Goa	MELAULI	SATTARI
320	41/55	V. M. SALGAOCAR & BRO.LTD. (SMI) Salgaocar Chambers, P. O. Box No. 35, Margao - Goa	TIVIM / PIRNA	BARDEZ
321	86/53	Shri V. M. SALGAOCAR (Late)(SALLITHO) Ores Pvt. Ltd) Salgaocar Chambers, P. O. Box No. 114, Margao - Goa	PALE	BICHOLIM
322	7/50	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	DUDAL / MAULINGUEM	SANGUEM
323	20/54	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	SONUS VONVOLIEM	SATTARI
324	05/54	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	SONUS VONVOLIEM	SATTARI
325	37/52	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	CARAPUR	BICHOLIM
326	35/52	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	RIVONA	SANGUEM
327	43/51	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	AGLOTE	SANGUEM
328	40/54	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	CURPEM / SULCORNA	SANGUEM / QUEPEM
329	3/51	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	CURPEM / SULCORNA	SANGUEM / QUEPEM
330	21/54	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	SURLA / CUDNEM	BICHOLIM
331	17/60	M/S V. S. DEMPO & CO. PVT. LTD./SESA RESOURCES LTD.Sesa Ghor, 20 EDC Complex, Patto, Panaji - Goa	NAVELIM	BICHOLIM
332	23/58	SHRI RAGHUVIR SHAMBA Naik (LATE) Smt. Sushila R. Naik Amonkar Legal heirs of Late Raghuvir Shamba Naik H. No. 37 near Galaxy Aparment Khorlim Mapusa Goa	NAVELIM	BICHOLIM
333	28/53	Zantye & Company Pvt.Ltd. Narsinhava Prasad (H.No. 71) Father Agnel Rd., Altinho-Panaji-Goa-403001.	SARVON	BICHOLIM
334	33/52	SHRI V. G. MEHTA (LATE)Shri Deepak G. Mehta, Power of attorney of all Legal Heir of Late Shri V. G. Mehta, G-28, Phoenix Estate, Gogal, Margao -	CURPEM	SANGUEM
335	10/41	M/S RAJARAM N. S. BANDEKAR & CO. PVT. LTD. 801,6th floor, Dr. Ozier Forum Nr. St.Andreus Church, P. O. Box No.31, Vasco-da-Gama - Goa	NUNDEM	SANGUEM

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DETAILS OF MINING LEASES IN MATTER IS SUBJUDICE				
336	8/59	SHRI SHRIPAD G.GHARSE (LATE) Smt . Kishori Shripad Gharse wife of late Shripad G. Gharse C/O. Tabrej M. Hinglajkar S1, Mecca Manzil Appt., Near Billal Masjid, Chandravaddo Fatorda Margao- Goa 403602	DHARBANDORA	SANGUE M
NOTE :	FROM THEW ABOVE LIST, 133 LEASES HAVE BEEN RECENTLY DECLARED AS LAPSED.			

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ANNEXURE – III

Table 1 - Environmental Clearance to Active Mines (Open cast) in Goa – Issued by MOEF

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
1	Mr. Salgaocar Mining industries Pvt. Ltd (Dudal iron ore mine)	90.5359 ha	November 8, 2007	40 m MSL (60 m BGL) from top level of 100)	159 m from mine pit level	43.03 %	1. Conservation measure to augment ground water resource. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 3. Construct new pizometers during mining operation. 4. Permission needs to take from authority for ground water withdrawal. 5. Water quality of surface and ground water shall be monitored and maintained.	-
2	Mr. Salgaocar Mining industries Pvt. Ltd. (Tolem de Quela Keli Iron ore mine)	73.85 ha	June 27, 2007	Present working depth- 30 m BGL Ultimate working Depth- 80 m BGL	Core zone -47-50 m MSL	-	1. Water so collected should be utilized for watering mine are, roads, green belt. 2. Regular monitoring of ground water level and quality shall be carried out by established network 4 times a year, pre monsoon, monsoon, post monsoon and winter. 3 Construct new pizometers during mining operation. 4 Water quality of surface and ground water shall be monitored and maintained for 4 times in year.	1. Ground water Stage development is given in EC and not visible
3	Sallitho ores pvt. Ltd. (Purmet -E-Purvedat Iron ore mine)	90.60 ha	April 30, 2007	A-82 m MSL B-26m MSL C- 17m MSL	605 m	63.67 %	1 Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2 In case of uncertainty in the geological formation during future course of mining if the water being drained from mine shows intrusion of sea water mining should be discontinued. 3 Construct new pizometers during mining operation.	

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Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
4	Sesa Goa Ltd. (Mareta sodo iron ore mine)	26.672 ha	December 5, 2006	Present working depth-15 m BGL and ultimate depth - 70 m BGL	30 m BGL in CORE ZONE and 7 m BGL in BUFFER ZONE	-	1. Water so collected should be utilized for watering mine are, roads, green belt. 2. Drain should be regularly desilted after monsoon. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. Construct new pizometers during mining operation.	1.Stage development is not given in EC
5	Sesa Goa Ltd. (Expansion of Sanquelim group of iron ore project)	203.5091 ha	July 6, 2007	Present working depth and ultimate working depth is 16 m below MSL	21 m above MSL	-	1. Water so collected should be utilized for watering mine are, roads, green belt. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 3. Prior permission should be taken from authority for drawl of ground water. 4. Construct new pizometers during mining operation.	1. Stage development is not given in EC
6	Sesa Goa Ltd. (Expansion of Botvadcacho Dongor Iron ore mine)	13.9585 ha	December 24, 2009	Ultimate pit limit BELOW 4 m MSL	45 m MSL	50.81 %	1. Rain water harvesting need to undertake to recharge ground water table. 2. Permission needs to undertake from authority to extract ground water if any. 3. Monitoring of ground and surface water quality shall be regularly undertake with record. 4. Design of check dam shall be so that as to prevent downstream flow of silt and regular desolation shall be carried out to avoid impact on downstream water bodies. 5. Sufficient number of check dam and gully plugs shall be constructed.	1.Construction of new pizometers are not recommended
7	Sesa Goa Ltd. (Expansion of Codil Iron Ore mine)	299.55 ha	December 29, 2008	Ultimate depth-45 m above MSL	28 m above MSL	26.88 %	1. Hydro geological study shall be review annually. 2. Mining will be stoped if effect on hydrogeology is observed and started again after remedial measures. 3. Hydro geological study shall be conducted at end of 5 year before starting to 6 year.	

NOTARY SUBHASH KRISHNA KANEKAR Regd. No. EXP.04.28/2027 GOVT. OF GOA (INDIA)

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Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							4 Rain water harvesting need to undertake to recharge ground water table. 5 Sufficient number of check dam and gully plugs shall be constructed. 6 Ground water in core zone shall be regularly monitored for contamination and depletion. 7 Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 8 Construct new pizometers during mining operation.	
8	Sesa Goa Ltd. (Expansion of Mareto Sodo Iron Ore mine)	26.6770 ha	December 24, 2009	ultimate pit limit 38 m MSL	40 m MSL	-	1. Rain water harvesting need to undertake to recharge ground water table. 2. Sufficient number of check dam and gully plugs shall be constructed. 3. No silt should transport in surface water. 4. Monitoring of ground water should be done and maintained. 5. Monitoring points should be properly located and maintained. 6. Monitoring of Arsenic should be properly checked.	1. Stage development is not given in EC. 2.Construction of new pizometers are not recommended
9	Sesa Goa Ltd. (Orasso Dongar iron ore mine)	99.40 ha	April 18, 2007	Present and ultimate depth-100 m BGL		-	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2. Construct new pizometers during mining operation. 3. Prior permission shall be taken to withdraw ground water.	1.Water table level and ground water stage development is not provided in EC.
10	Sesa Goa Ltd. (Pirna Iron Ore mine)	43 ha	June 9,2009	Ultimate depth-14 m above MSL	20 m above MSL	-	1. Caution should be taken to keep minimum distance from river to avoid any seepage. 2. Rain water harvesting and ground water recharge shall be developing in core mining area. 3. Attempt should be done to maintain zero water balance. 4. Silt load should be managed to avoid siltation in	1. Stage development is not given in EC.

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Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							river. 5. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 6. Construct new pizometers during mining operation.	
11	Shri. Shabbar H. Khan (Vangi Bindi Advona Manganese and Iron ore mine)	83.0666 ha	February 15,2006	Present working depth-55 m BGL and Ultimate working depth – 55 for manganese and 10 m BGL and 60 m for Iron ores.	37-35 m above MSL in core mine area	-	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2. Construct new pizometers during mining operation. 3. Permission need to undertake from authority to extract ground water if any.	1. Stage development is not given in EC.
12	Shri. Shaikh Salim (Devapan Dongar Manganese and Iron Ore mine)	63 ha	September 8, 2008	Ultimate depth-120 m above MSL	70-90 m above MSL.	-	1 Rain water harvesting for ground water recharge shall be develop. 2 Ground water quality in core zone should be regularly monitored and contamination and depletion due to mining activity should be checked and maintained. 3 Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4 Construct new pizometers during mining operation.	1. Stage development is not given in EC.
13	Smt. Shakuntalabai M. Renge (Gotukwadecho Tembo Iron ore mine)	33.25 ha	25 August 2006	Present working depth is 69 m MSL –PIT-1 and 71 m MSL –PIT-2.	74 m MSL In Pit1 and BUFFER ZONE	-	1 Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2 Construct new pizometers during mining operation. 3 Permission needs to undertake from authority to extract ground water if any. 4 Project authority should meet water requirement	1. Stage development is not given in EC.

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2888

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							of nearby village if village well go dry.	
14	Smt. Shakuntalabai M. Rege (Gotukwadecho Tembo Iron ore mine)	-	February 9, 2010	-	-	32%	1. Harvesting of mine pit water and rain water to recharge aquifers. 2. Monitoring of ground water regime modelling using real time data.	1.Construction of new pizometers are not recommended in EC 2. Mining area, Present Working Type, ground water table level, present mining depth are not provided in EC.
15	Shantilal Khushaldas & bros Pvt. Ltd. (Chuninimol Iron ore mine)	42.91 ha	January 12, 2009	Ultimate Depth-55 m BGL	20-30 m BGL	17.10 %	1. Rain water harvesting for ground water recharge shall be develop. 2. Ground water in core zone shall be monitored. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. Construct new pizometers during mining operation.	-
16	Shantilal Khushaldas & bros Pvt. Ltd. (Doncalavoilo Dongor Iron ore mine)	38.50 ha	December 24, 2009	20-30 m MSL	Ultimate pit limit is 35-40 m MSL	-	1.No slit originating will be transported in surface water 2. Permission to be obtained to explore ground water from authority. 3. Monitoring of ground water and surface water shall be maintained and recorded with monitoring point.	1. Stage development is not given in EC. 2.Construction of new pizometers are not recommended in EC
17	Shantilal Khushaldas & bros Pvt. Ltd. (Joleracho Dongor Iron Ore mine)	61.354 ha	March 2, 2008	Ultimate working depth-18 m above MSL	26 m above MSL	19.24 %	1. Hydro geological study shall be review annually. 2. Rain water harvesting for ground water recharge shall be develop. 3. Ground water in core zone shall be regularly monitored. 4. Regular monitoring of ground water level and quality shall be carried out by established network	-

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Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 5. Construct new pizometers during mining operation.	
18	Shantilal Khushaldas & bros Pvt. Ltd. (Matheepan –e-Satarcarachem Iron ore mine)	23 ha	March 26, 2009	Ultimate working depth-30 m above MSL	25 m above MSL	19.24 %	1. Hydro geological study shall be review annually and in case adverse effect on water quality is observed mining shall be stopped and resume after necessary steps. 2. Rain water harvesting for ground water recharge shall be develop. 3. Ground water in core zone shall be regularly monitored. 4. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 5. Construct new pizometers during mining operation.	-
19	Shri.Silakant M. Gharse (Zomblimolacho Soddo Iron ore mine)	90.50 ha	April 30, 2008	-	-	47.03 %	1. Mining shall not be carried out during rainy season. 2. Rain water harvesting for ground water recharge shall be develop. 3. Ground water in core zone shall be regularly monitored. 4. Water to be supplied for drinking shall be monitored for arsenic and fluoride. 5. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 6. Construct new pizometers during mining operation.	1. Water table level and present mine level are not provided in EC.
20	M/s. Sociedata Shri. Mahalaxmi companhia (Expansion of Macodiatolem E Mamatembo iron Ore	72.72 ha	August 9, 2007	57.75 m above MSL	71.75 MSL	-	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter.. 2. Construct new pizometers during mining	1.Ground water stage development is not provided in EC.

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2890

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Leve	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	mine)						operation. 3. Prior permission of authority for withdrawal of ground water if any.	
21	Ms. Sociedada Timblo Irmaos Limitada (Expansion of Copila Gaichem Paul Iron Ore mine)	94 ha	September 3, 2007	Ultimate working depth-82 m below BGL	4.8 to 7 3 m BGL	58.4 %	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2. Construct new pizometers during mining operation. 3. Rain water harvesting shall be undertaken 4. Regular monitoring of mine water discharge in river bodies, water bodies and talahs shall be undertaken.	-
22	Ms. Sociedada Timblo Irmaos Limitada (Dignem Iron ore mine)	13.1360 ha	September 30, 2005	Present working depth -60 m BGL Ultimate working depth-84m BGL	-	51.87 %	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2. Construct new pizometers during mining operation. 3. Project authority should meet the water requirements of nearby village in case of village wells go dry.	1. Depth of water table level is not provided in EC.
23	Ms. Sociedada Timblo Irmaos Limitada (Quelchlem Tour Tambdi Iron ore mine)	73.73 ha	August 20, 2007	-	-	50.81 %	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2. Construct new pizometers during mining operation. 3. Prior permission from authority to withdraw ground water if any. 4. Project authority shall implement suitable conservation measure to augment ground water resource.	1.Water table level and present mine level are not provided in EC.
24	Ms. Sociedada Timblo Irmaos Limitada (Carmolem E blog iron ore mine)	40.50 ha	August 22, 2007	Mining will go upto 78 m below water table	-	50.51 %	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter.. 2. Construct new pizometers during mining	1.Water table level is not provide in EC.

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Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							operation.	
25	Ms. Sociedada Timblo Irmaos Limitada (Fanascatem Iron Ore mine)	100 ha	May 13, 2008	-	-	-	1. Detail hydro geological study shall be conducted and mining shall be start only if hydro geological study without any adverse effect on ground water is observed. 2. Rain water shall be under taken to recharge ground water. 3. Ground water in core zone should be regularly monitored. 4. Ground water in core zone shall be regularly monitored. 5. Water to be supplied for drinking shall be monitored for arsenic and fluoride. 6. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 7.Construct new pizometers during mining operation.	1.Water table level, present mine level, ares not provide in EC. 2. Ground water stage development is not provided in EC.
26	Ms. Sociedada Timblo Irmaos Limitada (Gautona dusrifall Iron ore mine	40.765 ha	July 5, 2007	Current working depth-42m MSL And Ultimate working depth-49 m MSL	-	-	1. Project authority shall maintained suitable measure to augment ground water table. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 3. New pizometers shall be constructed during mining operation. 4. Prior permission from authority for withdrawal of ground water.	1.Ground water stage development and water table level are not provided in EC.
27	Ms. Sociedada Timblo Irmaos Limitada (Mauco Catodichi iron ore mine)	35.02 ha	May 14, 2009	Ultimate depth of mining-4 m above MSL	40 m above MSL	-	1. Hydro geological study shall be review annually if adverse effect on ground water observed then mining shall be stopped and resumed only if mitigation measures are implemented. 2. Rain water harvesting shall be implementing to recharge ground water. 3. Ground water in core zone should be monitored regularly. 4. Regular monitoring of ground water level and	1.Ground water stage development is not provided in EC.

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2812

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 5. Construct new pizometers during mining operation.	
28	Mr. Sova salgaocar chamber (Odamola iron ore mine)	85.72 ha	October 28, 2009	Ultimate working depth-90 m BGL	-	58. 40 %	1. Rain water harvesting shall be implementing to recharge ground water. 2. Desiltation hall be carried out before every monsoon. 3. No ground water shall be used for any mining operation without prior approval. 4. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 5. Construct new pizometers during mining operation.	1. Water Table level is not provided in EC.
29	Smt. Sudha M. Gaundalkar (Nirakal iron ore mine)	85.55 ha	June 27, 2007	Present working depth- 26 m BGL Ultimate working depth-58 m BGL	Pre monsoon -46 m BGL and Post monsoon-52 m BGL	26.98 %	1. Project authority shall maintained suitable measure to augment ground water table. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 3. New pizometers shall be constructed during mining operation. 4. Prior permission from authority for withdrawal of ground water.	-
30	M/s. Talaulicar and Sons (Expansion of Saniem Sacorda Iron ore mine)	50.30 ha	25 November , 2005	Ultimate working depth-110 m BGL Present working depth-86 m BGL	3.5-4 BGL in core zone 10.5 -11.5 in Buffer zone	4.53 %	1. Submit study on hydrogeology for 3 seasons. 2. Water harvesting measures should be undertaken 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. New pizometers shall be constructed in project area. 5. Prior permission from authority for withdrawal of ground water.	-
31	M/s Timbola Minerals	34.22 ha	30	18 m RL	35 m RL	41.64 %	1. Water harvesting measure should be taken up.	

NOTARY SUBHASH KRISHNA KANEKAR SALCETE TALUKA MARGAO-GOA Regd. No. 04/14 EXP. DT. 28/12/2021 GOVT. OF GOA (INDIA)

2893

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Pvt. Ltd. (Expansion of Qiteiro Divodgal iron ore mine)		September , 2005				2. No ground water should be used for mining purpose without prior permission. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. New pizometers shall be constructed at project area.	
32	Tisa Moreas mining industries (Ubeafatricho Dongor Iron ore mine)	63.83 ha	December 12, 2008	Ultimate working Depth-164 m above MSL	130-150 m above MSL	-	1. Rain water harvesting shall be implemented to recharge ground water. 2. Ground water in core zone shall be regularly monitored. 3. Hydro geological study of that area shall be review annually. In case of adverse effect mining shall be stopped till remedial measure are implemented. 4. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 5. New pizometers shall be constructed in mine area.	1.Ground water stage development is not provided in EC.
33	U.S. Tilve Sesa Goa Ltd. (Expansion of Codil Iron Ore Mine)	299.58 ha	September 6, 2005	Ultimate working Depth-35 m MSL	28-30 MSL and 31-36 MSL	-	1. Water harvesting shall be taken in and around mine are. 2. No addition ground water shall be used for mine area. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. New pizometers shall be constructed during mining operation.	1.Ground water stage development is not provided in EC.
34	Smt. Usha Kare (Mortimolavoril Soddo Iron ore mine)	87.37 ha	May14, 2009	7 m below MSL	6 m above MSL	27.89 %	1. Hydro geological studies sall be carried out and review annually and if adverse effect on ground water quality is observed mining shall be stoped and restart after necessary remedial measure. 2. Rain water harvesting shall be undertaken to recharge ground water zone.	-

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2894

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							3. Ground water in core zone shall be regularly monitored 4. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 5. New pizometers shall be constructed during mining operation.	
35	M/s. V.G. Quenim (Expansion of Sem Denominacao Especial Sonshi Iron ore mining)	56.79 ha	May 18, 2006	Present working Depth-24 m BGL Ultimate working depth - 71 m BGL	30 m BGL (pre monsoon) and 26 m BGL (post monsoon)	-	1. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 2. New pizometers shall be constructed during mining operation. 3. Prior permission shall be taken from authority for drawl of ground water if any.	1 Ground water stage development is not provided in EC.
36	V. M. Salgaonkar and Bro. Pvt. Ltd. (Expansion of Velgum/ Surla Iron ore mine)	286.6193 ha	March 28 2006	present and ultimate working depth- 74 m BGL	41 m BGL	-	1. Project authority shall implement suitable conservation measure to augment ground water resource. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 3. New pizometers shall be constructed during mining operation. 4. Prior permission shall be taken before withdrawal of ground water if any.	1 Ground water stage development is not provided in EC.
37	V. M. Salgaonkar and Bro. Pvt. Ltd. (Expansion of Sigao Iron ore mining)	174.71 ha	March 28 2006	Present and ultimate working depth- 75 m BGL	35 m BGL	-	1. Project authority shall implement suitable conservation measure to augment ground water resource. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 3. New pizometers shall be constructed during mining operation. 4. Prior permission shall be taken before withdrawal of ground water if any.	1 Ground water stage development is not provided in EC.

