MEGHALAYA CEMENTS LIMITED

CIN- U26942ML2003PLC007125

TOPCEM CEMENT
Mazbooti ka bharosa...hamesha

Ref: MCL/ENV/MoEF&CC/Compliance LS-I/2021-22/24 Date:-19/11/2021

To,

The Addl. Director General (Central),
Ministry of Environment Forest & Climate Change,
North Eastern Regional Office, Shillong,
Meghalaya.

STATE ENVIRONMENT IMPACT ASSESSMENT AUTHORITY
Receipt No.
24 NOV 2021
MEGHALAYA, SHILLONG

Sub: - Submission of half yearly compliance report for limestone mines for an area of 31.05 Ha for the period of **April '2021 to September'2021**.

Dear Sir,

We are hereby furnishing the half yearly compliance report (hard copy and soft copy) for the period from **April '2021 to September'2021** on Environmental Stipulations for limestone mining for an area of 31.05 Ha. at South Khliehjri at Village- Thangskai, East Jaintia Hills District, Meghalaya, vide your Environment Clearance letter no SEIAA/ (PR-19/2012) PT/PR-05/2015/444 dated: 9th Jan 2017.

This is for your kind information and perusal. You are requested to kindly acknowledge the receipt of the same.

Thanking You,

Yours Faithfully,

For **MEGHALAYA CEMENTS LIMITED**

(Authorized Signatory)

Encl: As stated above.

MEGHALAYA CEMENTS LTD. THANGSKAI

MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, REGIONAL OFFICE, SHILLONG

24/11/21

Copy to:

1) **The Member Secretary, Meghalaya State Pollution Control Board, Shillong.**
2) **The Member Secretary, State Environment Impact Assessment Authority, Shillong.**

Half yearly Compliance Report (for the period April'2021 to September'2021) on Environmental Stipulations for limestone mining for an area of 31.05 Ha, at South Khliehjeri, Thangskai Village, Khliehriat, East Jaintia Hills by M/s – Meghalaya Cements Ltd.,(MCL) – Environmental Clearance Letter No. SEIAA/ (PR-19/2012) PT/PR-05/2015/444; Dated 9th Jan 2017.		
Sl. No. as per letter dated 09.01.2017 of State Environment Impact Assessment Authority.		**Compliance Status**
A. SPECIFIC CONDITIONS		
(i)	The Project proponent (PP) shall obtain the requisite Wildlife Clearance from the National Board for Wildlife before operationlising the project.	**Complied With** The project area does not fall within the area of Eco Sensitive zone and the Project Proponent (PP) has obtained the requisite Wildlife Clearance from Divisional Forest Officer (Wildlife), Jaintia Hills, Wildlife Division, Jowai, (through office of APCC govt. of Meghalaya, Letter No. FWC/G/278/pt/928, Dated 6th June 2018) has already been submitted earlier.
(ii)	Mining activities shall be restricted to the 31.05Ha. Which is identified as the 'non – forest area' and shall not be extended to any other area.	**Agreed to Comply.** Mining activities is restricted to the 31.05Ha, which is identified as the 'non – forest area' and will not be extended to any other area at any condition.
(iii)	The revised mining plan is valid for 5 years only. After its expiry, The PP shall submit another mining plan duly approved by the authorized agency.	**Agreed to Comply.** The PP will submit review of mining plan duly approved by the authorized agency before the validity period of 5 years.
(iv)	The PP shall obtain Consent to Operate(CTO) from the State Pollution Control Board, Meghalaya, within 2 (two) months from the date of issue of the EC and copy of the same shall be forwarded to the SEIAA, Meghalaya and the MoEF&CC, Regional Office, Shillong. The PP shall effectively implement all the conditions stipulated therein in the CTO.	**Complied with.** The PP has obtained Consent to Operate (CTO) from the State Pollution Control Board, Meghalaya, vide CTO No. MPCB/CON-191-2016/2020-2021/6 dated 22nd March'2021 & it is valid upto 28th February 2022.
(v)	The Project Proponent should ensure that the mining activities shall not disturb the caves existing nearby the mining lease area.	No caves have been observed nearby the mining lease area.
(vi)	The PP shall ensure that a Biodiversity Conservation Plan with focus on conservation of the schedule –I species in the area, is prepared in consultation with the Forests and Environment Department, Meghalaya. The PP shall ensure adequate budgetary provisions and indicate a timeline for the implementation of the plan. The plan shall be submitted to the SEIAA and the NE regional office of the MoEF & CC, Shillong within a period of 1 year from the date of issue of EC.	**Complied with.** The company has started the work in co-ordination with Environment Department of North Eastern Hill University (NEHU), Shillong. The NEHU, officials have already appointed a Project fellow for the Project and he is now working at our site on Biodiversity Conservation Plan with focus on conservation of the schedule – I species in the area. The green house has already been developed and conservation of three flora species namely: *Fimbristylish nigrobrunnea, Cyperaceae, Begonia*

		rubrovenia, Begoniaceae and Ceologyne ovalis, Orchidceae has been initiated. The time line and budgetary provisions were described in the work order given to NEHU. Project report has been submitted earlier vide Letter No – MCL/Env/MOEF&CC/2021-22/05, Dated 19th May 2021.
(vii)	The Action Plan as spelt out in the EIA Report and on the issues raised during the Public Hearing dated 17/12/2014 shall be implemented by the PP with adequate budgetary provisions. The PP shall complete all the tasks within 1 (one) year and submit a Report to the SEIAA, Meghalaya, and the NE Regional Office, MoEF&CC.	**Agreed to Comply.** The PP has undertaken and completed all the tasks related to the issues raised during the Public Hearing accordingly and submit the report to the SEIAA, Meghalaya, and the NE Regional Office, MoEF&CC. **(Annex –i)**
(viii)	Proponent shall be appoints an Occupational Health Specialist for the medical examination of the workers engaged in the project. Occupational Health check-ups shall be undertaken once in six months for workers and necessary remedial / preventive measures shall be taken. The Recommendations of National Institute for ensuring a good occupational environment for mine workers shall be implemented. The prevention measures for burns, material, and provision of anti-snake venom including all other paramedical safeguards may be ensured before initiating the mining activities.	**Complied with.** Proponent has appointed an Occupational Health Specialist for the medical examination of the workers engaged in the project. Occupational Health check-ups schedule is being followed as per the guideline and necessary remedial/ preventive measures are taken. The Recommendations of National Institute for ensuring a good occupational environment for mine workers are implemented. All other paramedical safeguards are already provided to the workers for mining activities. **(Annex –ii)**
(ix)	The mining operations shall be restricted to above ground water table and it should not intersect groundwater table. In case of working below ground water table, prior approval of the Ministry of Environment, Forest and Climate Change and Central Ground Water Authority shall be obtained, for which a detailed hydro-geological study shall be carried out; The Report on six monthly basis on changes in Groundwater level and quality shall be submitted to the SEIAA, Meghalaya and the Regional Office of the Ministry.	**Agreed to Comply.** The mining operations are strictly restricted to above ground water table, till now no ground water is observed during mining operation. Necessary approval from central ground water authority (CGWA) will be obtained if work below the ground water table. No ground water is being used by project proponent for mining and other activities. A detailed hydro-geological study has been carried out by Centre for Ground water Studies (Kolkata). Report is attached herewith **(Annex-iii)**
(x)	The Pollution due to transportation shall be effectively controlled. Vehicles with Meghalaya Pollution Control Board pollution clearance certificate only shall be allowed to ply. The mineral transportation shall be carried out through covered trucks only and the vehicles carrying the mineral shall not be overloaded.	**Complied with.** Pollution due to transportation is being effectively controlled by proper maintenance of haul roads. PUC certified vehicles are being used by PP. The mineral transportation is carried out through covered trucks only and the vehicles carrying the mineral not allowed being overloaded. **(Annex –iv)**