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2895

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
38	M/s V.S. Dempo and Co. Pvt. Ltd. (Curpem Iron Ore mine)	148.6755 ha	November 17, 2005	Present working depth-114 MRL Ultimate working Depth-84 MRL	107-112 MRL in Core zone and 23-25 MRL In buffer zone.	41.64 %	1. Water harvesting shall be taken in and around mine area. 2. No addition ground water shall be used for mining. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. New pizometers shall be constructed during mining operation.	-
39	M/s V.S. Dempo and Co. Pvt. Ltd. (Culnavorli Sodo Iron ore mine)	38.85 ha	November 17, 2005	Present working depth-32 m BGL Ultimate working Depth-34 m BGL	10-12 m BGL in Core zone and 6-8 m BGL In buffer zone.	47.03%	1. Water harvesting shall be taken in and around mine area. 2. No addition ground water shall be used for mining. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. New pizometers shall be constructed during mining operation.	-
40	M/s V.S. Dempo and Co. Pvt. Ltd.(Expansion of Colomba Iron ore mine)	98.46 ha	November 17, 2005	Present working depth-30 MRL Ultimate working Depth-06 MRL	30-35 MRL in Core zone and 25-30 MRL In buffer zone.	19.24%	1. Water harvesting shall be taken in and around mine area. 2. No addition ground water shall be used for mining. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 4. New pizometers shall be constructed during mining operation.	-
41	M/s V.S. Dempo and Co. Pvt. Ltd.(Expansion of Surla Sonshi iron ore mine)	253.39 ha	November 17, 2005	Ultimate working Depth-0 MSL	25 MSL in Core zone and 18 MSL In buffer zone.	51.87 %	1. Water harvesting shall be taken in and around mine area. 2. Prior approval of MOEF and CGWB for using ground water. 3. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year pre monsoon,	-

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2896

Sr. No.	Name of Mine	Lease Area	Year of Sanct on	Present Mine Level	Water Table Level	Groundwa er Stage Development	Compliance for Water Management	Remark(s)
							monsoon, post monsoo n and winter. 4. New pizometers shall be constructed during mining operation.	
42	Shri.Vinay Mehata (Galiem Mola Ou Calzarigogo Iron and Manganese ore mine)	68.75 ha	August 7, 2009	Ultimate depth - 25 m above MSL	25 m above MSL	17.10 %	1. Precaution shall be taken to keep minimum distance from river bodies so that mine drainage and seepage shall not e nter in water bodies. 2. Detail hydrological studies shall be carried out before mining during 2 phase. 3. Rain water harvesting shall be taken in and around mine area to recharge ground water table. 4. Ground water in core zone shall be regularly monitored. 5. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 6. New pizometers sha l be constructed during mining operation.	-
43	Shri.Vinay Mehata (Vatasur Iron and Manganese ore mine)	21.70 ha	August 7, 2009	Ultimate depth - 25 m above MSL	25 m above MS	17.10 %	1. Precaution shall be taken to keep minimum distance from river bodies so that mine drainage and seepage shall not enter in water bodies. 2. Detail hydrological studies shall be carried out before mining during 2 phase. 3. Rain water harvesting shall be taken in and around mine area to recharge ground water table. 4. Ground water in core zone shall be regularly monitored. 5. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 6. New pizometers shall be constructed during mining operation.	-
44	M/s. Virginia Maria Simoes (Coti Donger Pirla Iron ore mine)	79 ha	May 17, 2017	Present working depth-10 m BGL Ultimate working Depth-	50-55 m MSL	-	1. Project authority shall implement suitable measure to augment ground water. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon,	1.Ground water stage development is not provided in EC.

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2874

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
				80 m BGL			monsoon, post monsoon and winter.. 3. New pizometers shall be constructed during mining operation. 4. Mining activity shall be rusticated above ground water table. 5. Company shall monitor ground water quality for faecal coli-form. 6. Prior permission shall be taken from authority before drawl of ground water.	
45	M/s. Virginia Mario Simoes (Maliatembo NaqucrimRivona Iron and Manganese ore mine)	50.80 ha	May 13, 2008	Ultimate depth 78 m Above MSL	-	-	1. Detail Hydrological studies shall be carried out. 2. If ground water is adversely effected mining shall be stopped and resumed after necessary mitigation measure 3. Rain water harvesting shall be undertaken to recharge ground water table. 4. Ground water in core zone shall be regularly monitored. 5. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 6. New pizometers shall be constructed during mining operation.	1.Ground water stage development and water table level are not provided in EC.
46	M/S. Xec Abdul Gofur (Pola Dongar Manganese Mine)	30.22 ha	May 17, 2007	Present working depth-80 m MSL Ultimate working depth-62 m MSL	Depth of water in core zone-55 m MSL And Buffer Zone -50 m MSL	-	1. Project authority shall implement suitable measure to augment ground water. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon, monsoon, post monsoon and winter. 3. New pizometers shall be constructed during mining operation. 4. Prior permission shall be taken before withdrawal of ground water if any.	1.Ground water stage development is not provided in EC.
47	M/s. Xec Cadar Xec Usman (Carpacegga Codli Iron Ore Mine)	40.29 ha	October 24, 2007	Ultimate working depth-45 m BGL	6.89 m BGL	26.98 %	1. Project authority shall implement suitable measure to augment ground water. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year, pre monsoon,	-

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2818

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							monsoon, post monsoon and winter. 3. New pizometers shall be constructed during mining operation. 4. Prior permission shall be taken before withdrawal of ground water if any.	
48	M/S. Zantye and Co.Pvt. Ltd. (Survona Iron and Manganese ore mine)	72 ha	August 21, 2007	Present working depth-5 m BGL Ultimate working depth-65 m BGL	5.9 m above MSL	59.82 %	1. Project authority shall implement suitable measure to augment ground water. 2. Regular monitoring of ground water level and quality shall be carried out by established network of wells for 4 times in year pre monsoon, monsoon, post monsoon and winter. 3. New pizometers shall be constructed during mining operation. 4. Prior permission shall be taken before withdrawal of ground water if any.	
49	Shri K. N. Shariff Govya Moll Iron Ore Mine, Solcorna, Quepem Taluk, South Goa Dist.	54.41 ha	Dec, 2007	180m MSL	Below 160m MSL	Not Provided in EC letter	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from tailing them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
50	M/S Kantilal and Co. Pvt. Ltd. Bamana Utkode-e-	97.94 ha	Dec, 2008	50m Below ground level from top level of 190m MSL	50-60m MSL	Not Provided in EC letter	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations.	

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2819

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	outrose Iron Ore Mine, Bati and Cumbari , Sanguem Taluk, South Goa Dist.						- Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August). Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from tolling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
51	M/S Kantilal and Co. Pvt. Ltd. Gogol-E-Galil Iron Ore Mine, Bati and Cumbari , Sanguem Taluk, South Goa Dist.	23.02 ha	Dec, 2008	40 m Below ground level from top level of 100m MSL	50m MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August). Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
52	M/S Kantilal and Co. Pvt. Ltd. Gonsumbordi Iron Ore Mine, Bati, Sanguem Taluk, South Goa Dist.	10 ha	June, 2008	40 m Below ground level from top level of 100m MSL	Not Provided in EC letter	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon	

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2900

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							(August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
53	M/S Kantilal and Co. Pvt. Ltd. Kariamola Khuntimol Tembo Iron Ore Mine, Bati, Sanguem Taluk, South Goa Dist.	98.70 ha	Feb, 2008	40 m below ground level from top of 110m MSL	Not Provided in EC letter	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
54	M/S Kantilal and Co. Pvt. Ltd. Karlmol Chardimol Iron Ore Mine, Bati, Sanguem Taluk, South Goa Dist.	98.36 ha	July, 2008	35 m below ground level from top of 95m MSL	Not Provided in EC letter	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly	

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2901

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
55	M/S Kantilal and Co. Pvt. Ltd. Khairade-e-Toleavoilli Iron Ore Mine, Bati and Nalquinim, Sanguem Taluk, South Goa Dist.	46.89ha	June, 2008	40 m below ground level from top of 100m MSL	Not Provided in EC letter	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
56	M/S Kantilal and Co. Pvt. Ltd. Mada Tembo-E-Tolitembo Iron Ore Mine, Bati, Sanguem Taluk, South Goa Dist.	99.1452 ha	Feb, 2008	40 m below ground level from top of 100m MSL	Not Provided in EC letter	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board	

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2902

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							- Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
57	M/S Kantilal and Co. Pvt. Ltd. Madanrica Iron Ore Mine, Bati and Cumbari, Sanguem Taluk, South Goa Dist.	116.772 ha	June, 2008	65m below ground level from top of 135m MSL	Not Provided in EC letter	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
58	M/S Kantilal and Co. Pvt. Ltd. Tollavolli Iron Ore Mine, Village Viliens, Sanguem Taluk, South Goa Dist.	94090 ha	May, 2008	60m below ground level from top of 120m MSL	50m MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards	5

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2903

Sr. No	Name of Mine	Lease Area	Year of Sanctior	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							- Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
59	M/S Kantilal and Co. Pvt. Ltd. Velipiares Iron Ore Mine, Village Bati, Sanguem Taluk, South Goa Dist.	93.315 ha	June, 2008	60 m below ground level from top of 175m MSL	Not Provided in EC letter	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
60	M/S Kantilal and Co. Pvt. Ltd. Zambu Soddo Iron Ore Mine, Village Bati and Cumbari, Sanguem Taluk, South Goa Dist.	50.82 ha	Feb, 2008	40 m below ground level from top of 100m MSL	50m MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored	

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2904

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							- Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
61	M/S Kashinath D.S.Talaulikar Carmolachem Moli Cudnem Iron Ore Mine, Village Cudoem, North Goa Dist. Goa.	97.54 ha	Dec. 2003	40m above MSL	35m above MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board -Hydro geological study of area shall be reviewed annually in case of adverse effect on ground water quality and quantity - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
62	Smt. Kunda S. Gharse Tollem Group of Mines, Village Tudou and Patiem, Sanguem Taluk, South Goa Dist.	261.79 ha	Sept. 2008	68 m below ground level	22-30m BGL in core zone and 18-32 m BGL in buffer zone	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be	

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2905

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
63	Smt. Kunda S. Gharse Carcariatemb Bombod Iron Ore Mine, Village Tudou and Patiem, Sanguem Taluk, South Goa Dist.	78.87 ha	Aug, 2008	48m RL above MSL (35m BGL)	55m RL above MSL (30m BGL)	4.53%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
64	M/S Late Shri Crishna Mukund Camotira Bencremdando & Cadiabanda Voril Dongor Iron and Manganese Ore Mine, Village Tudou and Patiem, Sanguem Taluk, South Goa Dist.	58.64 ha	Dec, 200[illegible]	50m MSL (80m BGL from top level of 130m MSL	70m MSL	41.64%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to	

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2906

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
65	M/S Lithoferro Callsamichonato de Oilmol Iron Ore Mine, Village Advalpale and Tivim, Tehsil Bcholin and Bardez, North Goa Dist. Goa.	47.03 ha	May, 2007	80m BGL (20m above MSL from top height of 100m above MSL)	40-42m MRL	57.33%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
66	M/S Madachem Bat Pvt. Ltd. Madachem Bat Iron Ore Mine, Village Pale, Tehsil Bcholin, North Goa Dist, Goa.	60.50 ha	Jan, 2008	84m BGL	5m BGL	63.73%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source	

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2907

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Re mark(s)
							- Monitoring of Drinking water quality shall be undertaken.	
67	M/S Manuel Da Costa Sem Denominacao Especial Patiem Iron Ore Mine, Village Patium and Todou, South Goa Dist, Goa.	95.09 ha	July, 2007	Ultimate working depth is 55m below ground level	Water table is at 76m below ground level	47.03 %	-Detailed hydrogeological Study (Quality and Quantity) on impact of mining on hydrogeology shall be carried out and report submitted to ministry -Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
68	Marzook and Kadar Pvt. Limited Devachi Raim Iron Ore Mine, Village Dharbodara, Sanguem Taluk, South Goa Dist, Goa	77.70 ha	Apr, 2007	Altitude of mine is 28m-115m Above MSL And Present depth of mining is 40m MSL from the top of 81m MSL	35m MSL	26.98%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored	

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2962

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							- Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
69	M/S Mineira Nacional Limitata Cuddegal Voril Soddo Iron Ore Mine, Village Santona, Sanguem Taluk, South Goa Dist. Goa	91.09 ha	March, 2008	Present working depth is 64m BGL	28-28-33m BGL in core zone and 3.2-6.2m BGL in buffer zone	27.15%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Monitoring of Drinking water quality shall be undertaken.	
70	M/S N.S. Narvekar Kalay Iron Ore Mining, Village Santana of Quirlapa, Sanguem Taluk, South Goa Dist. Goa	176.76 ha	May, 2007	78m BGL	33m BGL in Core zone and 6.2m BGL in buffer zone	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Monitoring of Drinking water quality shall be undertaken.	
71	Nacul Alias Gurudas	20.0 ha	May, 2008	68m BGL	5m BGL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells	

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2909

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Santona Tembo Iron Ore Mine, Village Vichundrein, Sanguem Taluk, South Goa Dist, Goa						and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Monitoring of Drinking water quality shall be undertaken.	
72	M/S Nalini Vinayak Naik Madiencho Soddo Iron Ore Mine, Village Sangod, Sanguem Taluk, South Goa Dist, Goa	98.20 ha	July, 2007	34m BGL (40m MSL)	35m MSL	58.4%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Monitoring of Drinking water quality shall be undertaken.	
73	M/S Smt Sudha M Gundalkar Nirankal Iron Ore Mine, Village Nirankal, Ponda Dist, North Goa.	35.55 ha	June, 2007	26m BGL	46 to 52m BGL	26.98%	- Conduct detailed hydrogeological study on impact of mining on hydrogeology of lease area to be carried out and report submitted to ministry - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a	

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2910

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Monitoring of Drinking water quality shall be undertaken.	
74	Noor Mohammad Sheikh Mussa Dudagal Culna Ore Mine, Village Dudagal, Sanguem Taluk, South Goa Dist, Goa	83.74 ha	Aug, 2008	52m RL above MSL	32m RL above MSL	47.03%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board -Hydro geological study of area shall be reviewed annually in case of adverse effect on ground water quality and quantity - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
75	M/S Pandurang Timblo Industries Bondra Advona Iron Ore Mine, Village	92.278 ha	Oct, 2007	Ultimate working depth is 108m BGL	Not metioned (mining will intersect water table)	26.98%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a	

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2911

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Darbondora, Sanguem Taluk, South Goa Dist, Goa						year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
76	M/S Pandurang Timblo Industries Suctoll Iron Ore Mine, Village Sungod, Sanguem Taluk, South Goa Dist. Goa	53.46 ha	May, 2006	Present working depth is 60m above MSL	101m above MSL in the core and buffer zone in pre-monsoon	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored	
77	M/S Pandurang Timblo Industries Borga Iron Ore Mine, Village Rivona, Sanguem Taluk, South Goa Dist, Goa	89.50 ha	July, 2007	84m above MSL	40m above MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board	

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29127

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							- Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
78	M/S Pandurang Timblo Industries Borga Iron Ore Mine, Village Rivona, Sanguem Taluk, South Goa Dist, Goa	71.98 ha	Feb, 2010	84m Above MSL	40m above MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
79	M/S Pandurang Timblo Industries Borga Iron Ore Mine, Village Rivona, Sanguem Taluk, South Goa Dist, Goa	89.50 ha	Feb, 2010	84m Above MSL	40m above MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards	

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2913

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							- Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source - Monitoring of Drinking water quality shall be undertaken.	
80	M/S Pandurang Timblo Industries Murmunem Iron Ore Mine, Village Melauli, Sattari Taluk, North Goa Dist, Goa	89.50 ha	March, 2009	6m below MSL Ultimate working depth will be (-)6 m above MSL	17m above MSL mining will intersect ground water table	27.89%	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board -Hydro geological study of area shall be reviewed annually in case of adverse effect on ground water quality and quantity - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source	
81	M/S Pandurang Timblo Industries Shigao Iron Ore Mine, Village Shingao, Sanguem Taluk, South Goa Dist, Goa	50.40 ha	Sept, 2007	Present working depth is 40m BGL (56 above MSL)	Not mentioned	58.43%	- Conduct detailed hydrogeological study on impact of mining on hydrogeology of lease area to be carried out and report submitted to ministry - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board	

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2914

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							- Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored	
82	Dr. Prafulla R. Hede Godeavadea Jawalachem Upor Iron Ore Mine, Village Collem, Sanguem Taluk, South Goa Dist, Goa	82.52 ha	Oct, 2005	Ultimate working depth is 80m BGL	Mining will intersect water table which is 15m BCL in pre-monsoon	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored	
83	Shri Prashant Damu Naique Cosmomoichem Mola Iron and Manganese Ore Mine, Village Sulcornan, Quepem Taluk, South Goa Dist, Goa	24.25 ha	Aug, 2007	Not mentioned	Not mentioned	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored	
84	Shri Pravin Kumar Gosalia Mahavir Bauxite Mine, Village Carbo-Du Rama,Nuem and	437.52 ha	Aug, 2009					Proposal Rejected

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2915

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Canaginium, in Conacona Taluk, South Goa Dist, Goa							
85	Shri Pravin Kumar Gosalia Shakti Bauxite Mine, Village Betul, Naqueri, Morpila, Velim, Fatorpa, in Salcete and Quepem Taluk, South Goa Dist, Goa	826.1580 ha	Sept. 2008	40m above MSL	10-25m above MSL	Not Provided in EC letter	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Rainwater harvesting shall be undertake to recharge ground water source	
86	Shri Pravin Kumar Gosalia Shakti Bauxite Mine, Village Betul, Naqueri, Morpila, Velim, Fatorpa, in Salcete and Quepem Taluk, South Goa Dist, Goa	826.158 ha	June, 2006	Ultimate working depth will be 40m above MSL	10-25m above MSL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezo meters during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board -The project authority Should implement suitable conservation measures to augment groundwater recourses in the area in consultation with Regional Director, Central Ground Water Board -Hydro geological study shall be reviewed annually	
87	M/S R.R. Painguinkar Chiraband-e-Vall Ore Mine, Village Patiem &	81.90 ha	Sept, 2005	Ultimate working depth is 40m BGL	15-32m BGL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations.	