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(xi)	The PP shall put in place proper rainwater harvesting measures at the site and shall also undertake conservation measures to augment groundwater resources in the area in consultation with the Central Ground water Board.	**Complied with.** Rainwater recharge measures are already being practiced at the site and will also undertake conservation measures to augment groundwater resources in the area.
(xii)	The Project Proponent shall adopt Best mining Practices for the giving mining conditions. In the mining area adequate number of check dams, retaining walls / structures, garland drains and settling ponds should be provided to arrest the wash-off with rain water in catchment area.	**Complied with.** Best mining practices are being adopted by the Project Proponent for the giving mining conditions. In the mining area adequate number of check dams, retaining walls / structures, garland drains and settling ponds are provided to arrest the wash-off with rain water in catchment area.
(xiii)	Use of effective sprinkler system to suppress fugitive dust on hauls roads and other transport roads shall be ensured, and cleaning of transport vehicles shall not be done outside the project area. Main haulage roads and other roads should be regularly wetted using water tankers fitted with sprinklers. Crusher and material transfer points should invariable be provided with Bag filters and or dry fogging system. Belt-conveyors should be fully covered to avoid air borne dust.	**Being compiled with** Mitigation measures to control dust emission including provision of water sprinkling, bag filters, are in place on crushing operations done, belt-conveyors are covered to avoid air borne dust. Regular water sprinkling through using water tanker filled with sprinklers is being practiced to suppress fugitive dust on Main haulage roads and other roads.
(xiv)	The project Proponent shall ensure that no natural water course and / or water resources shall be obstructed due to any mining operations. The Water Table should be nurtured so as not to go down below the pre-mining period. In case of water scarcity in the area, the Project Proponent shall not use local water for the project and also shall assist in arranging water to the villagers for their use.	**Agreed to comply.** The project Proponent ensures that no natural water course and / or water resources will be obstructed due to any mining operations. In case of water scarcity in the area, the Project Proponent will not use local water for the project also will arrange water to the villagers for their use.
(xv)	The PP shall ensure that the lights and sounds at night at the project site do not disturb the villages and the also animals. The PP shall must ensure that the biological clock of the village(r)s is not disturbed; by orienting the floodlights / masks away from the villagers and keeping the noise levels well within the prescribed limits for day light / night hours.	**Being compiled with** The PP is operating the mine in daylight hours only and maintaining the noise levels within the prescribed limits.
(xvi)	The PP shall not transport the minerals by road through the village, without their consent. A 'bypass' road shall preferable be constructed for the purpose of transportation of the minerals so that the impact of sounds, dust and accidents could be mitigated. The PP shall bear the cost towards the widening and strengthening of existing public road network in case the same is proposed to be used for the project.	**Agreed to comply.** Mineral is being transported by our own haul road without using any public/village road.

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(xvii)	Necessary permission as per Acts & Rules shall be obtained from the Competent Authorities for Storage and use of explosives and detonators. The instructions and Rules specified therein shall be strictly adhering to.	**Complied with.** Necessary permission as per Acts & Rules has already been obtained from the Competent Authorities for Storage and use of explosives and detonators. (Letter No A/EC/MG/P3/5(271) The instructions and Rules specified therein is being strictly adhering to. **(Annex –v)**
(xviii)	As per the Companies Act, 2013 and the CSR Rules, 2% of average net profit of last three years shall be made available by the PP for the socio economic development of the neighborhood habitats. This shall be properly planned by the PP with the help of expert institutes and implemented through registered Agency as per the CSR Rules. Compliance report shall be submitted to the SEIAA, Meghalaya, the NE Regional Office of the MoEF & CC, and Shillong on a six monthly basis.	**Agreed to comply.** 2% of average net profit of last three years is being made available by the PP for the socio economic development of the neighborhood habitats. Compliance report will be submitted to the SEIAA, Meghalaya, the NE Regional Office of the MoEF & CC, and Shillong on a six monthly basis. Meghalaya Cements Limited has already engaged socio economic development of the neighborhood habitant. **(Annex –vi)**
(xix)	A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment, Forest and Climate Change 5 years in advance of final mine closure for approval, with a copy to Mining & Geology Department, Meghalaya and the SEIAA, Meghalaya.	**Agreed to comply.** Final Mine Closure Plan with Corpus Fund as approved by IBM shall be submitted to MoEF& CC 5 years in advance of final mine closure for approval.

B. GENERAL CONDITIONS

(i)	No change in mining technology and scope of working shall be made without prior approval of the SEIAA, Meghalaya. No deviation shall be made in the calendar plan including excavation, quantum of mineral and waste.	**Agreed to comply.** Mining is being done as per mining plan approved by Indian Bureau of Mines. There will be no change in technology and scope of work without prior approval of MoEF & CC.
(i)-a	The Project Proponent shall not violate applicable provisions of any Acts, Rules Orders of the Government and judicial orders issued by the Hon'ble Supreme Court/High Courts/NGT, applicable to the project.	**Agreed to comply.** The Project Proponent is implementing all applicable provisions of any Acts, Rules Orders of the Government and judicial orders issued by the Hon'ble Supreme Court/High Courts/NGT, applicable to the project.
(ii)	Mining shall be carried out as per the provisions outlined in mining plan approved by Indian Bureau of mines (IBM) as well as by abiding to the guidelines of Directorate General Mines Safety (DGMS).	**Agreed to comply.** Mining is carried out as per the provisions outlined in mining plan approved by Indian Bureau of mines (IBM) as well as by abiding to the guidelines of Directorate General Mines Safety (DGMS).
(iii)	Sufficient number of Gullies / drainage channels shall be provided for better management of water. Regular Monitoring of pH shall be included in the monitoring plan and report shall be submitted to the NE Regional Office, MoEF & CC, Shillong	Sufficient numbers of Gullies / drainage channels are provided for better management of water. Regular Monitoring of pH is being done and reports are submitted to the NE Regional Office, MoEF & CC, Shillong and Meghalaya State

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	and Meghalaya State Pollution Control Board (MSPCB) on six monthly basis.	Pollution Control Board (MSPCB) on six monthly basis. **(Annex –vii)**
(iv)	Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution and having high levels of PM10 and PM2.5 such as haul road, loading and unloading point and transfer points. Fugitive dust emissions from all the sources shall be controlled regularly. It shall be ensured that the Ambient air parameters conform to the norms prescribed by the Central Pollution Control Board in this regard. Monitoring of Ambient Air Quality to be carried and record should be maintained.	**Complied with.** Water sprinkling is provided through water sprinkler on haul roads, loading /unloading points and transfer points and records are maintained and submitted to the State Pollution Control Board. **(Annex –viii)**
(v)	The limestone shall be preferably transported by covered conveyor belts to the cement plants which shall be set up by the PP. The vehicles carrying the mineral shall not be overloaded. Vehicular emissions shall be kept under control and regular monitored.	**Being complied with** All the HEMM (Heavy Earth Moving Machinery) are being serviced as per periodical as well as routine maintenance. The results are remained well within the prescribed limit. Smoke density emission testing analyzed by MSPCB for each HEMM and has been included in the compliance report.
(vi)	The top soil, if any, shall temporarily be stored at earmarked site (s) only and shall be used for land reclamation and plantation at the earliest. The over burden (OB) generated during the mining operations shall be stacked at earmarked dump site (s) only and it should not be kept active for a long period of time. The maximum height of the dumps shall not exceed 8m and width 20m and overall slope of the dumps shall be maintained to 45°. The OB dumps shall be scientifically vegetated with suitable native species to prevent erosion and surface run off. In critical areas, use of geo textiles shall be undertaken for stabilization of the dump. During closure of the time the over circumstances the PP shall bring top soil from other areas to fill the pit. In the partially filled pit, the maintenance of terraces should be strictly followed to allow soil to stabilize on the terraces. It is preferable that the orchard is raised by the PP on the reclaimed. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Status shall be reflected in the six monthly compliance reports.	**Complied with.** Top soil is being stored at earmarked site as per the mining plan approved by the Indian Bureau of Mines and is utilizing in greenbelt development. The soil and over burden (OB) generated during the mining operation is being stacked at designated dump site as per the approved mining plan. The height, width and angle of repose of dumps are maintaining as per the condition stipulated in the environmental clearance. OB dumps will be vegetated with native species.
(vii)	Catch drains and siltation ponds of appropriate size shall be constructed around the mine working, mineral and OB dumps to prevent run off or water and flow of sediments directly into the river and	**Complied with.** Catch drain and siltation ponds has been constructed to prevent the run-off water and flow of sediments. Water collected in mine pits is being

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	other water bodies. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains shall be regularly desilted and maintained properly. The sump capacity shall be designated keeping 50% safety margin over and above peak sudden rainfall (based on 50 years data) and maximum discharge in the area adjoining the mine site, and it shall allow adequate retention period for proper settling of silt material.	used for dust suppression and green belt development. Sedimentation tank are constructed to ensure that proper retention period for settling of silt.
(viii)	Plantation shall be raised in a 7.5 m wide green belt in the safety zone around the mining lease, backfilled and reclaimed area, around water body, along the roads etc. by planting native species, following the CPCB guidelines for green belt plantation and in consultation with the DFO (Social Forestry). Greenbelt shall be developed all along the mine lease in a phased manner and shall be completed within first five years.	**Being compiled with.** Project Proponent has also being carrying out plantation by maintaining a green belt of 7.5m safety zone around the mining lease, backfilled and reclaimed area, around water body, along the roads etc by planting native species, following the CPCB guidelines. Greenbelt is being developed all along the mine lease in a phased manner and will be completed within first five years. **(Annex –ix)**
(ix)	Regular monitoring of water quality, both upstream and downstream of water bodies shall be carried out; records / data shall be maintained and submitted to the NE Regional Office, MoEF&CC, Shillong and MSPCB.	**Complied with.** Monitoring of water quality both upstream and downstream are being maintained and records are submitted to the NE Regional Office, MoEF&CC, Shillong and MSPCB. **(Annex –vii)**
(x)	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease by stabling 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 may be sent regularly to the Regional Office, MoEF&CC, Shillong, and MSPCB.	Ground water is not being utilized by the Project Proponent for any activities. And also there is no availability of ground water source like Common well, Deep Tube well etc. in and around mining lease area. So, Ground water monitoring is not applicable for this area.
(xi)	The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered flora and fauna in the project area.	**Agreed to comply.** The PP has taken all precautionary measures during mining operation for conservation and protection of endangered flora and fauna in the project area.
(xii)	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc.	No Contract labours are employed in the mines.
(xiii)	Critical parameters such as $PM_{2.5}$, No_x, So_x, in the ambient air within the impact zone, peak particle velocity at 300m distance or within the nearest	**Noted for compliance.** During operation phase, periodically the critical parameter is being monitored.