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2916

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Uguem, Sanguem Taluk, South Goa Dist, Goa						-Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -No groundwater shall be used for mining operations. Prior approval of MOEF and CGWB shall be obtained for using ground water for mining operations -Water harvesting measures should be taken up in and around mining site	
88	Shri R Subramanian Sancordem Malpona Iron Ore Mine, Village Malpona, Sattari Taluk, North Goa Dist.	90.03	Nov, 2005	32m BGL	4.15-8.17m BGL	Not Provided in EC letter	-Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. -Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -No groundwater shall be used for mining operations. Prior approval of MOEF and CGWB shall be obtained for using ground water for mining operations -Water harvesting measures should be taken up in and around mining site	
89	M/S R.S. Shetye & Brothers	99.47 ha	Sept. 2005	Present working depth is 68m	Water table is at 37-41m BGL in	50.81 %	- Regular groundwater level monitoring shall be carried out establishing network of existing wells	

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2917

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Deulem Pissurlem Iron Ore Mine, Village Pissurtem, Sattari Taluk, North Goa Dist.			BGL	core zone and 6-15m BGL in buffer zone		and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April -May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Detailed hydrogeological study on impact of mining on hydrogeology shall be carried out and report sent to the ministry - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -Water harvesting measures should be taken up in and around mining site	
90	Shri R.T. Deulkar Carea Codil Uprl Adam Tembo-E-Sourlpar Iron Mine, Village Moulingum, Sanguemi Taluk, South Goa Dist.	22.4108 ha	Sept. 2007	Not mentioned	Not mentioned	58.4%	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - Water harvesting measures should be taken up in and around mining site	
91	M/S Raghuvir Sinai Gharse Cazreachem Culna-Cdnem Iron Ore Mining	79.53 ha	March, 2006	Present working depth is 73m BGL (15m RL) and ultimate working depth	18m BGL	Not Provided in EC letter	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a	

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2918

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Village Cumen, Sicholim Taluk, North Goa Dist.			will be 88m BGL (0m RL)			year- pre-moasoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - The project authority Should implement suitable conservation measures to augment groundwater recourses in the area in consultation with Regional Director, Central Ground Water Board	
92	The Managing Director, M/S Rajaram Bandekar Mines Pvt. Ltd. Village Sirigoo, Bicholem Taluk, North Goa Dist.	64.01 ha	Jan. 2007	73m below MSL	2m below MSL	Not Provided in EC letter	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - The project authority Should implement suitable conservation measures to augment groundwater recourses in the area in consultation with Regional Director, Central Ground Water Board	
93	M/S Ralph De Souza Valgar Shismamordilron Ore Ltd., Village Sangod, Sanguem Taluk, South Goa Dist.	96.48 ha	Apr. 2007	7m BGL	25m EGL	26.98%	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon. (August), Post-monsoon (November) and winter	

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2919

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							(January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - The project authority Should implement suitable conservation measures to augment groundwater recourses in the area in consultation with Regional Director, Central Ground Water Board	
94	M/S Ramachndra V.S. Velingkar Carpadega Iron Ore Ltd., Village Dharbadora, Sanguem Taluk, South Goa Dist.	59.65 ha	Feb. 2008	64m BGL	2-6m BGL	26.98%	- Project proponent shall conduct detailed hydrogeological study including impact of mining on hydro-geology based on three aeasion data of the area and submit the same to ministry - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - The project authority Should implement suitable conservation measures to augment groundwater recourses in the area in consultation with Regional Director, Central Ground Water Board	
95	M/S Roy Antao & Sane Antao Monte Iranqui Iron Ore Ltd.,	78.68 ha	Dec. 2006	55m BGL	65m BGL	Not Provided in EC letter	- Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Monitoring shall be carried out four times in a	

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2920

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Wate· Management	Remark(s)
	Village Potrem, Sanguem Taluk, South Goa Dist.						year- pre-monsoon (April-May), monsoon (August), Post-monsoon (November) and winter (January) and data thus collected shall be regularly sent to MoEF, Central Ground water authority, CPCB, and Goa state pollution control board - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored - The project authority Should implement suitable conservation measures to augment groundwater recourses in the area in consultation with Regional Director, Central Ground Water Board	
96	M/S Kantilal & Co. Pvt. Ltd. Asni Donger Iron Ore Mine, Village Curdi and Curpem, Sanguem Taluk, South Goa Dist.	43.62 ha	Dec, 2008	70m above MSL	55m above MSL	Not Provided in EC letter	-Ground water in the core zone shall be regularly monitored for contamination and depletion of due to mining activity and records maintained. The monitoring data shall be submitted to regional office of the ministry regularly. Further monitoring points shall be located between the mine and drainage in the direction of flow of ground water shall be set up and records maintained. - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -Rainwater harvesting shall be undertaken to recharge ground water sources -Hydro geological study shall be reviewed annually	
97	M/S Kantilal & Co. Pvt. Ltd. Dobacho Donger Iron and Manganese Ore Mine,	22.02 ha	Feb, 2009	210m above MSL	190m above MSL	Not Provided in EC letter	-Ground water in the core zone shall be regularly monitored for contamination and depletion of due to mining activity and records maintained. The monitoring data shall be submitted to regional office of the ministry regularly. Further monitoring points shall be located between the mine and	

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2921

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Village Curdi and Curpem, Sanguem Taluk, South Goa Dist.						drainage in the direction of flow of ground water shall be set up and records maintained. - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -Rainwater harvesting shall be undertaken to recharge ground water sources -Hydro geological study shall be reviewed annually	
98	M/S Kantilal & Co. Pvt. Ltd. Ganesh Gaudi Donger Iron and Manganese Ore Mine, Village Netrolim, Sanguem Taluk, South Goa Dist.	56.437 ha	Feb, 2009	250m above MSL	190m above MSL	Not Provided in EC letter	-Ground water in the core zone shall be regularly monitored for contamination and depletion of due to mining activity and records maintained - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -Rainwater harvesting shall be undertaken to recharge ground water sources -Hydro geological study shall be reviewed annually	
99	M/S Kantilal & Co. Pvt. Ltd. Gottovo Donger Iron and Manganese Ore Mine, Village Netrolim, Sanguem Taluk, South Goa Dist.	44.075 ha	March, 2009	216m above MSL	190m above MSL	Not Provided in EC letter	-Ground water in the core zone shall be regularly monitored for contamination and depletion of due to mining activity and records maintained. The monitoring data shall be submitted to regional office of the ministry regularly. Further monitoring points shall be located between the mine and drainage in the direction of flow of ground water shall be set up and records maintained. - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining	

NOTARY SUBHASH KRISHNA KANEKAR Regd. No. 5/94 SALCETE TALUKA MARGAO-GOA EXP. DT: 28/04/2021 GOVT. OF GOA (INDIA)

2922

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							operations. - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -Rainwater harvesting shall be undertaken to recharge ground water sources -Hydro geological study shall be reviewed annually	
100	M/S Kantilal & Co. Pvt. Ltd. Melca Donger Iron and Manganese Ore Mine, Village Sancordem, Sanguem Taluk, South Goa Dist.	73.80 ha	Oct, 2008	36m BGL	6-9m BGL	27.89%	-Ground water in the core zone shall be regularly monitored for contamination and depletion of due to mining activity and records maintained. The monitoring data shall be submitted to regional office of the ministry regularly. Further monitoring points shall be located between the mine and drainage in the direction of flow of ground water shall be set up and records maintained. - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations. - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -Rainwater harvesting shall be undertaken to recharge ground water sources -Hydro geological study shall be reviewed annually	
101	M/S Kantilal & Co. Pvt. Ltd. Motha Advona Concramall Iron Ore Mine, Village Sancordem, Sanguem Taluk, South Goa Dist.	85.29 ha	Sept. 2008	36m BGL	6-9m BGL	27.89%	-Ground water in the core zone shall be regularly monitored for contamination and depletion of due to mining activity and records maintained. The monitoring data shall be submitted to regional office of the ministry regularly. Further monitoring points shall be located between the mine and drainage in the direction of flow of ground water shall be set up and records maintained. - Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining	

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2923

Sr. No	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							operations. - Waste water shall be treated to conform to the prescribed standards - Discharged water from telling them shall be regularly monitored -Rainwater harvesting shall be undertaken to recharge ground water sources -Hydro geological study shall be reviewed annually	
102	A.H. Jaffar& Sons (GhattiMordi-Salginim Iron and Manganese Ore Mine)	42.295 ha	June, 2008	Not provided in EC letter	Not provided in EC letter	Not provided in EC letter	Not provided in EC letter	1. No specific condition is provided in EC letter
103	Shri A.X. Poi Palondicar (Hunantlodongar Manganese Mines)	44.69 ha	March, 2008	Ultimate-60m (conceptual)	45m MSL	Not provided in EC letter	-Rain water harvesting shall be undertaken to recharge the ground water source. Status of the implementation shall be submitted to the regional office of the ministry within six months and thereafter every year from the next consequent year -Waste water shall be treated to conform to the prescribed standards before discharging in to the natural stream. The discharged water from the Tailling dam (if any)shall be regularly monitored and report submitted to the MOEF, CPCB and Goa state pollution control board -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May). Monsoon (August),	1. Groundwater stage development is not provided in EC letter

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2924

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							post-monsoon (November), and winter (January) and the data thus collected shalle be regularly sent to MOEF, CGWA and Regional Director, CGWB	
104	Shri A.X. Poi Palondicar (Hunantlodongar Manganese Mines)	34.17 ha	December, 2009	Not provided in EC letter	Not provided in EC letter	Not provided in EC letter	-Monitoring of ground and surface water quality shall be regularly conducted and records maintained and data submitted to the Ministry regularly. Further, monitoring points shall be located between the mine and drainage in the direction of flow of groundwater and records maintained. Monitoring of arsenic in groundwater shall be undertaken -Waste water shall be treated to conform to the prescribed standards before discharging in to the natural stream. The discharged water from the Tailling dam (if any)shall be regularly monitored and report submitted to the MOEF, CPCB and Goa state pollution control board	1. Construction of piezometer not directed in EC letter 2. Groundwater stage development and water table are not provided in EC letter
105	Smt. AhiliabaiSardesai (Kirapale Iron Ore Mine)	82.50 ha	January, 2008	Ultimate- 54m (BGL)	Not provided in EC letter	47.03	-No additional GW shall be used for mining operations. Prior approval of the MOEF and CGWA shall be obtained for using GW for mining/processing operations. Additional water requirement, if any, shall be met from recycling of water by from mining/processing operations and from water harvesting measures -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times	1. Water table is not provided in EC letter

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2925

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent toCGWB on annual basis -Water Harvesting measures should be taken up in and around mine site	
106	ShriAjit V.M. Kadnekar (Bateagal Iron Ore Mine)	31.16 ha	June, 2007	Present-90m (RL) Ultimate- 75m (from the top level of 120m RL)	90-92m and 8-10m in core and buffer zone respectively (Pre-monsoon)	17.10	-Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January)and the data thus collected may be regularly sent to MOEF, CGWA and Regional Director CGWB -The leachate characteristics shall be analyzed and its impact on the GW assess and data submitted to the Ministry	
107	Shri Ajit V.M. Kadnekar(Chunimolo Iron Mine)	88.15 ha	September , 2007	Not provided in EC letter	Not provided in EC letter	17.10	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the	1. Mine level and water table are not provided in EC letter.

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2926

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -Waste water shall be treated to conform to the prescribed standards	
108	Shri Ashok P. Kudchadkar (Expansion of NavelamDongar Manganese Mines)	31.43 ha	August, 2006	Ultimate-115 m above MSL	60 m above MSL	Not provided in EC letter	-The mining operations shall not intersect GW table. Prior approval of the MOEF and CGWA shall be obtained for mining below water table -The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW/ level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	1. Groundwater stage development is not provided in EC letter
109	M/S Atchuta V.S. Velingkar (Sancordem	47.72 ha	October,	Present- 70	54.9 MSL (Post-	48	-Minewater shall not be discharged into the natural drainage of Ragda river and onto agricultural lands	

7927

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Iron Ore Mine)		2007	MSL Ultimate- 25 MSL	monsoon)		unless they are treated to conform to prescribed standards. Monitoring of mine discharge water from all outlets from the lease shall be regularly undertaken and records maintained thereof. -Water Harvesting measures should be taken up in and around mine site -No GW shall be used for mining operations. Additional water requirement, if any, shall be met from recycling of water from mining operations and from rainwater harvesting measures -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron	
110	A.V.S. Velingkar (Vichundrem Iron Ore Mine)	42.97 ha	June, 2007	54m MSL.	20-30m MSL.	Not provided in EC letter	-Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May),	1. Groundwater stage development is not provided in EC letter

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2928

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
111	ShriBabalSanvloNaikTar i (Chormal Iron Ore Mine)	41.46 ha	February, 2008	Present- 18m (BGL) Ultimate- 42m (BGL)	6m (BGL)	26.36	-Rain water harvesting shall be undertaken to recharge the ground water source. Status of the implementation shall be submitted to the regional office of the ministry within six months and thereafter every year from the next consequent year -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May). Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -Waste water shall be treated to conform to the prescribed standards before discharging in to the natural stream. The discharged water from the Tailling dam (if any)shall be regularly monitored and report submitted to the MOEF, CPCB and Goa state pollution control board	
112	M/s BaddrudinHussainbhaiM avani (Expansion of Nomoxitembo de Cauren	100 ha	August, 2007	Present- 42 m (BGL) Ultimate- 68 m	Not provided in EC letter	4.53	-Mine water shall be discharged into the Kushwati river and for irrigation purpose only after treating to conform to prescribed standards. Monitoring of mine water discharged through outlets from ML	1. Water table not provided in EC letter

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2929

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Mine)			(BGL)			shall be regularly carried out and proper records maintained thereof -Wastewater from mineral beneficiation plant shall be treated to conform to prescribed standards before being discharged outside the lease -Water Harvesting measures should be taken up in and around mine site -No GW shall be used for mining operations. Additional water requirement, if any, shall be met from recycling of water from mining operations and from rainwater harvesting measures -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron	
113	Bandekar Bothers Pvt. Ltd. (Expansion of JaquelaOuJacadevichoMollo Iron ore Mining	99.45 ha	April 2007	Present- 78 m BGL (18m RL) Ultimate – 99 m BGL (-3m RL)	50 m BGL (46m RL)	Not provided in EC letter	-Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations	1. Groundwater stage development is not provided in EC letter

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2930

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
	Project)						in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron	
114	Smt. Bena De Rego E Fernandes (MortegalMordi Iron Ore Mines)	70.46 ha	December , 2005	Present- 31 m (BGL) Ultimate – 84 m (BGL)	Not provided in EC letter	Not provided in EC letter	-Mine water shall not be discharged into the natural drainage channels/nallahs of the Uguem. River and onto agricultural land unless they are treated to the prescribed standards. Monitoring of mine discharge water from all outlets from the lease shall be regularly undertaken and records maintained thereof	1. Water table and groundwater stage development are not provided in EC letter 2. Construction of piezometer not directed
115	M/s shriBhanudas B.S. Cossombo (CanvorzoriTemboMotat embo E BandoliDongor Iron and Manganese Ore Mine)	98.96 ha	December , 2007	26m MSL (70m BGL from top level of 96 m MSL)	40m MSL	41.64	-Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area.The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron -Water quality for both surface water as well as	

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2931

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							GW in the core zone shall be regularly monitored and records maintained. In case contamination is observed measures for control and action taken shall be reported to the state government as well as the ministry.	
116	M/s C.F. Naik (Expansion of GodbeamOuCuttienCurpen Iron Ore Mine)	69.47 ha	July, 2007	Present- 30m (BGL) Ultimate-42m (BGL)	38–45m (BGL) in buffer zone	41.64	-Mine water discharged from the lease shall be treated to prescribed standard and to ensure that there is no adverse impacts on Netravall/GuloliNodi/Salaulim drainage -Water Harvesting measures should be taken up in and around mine site -No additional GW shall be used for mining operations. Additional water requirement, if any, shall be met from recycling of water from mining operations and from rainwater harvesting measures -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron	

2932

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
117	M/s Chowgule and Company Ltd. (Gavanem Iron ore Mine)	98.08 ha	May, 2007	Present-60m MSL Ultimate – 50 m MSL	Not provided in EC letter	48	-Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	1. Water table is not provided in EC letter
118	Chowgule and Company Ltd. (Tudou Iron Ore Mine)	171.86 ha	November , 2007	Present- 65 m BGL (45 MSL) Ultimate-110 m BGL (0m MSL)	60m (BGL)	4.53	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
119	Chowgule and Company Ltd. (Monte UDO Iron and Manganese Ore Mine)	74.005 ha	June, 2007	Present- 110m RL (10m BGL from top level of 115 m RL)	75m RL and 76m RL in core and buffer zone respectively (Pre-	19.24	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB	

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2933

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
					monsoon)		-Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB . In case the depletion in groundwater table is observed, CGWB will take an appropriate action to control the depletion	
120	Chowgule and Company Ltd. (Onda Iron Ore Mine)	74.61 ha	November , 2007	Present- 40m BGL Ultimate-82m BGL	Not provided in EC letter	50.81	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	1. Groundwater table is not provided in EC letter
121	M/s V.D. Chowgule(CavremDoug or Iron and Manganese Ore Mine Project)	99.825 ha	July, 2007	Present-80m BGL (10m BGL from top level of 90m RL) Ultimate- 60m BGL (30m BGL	45 m BGL	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing	1. Groundwater table is not provided in EC letter

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2934

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
				from top level of 90m RL)			wells and constructing new piezometers during the mining operation The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
122	Chowgule and Company Ltd. (Costi Iron Ore Mining Project)	127.9257 ha	December , 2006	Present- 25m above MSL (69m BGL) Ultimate- 4m below MSL (98m BGL)	46m above MSL (48m BGL) Pre-monsoon 47m above MSL (47m BGL) Post-monsoon in core zone	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	1. Groundwater table is not provided in EC letter -
123	Chowgule and Company Ltd. (Costi Iron Ore Mining Project), Dudai and Saniona village	167.78 ha	November 2008	Not provided in EC letter	Not provided in EC letter	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November),	1. Mine level, Groundwater table and stage development are not provided in EC letter

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2935

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron-Waste water shall be treated to conform to the prescribed standards	
124	Chowgule and Company Ltd. (Gavanem Iron ore Mine)	100 ha	August, 2006	Present- 44m BGL Ultimate- 50m BGL	95m BGL in core (Pre-monsoon)	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	1. Groundwater stage development is not provided in EC letter
125	Chowgule and Company Ltd. (Pale Iron Ore Mining Project)	152.638 ha	November, 2006	Present- 30m MSL Ultimate- 26m MSL	Not provided in EC letter	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected	1. Groundwater table and stage development not provided in EC letter