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	habitation, whichever is closer shall be monitored periodically as per MoEF's notification in 2009.Further, quality of discharged water shall also be monitored (TDS, DO, pH and Total suspended Solids-TSS). The data shall be uploaded on the website of the company and also prominently displayed at the project site. The circular No-J20012/1/2006-IA-II(M) dated 27.05.2009 issued by the MoEF&CC, which is available on the website of the Ministry www.envfor.nic.in shall also be referred to in this regard for its compliance.	The monitoring data is being uploaded on the company website and displaying at the main gate of the project. **(Annex –vii) & (Annex –viii)**
(xiv)	Industrial waste water (workshop and waste water from the mine) shall be properly collected, treated so as to conform to the standard prescribed under GSR 422 (E) dated 19th May, 1993 and 31st December, 1993 or as amended from time to time. Oil and grease trap shall be installed before discharge of effluents.	**Agreed to comply.** Effluent Treatment Plant has already been installed at HEMM workshop. Workshop waste water is being reuse after treatment and oil sludge are being properly collected and utilize as alternative fuel.
(xv)	Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects.	**Complied with.** PPEs are being provided to all workers. Safety and health training are given to them regularly.
(xvi)	A separate environmental management cell with suitable qualified personnel shall be set-up. The PP shall put in place an administrative mechanism to deal with environmental issues, to ensure compliance to the EC conditions and to implement the EMP, biodiversity action plan, etc. The PP shall inform the details along with the name of such responsible officials, to the SEIAA, MSPCB and the Regional Office of the MoEF & CC, Shillong. In case of any change in respect of the officials responsible, the same shall be intimated by the PP.	**Complied with.** A separate environmental management cell with suitable qualified personnel is already set up and they are reporting directly to the Head of the Plant. The environmental Cell is prepared with the guidance of Indian Bureau of Mines (IBM) and the cell is looking after all the compliances of EC conditions, CTO conditions of MSPCB and sustainable development of mining activities and also responsible for the said works.
(xvii)	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purposes. Year wise expenditure shall be reported to the SEIAA, Meghalaya and the Regional Office, MoEF&CC, Shillong.	**Agreed to comply.** The funds earmarked for environment protection measure are kept in the separate account. Year wise expenditure is being reported to SEIAA, Meghalaya and Regional Office, MoEF & CC, Shillong. Detailed expenditures for the year 2020-21 is being attached as **(Annex –x)**
(xviii)	Environment Statement for each financial year ending 31st March in Form – V as mandated shall be submitted to MPSCB with copy of the same to SEIAA, Meghalaya and Regional Office, MoEF&CC, Shillong	**Agreed to comply.** MEGHALAYA CEMENT THANGSKAI

(xix)	The Project Proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Regional Office, MoEF&CC, Shillong, Central Pollution Control and State Pollution Control Board. The certified copy of the same shall be forwarded to the SEIAA and SEAC, Meghalaya.	**Agreed to Comply.**
(xx)	A copy of clearance letter shall be marked to concerned local bodies / NGOs, if any, from whom suggestion / representation has been received while processing the proposal.	**Complied With.**
(xxi)	The project authorities shall advertise at least in two local newspapers widely circulated, one of which shall in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance. A copy of the clearance letter shall be made available on the website of the PP.	**Complied With.**
(xxii)	Official from the Regional Office of MoEF & CC, Shillong, MSPCB or any authorized officials, who would be monitoring the implementation of the conditions mentioned herein, shall be given full cooperation, facilities and documents / data by the PP during their inspection.	**Agreed for compliance.** Full co-operation are given to the official from Regional Office of the MoEF& CC, Shillong, MSPCB by furnishing the documents / data / information / monitoring reports during their inspection.
(xxiii)	The Project Proponent shall not violate applicable provisions of any Acts, Rules, Orders of the Government and judicial orders issued by the Hon'ble Supreme Court / High Courts/ NGT, applicable to the project.	**Agreed for compliance.** The PP do not violate applicable provisions of any Acts, Rules, Orders of the Government and judicial orders issued by the Hon'ble Supreme Court / High Courts/ NGT, applicable to the project.
(xxi)	The SEIAA reserves the right to add or delete any conditions or safeguarding measures found necessary, and to take action including revoking the clearance granted, if conditions stipulated are not implemented by the PP or in case of submission of false document / wrong declaration.	**Noted.** **Agreed to compile with.**
(xxv)	Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green tribunal Act, 2010.	**Noted.**

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Details of Action Plan for the issues raised during the Public Hearing by the stakeholders of the Elaka Narpuh for 31.05 ha Limestone mines area (as per EIA) and agree to comply.

Annex-I

Sl.No.	Issues	Action Plan	Status / Compliance
1.	During the Public Hearing concern was raised by the stakeholders that as per the environmental conditions granted to Meghalaya Cements Limited for 31.05 ha. limestone mines that the company should allocates about 40 lakh as a capital cost & 25 lakh as annual recurring cost will be kept for the various CSR activities like Health facilities (Ambulance), Education (Development School), Welfare of youth and community development.	M/s Meghalaya Cements Limited will allocate about 40 lakh as a capital cost & 25 lakh as annual recurring cost will be kept for the various CSR activities like Health facilities (Ambulance), Education (development School), welfare of youth and community development.	The detail CSR activities for financial year 2018-2019 have attached. (Annexure –II) Attached herewith as CSR detail - (Annexure –IV)
2.	Local residents have demand from the company to provide the cement at cheap rate.	The company will provide cement at cheap price to local residents.	The detail of cement distribution has attached. (Annexure –II)
3.	The local residents has raised the concern and requested the officials of M/s Meghalaya Cements Limited to take appropriate mitigative measures to avoid pollution to the neighboring village due to mining activities.	M/s Meghalaya Cements Limited has taken appropriate mitigative measures to avoid pollution to the neighboring village due to mining activities.	The detail of action plan has attached (Annexure –II (a))
4.	The local residents has raised the concern and demanded that M/s Meghalaya Cements Limited should generate 60% employment for local people also the Meghalaya Cements Limited should not emit any air pollution from its plant and should not discharge any waste into rivers bodies.	M/s Meghalaya Cements Limited will provide 60% employment to local people also will not emit any air pollution from plant and should not discharge any waste into rivers bodies.	Detailed employment record for mines has attached. The employment given in the mines is controlled by the department mining of our company and the list of employee working under the mining department is already submitted. Detail action plan to mitigate air and water pollution has attached. Annexure –II (a).