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2936

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron -Waste water shall be treated to conform to the prescribed standards	
126	Chowgule and Company Ltd. (Sulcorna Iron & Manganese Ore Mining Project)	99.35 ha	May. 2007	Present-125 m RL (35m BGL from top level of 130 m RL) Ultimate- 55m RL (35 m BGL from top level of 90m RL)	75m (Pre-monsoon)	Safe (Exact value not provided)	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operationThe monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
127	M/s V.D. Chowgule (Vaguriem Iron Ore Mine)	62.26 ha	February. 2008	Present-56m BGL Ultimate- 90m BGL	Not provide d in EC letter	63.76	-Water Harvesting measures should be taken up in and around mine site -No additional GW shall be used for mining operations. Prior approval of the MOEF and CGWA shall be obtained for using GW for mining/processing operations. Additional water requirement , if any, shall be met from recycling of water by from mining/processing operations and from water harvesting measures	1. Water table is not provided in EC letter

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2937

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							-Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron -Waste water shall be treated to conform to the prescribed standards	
128	CompanhiaMineria Progresso Ltda	80.60	September 2007	Ultimate- 46m in buffer zone	48m BGL (core zone) and 46m (buffer zone)	41.64	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -Waste water shall be treated to conform to the prescribed standards -Water quality shall be periodically tested (every	

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2938

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							six months) for contamination when mining intersect GW table and testing results shall be submitted to the Ministry as well as to the concerned department of the state government	
129	Cosme Costa & Sons	62	September 2006	Present- 175m BGL (-45m MSL) Ultimate- 186 m BGL (-56m MSL)	90m BGL (40m MSL)	Not provided in EC list	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -Waste water shall be treated to conform to the prescribed standards	1. Groundwater stage development is not provided in EC letter
130	D.B. Bandodkar& Sons Pvt. Ltd.	48.4392	October 2006	Present- 39m MSL Ultimate- 0m MSL	30-32m above MSL	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November).	1.Groundwater stage development is not provided in EC letter

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2939

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
131	DamodarManglaji& Company Ltd.	18.74	October, 2007	Ultimate- 63m BGL	18-23m BGL in core zone 6-15m in buffer zone	50.81	-Water Harvesting measures should be taken up in and around mine site -No additional GW shall be used for mining operations. Prior approval of the MOEF and CGWA shall be obtained for using GW for mining/processing operations. Additional water requirement , if any, shall be met from recycling of water by from mining/processing operations and from water harvesting measures -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron -Waste water shall be treated to conform to the prescribed standards	
132	DamodarManglaji& Company Ltd. (Marsodo Iron Ore Mine)	98.87	April, 2007	Not provided in EC letter	Not provided in EC letter	50.81	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional	1.Mine level and Water table are not provided in EC

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2940

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operationThe monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -Waste water shall be treated to conform to the prescribed standards.	letter
133	DamodarMangalji& Company Ltd. (AmbeavalemBharad Iron Ore Mine)	29.14	November 2007	Ultimate- 6m RL (from 120 m RL)	45m BGL (from top level 80m MSL)	63.76	-Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -Water quality for both surface water as well as GW in the core zone shall be regularly monitored and records maintained. In case contamination is observed measures for control and action taken shall be reported to the state government as well as the Ministry	

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2941

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -The waste water from the mine shall be treated to conform to the prescribed format before discharging in the natural stream. The test results shall regularly be submitted to the MOEF, CPCB and Goa Pollution Control Board	
134	DamodarMangIaji& Company Ltd.(GavanvorliDongor Iron Ore Mine)	75.40	May, 2009	Ultimate- 6m below MSL	6m above MSL	27.89	-GW in the core zone shall be regularly monitored for contamination and depletion due to mining activity and records maintained. The monitoring data shall be submitted to the regional office of the ministry regularly. Further, monitoring points shall be located between the mine and drainage in the direct on of flow of GW shall be set up and records maintained. - Hydro-geological study of the area shall be reviewed annually. In case adverse effect on GW quality and quantity is is observed mining shall be stopped and resumed only after mitigating steps to contain any adverse impact on GW is implemented. Specific hydro-geological shall be conducted at the end of mining plan of the 5th year of mining, before proceeding to undertake mining in the 6th year. The report shall be submitted to the Regional office of the Ministry. -Rain water harvesting shall be undertaken to recharge the ground water source. Status of the implementation shall be submitted to the regional	

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2942

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							office of the ministry within six months and thereafter every year from the next consequent year. -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
135	DamodarManglaji& Company Ltd.(Marsado Iron Ore Mine)	78.274	October 2007	Ultimate- 6m RL (from 120m RL)	85m BGL (from top level 120m RL)	63.76	-Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -Water quality for both surface water as well as GW in the core zone shall be regularly monitored and records maintained. In case contamination is observed measures for control and action taken shall be reported to the state government as well as	

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2943

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							the ministry. -The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -The waste water from the mine shall be treated to conform to the prescribed format before discharging in the natural stream. The test results shall regularly be submitted to the MOEF, CPCB and Goa Pollution Control Board	
136	Dempo Mining Corporation (P) Ltd. (Bicholim Iron Ore Mine)	479.30	September , 2007	Ultimate-40m BGL.	Not provided in EC letter	60	-Water Harvesting measures should be taken up in and around mine site -No additional GW shall be used for mining operations. Additional water requirement, if any, shall be met from recycling of water from mining operations and from rainwater harvesting measures -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals	1.Groundwater stage development is not provided in EC letter

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2944

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							including iron	
137	Elray Minerals & Co. (AiliVaguiben Mine Project)	100 ha	May 2007	Present- 90 m MSL (10m BGL from top level of 100m MSL) Ultimate- 65m MSL (35m BGL from top level of 100m MSL)	55m in MSL (45m BGL from top level of 100m MSL)	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	1. Groundwater stage development is not provided in EC letter
138	Emca Goa Pvt. Ltd. (Bimbol Iron Ore Mine)	146.04	October, 2007	Ultimate- 91m BGL	Not provided in EC letter	58.40	-Water Harvesting measures should be taken up in and around mine site -No GW shall be used for mining operations. Additional water requirement, if any, shall be met from recycling of water from mining operations and from rainwater harvesting measures -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May),	1. Water table is not provided in EC letter

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2945

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron	
139	Francis Miguel Mascarenas (CaneliDongor Iron Ore Mine)	82.60	October, 2007	Present- 5m BGL Ultimate- 56m BGL	4m BGL	41.64	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB In case the depletion in groundwater table is observed, CGWB will take an appropriate action to control the depletion -Water quality for both surface water as well as GW in the core zone shall be regularly monitored and records maintained. In case contamination is observed measures for control and action taken shall be reported to the state government as well as the ministry.	
140	Santonachi Iron Ore Mine	98.30	October, 2005	Present- 25m BGL	18-23m BGL in core zone and 7-14m in buffer	Not provided in EC letter	-Water Harvesting measures should be taken up in and around mine site	1. Groundwater stage development is not provided in

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2946

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
				Ultimate- 70m BGL	zone		-No GW shall be used for mining operations. Additional water requirement, if any, shall be met from recycling of water from mining operations and from rainwater harvesting measures	EC letter
141	VagxepDandoAmbeyaTemtoMolcornem Iron Ore and Manganese Mining Project)	65.24	June. 2007	Present- 87m MSL Ultimate-70 m MSL	55m	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director. CGWB -Water quality for both surface water as well as GW in the core zone shall be regularly monitored and records maintained. In case contamination is observed measures for control and action taken shall be reported to the state government as well as the ministry.	1. Groundwater stage development is not provided in EC letter
142	NuldolDongorBimbol Iron Ore mine	97.50 ha	August 2007	Present- 78m BGL Ultimate- 110m BGL	Not provided in EC letter	4.53	-Treated mine water confirming to prescribed standards only shall be discharged into the Doodhsagar river and for irrigation purpose only after treating to conform to prescribed limits. Monitoring of mine water discharged through outlets from ML shall be regularly carried out and	Water table is not provided in EC letter

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2947

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							proper records maintained thereof. -Water Harvesting measures should be taken up in and around mine site -No additional GW shall be used for mining operations. Prior approval of the MOEF and CGWA shall be obtained for using GW for mining/processing operations. Additional water requirement , if any, shall be met from recycling of water by from mining/processing operations and from water harvesting measures -Regular groundwater level monitoring shall be carried out establishing network of existing wells and constructing new piezometers during mining operations.The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Mogsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron	
143	CapHagalChemGuedd Iron Ore Mining	99.80 ha	August 2008	Ultimate- 25m above RL	42m RL	58	- Hydro-geological study of the area shall be reviewed annually. In case adverse effect on GW quality and quantity is is observed mining shall be stopped and resumed only after mitigating steps to contain any adverse impact on GW is implemented. -Rain water harvesting shall be undertaken to recharge the ground water source. Status of the	

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2948

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							implementation shall be submitted to the regional office of the ministry within six months and thereafter every year from the next consequent year. -Water quality for both surface water as well as GW in the core zone shall be regularly monitored and records maintained. In case contamination is observed measures for control and action taken shall be reported to the state government as well as the Ministry -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -The waste water from the mine shall be treated to conform to the prescribed format before discharging in the natural stream. The test results shall regularly be submitted to the MOEF, CPCB and Goa Pollution Control Board	
144	BorchiMordiMaina Iron Ore Mine	92.243	December .2006	Present- 15m BGL (41.4 m MSL) Ultimate- 24m BGL (32.4 m	14m BGL (42.4 m MSL)	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall	1. Groundwater stage development is not provided in EC letter

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2949

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
				MSL)			be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
145	Gasa Goa Limitada (SuktoliChimtevalaveri Iron Ore Mines)	96.85 ha	June, 2007	Present- 45m MSL (25 m BGL from top level of 70 m MSL)	35m MSL (35m BGL from top level of 70m MSL)	58.40	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB. In case the depletion in groundwater table is observed, CGWB will take an appropriate action to control the depletion	
146	Guelliem E Gaval (Pissurlam) Iron Ore Mining	87.555 ha	January, 2007	Present- 67m above MSL (72m BGL) Ultimate-22m above MSL (117m BGL)	37m above MSL (102m BGL)	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the	1. Groundwater stage development is not provided in EC letter

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2952

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB on an annual basis. The monitoring shall include levels of heavy metals including iron	
147	OliemAravalem Iron Ore Mining Project	85.85 ha	April 2007	Present- 20m BGL Ultimate- 50m BGL	2-3m BGL (Pre-monsoon)	Not provided in EC letter	-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	I. Groundwater stage development is not provided in EC letter
148	GogaroOuGulcandongor Mine	70.187 ha	March, 2007	Ultimate- 21m BGL (83m MSL) for Manganese and 56m BGL. (39 m MSL) for Iron ore	75.5m above MSL (6.53m BGL)		-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May).	

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2951

Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), M. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shalle be regularly sent to MOEF, CGWA and Regional Director, CGWB	
149	Vichundremlron Ore Mine .	100 ha	January, 2008	Present- 15m BGL Ultimate- 42m BGL	40-50m BGL	41.64	-Water Harvesting measures should be taken up in and around mine site -No GW shall be used for mining operations. Additional water requirement, if any, shall be met from recycling of water from mining operations and from rainwater harvesting measures -Regular monitoring of GW level and quality and surface water quality of the natural water bodies in the impact area of the buffer zone should be carried out by establishing a network of existing wells and constructing new piezometers at suitable locations in project area. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
150	Polo Dongor Mine .	58.27 ha	November . 2008	Present- 20m BGL from top level of 150m above MSL Ultimate- 60m	90m BGL from 160m above MSL		-The project authority shall implement suitable conservation measures to augment GW resources in the area in consultation with the Regional Director, CGWB -Regular monitoring of GW level and quality shall	

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Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
				BGL from top level of 160m above MSL			be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB	
151	TembeachemDongor Iron and Manganese Ore Mine	99.37 ha	October, 2007	Present- 125m RL (5m BGL from top of 130m RL) Ultimate- 90m RL (40m BGL from top of 130m RL)	53m BGL (from top of hill and 130m RL)		-Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and Regional Director, CGWB -The waste water from the mine shall be treated to conform to the prescribed format before discharging in the natural stream. The test results shall regularly be submitted to the MOEF, CPCB and Goa Pollution Control Board	
152	Careomol Iron Mine	98.76 ha	October, 2007	Not provided in EC letter	Not provided in EC letter	31.13	-Regular monitoring of GW level and quality shall be carried out by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year. Pre-monsoon (April-May), Monsoon (August), post-monsoon (November), and winter (January) and the data thus collected shall be regularly sent to MOEF, CGWA and	1. Mine level and water table are not provide in EC letter

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Sr. No.	Name of Mine	Lease Area	Year of Sanction	Present Mine Level	Water Table Level	Groundwater Stage Development	Compliance for Water Management	Remark(s)
							Regional Director, CGWB -The waste water from the mine shall be treated to conform to the prescribed format before discharging in the natural stream. The test results shall regularly be submitted to the MOEF, CPCB and Goa Pollution Control Board -The waste water from the mine shall be treated to conform to the prescribed format before discharging in the natural stream. The test results shall regularly be submitted to the MOEF, CPCB and Goa Pollution Control Board	

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Annexure IV

PROFORMA FOR ENVIRONMENTAL DATA COLLECTION OF MINING PROJECTS
(MINING SECTOR PROJECTS)

Note 1 : All information to be given in the form of Annex/s should be properly numbered and form part of reply to this proforma.

Note 2 : Please enter √ in appropriate box where answer is Yes / No

Note 3 : No abbreviation to be used - **Not available** or **Not applicable** should be clearly mentioned.

Note 4 : **Core zone** is the mining lease area.
Buffer zone in case of ML area up to 25 ha. is to be considered as **5 km** all around the periphery of the core zone and for ML area above 25 ha. an area **10 km** all around the periphery of the core zone.

Note 5 : Adopt **Scoping process** in carrying out EIA study.

Note 6 : Please indicate source of data.

1. **General Information**

(a) Name of the project :

(i) Name of the proponent :

Mailing Address :

E-mail :

Telephone :

Fax No. :

(b) Objective of the project :

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(c) Location of mine (s)

Village(s)	Tehsil	District	State

(d) Does the proposal relate to

(i) New mine Yes ☐ No ☐

(ii) Expansion Yes ☐ No ☐

- Increase in ML area Yes ☐ No ☐
- Increase in annual production Yes ☐ No ☐

(iii) Renewal of ML Yes ☐ No ☐

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(iv) Modernisation Yes ☐ No ☐

(e) Site Information

(i) Geographical Location

- Latitude
- Longitude
- Survey of India Topo sheet number
- Elevation above Mean Sea Level
- Total mining lease area (in ha.)

(ii) Dominant nature of terrain

- Flat Yes ☐ No ☐
- Undulated Yes ☐ No ☐
- Hilly Yes ☐ No ☐

2. Land usage of the mining lease area (in ha.)

(a) Agricultural

(b) Forest

(c) Waste land

(d) Grazing

(e) Surface water bodies

(f) Others (Specify)

Total

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3. Indicate the seismic zone in which ML area falls. In case of zone IV & V, details of earth quakes in last 10 years.

(a) Severity (Richter Scale)

(b) Impact i.e. Damage to

- Life Yes ☐ No ☐
- Property Yes ☐ No ☐
- Existing mine Yes ☐ No ☐

4. Break-up of mining lease area (in ha.) as per approved conceptual plan:

Purpose	Mining Lease Area				Total	Area acquired				Area to be acquired			
	Government		Private			Government		Private		Government		Private	
	Forest	Others	Agri.	Others		Forest	Others	Agri.	Others	Forest	Others	Agri.	Others
1. Area to be excavated													
2. Storage for top soil													
3. Overburden / Dumps													
4. Mineral storage													
5. Infrastructure (Workshop, Administrative Building)													
6. Roads													
7. Railways													
8. Green Belt													
9.Tailings pond													
10.Effluent treatment plant													
11.Coal handling plant / mineral separation plant													
12. Township area													
13.Other (Specify)													
TOTAL													

NEERI/APC Q-3



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5. Township (outside mining lease)

(a) Total area (in ha)

(b) No. of dwelling units

(c) Distance from mine site

6. Distance of water bodies (in km)

Distance from	River Bank *	Other Water bodies * Sea / creek / lake / nalla etc. (specify)
Mining lease boundary		
Ancillary facilities		

[* From highest flood line / high tide line]

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7. For projects falling within the Coastal Regulation Zone (CRZ)

Whether the mineral to be mined is of rare nature and not available outside CRZ? Yes ☐ No ☐

if yes, annex a scaled location map showing low tide line (LTL), high tide line (HTL) duly demarcated by one of the authorized agencies* [*Director, Space Application Centre, Ahmedabad: Centre for Earth Sciences Studies, Thiruvananthapuram: Institute of Remote Sensing, Anna University, Chennai: Institute of Wetland Management & Ecological Designs, KolKata: Naval Hydrographers's Office, Dehradun: National Institute of Oceanography, Panjim, Goa: and National Institute of Ocean Technology, Chennai], boundary of mining lease area, distance of ML area from LTL and HTL CRZ boundary and CRZ classification of the project area as per the approved Coastal Zone Management Plan, and settlements, sand dunes, mangroves, forest land/patches, turtles breeding and nesting sites etc., if any, in the project area.

8. Indicate aerial distance from the periphery of core zone / area from the periphery of the buffer zone to the boundary of following (up to 10 km):

S. No.	Areas	Name	Aerial distance from (in km.) Core * Zone	Buffer* Zone
1.	National Park / Sanctuary			
2.	Biosphere Reserve / Tiger Reserve / Elephant Reserve / any other Reserve			

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3.	Forest (RF / PF / unclassified)		
4.	Habitat for migratory birds		
5.	Corridor for animals of schedule I & II of the Wildlife (Protection) Act, 1972		
6.	Archaeological sites * Notified * Others		
7.	Defence Installation		
8.	Industries / Thermal Power Plants		
9.	Other Mines		
10.	Airport		
11.	Railway Lines		
12.	National / State Highways		

[* Buffer zone in case of ML area up to 25 ha. is to be considered as **5 km** all around the periphery of the core zone and for ML area above 25 ha. an area **10 km** all around the periphery of the core zone].

9. Description of flora & fauna separately in the core and buffer zones.*

[* Consult the Wildlife (Protection) Act, 1972 as amended subsequently and list species with (1) Common name (2) Scientific name and (3) under which schedule of the Wildlife (Protection) Act the identified species fall. Get the list authenticated by an Expert in the field / credible scientific institute / University / Chief Wildlife Warden office. **Information to be based on field survey.**]

A.	**Flora**	Core Zone	Buffer Zone
1.	Agricultural crops		
2.	Commercial crops		
3.	Plantation		
4.	Natural vegetation / forest type		
5.	Grass lands		

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6.	**Endangered species**		
7.	Endemic species		
8.	Others (Specify)		
B.	**Fauna**		
1.	Total listing of faunal elements		
2.	Endangered species		
3.	Endemic species		
4.	Migratory species		
5.	Details of aquatic fauna, if applicable		

10. Details of mineral reserves (as per approved Mining Plan)

Quantity (in million tonnes)

(a) Proved

(b) Indicated

(c) Inferred

(d) Mineable reserves

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11. Major geological formation / disturbances in the mining lease area

(a) Geological maps submitted Yes ☐ No ☐

(b) Geological sections submitted Yes ☐ No ☐

(c) Contour map submitted Yes ☐ No ☐

(d) Whether the presence, if any, noted of

(i) Faults Yes ☐ No ☐

(ii) Dykes Yes ☐ No ☐

(iii) Shear Zone Yes ☐ No ☐

(iv) Folds Yes ☐ No ☐

(v) Other weak zones Yes ☐ No ☐

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(e) Source of data (Indicate)

12. Production of mineral(s) and life of mine

(a) Rated capacity of mine mineral wise (Tonnes / annum)

(b) Life of mine at proposed capacity (Years)

(c) Lease period (Years)

(d) Date of expiry of lease (D /M /Y)

(e) Indicate in case of existing mines

(i) Date of opening of mine

(ii) Production in the last 5 years from year..... to year ..... in million tonnes. — 1st year / 5th year

(iii) Projected production for the next 5 years from year ..... to year .....in million tonnes. — 6th to 10th year

(iv) Whether mining was suspended after opening of the mine? Yes ☐ No ☐

If yes, details thereof including last production figure and reason for the same.

(f) Whether plans & sections provided? Yes ☐ No ☐

13. Type and method of mining operations

TYPE		METHOD	
Opencast	☐	Manual	☐
Underground	☐	Semi-mechanised	☐
Both	☐	Mechanised	☐

14. Details of ancillary operations for mineral processing

(a) Existing

(b) Additional

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15. Mine details

(a) Opencast mine

(i) Stripping ratio (mineral in tonnes to over burden in m^3)

(ii) Ultimate working depth (in m bgl)

(iii) Indicate present working depth in case of existing mine (in m bgl)

(iv) Thickness of top soil (in m.)

- Minimum
- Maximum
- Average

(v) Thickness of overburden (in m.)

- Minimum
- Maximum
- Average

(vi) Mining Plan

- Height and width of the bench in overburden / waste.
- Height & width of the bench in ore body / coal seam.
- Proposed inclination / slope of the sides of the opencast mine (separately for overburden, coal / ore and overall slope of the pit sides) both while operating the mine as well as at the time of closure of the mine.
- Whether transverse sections across the opencast mine at the end of fifth year and at the end of the life of the mine have been submitted? Yes ☐ No ☐

(vii) Type of blasting, if any, to be adopted.

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(b) Underground mine

(i) Seam / Ore body | Min.Depth (m) | Max. Depth (m) | Avg. thickness (m)

Rate of dip in degree	Direction of dip

(ii) Mode of entry into the mine

- Shaft
- Adit
- Incline

(iii) Details of machinery

- On surface
- At Face
- For transportation
- Others

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(iv) Method of stoping (metalliferrous mines)

- Open
- Filled
- Shrinkage
- Caving
- Combination of above
- Others (Specify)

(v) Extraction method

- Caving
- Stowing
- Partial extraction

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(vi) Subsidence

- Predicted max. subsidence (in m) ☐
- Max. value of tensile strain (in mm/m) ☐
- Max. slope change (in mm/m) ☐
- Whether identified possible subsidence area(s) superimposed on Surface Plan has been submitted? ☐ ☐
- Major impacts on surface features like natural drainage pattern, houses, buildings, water bodies, roads, forest, etc.
- Salient features of subsidence management (monitoring and control).

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16. Surface drainage pattern at mine site

(a) Whether the pre-mining surface drainage plan submitted? Yes ☐ No ☐

(b) Do you propose any modification / diversion in the existing natural drainage pattern at any stage? If yes, when. Provide location map indicating contours, dimensions of water body to be diverted, direction of flow of water and proposed route / changes, if any i.e. realignment of river / nallah / any other water body falling within core zone and its impact. Yes ☐ No ☐

17. Embankment and / or weir construction

(a) Do you propose, at any stage, construction of

(i) Embankment for protection against flood? Yes ☐ No ☐

(ii) Weir for water storage for the mine? Yes ☐ No ☐

(b) If so, provide details thereof.

(c) Impact of embankment on HFL and settlement around.

(d) Impact of weir on down stream users of water.

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18. Vehicular traffic density (outside the ML area)

		Type of vehicles	No. of vehicles per day
(a)	Existing		
(b)	After the proposed activity		
(c)	Whether the existing road network is adequate? If no, provide details of alternative proposal?	Yes	No

19. Loading, transportation and unloading of mineral and waste rocks on surface:

(a)	Manual	Yes	No
(b)	Tubs, mine cars, etc.	Yes	No
(c)	Scraper, shovels, dumpers / trucks.	Yes	No
(d)	Conveyors (belt, chain, etc.)	Yes	No
(e)	Others (specify).		

20. Mineral(s) transportation outside the ML area

		Qty. (in TPD)	Percentage (%)	Length (in km)
(a)	Road			
(b)	Rail			
(c)	Conveyors			
(d)	Rope way			
(e)	Water ways			
(f)	Pipeline			
(g)	Others (Specify)			
	Total			

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21. Baseline Meteorological and Air Quality data

(a) Micro-meteorological data

[Continuous monitoring through autographic instrument for one full season other than monsoon]

(I) Wind rose pattern for one full season (16 points of compass i.e. N, NNE, NE, ---) based on 24-hourly data. For coastal area also furnish day-time and night time data.

- Day time
- Night time
- 24 – hours period

(ii) Site specific monitored data

Month	Wind Speed (kmph)			Temperature (°C)			Relative Humidity (%)			Rain Fall * (mm)			Cloud Cover** (Octas of sky)
	Mean	Max.	% of calm	Mean (Dry Bulb)	Highest	Lowest	Mean	Highest	Lowest	Total	24-hours Highest	No. of rainy days	Mean

* 24-hours rainfall should be reported from 08:30 hrs. IST of previous day to 08:30 hrs. IST of the day.

* Rainy day is considered when 24 hrs. rainfall is ≥ 2.5 mm.

** Visual observations of cloud cover should be recorded four times a day at regular intervals.

(iii) Indicate name and distance of the nearest IMD meteorological station from which climatological data have been obtained for reporting in the EIA report, if any.



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(b) Ambient air quality data* (RPM, SPM, SO_2, and NOx)

[*Monitoring should be carried out covering one full season except monsoon – same season as in 21 (a) (i)]
[*Frequency of sampling: Sampling to be done twice a week for the entire season 24 hourly for SPM & RPM. For gaseous pollutants 24- hourly data be given irrespective of the sampling period.]

(i) Season and period for which monitoring has been carried out.

(ii) No. of samples collected at each monitoring station

Name of monitoring equipment used			SPM			RPM			SO_2			No_x			Pb**		
Equipment sensitivity																	
Permissible AAQ standard (CPCB)		R															
		I															
		S															
Monitoring Location	No. of Samples Drawn	Category* (R, I, S)	Min.	Max.	95% tile	Min.	Max.	95% tile	Min.	Max.	95% tile	Min.	Max.	95% tile	Min.	Max.	95% tile
Core zone CA_1																	
CA_2																	
CA_3																	

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Buffer zone BA_1																	
BA_2																	
BA_3																	

*R = Residential; I = Industrial; S = Sensitive

**Pb for mineral specific sites only.

Annex a location map indicating location of AAQ stations, their direction and distance with respect to project site.

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22. Stack and emission details, if any*

Sl. No.	Process / unit of operation (e.g. DG Set, Boiler)	Height of stack (m)	Internal top dia. (m)	Flue gas exit velocity (m/sec)	Emission rate (kg/hr)				Heat emission rate from top of stack (K.cal/hr)	Exhaust / Flue gas			
					SPM	SO_2	NO_x	CO		Temp °C	Density	Specific Heat	Volumetric flow rate (m^3/hr.)

23. Details of fugitive emissions during mining operations*

24. Air Quality Impact Prediction (AQIP)*

(a) Details of model(s) used for AQIP including grid size, terrain features, and input meteorological data

(b) Maximum incremental GLC values of pollutants based on prediction exercise

(in $\mu g/m^3$)

S. No.	Pollutants	Incremental Value	Ambient Air Quality	Resultant Air Quality
1.	SPM			
2**.	SO_2			
3**.	NO_x			

[* Question Number 22, 23 & 24 need not be filled-in for mines having ML area of **25 ha. or less.**]

[**Information on item no. 2 & 3 to be provided in cases with captive power generation of 500 KVA and above]

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25. Water requirement (m^3/day)

Purpose	Avg. Demand	Peak Demand
A. <u>Mine site</u> 1. Mine operation 2. Land reclamation 3. Dust suppression 4. Drinking 5. Green Belt 6. Beneficiation 7. Washeries 8. Fire Service 9. Others (specify) **B. <u>Township</u>** 1. Green Belt 2. Domestic 3. Other (specify)		
Total		

26. Source of water supply*

S. No.	Source	m^3/day
1	River (name)	
2	Ground water	
3	Mine water (sump / pit)	
4	Other surface water bodies (specify)	

[*Annex a copy of sanction letter / permission from the concerned authority (Central Ground Water Authority in case of ground water abstraction is from notified area / State Ground Water Board in case of non-notified area / State Irrigation Department for surface water pumping) for drawing water.]

27. Lean season flow in case of pumping from river / nalla (cumecs)

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28. Ground water potential of the study area

28.1. Ground water availability

(a) Range of water table (m bgl)

(i) Pre-monsoon (April/May)

- Core Zone
- Buffer zone

(ii) Post-monsoon (November)

- Core Zone
- Buffer zone

(b) Total annual replenishable recharge (million m^3/ year)

- By ground water table fluctuation method
- By rainfall infiltration factor method

(c) Annual draft excluding estimated draft through mine discharge (million m^3/ year)

(d) Estimated draft through mine discharge (million m^3/ year)

(e) Net annual ground water availability (million m^3/ year)

(f) Stage of ground water development in %

28.2. Water demand - Competing users of the water source

S. No.	Usage	Present Consumption (m^3/day)		Additional proposed as per local plan (m^3/day)		Total (m^3/day)	
		Surface	Ground	Surface	Ground	Surface	Ground
1	Domestic						
2	Irrigation						
3	Industry						
4	Mining						
5	Others (specify)						
	Total						

29. Water quality*

(a) Annex physico -chemical analysis of water at intake point **

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28. Ground water potential of the study area

28.1. Ground water availability

(a) Range of water table (m bgl)

(i) Pre-monsoon (April/May)

- Core Zone
- Buffer zone

(ii) Post-monsoon (November)

- Core Zone
- Buffer zone

(b) Total annual replenishable recharge (million m^3/ year)

- By ground water table fluctuation method
- By rainfall infiltration factor method

(c) Annual draft excluding estimated draft through mine discharge (million m^3/ year)

(d) Estimated draft through mine discharge (million m^3/ year)

(e) Net annual ground water availability (million m^3/ year)

(f) Stage of ground water development in %

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28.2. Water demand - Competing users of the water source

S. No.	Usage	Present Consumption (m^3/day)		Additional proposed as per local plan (m^3/day)		Total (m^3/day)	
		Surface	Ground	Surface	Ground	Surface	Ground
1	Domestic						
2	Irrigation						
3	Industry						
4	Mining						
5	Others (specify)						
Total							

29. Water quality*

(a) Annex physico -chemical analysis of water at intake point **

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(b) In case of existing mine, annex report on quality of water discharge i.e. complete physico - chemical analysis**

[*For non-discharging mines at least four ground water samples to be taken preferably from downstream direction of the mine in pre-monsoon and post-monsoon periods and analysed. For discharging mines six samples are to be analysed]

**All parameters as per BIS 10500. Indicate name of Methodology, Equipment used for analysis, and Detection Level (DL) for each parameter.

*** Wherever any analytical parameter is below detection level, "BDL" (Below Detection Level) should be written instead of 'NIL'.

30. Impact on ground water regime / stream / lake / springs due to mine dewatering *

(a) Radius of influence (in m)

[To be estimated based on analysis of pumping test data and application of empirical formula] ☐

(b) Whether saline water ingress will take place? (applicable to coastal areas) Yes ☐ No ☐

(c) Impact on stream / lake / springs

[* **Provide a comprehensive hydro-geological assessment report** if the average mine dewatering is more than 100 m^3/day and or going below water table in non-monsoon period. The report should be based on preferably latest one year pre-monsoon and post-monsoon baseline data covering information on ground water situation, aquifer characteristics, water level conditions (April – May and November), estimate of ground water resources, predicted impact of the project on ground water regime and detailed remedial / conservation measures such as artificial recharge of ground water etc. The report should be based on actual field inventory out of existing wells, at least 30 observation wells in the buffer zone with supplementary information from secondary sources (mention name). For estimation** of ground water resource (refer question no. 28 above) be designated study area of the buffer zone may be sub-divided into command and non-command areas, watershed-wise (in case of hard rock / consolidated formations) / block-wise / mandal-wise in case of alluvial / unconsolidated formations)]

[**For estimating ground water resources in the area follow the Ground Water Estimation Committee recommendations of 1997]

31. Waste Water Management

Mine

(a) Daily average discharge (m^3/day) from different sources

(i) Mine water discharge during

- Lean period ☐
- Monsoon period ☐

(ii) Workshop ☐

(iii) **Domestic (mine site)** ☐

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(iv)	Beneficiation / Washeries	
(v)	Coal Handling Plant	
(vi)	Tailings pond	
(vii)	Others (Specify)	
	Total	

(b) Waste water treatment plant; flow sheet for treatment process attached. Yes ☐ No ☐

(c) Quantity of water recycled / reused / to be recycled in

(i) Percentage

(ii) m^3/day

(d) Point of final discharge

Final Point	Quantity discharged (in m^3/day)
1. Surface (i) Agricultural land (ii) Waste land (iii) Forest land (iv) Green belt	
2. River / nallah	
3. Lake	
4. Sea	
5. Others (specify)	
Total	

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(e) Users of discharge water

(i) Human Yes ☐ No ☐

(ii) Livestock Yes ☐ No ☐

☐

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(iii) Irrigation Yes ☐ No

(iv) Industry Yes ☐ No ☐

(v) Others (specify) ☐

(f) Details of the river / nalla, if final effluent is / will be discharged (cumecs)

(i) Average flow rate ☐

(ii) Lean season flow rate ☐

(iii) Aquatic life

(iv) Analysis of river water 100 meters upstream and 100 meters downstream of discharge point submitted. Yes ☐ No ☐

Township

(a) Waste water generation from township (m^3/day) ☐

(b) Are you planning to provide sewage treatment plant? Yes ☐ No ☐

(c) Usage of treated water

32. Attach water balance statement in the form of a flow diagram indicating source (s), consumption (Section-wise) and output.

33. Ambient noise level leq dB(A)

Location of sampling station	Noise level	
	Day Time	Night Time
A. Core Zone CN_1 CN_2		
B. Buffer Zone BN_1 BN_2		

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34. Solid Waste

(a) Top soil and Solid waste quantity and quality

Name (Lump/fines/slurry/ Sludge/others)	Composition	Quantity (m^3/month)	Method of disposal
Mining activity* a. Top Soil b. Over burden c. Tailings d. Others (specify)			
Effluent Treatment Plant (sludge)			
Total			

[* Annex layout plan indicating the dump sites.]

(b) (i) Does waste (s) contain any hazardous/toxic substance/ radioactive materials or heavy metals? Yes ☐ No ☐

(ii) If yes, whether details and precautionary measures provided? Yes ☐ No ☐

(c) Recovery and recycling possibilities.

(d) Possible user(s) of the solid waste.

(e) (i) Is the solid waste suitable for backfilling? Yes ☐ No ☐

(ii) If yes, when do you propose to start backfilling. ☐

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(in million m^3)

Solid waste (s)	Already accumulated (A)	To be generated (B)	% of A & B to be backfilled	
			A	B
Over burden				
Others (specify)				

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Land reclamation Plan

(f) In case waste is to be dumped on the ground, indicate

(i) Associated environmental problems

(ii) Number & type of waste dumps

- No. of external dumps ☐
- Max. projected height of dumps (in m) ☐
- No. of terraces and height of each stage ☐
- Overall slope of the dump (degree) ☐
- Proposed reclamation measures

(iii) Section of the waste dump in relation to the adjacent ground profile attached. Yes ☐ No ☐

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35. Fuel / Energy requirements*

[*To be furnished for mines having ML area more than 25 ha. or captive power generation of 500KVA and above]

(a) Total power requirement (in MW)

S. No.		Mine Site	Township	Others (specify)	Total
1	Present				
2	Proposed / additional				
	Total				

(b) Source of power (in MW)

S. No.		SEB/Grid*	Captive power plant	DG Sets
1	Present			
2	Proposed			
	Total			

[* Annex a copy of the sanction letter from the concerned authority]

(c) Details of fuels

S.No.	Fuel	Daily Consumption (TPD)		Calorific value (Kcals/kg)	% Ash	% Sulphur
		Existing	Proposed			
1	HSD					
2	LSHS					
3	Other (specify)					

36. Storage of inflammable / explosive materials

S. No.	Name	Number of Storages	Consumption (in TPD)	Maximum Quantity at any point of time
1	Fuels			
2	Explosives			

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37. Human Settlement

	Core Zone	Buffer Zone
Population*		
No. of villages		
Number of households village-wise		

[* As per 2001 census record or actual survey]

38. Rehabilitation & Resettlement (R&R) Plan*

[*Provide a comprehensive rehabilitation plan, if more than 1000 people are likely to be displaced, other-wise a summary plan]

(a) Villages falling within the study area

	Villages	
	Number	Name
Core zone		
500 m from the blasting site (s)		
Buffer zone		
Township site		

(b) Details of village(s) in the core zone

S. No.	Village name	Population*		Average Annual Income
		Tribal	Others	

[*As per 2001 census / actual survey]

(c) Population to be displaced and / or Land oustees

Name of village(s) falling within	Number of oustees		
	Land (only)	Homestead (only)	Land and Homestead (both)
Mining Lease 1. 2. ▪ ▪			
Township Site 1. 2. ▪			

(d) Whether R&R package has been finalised?
If yes, salient features of R&R plan for oustees.

(i) Site details where the people are proposed to be resettled & facilities existing / to be created.

(ii) Funds earmarked for compensation package.

(iii) Agency /Authority responsible for their resettlement.

(iv) Time of commencement of resettlement of Project Affected People (PAP).

(v) Period by which resettlement of PAP will be over.

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39. Lease -wise plantation details

			Existing mine	New mine
(a)	Lease area (in ha.)			
	(i)	Area broken up		
	(ii)	To be broken up		
	(iii)	Area not to be broken-up		
(b)	Township area (in ha.)			

(c) Area afforested and proposed (in ha.)

	Peripheral	Dumps	Roads	Township	Others
(i) Existing					
(ii) Proposed					

(d) No. and type of trees planted and proposed

(i) Existing

- When plantation was started? Month / Year

No.of plant species planted	Number saplings (per ha.)

Survival rate % • Avg. height

(ii) Proposed

No. of plant species to be planted	Number of saplings (per ha.)

40. Environmental health and safety

(a) What major health and safety hazards are anticipated?

(b) What provisions have been made/proposed to be made to conform to health and safety requirements?