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Annex-I

ACTION PLAN FOR MITIGATION OF ENVIRONMENTAL POLLUTION

Annex-II – (a)

Sl.No.	Environmental Impact	Action Plan	Status / Compliance	Cost	
				Capital cost	Recurring Cost
1.	Water pollution due to surface run-off from mines area.	a) M/s Meghalaya Cements Limited will construct check dam to avoid water contamination of local water body due to carry over sedimentation from mines area due mining activities.	The company have constructed check dam of length about 160 m at the upstream to control the runoff water to the mines and another two check dams is constructed below the waste dam and soil dam having length of about 580 m and 530 m (the last one is in progress) at the downstream.	Check dam construction – Rs 2.1 Lacs	Cleaning – once in a year – Rs 0.25
		b) M/s Meghalaya Cements Limited will construct garland drain on both side of the haul road and around the soil dump and OB dump to avoid mixing of sediments from mines area to surface run –off.	To avoid mixing of sediments from mines area to surface run –off the company have constructed garland drain of about 1125 m long on both side of the haul roads and dumping yards.	Garland Drain construction – Rs 2.8 lacs	Cleaning – once in a year – Rs 0.25 Lacs
2.(a)	Air pollution due to generation of fugitive dust.	a) M/s Meghalaya Cements Limited will take necessary measures to avoid generation of fugitive dust due to movement of vehicles by providing water sprinkler on haul road for dust suppression.	Water sprinkling is being carried out regularly at the loading point and unloading points, haul roads regularly to suppress the fugitive dust.	i) Water Tanker – Rs 12.0 Lacs	i) Maintenance Cost- 0.4 Lacs ii) Driver Salary – Rs- 4.08 Lacs ii) Diesel & Lubricants- Rs- 2.0 lacs

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Annex-1

(b)		b) Plantation of native species to minimize the generation of air born dust due to moment of vehicles.	The afforestation is being carried out as per the approved mining plan and EIA and EMP. A total of 2324 nos. saplings of local species have been planted as on September, 2019 with survival rate of about 77.41%.	Area preparation , Sapling cost, Fertilizer and Fencing – Rs 2.75 lacs	Watch & ward – Rs- 3.25 Lacs
(c) & (d)	Air pollution due to dust generation during mining operation.	c) M/s Meghalaya Cements Limited will use wet drilling system to avoid fugitive emission due to drilling process.	The Meghalaya Cements Limited is using wet drilling from the inception of mining activities and the drilling machines are well equipped with the process.	i) Installation of Wet drilling system to ROC – Rs 0.7 Lacs. ii) Purchase of Real-time Air Sampler – Rs 4.2 Lacs.	
		d) Construction of metallic Haul Road to minimize fugitive dust generation	Metallic haul road has been prepared to transport/carryout limestone as well as Overburden.	Construction Cost – Rs 7.2 Lacs	Maintenance Cost – Rs 3.5 Lacs.
3.	Modification of exhaust system of mining machineries.	M/s Meghalaya Cements Limited will upgrade the exhaust of drilling and excavation machine to mitigate exhaust emission from the machines.	Continuously and periodically we are monitoring the emission of CO_2 gases and we are taking necessary initiatives as and when required.	i) Flue Gas Analyzer Cost- Rs 2.15 Lacs	i) Spare & maintenance – Rs 0.1 Lacs
4.	Vibration due to use of traditional explosives.	M/s Meghalaya Cements Limited will use advance explosive (NONEL) to minimize the vibration generated during the explosion activity.	i) The Meghalaya Cements Limited is using NONEL/ (bottom initiations system) resulting least vibration.	i) Purchase of Minimate to measure ground vibration – Rs 2.47 Lacs/-	i) Cost of Nonel – Rs 4.7 Lacs
5.	Maintenance of Soil Dump, OB Dump and Haul road.	Compaction of dumps and Haul roads to maintain the Stability.	JCB Compactor is used to maintain the stability of dumps and haul roads.	i) JCB Compactor – Rs 12.0 Laks	i) Maintenance Cost- 1.5 /- Lacs ii) Driver Salary – Rs- 2. 2 Lacs ii) Diesel & Lubricants- Rs- 0.8 lacs

MEGHALAYA CEMENT LTD THANGSKAI

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Annex- II

M/s Meghalaya Cements Ltd
Vill- Thangskai, P.O- Lumshnong, East Jaintia Hills
Meghalaya - 793210.

List of Occupational Health check-ups of Manpowers working in the South Khliehjari Limestone Mine (31.05 ha)
From 1st April'2021 to 30th September'2021

SL No	Name of Employee	Designation	Check-up Date	Remrks
1	Umesh Kumar	Manager	20.04.2021	
2	Abdul Motin Barbhuiya	Geologist	20.04.2021	
3	Manish Singh Karki	Asstt. Manager	20.04.2021	
4	Uday Kumar Jha	Foreman	20.04.2021	
5	Hansraj Pal	Blaster	20.04.2021	
6	Ashok Kumar	Foreman	20.04.2021	
7	Sanjay Kumar Singh	Mining Mate	20.04.2021	
8	Rakesh Kumar Sharma	Mining Mate	20.04.2021	
9	Sitaram Chetri	Dumper Opt	20.04.2021	
10	Hemanta Borah	Drill Opt	20.04.2021	
11	Nabajit Nath	Supervisor	20.04.2021	
12	Balaram Roy	Surveyor	06.05.2021	
13	Samuel Rymbai	Dumper Opt	06.05.2021	
28	Sudarsan Dasgupta	Foreman	06.05.2021	
14	Pyniohlad Dkhar	Dumper Opt	06.05.2021	
15	Noril Shylla	Dumper Opt	06.05.2021	
16	Upendra Prassad	Drill Opt	06.05.2021	
17	Binay Sinha	Excavator Opt	06.05.2021	
18	Ganesh Chandra Mahto	Excavator Opt	06.05.2021	
19	Prosper Rymbai	Dumper Opt	06.05.2021	
29	Vakil Pandit	Mining Mate	06.05.2021	
20	Deibormi Lapasam	Dumper Opt	24.06.2021	
21	Oniton Pajat	Dumper Opt	24.06.2021	
22	Amar Kalita (Dkhar)	Dumper Opt	24.06.2021	
23	Pankaj Kumar	Mechanical Engineer	24.06.2021	
24	Bikky Kumar	Supervisor	24.06.2021	
25	Chandra Mohan Jha	Supervisor	24.06.2021	
26	Mintu Malakar	Supervisor	24.06.2021	
27	Abhay Kumar	Helper	24.06.2021	
30	Ajay Kr Thakur	Blaster	24.06.2021	
31	B.P. Nongrum	Helper	24.06.2021	
32	N.I. Laskar	Diesel Mechanic	13.07.2021	
33	Arun Kr Swargiary	Drill Opt	13.07.2021	
34	Sunil Kr Singh	Dumper Opt	13.07.2021	
35	Joy Gobind Bhuiyan	Dumper Opt	13.07.2021	
36	Evenungson Swer	Dumper Opt	13.07.2021	
37	Talky Suting	Dumper Opt	13.07.2021	
38	Jitendra Kr Singh	Excavator Opt	13.07.2021	
39	Nanhe Kr Singh	Helper	13.07.2021	
40	Arun Sinha	Auto Electrcian	13.07.2021	
41	Ram Kalesh Pal	Helper	13.07.2021	

Dr. N. Ranjit Singh
Medical Officer
Meghalaya Cements Ltd.

Medical Officer
Meghalaya Cements Ltd

Umesh Kumar
Manager
South Khliehjari Limestone Mines
Mines Manager
South Khliehjari Limestone Mines
M/s Meghalaya Cements Ltd
Thangskai, Lumshnong
East Jaintia Hills
Meghalaya – 793210

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REPORT ON HYGROGEOLOGICAL STUDY IN AND AROUND MEGHALAYA CEMENTS LIMITED, EAST JAINTIA HILLS DISTRICT, MEGHALAYA

Submitted to:

MEGHALAYA CEMENTS LIMITED

Centre for Ground Water Studies

54/B/2 Jadavpur Central Road,

Kolkata 700032

Phone No.: 033 2412 0142

E-mail: cgws@rediffmail.com

August, 2021

MEGHALAYA CEMENTS LTD THANGSKAI

Annex- III

REPORT ON HYGROGEOLOGICAL STUDY IN AND AROUND MEGHALAYA CEMENTS LIMITED, EAST JAINTIA HILLS DISTRICT, MEGHALAYA

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E-mail: cgws@rediffmail.com

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ACKNOWLEDGEMENT

The team of consultants from Centre for Groundwater Studies (CGWS) conducted the hydrogeological survey in and around Meghalaya Cements Limited (MCL) , duly acknowledge the cooperation including all logistic support and technical inputs during the survey, from the team of Senior Management & Senior officers of MCL namely Vice President (Projects), DGM (Purchase), Vice President (P&M), G M (Mines), Asst. Manager (Geology& Planning), Sr. Engineer (ISO & Environment) & Asst. Engineer (Geology & Planning).

MEGHALAYA CEMENT LTD
THANGSKAI

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EXECUTIVE SUMMARY

The Meghalaya Cement Limited (Topcem), through its order no 4700018838, dated 23.03.2021, assigned a scientific study on Hydrogeological Survey and Investigation in and around the Limestone mining area of the company (MCL) to Centre for Ground Water Studies,(CGWS), Kolkata. The mining area is located in Thangskai village near village Lumshnong in Khliehriat block of East Jayantia Hill district of the state of Meghalaya. The scope of work in the study, envisaged to take into account all the major components of Hydrology and Hydrogeology in terms of Geomorphological studies (geomorphic features such as landforms etc) movement of surface water, natural surface gradient. The work also includes Geological studies (presence of fractures), Hydrogeological studies (ground water occurrence its potential both in terms of quantity and quality) .