(c) In case of an existing mine

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10.	Wildlife conservation		
11.	Forest protection		
12.	Others (specify)		

[* As applicable]

42. Compliance with environmental safeguards (For existing units)

(a) Status of the compliance of conditions of environmental clearance issued by MoEF, if any, enclosed. Yes ☐ No ☐

(b) Status of the compliance of 'Consent to Operate' issued by SPCB, if any, enclosed. Yes ☐ No ☐

(c) Latest 'environmental statement' enclosed. Yes ☐ No ☐

43. Scoping of EIA

Whether environmental impact assessment of the project has been carried out by following scoping process? Yes ☐ No ☐

If yes, a copy of scoping of EIA annexed. Yes ☐ No ☐

44. Mine closure

(a) Have you planned mine closure? Yes ☐ No ☐

(b) Submitted a conceptual mine closure plan. Yes ☐ No ☐

(c) If yes, indicate estimated amount for implementing the same (in Rs. lakhs) ☐

45. Capital cost of the project (in Rs. Lakh) (Based on latest estimate) ☐

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46. Cost of environmental protection measures

(In Rs. Lakh)

S. No.		Capital cost		Annual recurring cost	
		Existing	Proposed	Existing	Proposed
1	Pollution Control (Separately provide break-up)				
2	Pollution Monitoring (Separately provide break-up)				
3	Occupational Health				
4	Green Belt • Mine • Township)				
5	Reclamation / Rehabilitation of mined out area				
6	Others (specify)				
	Total				

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47. Amount earmarked forsocio-economic welfare measures for the nearby villages other than R&R plans.

48. Public Hearing

(a) Date of Advertisement

(b) Newspapers in which the advertisement appeared

(c) Date of public hearing (DD/MM/YYYY)

(d) Public Hearing Panel chaired by & members present

(e) No. of people attended the public hearing meeting and number of people from the lease area.

(f) Summary/details of public hearing in tabular form.

Issues raised by the Public	Response/Commitment of Project Proponents	Suggestions made by the Public Hearing Panel

49. Whether the following approvals* (wherever applicable) have been obtained?

(i)	Site clearance from MoEF	Yes ☐	No ☐
(ii)	'Consent for Establishment' from the State Pollution Control Board	Yes ☐	No ☐
(iii)	NOC from Atomic Mineral Division	Yes ☐	No ☐
(iv)	Mining plan approval from IBM / Ministry of Coal	Yes ☐	No ☐
(v)	In case of existing mines, mining scheme approval from IBM	Yes ☐	No ☐
(vi)	Forestry clearance under FCA, 1980	Yes ☐	No ☐
(vii)	NOC from Chief Controller of Explosives	Yes ☐	No ☐

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(viii) Commitment regarding availability / pumping of water from the concerned Authorities — Yes ☐ No ☐

(ix) In case of ML area falling in notified areas of the Central Ground Water Authority, NOC from them. — Yes ☐ No ☐

[* Annex copies of approvals and number them]

50. Was / is there any court case relating to the project or related activities? If so, provide details present status.

Verification: The data and information given in this proforma are true to the best of my knowledge and belief.

Date:

Place:

Signature of the applicant* with full name & address

[* Owner or his authorized signatory]

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Given under the seal of organisation on behalf of whom the applicant is signing

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THIRD REPORT ON
ILLEGAL MINING OF
IRON AND MANGANESE ORES
IN THE STATE OF GOA

OCTOBER, 2013

VOLUME: I



Justice M. B. Shah
Commission of Enquiry
for
Illegal Mining of Iron Ore & Manganese

INDEX

Volume: I

Illegal Export, under-invoicing and others

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* * *

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T.C. Nos. 11/41, 12/41, 13/41, 14/41 and 15/41

One Dempo and Souza Limited of Goa was the original concessionary of all these five (5) leases. Thereafter, these five (5) mines were operated by "Comphania Mineira Dempo & Souza Limited of Goa".

However, the Environmental Clearance (EC) for all these mines has been granted by the Ministry of MoEF (GOI) in favour of "M/s. Dempo Mining Corporation Limited" on 17/11/2005 and 17/09/2007 (one common EC for all the five (5) different leasehold areas).

Undisputedly, today all these mining areas are operated and mineral is being excavated by a public limited company namely "Sesa Mining Corporation". An attempt has been made that the Sesa Mining Corporation Limited has acquired leasehold interest.

On inquiry by this Commission, the Registrar of Companies, Goa Daman and Diu, has issued a certificate that "M/s. Dempo Mining Corporation Private Limited" is changed to "M/s. Dempo Mining Corporation Limited".

He has also forwarded a second certificate to the effect that "M/s. Dempo Mining Corporation Limited" with the approval of Central Government is changed to "Sesa Mining Corporation Limited" on the basis of resolution passed by M/s. Dempo Mining Corporation Limited under the Companies Act.

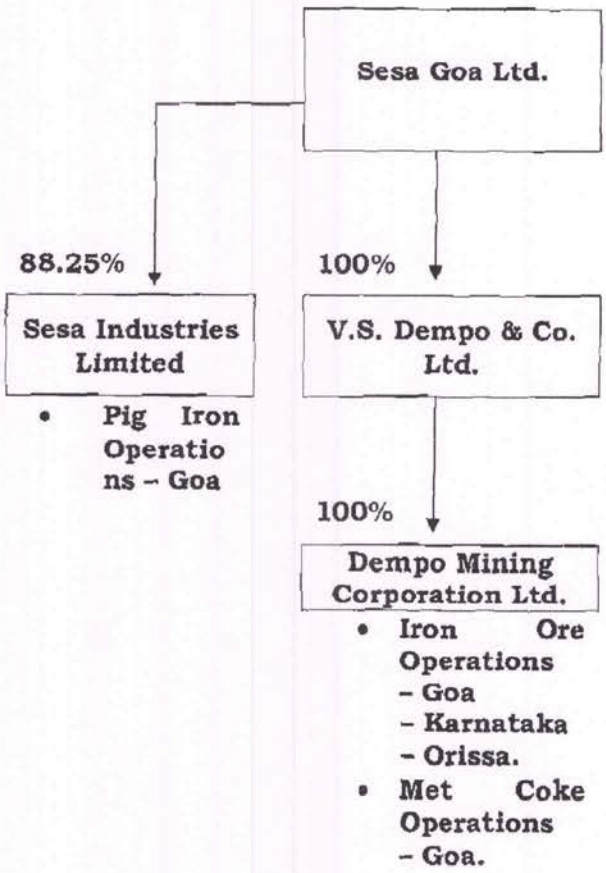
It is to be stated that on 12/11/2010, name of Dempo Mining Corporation Private Limited was changed

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as "Dempo Mining Corporation Limited" and the name of Dempo Mining Corporation Limited then is changed as "Sesa Mining Corporation Limited" on 18/11/2010.

Similarly the name of 'V.S. Dempo & Company Private Limited' is also changed as V.S. Dempo & Company Limited on 19/11/2010 and the name of V.S. Dempo & Company Limited is subsequent change as 'Sesa Resources' on 19/11/2010.

It appears from the statement of the Chief Executive of Sesa Goa Ltd. in the general meeting of shareholders for the year 2009-10 that "Sesa Goa Limited" is a part of Vedanta Group and the Sesa Goa's group structure is as follows:





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The speech delivered by the Chief Executive of Sesa Goa in the meeting of shareholders for the year 2009-10 on the count of acquisition is as under :-

"In June 2009, your Company acquired the mining assets of ***V.S. Dempo and Company Private Limited ('VSD' or 'Dempo")*** *and its subsidiaries and associates. The acquisition of Dempo's mining assets in Goa on a debt-free and cash-free basis for Rs. 1,750 crore (based on nominative working capital) which was financed through internal accruals. Dempo is a logical and strategic fit with Sesa's existing iron ore business. While integration is continuing, your Company has already started leveraging synergies to create significant long term value for all shareholders. Some areas where work is progressing are:*

- *Utilization of Sesa Goa's mining and project management skills to develop and optimize Dempo's operations;*
- *Further exploration of Dempo's longer life mining assets; and*
- *Synergizing Dempo's operations with Sesa Goa's to create mining and logistics efficiencies.*

The integration process is moving as planned and in doing so, there has been a significant growth in production of saleable ore for Dempo. These added to the consolidated growth of Sesa Goa.

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Dempo has been the first major acquisition by your Company. And the success of the post-merger fit has given us confidence to pursue the acquisition route for growth for coming years."

From the above speech, it is clear that the assets of above both the companies have been acquired by "Sesa Goa Limited" for the purpose mentioned in the above speech.

It is relevant to note that one Japanese firm Mitsui Finsider International Ltd. had majority control of Sesa Goa and decided to sale its stake to exit from the mining business and that a multinational company Vedanta has purchased shares with a bid of Rs. 2,036/- per share.

The ministry of corporate affairs directed to initiate action against Sesa Goa on various grounds. Thus, it is apparent that this is not a case of change in the name of a company incorporated earlier but is an acquisition / transfer of leasehold interest in above all five (5) lease areas.

Further, the leasehold interest of M/s. Sesa Goa Limited (Sesa Goa together with its subsidiaries) has entered into merger agreement with Sterlite Industries (India) Limited and a multinational company namely Vedanta Resources. The word Vedanta includes Vedanta Resources Public Limited and its subsidiaries and the same forms a group. A note released for publication and

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distribution dated 25/02/2012 by Sesa Goa Limited as one of the Vedanta groups of companies amply clarifies that Sesa Goa Limited now is 'Sesa Sterlite Limited'. With this fact situation more than one company including Vedanta Resources can claim leasehold interest in the mines along with other mines claimed to be under control and operation by 'Sesa Goa Limited'. **This includes one more T.C. No. 9/49.**

It would not be either legal or proper to say that certain procedures required under the Company's Act if are complied with, would immune such company from compliance of other statutory obligations which are mandatory in nature. This is not a case of a mere change in the name of a company on account of change of holding pattern of shares of a limited company. Hence, the excavation of mineral namely iron ore from the day one is in contravention of Rule 37 of MCR, 1960.

The Stake in Multinational Company Vedanta Group of Companies by a Non Indian may have direct bearing on legality of even indirect transfer of lease hold interest in a lease area in view of the scheme Section 5(a) of MM(DR) Act, 1957. All Directors of Vedanta will have control on administration and dealing of other subsidiaries, including Sesa Goa Ltd. or Sesa Resources Ltd., etc. because Vedanta Group of Companies is holding 51% or more shares. Unless all directors of Vedanta Group of Companies are Indian Nationals, they

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can not obtain mining lease and / or create interest, in any direct or indirect manner, in the lease hold rights. The matter become more serious being the lease lands are forest land. This would amount of violation of the purpose of the Act in general and Section 5(a) of MM(DR) Act, 1957 in particular.

Vedanta Resources Plc (Vedanta)'s holding in SesaGoa is more than 51%. As on 27th January, 2012, Vedanta was holding more than 55% shares in SesaGoa through three 100% direct subsidiaries. Two companies have created interest in lease-hold rights of above TCs and other TCs., of which the Directors are not Indian nationals. They have U.K. and Mauritius based. Acquisition of lease-hold rights over mining areas either in Goa or in anywhere in India by the companies having non-Indian Directors is illegal under Section 5(a) of MMDR Act, 1957. Transfer of lease-hold interest is additional illegalities.

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The submission made by the Sesa Goa Ltd. and Vedanta Resources Plc are reproduced as under:



"SESA GOA LIMITED,
Sesa Ghor,
20 EDC Complex, Patto,
Panjim, Goa.403001.
Tel : +91 – 832 2460600.
GM : SESAGOA.

(A) At the outset, we bring to your kind notice that M/s. Sesa Goa Limited is a public Limited Company listed on Bombay Stock Exchange Limited and National Stock Exchange of India Limited and as such Shares of M/s. Sesa Goa Limited are freely tradable on the said Stock Exchanges. From October 1996 to April 2007, Japanese Company namely M/s. Mitsui & Co. Ltd. through its UK based subsidiary M/s. Finsider International Company Limited had majority shareholding in M/s. Sesa Goa Limited. In April 2007 Vedanta Resources Plc acquired M/s. Finsider International Company Limited and as such M/s. Finsider International Company Limited became subsidiary of Vedanta Resources Plc.

The paid up equity share capital 39362020 shares of Rs.10/- each of Sesa Goa Limited before April, 2007.

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2. Sesa Goa Limited exported iron ore. However there was no export by any of its subsidiaries/sister concerns of Sesa Goa Limited during the year 2006-2007 and 2007-2008.

3. The details of M/s. Vedanta Resources Plc shareholding through its subsidiaries as on 20/4/2007 and subsequently as per the following table:

Sr. No.	Company	Number of shares on 23/4/2007 held directly in Sesa Goa Limited.	Number of shares as of today in Sesa Goa Limited.
1.	Finsider International Company Limited	20074824 shares of Rs. 10/- each 51.0% shareholding. Total paid up capital 39362020 shares of Rs.10/- each.	401496480 shares of Rs.1/- each 46.19% shareholding. Total paid up capital 869101423 shares of Re.1/- each.
2.	Twinstar Holdings Limited	Nil	33274000 shares 5.10% shareholding. Total paid up capital 869101423 shares of Re.1/- each.
3.	Westglobe Limited	Nil	44343139 shares 3.83% shareholding. Total paid up capital 869101423 shares of Re.1/- each.

Vendata Resources Plc does not directly hold any shares of Sesa Goa Limited and in sister concerns of Sesa Goa Limited.

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There was no representation submitted by Sesa Goa Limited individually to the Ministry of Finance on the Budget proposal presented on 28/02/2007. However Sesa representative was part of a delegation from Goa who met various authorities in Delhi in respect of Export Duty imposed in the Budget.

M/s. Mitsul Co. Ltd. through its subsidiary M/s. Finsider International Company Limited was holding shares in Sesa Goa Limited since October 1996 till April 2007. The holding of M/s. Finsider International Company Limited in October 1996, was 10037412 shares which amounted to 51.12% of the shareholding. Total paid up capital 19633587 shares of Rs.10/- each. In the year 2005 pursuant to Bonus issue of shares by Sesa Goa Limited in the ratio of 1:1, the shareholding of M/s. Finsider International Company Limited stood increased to 20074824 shares which amounted to 51% shareholding. Total paid up capital 39362020 shares of Rs. 10/- each.

M/s. Mitsui & Co. Ltd off loaded the shares of its subsidiary M/s. Finsider International Company (UK) and therefore, information about the bidders are not available with us. However, due diligence of Sesa Goa was done by 1) Vedanra 2) Arcelor Mittal 3) Aditya Birla Group 4) CVRD, 5) JSW 6) Anglo American.

It's obvious that M/s. Vedanta succeeded in acquiring shares in M/s. Finsider International Company (UK) who

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was holding 51% share of paid up equity share capital of Sesa Goa Limited. We do not have information about the bidders. However due diligence of Sesa Goa was done by the parties mentioned as above.

For Sesa Goa Limited
SD/-
P.K. MUKHERJEE
MANAGING DIRECTOR

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SALCETE TALUKA
MARGAO-GOA
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Vedanta

9th February, 2012

Vedanta Resources plc
Berkley Street
London W1J BDZ

Tel : + 44(0) 20 7499 5900
Fax: + 44(0) 20 7491 8440
Wwx.vedantaresources.com

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SUBHASH KRISHNA KANEKAR
SALCETE TALUKA
MARGAO-GOA
Regd.No. 44/14
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Thank you for your fax dated 1st February, 202. Please note Vedanta Resources PLC (the Company) is a UK listed and registered company and operates from 16 Barclays Street, 5th Floor, London WIJ 8DZ, UK address. Please make all correspondence to said address.

Please find our responses to your letter point wise:

(1) Following were the Executive and Non Executive Directors of Vedanta Resources Plc during the period from 1st January 2003 to 24th May 2004. Classification in Executive (E) and Non-Executive Directors (NED) as per the UK rules.

Sr. No	Name	Date of Appointment	Date of Resignation	E/NED	India Based / London Based.
1	Anil Agarwal	16.5.2003	-	E	London
2	Peter Sydney Smith	14.11.2003	4.8.2005	E	London
3	Brian P. Gilbertson	4.12.2003	6.7.2004	NED	London
4	Michael Fowle	14.11.2003	23.03.2005	NED	London
5	Sir David Gove Booth	14.11.2003	31.10.2004 Died	NED	London

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Sr. No	Name	Date of Appointment	Date of Resignation	E/NED	India Based / London Based.
6	Jean Pierre Rodier	14.6.2004	23.3.2005	NED	London
7	P Chidamba ram	14.11.2003	22.5.2004	NED	India
8	Naresh Chandra	18.05.2004	-	NED	India
9	Instant Companie s Ltd.	22.4.2003	16.5.2003	Initial Incorpo ration Director	London
10	Swift Incorporat ions Ltd.	22.4.2003	16.5.2003	Initial Incorpo ration Director	London

2. The company was incorporated on 22nd April, 2003. Sterlite was not reconstituted as Vedanta Resources Plc in the year 2002.

3. Vedanta Resources Plc through its 100% subsidiary holds following shares in Sesa Goa Ltd. The Company does not hold any shares in Sesa Resources Limited directly. Sesa Resources Limited is 100% Subsidiary Company of Sesa Goa Limited.

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SN	Company	Number of shares on 23.4.2007 held directly in Sesa Goa Ltd.	Number of shares as of today	Percentage holding.
1.	Finsider International Company Limited.	20074824 shares of RS 10 each, Total paid up capital 39362020.	401496480 shares of Re 1/- each. Total paid up capital 869101423 shares of Re. 1/- each.	51.0% on 23.4.2007 and as of 27.1.2012 46.19%
2.	Twinster Holdings Limited	Nil	23274000 shares of Re 1/- each Total paid up capital 869101423 shares of Re 1/-.	5.10% as of 27.1.2012
3.	Westglobe Limited	Nil	44343139 shares of Re 1/- each. Total paid up capital 869101423 shares of Re.1/- each.	3.83 % as of 27.1.2012

(4) The company made final bid of US$981 million on 28th March, 2007, which amounted to Rs.2,036 per share. This bid was accepted by the Mitsui on 16th April, 2007.

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(5) There was no representation submitted by Vedanta Resources Plc to reduce export duty on iron ore export proposed in the Union Budget on 28/02/2007. Please note we don't have any company by name of Vedanta Resources Plc (India).

There was no matter before the Hon'ble High Court of Bombay regarding tax matters (ED) of Sterlite/Vedanta Resources Plc in 2003.

SD/-

Deepak Kumar

Company Secretary

For and Behalf of Vedanta Resources Plc.

All the above stated issues are required to be further investigated by Central Bureau of Investigation because the violation / misuse of the laws goes beyond the State jurisdiction.

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Report against working of Vedanta Group of Companies

For Vedanta Resources, hue and cry was raised in U.K. The report is published in the newspaper.

THE HINDU dated 29.8.2012

"U.K. rights groups protest against Vedanta

Hasan Suroor

LONDON: *Activists of several rights groups held a protest here on Tuesday calling mining group Vedanta Resources, an FTSE 100 company, to be struck off from the London Stock Exchange because of its controversial trade practices and human rights record.*

Carrying banners and raising slogans against its policies, the protesters gathered outside the venue of the company's annual general meeting in central London and booed its shareholders as they arrived.

Senior Labour MP john McDonnell also joined the protest.

Campaign group Survival International released a message from representatives of the Dongria Kondh tribe protesting against Vedanta's mining project in the Niyamgiri Hills in Orissa: "Even if Anil Agarwal [Vedanta's CEO] himself comes here, we won't leave our land. We will use all our strength to make them leave this place. Let us live our lives in peace," the message said.