A study report based on the findings of the investigations is required to be prepared and submitted to MCL. Field visit to the study area could not be taken up after receiving the work order due to surge in covid-19 cases all over the country including Meghalaya, Assam and West Bengal during the period April'21 to June'21, however citing literature and collection of secondary data was in progress till the last week of June 2021. Field study was taken up during the period 5.7.2021 to 9.7.2021.

The Study Area of the present work comprises the Thangaskai village in Khliehriat block under East Jayantia Hill district of the state of Meghalaya with limestone mining lease area of 31.05 Ha and the adjoining cement workshop area as the core and a buffer area which is within 10 km radius in the vicinity of the mining area.

The objective of the study is to prepare a comprehensive hydrogeological report containing technical details on groundwater condition prevailing in the study area in terms of depth to groundwater level below the mining lease hold area and to assess the quality of groundwater in the buffer zone area so as to ascertain any adverse impact of mining on quality of groundwater.

Daily requirement of water for different uses ie. domestic purpose, cement plant, industrial cooling, CPP, plantation and dust suppression in the mine area is about **1355 m^3/day.**

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The scope of work covers geological, geomorphological, hydrological and hydrogeological investigations in the study area. Hydrological and hydrogeological studies include collection of rainfall data from IMD (Indian Meteorological Department) and analyses of rainfall data received, inventory of depth to groundwater levels. Collection of water samples from different sources, their chemical analysis in a recognized laboratory provides qualitative assessment of ground water.

The methodology of study can broadly be divided into three parts. The first part involves investigation of study area at field level with generation of both primary and collection of secondary data from the technical personnel of MCL. The other part involves collection of reliable secondary data from the institutions of repute engaged in specialized work in that discipline.

Geomorphologically, the area is an undulating one comprising dissected plateau, denudational (remnant after erosion in the geologic past) high and low hills with deep gorges. Undulating topography, dissected by numerous rivers and streams is the characteristic feature of the study and its adjoining area. This feature favours surface run-off and and does not allow water received from rainfall to get infiltrated into the underlying aquifer, if any. The drainage pattern of dendritic, rectangular and at places parallel to sub-parallel types are found in the area which indicates mainly structural control with topography playing a minor role. It is being controlled by joints and faults as indicated by the straight courses of the rivers and streams with deep gorges.

The climate of any region is governed by the two parameters ie, temperature and rainfall. On analyses, it is found that the month of January is the coldest month, when temperature goes down to about 9^0C. The maximum temperature of the year, is experienced in the months of May to August when temperature revolves around 30^0C. The area is influenced by the south-west monsoon and rainfall is assured during summer. The average rainfall is of the order of 6683.18 mm per annum. Rainfal data recorded by the Indian Meteorological Department (IMD) has been taken into account for computation and analyses. The area receives a fairly high rainfall throughout the year. Most of the precipitation occurs between June to September due to south-west monsoon originating from the Arabian sea. The months of April and May also receive a fair amount of rainfall of the order of 500 mm to 800 mm, if it is compared with the

MEGHALAYA CEMENT LTD. THANGSKAI

rainfall of the same period in rest of India- although it constitutes only 20% of the total annual rainfall in the region. This orographic rain during the non-monsoon period, results from clouds originating in the Bay of Bengal that drifts towards the Bangladesh plains after hitting the Jaintia hills and rapidly rise to the upper atmosphere, where they swiftly cool down and result in heavy precipitation. This implies that rainfall is well distributed throughout the year and non- monsoon months also contribute to the annual rainfall in the area. July is the wettest month, when rainfall down pouring on the area is as high as 1500 to 2000mm, which can be compared with the annual rainfall of some of the high rainfall eastern states of India.

The district area falls mainly within the Shillong or Meghalaya Plateau which is constituted mainly of Precambrian rocks of gneissic composition in which granites, schists, amphibolits, calc-silicate rocks occur as inclusions of various dimensions. The gneisses form the Basement Complex for the overlying Shillong Group of rocks (Tertiary sediments) and is separated from the later by an unconformity indicated at places by the occurrence of a conglomerate bed.

These occur mostly as thick layers. Grainite Plutons occur as isolated patches in the district , intruding the Basement Gneissic complex and Shillong Group of rocks. The Granites occur as intrusive body in the Basement Gneissic complex. Both Porphyritic and fine-grained pink granite occur in the area.

The Shella Formation of Jaintia Group consists of alteration of sandstone and limestone occurs in the south-central and south-western part of the district. The different lithounits of the area belong to Jaintia series of Eocene age. The limestone unit belongs to Sylhet stage Shella Formation of Jaintia series of middle Eocene age. Three bands of limestone occur in the area which are Known as Prang, Umlatdoh and Lakadong limestone bands. These are separated by Narpuh sandstone and Lakadong sandstone. The topmost limestone band i.e. Prang limestone occurs further south of the study area.

In hydrogeological study, lithological logs of the selective borehole were studied and it was found that the overburden consisting of Narpuh sandstone with loose soil and limestone boulder ranges in thickness from 7.80 to 16 m , Umlatodh limestone 21 to 33m, Lakdong sandstone 4.80 m and Lakadong limestone 4.60 to 5.90 m. In almost all the boreholes there is an alternate layer of Sandstone & Limestone. **It has been further reported by MCL that no**

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water bearing fracture zones were encountered in any of the core bore holes drilled in the mining lease area down to the reduced level depth of 668 mamsl. During the course of hydrogeological survey in the study area field traverse in the core area & in the buffer zone area of 10 Km radius was taken. Three bore wells were found in operation, the reported depth of the bore wells ranges from 80 m to 130 m below respective reduced levels and yield of one such bore well was measured and recorded as 1.5 (IOCL Petrol pump, 483 mamsl). Field level hydrogeological study also indicates that ground water level is at a depth far below the reduced level of the present lowest bench of the mining activity except for a few locations where cavity within the limestone might have been encountered which reflects an anomaly from the general ground water level scenario in the area. The findings at the ground level matches with the recorded borehole logs which indicate that no water bearing zone was encountered during the core drilling of approximately of 20 core boreholes. It is therefore expected that water bearing fractures are much below the present lowest bench of mining.

The water samples from one surface water resource, five groundwater structures and rainwater were collected during field survey to study the water quality as well as hydro-geochemistry of water in the area. The samples were subjected for analysis for both major and minor parameters viz. pH, Total dissolved solids, Conductivity, Sodium, Calcium, Potassium, Manganese, Chloride, Sulphate, Carbonate, Bicarbonate, Iron, Total Hardness and Total Alkalinity. In order to study the chemical quality, ground water samples were also analyzed for Arsenic. the pH of ground water samples at all the sampling points was found to be slightly alkaline ranges from 6.69 to 8.16, except spring water collected at Lumshnong. The alkaline pH of water samples near limestone mining and cement manufacturing sites found in present study may be due to the weathering of calcium carbonate rocks and minerals present in limestone of this area. All other parameters of water quality analyses are well within the permissible limit of drinking water limits of BIS (Bureau of Indian Standard) including Arsenic and Calcium. Slightly higher pH is not harmful. Rock-water interaction behavior is important to evaluate the weathering, ion exchange process, and dissolved constituent that consequences in the groundwater quality. Gibbs diagram that is widely used to recognize the functional sources of the dissolved chemical element of the water and the effect of hydrogeochemical processes,

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such as precipitation dominance, evaporation dominance, and rock–water interaction dominance, was applied to ascertain the origin of water samples collected. In the present study the Gibbs diagram based on TDS and the concentration of cations and anions, shows that most of the cations and anions in groundwater of deeper aquifer have a rock-dominance and spring water (Shallow aquifer) have a Precipitation dominance origin.

The information collected from MCL, reveals that the general orientation of the pits is in NE-SW direction and the existing working pits are located in the central, south eastern part & SW boundary of the lease area. The lowest level of the existing mine pit is 668 mamsl (RL). From the results of the boreholes & surface exposures it was established that entire lease area is limestone bearing and depth wise extension was proved down to 643.20 mamsl (RL). The reduced level for the lowest bench for the present Mining Plan shall be 661.2 mamsl (RL).

Since aquifers (water bearing layer) in this undulating topography with hard sedimentary rocks beneath the ground surface, are localized in nature and cannot be extended regionally. However, considering the hydrogeological set up of the area, it can be inferred that the groundwater level, is well below the present lowest mining level of 668 mamsl. Groundwater is not likely to be encountered, within the present Mining Plan of 661.2 mamsl (RL).

Construction of a monitoring well is recommended which will establish the inference drawn about the depth of groundwater level in the mining lease hold area. This monitoring well can be used for recording both depth to water level and water quality analyses results, periodically and the data generated can be placed before the regulating agencies like Indian Bureau Of Mines, Central Pollution Control Board and Central Ground Water Authority.

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CHAPTER I

INTRODUCTION

The Meghalaya Cement Limited (Topcem), through its order no 4700018838, dated 23.03.2021, assigned a scientific study on Hydrological Survey and Investigation in and around the Limestone mining area of the company (MCL) to Centre for Ground Water Studies (CGWS), Kolkata. The mining area is located in Thangskai village near village Lumshnong in Khliehriat block of East Jayantia Hills district of the state of Meghalaya. The scope of work in the study, envisaged to take into account all the major components of Hydrology and Hydrogeology in terms of Geomorphological studies (geomorphic features such as landforms etc) movement of surface water, natural surface gradient. The work also includes Geological studies (Presence of fractures), Hydrogeological studies (ground water occurrence its potential both in terms of quantity and quality.

A study report based on the findings of the investigations is required to be prepared and submitted to MCL. Field visit to the study area could not be taken up after receiving the workorder due to surge in COVID-19 cases all over the country including Meghalaya, Assam and West Bengal during the period April'21 to June'21. However citing literature and collection of secondary data was in progress till the last week of June 2021. Field study was taken up during the period 05.07.2021 to 09.07.2021.

STUDY AREA

The Study Area of the present work (Fig. 1) comprises the Thangaskai village in Khliehriat block with limestone mining lease area of 31.05 hector and the adjoining cement workshop area as the core and a buffer area which is within 10km radius in the vicinity of the mining area.

LOCATION AND ACCESSIBILTY

The study area falls in Thangskai village in Khliehriat block under East Jayantia Hills district of the state of Meghalaya. The study area falls in Survey of India toposheet no. 83C/SW (New) or 83C/8 (Old). The Study area at Thangskai is bounded by longitude 92023'00'' E to 92^{0}23'18'' E

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and by latitude 25^0 12'12" N to 25^0 12'48"N. Its distance from the state capital Shillong is 104 Kms on the National Highway number 44 connecting the capital and the eastern part of Assam passing through the district. The study area is located at a distance of 18 km south of district and block headquarters Khliehriat. The air route is through Shillong airport and Guwahati airport. The rail route is through Badarpur railway junction. Thangaskai is situated on a all weather metalled road which runs upto Agartala in the state of Tripura through Silchar in Assam.

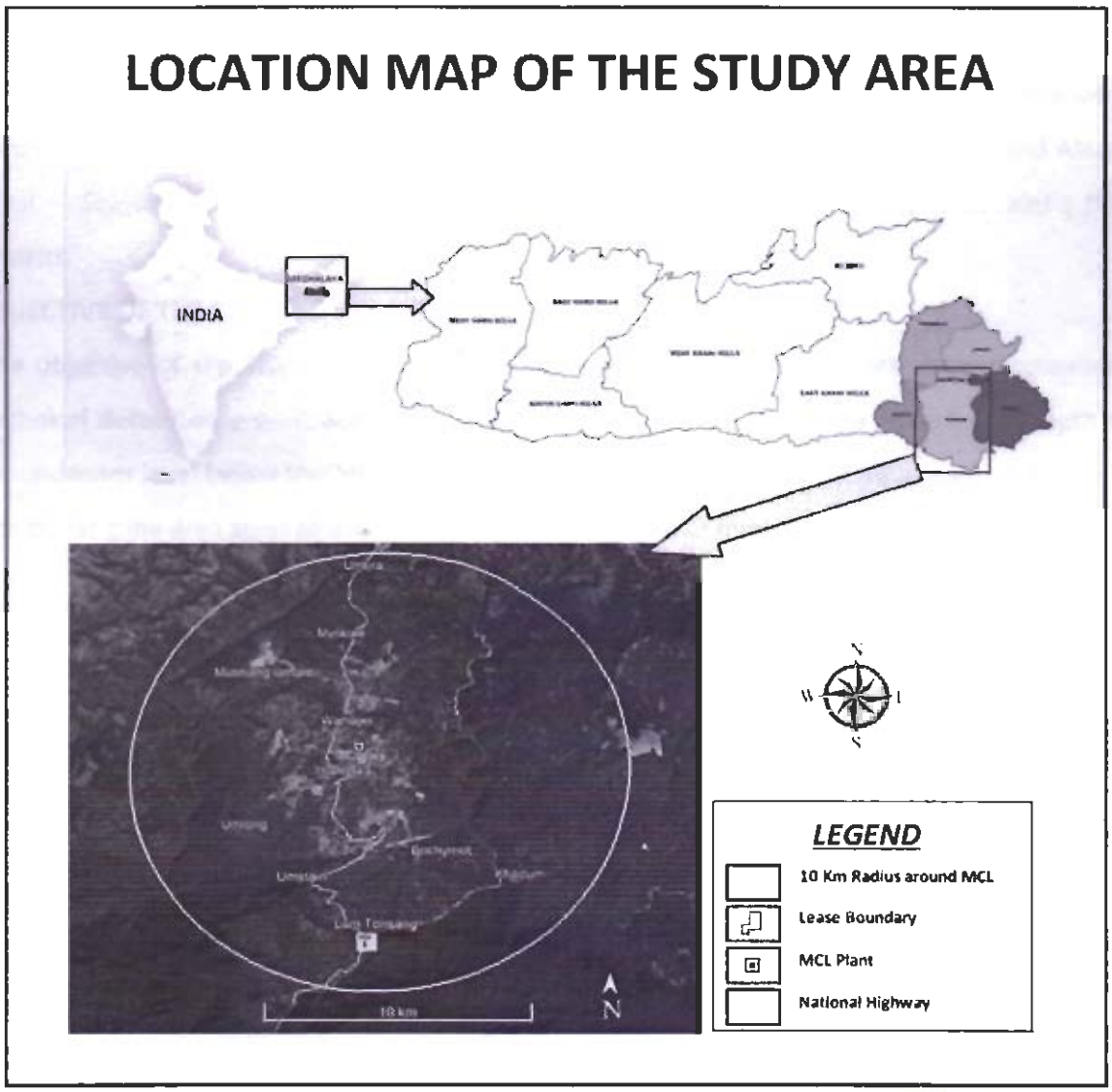

Fig 1 : Location map of the study area

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ADMINISTRATIVE SETUP

Thangskai village is located in East Jayantia Hills District. East Jaintia Hills District is one of the 11 (eleven) districts of the state of Meghalaya with the bifurcation of the erstwhile Jaintia Hills District into East and West Jaintia Hills District. East Jaintia Hills District came into existence on 31st July 2012 with its Head Quarter at Khliehriat. East Jaintia Hills is the home of one of the major tribes of the state of Meghalaya popularly known as the 'Jaintias' or the 'Pnars' and sub tribes like the 'Wars' and the 'Biates'.

It comprises all the village of two community and rural development blocks viz. Saipung community & Rural Development Block and Khliehriat Community & Rural Development Block. **Thangskai falls in Khliehriat Community & Rural Development Block** with the following boundaries in the North – West Jaintia Hills District and Assam, South – Bangladesh and Assam ,East – Saipung Community & Rural Development Block and in the West – West Jaintia Hills District.

OBJECTIVE OF THE STUDY

The objective of the study is to prepare a comprehensive hydrogeological report containing technical details on groundwater condition prevailing in the study area in terms of depth to groundwater level below the mining lease hold area and to assess the quality of groundwater in the buffer zone area so as to ascertain any adverse impact of mining on quality of groundwater.

Water in the study area is utilized for various purposes. Wet drilling is practiced to reduce noise generation, dust suppression is carried out in mine working area and on haul roads (transport roads) by sprinkling water from water tanker. Plantation is carried out to develop Green belt. The total requirement of water of MCL is met from the river Lunar, which is 5km away from the Cement Plant or workshop of MCL.. Withdrawal of groundwater is not envisaged by the company authority, as there is adequate water available in Lunar river throughout the year, which is brought to the plant area through pipeline deploying multistage pumping.

SCOPE OF WORK

The scope of work covers geological, geomorphological, hydrological and hydrogeological investigations in the study area. Geological investigation covers identification of rock types

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present, the noticeable structural features on them at the field level and correlating the features with the available authentic literature on the geology of the area. Scope of work also involves study of physiography (landforms, landslopes and categorizing them in different units etc) and drainage (movement of surface water, preparation of drainage map) in the area as part of the Geomorphological studies. Hydrological and hydrogeological studies include collection of rainfall data from IMD (Indian Meteorological Department) and analyses of rainfall data received, inventory of depth to groundwater levels. Collection of water samples from different sources, their chemical analysis in a recognized laboratory provides qualitative assessment of ground water.