Stephen Corry, Director of Survival, said: "Ignoring tribal rights does not pay: it devastates people's lives, and

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– as Vedanta has found – is financially reckless. The Dogria have the right to be consulted, and to give – or withhold – their consent. If Vedanta had talked to them first and respected their fundamental attachment to their land, they would have saved themselves and the Dongria a lot of trouble."

The South Asia Solidarity Group (SASG) demanded that the British government must end its "support" to Vedanta sponsored projects.

"This year the list of Vedanta's atrocities is longer than ever before and there are massive popular struggles against it in India and Zambia. Like the notorious Lonmin in South Africa, Vedanta is bringing shame on the London Stock Exchange. Isn't it time they were deleted from it? We call on the British government to stop backing it," said SASG spokesperson Amrit Wilson.

The protest, also backed by Foil Vedanta and Save Goa Campaign, coincided with parallel demonstrations in Goa, Tamil Nadu and Orissa.

'Glossing over record'

Amnesty International accused Vedanta of attempting to "gloss over" criticisms of its human rights record by publishing what it described as a "meaningless and hollow" account of its operations in India.

"Amnesty believes 'the Vedanta's Perspective' report is an attempt to calm investor fears over its controversial operations in India as it seeks to expand them," it said, accusing the company of ignoring the impact of its policies on the human rights of local communities in Orissa."



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In addition, it is reported in the Indian Express dated 17.10.2012 as under :-

"VEDANTA RESOURCES HAD PAID $5.69 MILLION (ABOUT ` 28 CRORE) TO POLITICAL PARTIES IN INDIA IN THE PAST THREE YEARS

New Delhi :

The Election Commission has asked the Ministry of Home Affairs to probe into allegations of suspected violations of the Foreign Contribution (Regulation) Act by the Congress and the BJP in their acceptance of donations from subsidiaries of multinational firm Vedanta Group.

The EC asked the Home Ministry to probe into the matter after a retired secretary to the Government of India, E A S Sarma, from Vishakhapatnam in Andhra Pradesh, approached the poll panel with relevant documents, alleging that both the parties had received about ` 5 Crore each from two subsidiaries of the Vedanta Group -- Sterlite Industries and the Sesa Goa Group. "Our role is limited to recommending a probe into the matter by the Home Ministry. What possible action can be taken, if the relevant Act has been violated, can be decided by the Home Ministry alone. I have asked for a report from the Home Ministry," Chief Election Commissioner V S Sampath told Express.

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In this petition, the complainant said: " The donations, prima facie, violate Section 29-B of the Representation of the People Act, which states that no political party shall be eligible to accept any contribution from any foreign source defined under clause(e) of the Section 2 of the Foreign Contribution (Regulation) Act, 1976.

Vedanta Resources, according to its annual report of 2011-12, had paid $5.69 million (about ` 28 crore) to political parties in India in the past three years. Without disclosing the identity of the beneficiaries, billionaire Anil Agarwal-promoted Vedanta has stated on the report that it paid $2.01 million to various political parties during 2011-12."

Admittedly, the Company Vedanta is working in Indian Mines and its Directors are non-Indians.

The personal hearing was given to Vedanta and its subsidiary companies Sesa Goa, Sesa Mining Corporation and Sesa Resources, etc. I have heard the Ld. Advocate, Mr. Mahesh Sonak appearing on behalf of the above Company. The Ld. Advocate has advanced the following arguments.

"*1. Under the Portuguese Colonial Mining Laws, grant was made in favour of "M/s. V.S. Dempo & Cia Ltda.".*

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2. On 28/11/1962; Goa, Daman and Diu (Laws) Regulations, 1962, came to be enacted. One of the Acts made applicable was "the Mines & Minerals (Regulation and Development) Act, 1957 (MMDR)."

3. With effect from 15/05/1987, the Mining Concessions (Abolition and Declaration as Mining Lease) Act, 1987 came to be passed by the Parliament.

4. On 30/09/1963 Notification came to be issued/ published appointing 1st of October, 1963 as the date on which the MMDR Act (except Section 16 thereof), came into force in Goa, Daman and Diu. Section 16 of the MMRD Act, was brought into force with effect from 15/01/1966 vide Notification dated 4th January, 1966.

5. In meanwhile "M/s. V.S. Dempo & Cia Ltda." the Concessionaire Corporate Entity was formally registered/ incorporated as a Company, under the extended Indian Companies Act, 1956, under the name and style of "M/s. V.S. Dempo & Co. Pvt. Ltd."

6. Number of Writ Petitions came to be filed questioning the constitutional validity of the 1987 Act. By the common judgment and order dated 20/06/1997 (Quexova Cunde V/s. Union of India, reported in 1997 (2) GLT 205) the Division Bench of the Hon'ble High Court was pleased to upheld the constitutional

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validity of the 1987 Act. The matters have been thereafter carried to the Hon'ble Supreme Court of India and Leave has been granted and an interim order is passed, which reads as follows :

"During the pendency of the appeals, the appellants are permitted to carry on mining operations and mining business in the mining areas for which renewal applications have been made on the condition that the appellants shall pay to the respondents from the date of commencement of the impugned Act all the amount of dead rent, royalty as now stipulated by the respondents under the impugned Act without prejudice and under protest. The appellants will also comply with all other conditions. As regards the period from 1961 till the coming into force of the impugned Act, it will be open to the respondents to take proceedings for assessment of the amounts payable by the appellants but no recovery shall be made without further orders from the Court."

7. *Upon coming into force the 1987 Act, there was no dispute that the Mining Leases in respect of the aforesaid mining concessions/leases was "M/s. V.S. Dempo & Co. Pvt. Ltd." On this basis, the State of Goa has executed Mining Lease Deeds in the prescribed "Form K" as appended to the MCR, 1960.*

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8. *In pursuance of the fresh Certificate of Incorporation consequent upon change of name as aforesaid to Public Limited Company issued by the Registrar of Companies on 19/11/2010, the name of the aforesaid Company was changed from "M/s. V.S. Dempo & Co. Pvt. Ltd." to "V.S. Dempo & Co. Ltd."*

9. *Further, pursuant to the fresh Certificate of Incorporation consequent upon change of name issued by the Registrar of Companies on 19/11/2010, the name of the Company "M/s. V.S. Dempo & Co. Ltd." was changed to "M/s. Sesa Resources Limited."*

10. *That "M/s. V.S. Dempo & Co. Pvt. Ltd." and "M/s. Sesa Resources Limited" is one and the same Company or legal entity and there has only been a change of name upon due compliance with the procedures prescribed under the Companies Act, 1956.*

11. *The learned advocate has argued that the legal entity to which the initial Mining Concession came to be granted or in any case, the Mining Lessee to which the Mining Lease came to be granted, continues to be the Concessionaire/ Mining Lessee as on date. Accordingly, there is no issue of transfer or assignment of Mining Concession/Lease as contemplated by Rule 37 of the MCR, 1960.*

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11.1 Learned advocate has argued that in terms of the definite Share Purchase Agreement dated 11/06/2011, "M/s. Sesa Goa Limited" has acquired all the outstanding common shares of "M/s. V.S. Dempo & Co. Pvt. Ltd.", neither factually, nor legally attracts the provisions of Rule 37 of the MCR, 1960 because it is well established legal concept, that Company is a "separate and legal entity" different and distinct from the shareholders which comprise it. Accordingly, the property, assets or money belonging to a Company cannot by any stretch be regarded as property, assets or money belonging to the shareholders. In support of his argument, he has cited a decision of the Hon'ble Supreme Court in the case of "Bacha F. Guzdar V/S Commissioner of Income Tax, Bombay, reported in AIR 1955 SC 74". Relevant paragraphs of the judgment are as follow:

"The company is a juristic person and is distinct from the shareholders. It is the company which owns the property and not the shareholders. The dividend is a share of the profits declared by the company as liable to be distributed among the shareholders. Reliance is placed on behalf of the appellant on a passage in Burkle's Companies Act, 12th Ed., page 894, where the etymological meaning of dividend is given as dividendum, the total divisible sum but in its ordinary sense it means the sum paid and received

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as the quotient forming the share of the divisible sum payable to the recipient. This statement does not justify the contention that shareholders are owners of a divisible sum or that they are owners of the property of the company."

"There is nothing in the Indian law to warrant the assumption that a shareholder who buys shares buys any interest in the property of the company which is a juristic person entirely distinct from the shareholders."

12. *There cannot be any dispute about factual and legal position that mere transfer of shares in the Company does not involve or amount to transfer or assignment of the property of the Company, or any right, title or interest in the property of the Company.*

12.1 *He argued that the transfer of shares in the present case, does not involve or amount to transfer, assignment, subletting or mortgage of the Mining Lease or any right, title or interest therein. Clearly, therefore, Clause (a) of Rule 37 (1) of the MCR, 1960 is in no manner attracted.*

12.2 *Learned advocate has argued that now so far as the issue of royalty payments for the period between 2000-2001 and 2008-2009 in respect of the mining concessions/ leases /concession has been made in name of "M/s. Sesa Resources Ltd." and further*

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royalty payment for the subsequent period – 2009-10 and 2010-11 has been made in the name of "M/s. V.S. Dempo & Co. Ltd." is patently erroneous and perhaps it has been submitted out of inadvertence.

12.3 *Learned advocate has argued that so far as the speech of the Chief Executive in the Share Holders' Meeting that "Company acquired the mining assets of M/s. V.S. Dempo & Company Pvt. Ltd." is concerned, it was a casual and general statement without considering the facts and law on this point. This statement is made only with a view to explain to the persons who do not know the law, and therefore, the statement has no bearing in deciding the transfer of lease/mines."*

It is to be highlighted that "Corporate Personality is a reality and not an illusion or factious construction of law."

We have to keep the above principle in mind in appreciating the contentions raised by the Ld. Counsel.

Firstly, it is to be understood that it is easy to say that company's name is changed from "M/s. V. S. Dempo & Co. Limited" to "M/s. Sesa Resources Limited". In the same way, the name is changed from "Dempo Mining Corporation Private Limited" to "Sesa Mining Corporation Limited". Once it is realized that each company is a corporate legal entity, there is no question in change of

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mere name but it would establish that the company is transferred to another legal entity – a juristic person. This would not amount mere transfer of shares to contend that it was mere change of name. It is illusion to get out from the rigour of the law. Therefore, the contention of the Ld. Counsel for Sesa Goa that there was a mere change of name from "M/s. V. S. Dempo & Co. Limited" to "M/s. Sesa Resources Limited" and from "Dempo Mining Corporation Private Limited" to "Sesa Mining Corporation Limited" requires to be rejected.

Secondly, as observed in the aforesaid Hon'ble Supreme Court Decision, this would be *"Big fish will always eats away small fish in diverse forms, so as to drive the latter away from the area."*

Thirdly, Vedanta Group which is internationally known a very big fish intends to have is controlling the extraction and export of iron ore from India by various means including unlawful means, as stated above. Vedanta Group as reported in 2012 is having more than 55% shares in various companies of Sesa Goa Ltd. and Sesa Resources Ltd.

In Company Petition No.5 of 1979, Order u/s. 394 of the Companies Act was passed by the Court of the Judicial Commissioner, Goa, Daman & Diu, Panaji, in the matter of amalgamation of Mingoa Private Limited

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with Sesa Goa Private Limited on 25.3.1980 wherein it was stated as under :-

"*(1) That all the property, rights and powers of the Transferor Company specified in the first, second and third parts of the Schedule hereto and all the other property, rights and powers of the Transferor Company be transferred without further act or deed to the Transferee Company and accordingly the same shall, pursuant to section 394(2) of the Companies Act, 1956, be transferred to and vest in the Transferee Company for all the estate and interest of the Transferor Company therein but subject nevertheless to all charges now affecting the same; and*

(2) That all the liabilities and duties of the Transferor Company be transferred without further act or deed to the Transferee Company and accordingly the same shall, pursuant to Section 394(2) of the Companies Act, 1956, be transferred to and become the liabilities and duties of the Transferee Company;"

Fourthly, even the Chief Executive of Sesa Goa in the meeting of shareholders for the year 2009-10 on the account of acquisition has admitted as under :-

"*In June 2009, your Company acquired the mining assets of* ***V.S. Dempo and Company Private Limited ('VSD' or 'Dempo")*** *and its subsidiaries and associates. The*



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acquisition of Dempo's mining assets in Goa on a debt-free and cash-free basis for Rs. 1,750 crore (based on nominative working capital) which was financed through internal accruals. Dempo is a logical and strategic fit with Sesa's existing iron ore business. While integration is continuing, your Company has already started leveraging synergies to create significant long term value for all shareholders. Some areas where work is progressing are:

- *Utilization of Sesa Goa's mining and project management skills to develop and optimize Dempo's operations;*
- *Further exploration of Dempo's longer life mining assets; and*
- *Synergizing Dempo's operations with Sesa Goa's to create mining and logistics efficiencies.*

The integration process is moving as planned and in doing so, there has been a significant growth in production of saleable ore for Dempo. These added to the consolidated growth of Sesa Goa.

Dempo has been the first major acquisition by your Company. And the success of the post-merger fit has given us confidence to pursue the acquisition route for growth for coming years."

For the aforesaid admission, the Ld. Advocate for the company contended that the aforesaid statement of

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the C.E.O. in the annual general meeting is merely a formal speech which can not be considered as admission. In our view, we would again state that the said contention is merely illusion on the part of the company. The responsible officer like C.E.O. is presumed to state exact affairs of the company in its annual general meeting and the same can not be ignored.

As observed by the Apex Court in the aforesaid decision, it is apparent that ***"there is a facade of compliance of law, but it is only a subterfuge to comply with the law and an attempt by a private company to secure unjustifiable enrichment-The entire transaction is smacked of mala fides and would defeat constitutional objectives."***



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T.C. Nos. 3/51, 35/52, 5/54, 20/54 and 21/54

The Original Concessionary of all these five mines was one firm V.S. Dempo and Cia Limited of Goa. Thereafter, the leases were running in the name of "M/s. V.S. Dempo and Co. Pvt. Ltd." During investigation it is found that all these five (5) mines are being actually operated and iron ore is being extracted by "Sesa Resources Limited", a public limited company.

The status of a private limited company is found changed alongwith the name of the company in present case. This has happened on account of transfer of leasehold interest in favour of Sesa Resources Limited. Transfer of leasehold rights of a firm in favour of a private limited company or transfer of such right of a private limited company in favour of a public limited company amounts to transfer of interest within the meaning of Rule 37 of MCR, 1960.

The Environmental Clearance (EC) has been granted by MoEF (GOI) for T.C. No. 3/51 in the name of **M/s. V.S. Dempo and Co. Pvt. Ltd. on 07/11/2005** and the same has been extended vide **letter dated 02/10/2008.**

For T.C. No. 5/54 is concerned, the same company had applied for EC and was granted clearance on 17/11/2005 and the same was extended on 01/01/2008.

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"In June 2009, your Company acquired the mining assets of V.S. Dempo and Company Private Limited ('VSD' or 'Dempo") and its subsidiaries and associates. The acquisition of Dempo's mining assets in Goa on a debt-free and cash-free basis for Rs. 1,750 crore (based on nominative working capital) which was financed through internal accruals. Dempo is a logical and strategic fit with Sesa's existing iron ore business. While integration is continuing, your Company has already started leveraging synergies to create significant long term value for all shareholders. Some areas where work is progressing are:

- *Utilization of Sesa Goa's mining and project management skills to develop and optimize Dempo's operations;*
- *Further exploration of Dempo's longer life mining assets; and*
- *Synergizing Dempo's operations with Sesa Goa's to create mining and logistics efficiencies.*

The integration process is moving as planned and in doing so, there has been a significant growth in production of saleable ore for Dempo. These added to the consolidated growth of Sesa Goa.

Dempo has been the first major acquisition by your Company. And the success of the post-merger fit has given us confidence to pursue the acquisition route for growth for coming years."

Hence, it is clear that the assets of above both the

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companies have been acquired by "Sesa Goa Limited" for the purpose mentioned in the above speech.

It is relevant to note that one Japanese firm Mitsui Finsider International Ltd. had majority control of Sesa Goa and decided to sale its stake to exit the mining business and a multinational company Vedanta has purchased shares with a bid of Rs. 2,036/- per share. The ministry of corporate affairs directed to initiate action against Sesa Goa on various grounds. Thus, it is apparent that this is not a case of change in the name of a company incorporated earlier but is an acquisition / transfer of leasehold interest in above all five (5) lease areas.

The leasehold interest of M/s. Sesa Goa Limited (Sesa Goa together with its subsidiaries) has entered into merger agreement with Sterlite Industries (India) Limited and a multinational company Vedanta Resources. The word Vedanta includes Vedanta Resources Public Limited and its subsidiaries and the same forms a group. A note released for publication and distribution dated 25/02/2012 by Sesa Goa Limited as one of the Vedanta group of companies amply clarifies that Sesa Goa Limited now is Sesa Sterlite Limited. With this fact situation more than one company including Vedanta Resources can claim leasehold interest in the mines along with other mines claimed to be under control and operation by Sesa Goa Limited. This includes one more T.C. No. 9/49.

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On inquiry by this Commission, the Registrar of Companies, Goa Daman and Diu, has issued a certificate dated 19/11/2010 to the effect that "M/s. V.S. Dempo & Company Private Limited" having duly passed the necessary resolution on 18/10/2010 in terms of Section 31/21 read with Section 44 of the Companies Act, 1956, the name of the said company was changed to "M/s. V.S. Dempo & Company Limited".

He has also forwarded a second certificate dated 19/11/2010 to the effect that "M/s. V.S. Dempo & Company Limited" on the basis of the resolution and approval of the Central Government the name of the said was changed to "Sesa Resources Limited" under the Companies Act.

This Commission found that without approval of the State Government, the transfer in both the cases namely "Dempo and Souza Limited" and "V.S. Dempo and Cia Limited" to "Sesa Mining Corporation" and "Sesa Resources Limited" respectively is apparently violation of Rule 37 of MCR, 1960.

For this purpose, this Commission sought explanation from the concerned companies.

In response, the Mines Manager of Sesa Mining Corporation Ltd., addressed a letter dated 16/1/2012 which reads as under:

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"We are in receipt of above referred letter received by us on 21/12/2011, in respect of the same it is stated as under:

(a) It is most respectfully submitted that M/s. Sesa Mining Corporation Limited and M/s. Dempo Mining Corporation Limited are the one and the same legal entity.

(b) It is most respectfully submitted that name of M/s. Dempo Mining Corporation Private Limited was changed to M/s. Dempo Mining Corporation Limited pursuant to Fresh Certificate of Incorporation Consequent upon change of name of conversion to Public Limited Company issued by Registrar of Companies, Goa, Daman and Diu dated 12/11/2010. The copy of the Fresh Certificate of Incorporation Consequent upon change of name on conversion to Public Limited Company issued by the Registrar of Companies, Goa, Daman and Diu dated 12/11/2010 is attached as ***Annexure "A".***

(c) That subsequently name of M/s. Dempo Mining Corporation Limited was changed to M/s. Sesa Mining Corporation Limited pursuant to Fresh Certificate of Incorporation consequent upon change of name issued by Registrar of Companies, Goa, Daman and Diu dated 18/11/2010. The copy of the Fresh Certificate of Incorporation consequent upon change issued by Registrar of Companies, Goa, Daman and Diu dated 18/11/2010 is attached as ***Annexure "B".***

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(d) *The latest copy of the Memorandum of Association and Articles of Association of Our Company is attached as* ***Annexure "C".***

(e) *The details of Mining Lease held by M/s. Sesa Mining Corporation Limited (earlier known as Dempo Mining Corporation Limited) is as follows:*

Sr. No.	***Mining Concession / Lease***	***Area (ha.)***
1	T.C. No.11/1941 (Lamgao)	100.00
2	T.C. No.12/1941 (Vagachiper)	99.96
3	T.C. No.13/1941 (Gaotor)	99.50
4	T.C. No.14/1941 (Tolichomor Dongor)	99.91
5	T.C. No.15/1941 (Mandorbaga)	99.55
6	T.C. No.11/1952 (D0bdobo)	50.12
	TOTAL	***549.04***

We shall be obliged to provide any further information that your Lordships may seek on the subject matter. We humbly request your Lordship to provide us an opportunity of personal hearing in the matter, so that matter can be personally explained on our behalf."

Further the Associate General Manager (Mines) of Sesa Resources Ltd., addressed a letter dated 16/1/2012 to the Commission which reads as under:

"We are in receipt of above referred letter received by us on 21/12/2011, in respect of the same it is stated as under:

(a) *It is most respectfully submitted that M/s. Sesa Resources and M/s. V.S. Dempo & Company Limited are the one and the same legal entity.*

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(b) *It is most respectfully submitted that name of M/s. V.S. Dempo & Company Private Limited was changed to M/s. V.S. Dempo & Company Limited pursuant to Fresh Certificate of Incorporation Consequent upon change of name on conversion to Public Limited Company issued by Registrar of Companies, Goa, Daman and Diu dated 19/11/2010. The Copy of the Fresh Certificate of Incorporation Consequent upon change of name on conversion to Public Limited Company issued by Registrar of Companies, Goa, Daman and Diu dated 19/11/2010 is attached as* ***Annexure "A".***

(c) *That subsequently name of M/s. V.S. Dempo & Company Limited was changed to M/s. Sesa Resources Limited pursuant to Fresh Certificate of Incorporation Consequent upon change of name issued by Registrar of Companies, Goa, Daman and Diu dated 19/11/2010. The copy of the Fresh Certificate of Incorporation Consequent upon change issued by Registrar of Companies, Goa, Daman and Diu dated 19/11/2010 is attached as* ***Annexure "B".***

(d) *The latest copy of the Memorandum of Association and Articles of Association of our Company is attached as* ***Annexure "C".***

(e) *The details of Mining concession / Leases held by M/s. Sesa Resources Limited (earlier known as V.S. Dempo & Company Limited) is as follows:*

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Sr. No.	Mining Concession / Lease	Area (ha.)
1	T.C. No.21/1954 (Tolpi – Mardando)	65.79
2	T.C. No.5/1954 (Onvalienchi Math)	96.64
3	T.C. No.20/1954 (Onvalienchi Palthana)	90.95
4	T.C. No.7/1950 (Culnavoril Sodo)	38.84
5	T.C. No.3/1951 (Cantor)	97.67
6	T.C. No.40/1954 (Sem Denominacao)	51.05
7	T.C. No.35/1952 (Tembessodo)	98.46
8	T.C. No.17/1960 (Godbaim)	70.68
9	T.C. No.43/1951 (Navientil Galivoril Advona)	100.00
10	T.C. No.37/1951 (Condulgo)	36.94
TOTAL		**747.02**

We shall be obliged to provide any further information that your Lordships may seek on the subject matter. We humbly request Your Lordships to provide us an opportunity of personal hearing in the matter, so that matter can be personally explained on our behalf."

Further, for payment of royalty, the DGM, Goa has sent the information wherein it has been pointed out that for various T.C. Numbers, since 2003 onwards, Sesa Resources Ltd. has paid the royalty. The copy thereof is annexed herewith.

In addition to this, the Director's Report of VS Dempo & Company Limited is inter-alia as follows :–

*"The **FORTY FOURTH ANNUAL REPORT** of the Company together with the Audited Statement of*

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Accounts for the Financial Year ended 31st March 2010 is presented herewith.

Your Company is a wholly owned subsidiary of Sesa Goa Limited consequent to the acquisition of its shareholding since 11th June 2009, post the acquisition by Sesa Goa Limited through a definitive share purchase agreement signed between Sesa Goa Limited and your Company."

Further, from the Annual Report, 2010 of the Sesa Goa, it is found as under :-

"*Sesa Goa at a Glance*

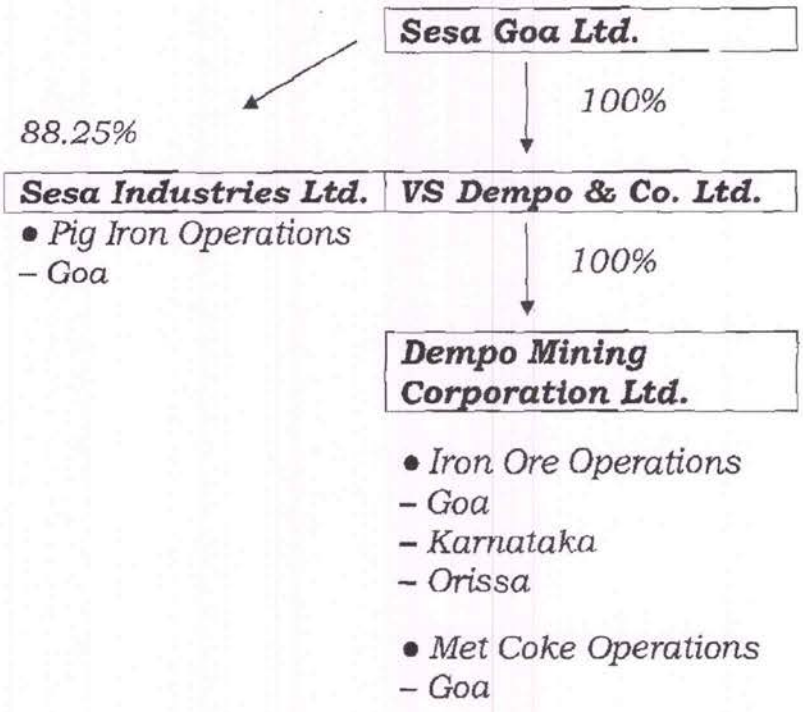
Sesa Goa Limited (or 'Sesa Goa' or 'the Company') is part of the Vedanta Group, a diversified global metals and mining major. It drives the Group's ferrous minerals business with a commitment to create a world class enterprise with high quality assets, low cost production and superior returns to stakeholders.

Sesa Goa is today India's largest private sector iron ore producer and exporter. Apart from iron ore, it also produces pig iron and metallurgical coke. The Company also provides proprietary technology in coke manufacturing.

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Sesa Goa's Group Structure



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The statement of the Chief Executive of Sesa Goa in the meeting of shareholders for the year 2009-10 is as follows :–

"In June 2009, your Company acquired the mining assets of V.S.Dempo and Company Private Limited ('VSD' or 'Dempo') and its subsidiaries and associates. The acquisition of Dempo's mining assets in Goa on a debt-free and cash-free basis for Rs. 1,750 crore (based on normative working capital) which was financed through internal accruals. Dempo is a logical and strategic fit with Sesa's existing iron ore business. While integration is continuing, your Company has already started leveraging synergies to create significant long term value for all shareholders. Some areas where work is progressing are:

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- *Utilisation of Sesa Goa's mining and project management skills to develop and optimise Dempo's operations;*
- *Further exploration of Dempo's longer life mining assets; and*
- *Synergising Dempo's operations with Sesa Goa's to create mining and logistics efficiencies.*

The integration process is moving as planned and in doing so, there has been a significant growth in production of saleable ore for Dempo. These added to the consolidated growth of Sesa Goa.

Dempo has been the first major acquisition by your Company. And the success of the post-merger fit has given us confidence to pursue the acquisition route for growth in coming years.



... ...

Vision

Over the last few years, Sesa Goa has been growing profitably, and at a rapid pace. The lessons learnt and the experience developed has given your Company the conviction to set a time bound target for aggressive growth.

The goal is to be the fourth largest iron ore producer in the world by 2012-13 with an annual production of 50 million tonnes. This is the vision that your Company has adopted to guide its activities in the next three years.

With a total consolidated production of 21.4 million tonnes in the 2009-10, Sesa Goa has become the 13th largest iron ore producing company in the world. The three

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major players – Vale, Rio Tinto and BHP Billiton – stand out with productions of 227 million tonnes, 218 million tonnes and 137 million tonnes respectively. Clearly, their scales of operations are much larger than any of the other players, with very different sets of challenges and risks.

Sesa Goa believes that an annual production of 50 million tonnes will give it the right mix of global scale with the positioning of a 'low cost producer' with flexible operations. Equally, the Company recognises that the task is challenging. According to the plan, in a span of three years, total production and transportation of iron ore has to grow 2-3 times."

Not only this, as per THE ECONOMICS TIMES, dated 17th May, 2011, it has been inter-alia found as under :-

> *"PANAJI : **Five mines operated by companies owned by Vedanta Resources** have been pulled up by the Goa Government for **illegalities in mining operations in the last financial year. Forest Minister Filipe Neri Rodrigues has said.***
>
> *In a written reply to a query from an opposition legislator in the state assembly Wednesday, Rodrigues said **the forest department had noticed 17 instances of illegal mining in the last three years in Goa's forested areas.***
>
> *According to the written reply, **three separate complaints** were filed against officials of Dempo mining corporation and Sesa Goa Ltd. for illegal*

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mining in forest areas in Bicholim and Sanguem sub-districts in north and south Goa respectively.

In two other instances, the forest department also warned officials of V. S. Dempo & Company against ***using forest land for transportation*** *of ore and ferrying of trucks, the reply stated.*

Dempo mining corporation, V. S. Dempo and Company and Sesa Goa Ltd. were acquired by billionaire Anil Agarwal-owned Vedanta Resources in the recent past, making the latter the biggest player in Goa's mining industry that ***exports nearly 45 million tonnes of iron and manganese ore annually.***

Illegal and unchecked mining is a sensitive issue in Goa, *with both civil society groups and the opposition repeatedly voicing their concern over the issue.*

According to data submitted in the monsoon session of the Goa assembly, ore worth Rs.4,000 crore was illegally mined and exported *out of Goa to countries like China, Japan and Romania.*

According to Leader of Opposition Manohar Parrikar, ***nearly 18 percent of Goa's total 40 million mining output comprises illegally-mined ore.***

He has also accused Chief Minister Digambar Kamat and several of his cabinet ***ministers of being hand-in-glove with the illegal mining mafia.***"

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Sesa Goa History & Milestones

1954 Baron Ludovic Toeplitz lands in Goa. With the financial backing of an enterprising Italian, alessandro, he acquires the Orosso Dongor Mining Concession in North Goa and starts a Company called Scambi Economici S.A. Goa.

1955 The Company renamed Sesa Goa Limited is bought over jointly by Gewerkeshaft Exploration e Bergbau represented by Eugene Plotzki and by Ferromin S.p.A. of Italy (a subsidiary of Finsider S.p.A of the IRI Group) represented by Paolo Tradardi, both parties having equal shareholding.

1957 Another company started in Goa, Mingoa Sociedade Mineral Goesal S.a.r.l. is incorporated with Flat of Torino as the Principal shareholder.

1963 Finsider S.p.A. acquires the West German interest in Sesa Goa Limited and also all the shares of Mingoa.

1965 Sesa Goa and Mingoa are incorporated as Private Limited Companies under the Indian Companies Act 1956.

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1979 A single Company, Sesa Goa Private Limited, is formed with amalgamation of Sesa Goa and Mingoa fully owned by Finsider S.p.A.

1981 Sesa Goa goes public with 42,000 Indian shareholders holding 60% of its shares and the remaining 40% held by Finsider International (Later became ILVA INTERNATIONAL).

1984 Sesa Goa starts a barge construction unit at Sirsaim which has since developed into the Shipbuilding Division.

1992 First phase of 150,000 tons per year Pig Iron Plant is commissioned and manufacture of low phosphorous foundry grade pig iron starts.

1993 ILVA INTERNATIONAL raises its equity in Sesa Goa to 51%. Sesa Goa reduces its equity in SESA SEAT of 15% while STET continues to hold to 40% of the expanded capital to SESA SEAT.

1994 Second blast furnace is commissioned in July.



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1995 Sesa Shipping is launched in January with the acquisition to Transhipper M.V. ORISSA. 84 coke ovens are commissioned in April.

1996 On 11 October, MITSUI & CO. of Japan, through Earlyguard, UK, buys Finsider International with its 51% equity in Sesa Goa Ltd.

1997 Sesa Kembla becomes 100% subsidiary of Sesa Goa. Karnataka Mining developments commence.

1998 Sesa Goa relinquishes representation on Board of Sesa Seat. Sesa Community Development Foundation encompassed NCM Sesa Technical School and a new Sesa Football Academy.

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1999 Sesa Goa commences mining operations at Barbil in Orissa, producing high grade iron ore and exporting from the nearby ports of Haldia and Paradip.

2000 Sesa Kembla Coke completes the development of an indigenous and environment friendly technology for producing high quality metallurgical Coke and generating power as a

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by-product. Sesa Kembla applies for international patents for its technology.

2001 Sesa Goa commissions a new process plant for its mining operations at Orissa, which aids both, the production and the quality of iron ore produced.

2002 Sesa Group becomes the first business of its kind to be certified with OHSAS 18001. The Shipbuilding Division launches its 60th vessel, MV Toni, mini-bulk carrier.

2003 Sesa Goa equity in Sesa Industries raised to 88.25%.

2004 Sesa Group completes 50 years of operations. Sesa Goa's Shipbuilding Division builds its 62nd vessel, a 2200T barge for its own fleet.

2005 Iron ore sales crossed 9.8 million tones. Sesa Goa issues bonus shares to its shareholders. Sesa Group declares a final dividend of 200% in addition to an interim dividend of 50% on the pre-bonus share capital.

2007 Vedanta Resources plc, a diversified metals and mining group, listed on the London Stock

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Exchange acquires 51% controlling stake in Sesa Goa Limited from Mitsui & Co. Ltd. Iron ore sales rise to 10.87 million tonnes in 2006-07.

2008 Iron ore sales rise to 12.39 million tonnes in 2007-08.

2009 Sesa Goa Limited and Dempo Group have signed a definitive Share Purchase Agreement under which sesa has acquired all the outstanding common shares of VS Dempo & Co. Private Limited, along with its 100% equity shares of Dempo Mining Corporation Pvt. Ltd and 50% equity shares of Goa Maritime Private Limited.

2010 In the FY2010 Sesa Goa's Iron Ore production and sales increased to 21.4 million tones and 20.5 million tones, respectively.

NOTARY
SUBHASH KRISHNA KANEKAR
SALCETE TALUKA
MARGAO GOA
Regd No 3/15/14
Exp. Dt: 26/02/2027
GOVT. OF GOA (INDIA)

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T.C. No. 110/53

Now, at this stage, we would like to add that **T.C. No.110/53** which is also operated by Sesa Resources Ltd. and of M/s. Sesa Goa Ltd.

1. Name of Original Concessionaire: Jose X. Cosme da Costa, of Curtorim (Date of grant of Original Concession is 16/10/1953). This mine is located at Village Pissurlem of Sattari Taluka.

2. Name of Lessee as per First Schedule: Jose Cosme da Costa of Curtorim.

3. As per record of the DMG, the lessees are Carminho de Costa son of Jose Xavier Cosme Costa of Mapusa and Cesar de Costa son of Jose Xavier Cosme Costa of Mapusa. Two brothers were carrying on business in the name and style of M/s. Cosme Costa & Sons.

4. The lease deed in Form K was executed between the partners of the firm and the Government of Goa on 26th June, 1990 and deed of renewal was also executed on 1st April, 2002. An application for renewal of mining lease in 'Form J' was submitted on 9th November, 2006.

5. Original concession was in favour of an individual. However, even as per the record of the Government M/s. Cosme Costa & Sons, a firm is in the control of the mine. Thus apparently this is a case of transfer,

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without prior permission from the Government.

6. The Environmental Clearance was prayed by M/s. Cosme Costa & Sons from MoEF and the same was granted on 26th March, 2009.

7. **Apart from the above facts, it is found that actual operation and control of the mine and mining operation is carried out by M/s. Sesa Resources Limited and of M/s. Sesa Goa Ltd.**

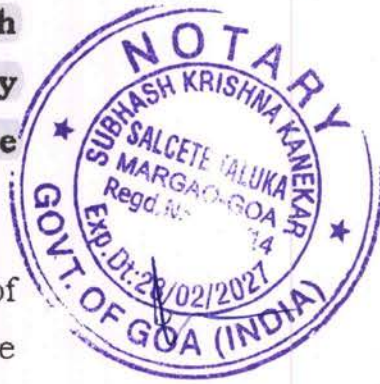
(a) For this purpose on record, there is one letter of Government of India (IBM dated 08/03/2006) reveals that IBM was aware about the fact that effective operation of lease area i.e. T.C. No. 110/53 is with M/s. Sesa Goa Ltd. The letter addressed to M/s. Cosme Costa & Sons was also sent to one Shri U.S. Tilve, Agent, C/o. Codli Mines of M/s. Sesa Goa Limited (**Raising Contractor**), P.O. Kirlapale, Dabal, Goa – 403 727.

(b) Next letter is dated 07/11/2007 written by Junior Mining Geologist from the office of IBM, Goa to Shri U.S. Tilve, Agent, C/o. Codli Mines of M/s. Sesa Goa Limited (**Raising Contractor**), Post office: Kirlapale, Dabal, Goa – 403 727 stating that Regional Controller of Mines, IBM would be visiting the iron ore mines situated in village – Sonshi and

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therefore your representative be sent at IBM office, Margao with **TMIS data sheet** and random inspection proforma. **This letter indicates that effective control was with M/s. Sesa Goa Limited and therefore they were asked to depute their representative to accompany IBM office.**



(c) Thereafter on 11/02/2008, Asst. Controller of Mines, IBM, Goa wrote again one letter to the same effect and a request was made to send a representative at the mine office at 10.00 AM. If original lessee was operating the mines there was no necessity to ask Mr. U.S. Tilve to send representative.

(d) On 30/03/2007, a letter was written by Director of Mines Safety Goa Region to the effect that contraventions mentioned therein were found and therefore explanation and compliance was sought. That letter is also addressed to that Agent (i.e. Mr. U.S. Tilve). This would also establish that the Agent Mr. U.S. Tilve of M/s. Sesa Goa Limited was in-charge of the mining operation.

(e) On 30/04/2007, Agent (i.e. Mr. U.S. Tilve) wrote a letter to Director of Mines Safety submitting explanation and compliance to the

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aforesaid letter.

(f) Thereafter on 02/07/2008, a letter was written by the Director of Mines Safety, Goa to Mr. U.S. Tilve as Agent / General Manager with regard to the violation and copy was forwarded to **M/s. Sesa Goa Limited, owners** Gaval – Sonshi (name of the village) Iron Ore Mines of M/s. Cosme Costa & Sons. This also establishes that M/s. Sesa Goa Limited was operating the mines.

This very person Mr. U.S. Tilve has been addressed as an Agent / General Manager of M/s. Cosme Costa & Sons in the letter dated 23/07/2009 written by Ministry of Labour & Employment, Goa Region.

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