The scope of work also includes preparation of a technical report containing the findings of the investigations with facts and figures, suitably represented by tabulated formats, graphs and maps wherever necessary. The report in conclusion includes recommendations with measures of interventions.

METHODOLOGY OF INVESTIGATIONS

The methodology of study can broadly be divided into three parts as follows

1. The first part involves investigation of study area at field level with generation of both primary and collection of secondary data from the technical personnel of MCL. While generating primary data, inputs were recorded either through direct measurements during the field investigation or enquiring from the officials of MCL who accompanied the consultants from CGWS during all the 3days and collection of secondary data from the officials of Environmental Department of MCL.

2. The other part involves collection of reliable secondary data from the institutions of repute engaged in specialized work in that discipline. Use of Google map and available literature in soft and hard copies to comprehend the scenario with respect to ground water in the area.

3. Synthesis, of both primary and secondary data, analyses of data using various tools, and interpretation of the findings in terms of required output.

In the first part, field traverses were undertaken, to study and record the inputs on the geology, geomorphology, hydrogeology, watershed, catchment area etc. to ascertain the availability of the existing sources of water for the mining industry and also for the consumption of villagers in

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the core and buffer area. The water sources may be from open or dug well with or without pumping devices, the other source may be bore wells or fitted with pumps having an overhead tank. Another source is deep bore wells, energized with electric pumps . Spring water is tapped at various convenient locations with simple rubber or plastic pipes which at places connected to stand point structure. Water samples of both surface and ground water sources were collected for chemical analyses to ascertain the quality of water, specially from the point of view of drinking water standard of BIS (Bureau of Indian Standard).

The input data collected from MCL, in terms of Water consumption data, raw river water quality data, water quality data of captive power Plant, Scrutiny Comments, on Draft Review of Mining plan report, were consulted and incorporated wherever necessary.

CHAPTER II

GEOMORPHOLOGY & CLIMATE

Geomorphology

The study area, is sparsely populated mountainous region which constitutes part of the Meghalaya plateau and has an average elevation of more than 3,000 feet (900 metres). It receives generally heavy rainfall and is densely forested. It is a rolling tableland. Geomorphologically, the district is an undulating one comprising dissected plateau, denudational (remnant after erosion in the geologic past) high and low hills with deep gorges. Undulating topography, dissected by numerous rivers and streams is the characteristic feature of the study area and its adjoining area. This feature favours surface run-off and and does not allow water received from rainfall to get infiltrated into the underlying aquifer, if any.

The area represents a remnant of ancient plateau of Indian Peninsular shield uplifted to its present height due to tectonic activities in the past and deeply dissected, suggesting several geotectonic and structural deformities that the plateau has undergone. The southern parts form a platform on which Tertiaries were deposited in the post- cretaceous period. Topography

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varies from gently rolling type to highly undulating type. The study area (buffer zone) can be differentiated into two major following geomorphic units.

- Alluvial plain in the southern part of the study area bordering Bangladesh.
- Area having denudo-structural hills and highly undulating topography.

Drainage

The drainage pattern of dendritic, rectangular and at places parallel to sub-parallel types are found in the area which indicates mainly structural control with topography playing a minor role. It is being controlled by joints and faults as indicated by the straight courses of the rivers and streams with deep gorges.

The important river and stream in East Jaintia Hills district includes WahLukha, Umtyrngai, Umlunar, Seshympa, Wahlaring, Umbadoh, Umutha, Lubachhra, Sharigoyain. Umparthi and Umchyrtong streams join Umlunar which is a tributary of Lukha river . Sharigoyain river act as physical boundary between West Jaintia hills and East Jaintia Hills. The rivers of the study area fall in Meghna basin . Lukha river is located at a distance of 5 km from the study area. The river is beautifully bounded by beautiful mountains and landscape on both sides as it is flowing downward to Bangladesh. All the major rivers and streams flow towards south. The drainage map, map of major river basin in Jaintia Hills and map of major rivers and catchments in Jaintia Hills is shown in Fig. 2,3 and 4.

The drainage system of the district is also to an extent controlled by topography. The streams and rivers of the study area flow in the southerly direction and towards the Surma valley in Bangladesh.

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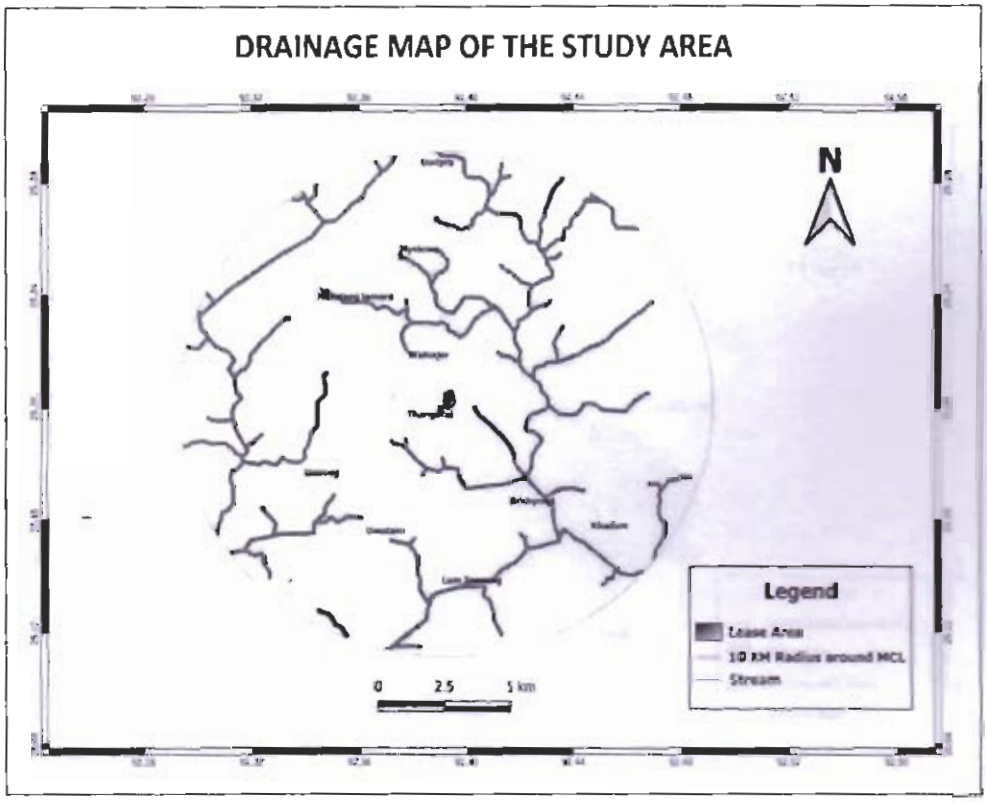

Fig 2: Drainage map of the study area (Source: CGWB)

(Map prepared by CGWS, Kolkata

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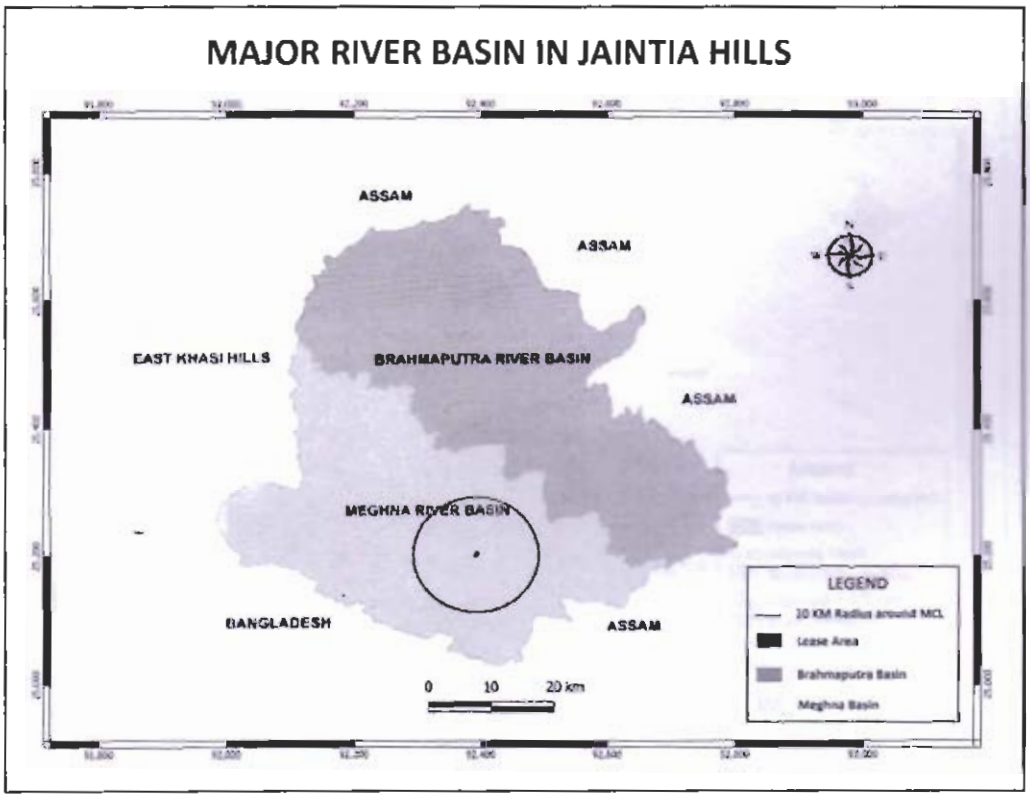

Fig 3: Major river basin in Jaintia Hills

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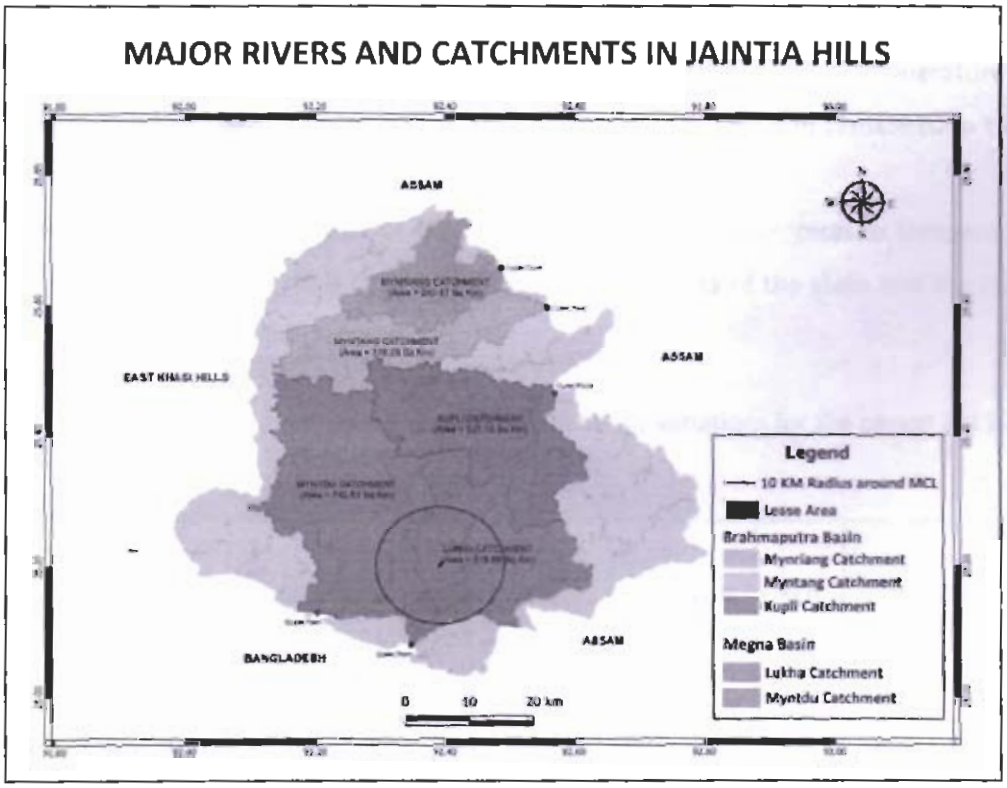

Fig 4: Major rivers and catchments in Jaintia Hills

CLIMATE:

Temperature:

The climate of any region is governed by the two parameters ie,temperature and rainfall. The temperature data of the last five years (from 2015 to 2019), has been analysed. On analyses, it is found that the month of January is the coldest month, when temperature goes down to about 9^0C, followed by the months of December and February. The maximum temperature of the year, is experienced in the months of May to August when temperature revolves around 30^0C. The mean temperature has been computed taking into consideration, mean temperature of each day of every month for a period of 5 years. The temperature data collected from NASA LaRC Sciences Data Center and analysed, has been presented in tabular form (Table 1) and also graphically in the figure number 5 and 6.

Based on temperature, the climate of the study area is mildly sub-tropical to temperate. In the winter months the climate is pretty cold like the other parts of the state and the district, the study area has a very pleasant climate.

Table 1: Monthly minimum, maximum and mean temperature variations for the period 2015-2019 (Data Source: NASA LaRC Sciences Data Center)

Year (2015-2019)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Max Temp	22.29	24.54	28.6	28.88	28.99	28.95	29.09	30.05	28.65	27.96	25.11	23.13
Mean Temp	14.93	17.36	20.73	23.25	24.72	25.59	25.56	25.85	25.11	23.05	19.50	16.03
Min Temp	9.17	11.4	14.24	18.45	20.94	22.94	22.81	23.01	22.36	18.02	14.01	10.43

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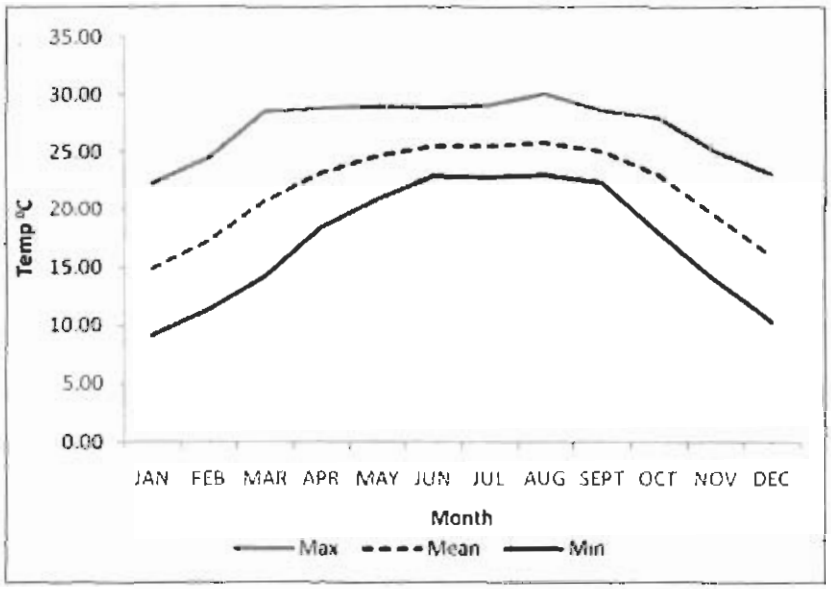

Fig 5: Monthly minimum, maximum and mean temperature variations for the period 2015-2019

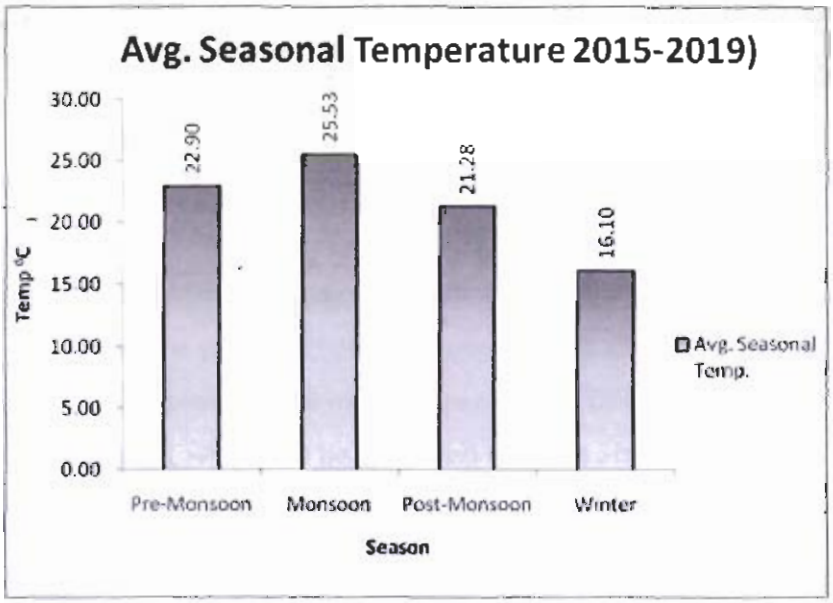

Fig 6: Average seasonal temperature variation

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Annex- III

RAINFALL

The area is influenced by the south-west monsoon and rainfall is assured during summer. Rainfal data recorded by the Indian Meteorological Department (IMD) has been taken into account for computation and analyses. Since the data available for Jowai recording station of IMD, was not available in a continuous time series for the last five years, the data available for Shillong station for the last five years (2016-2020), was analysed. It was observed that the data of Jowai and Shillong does not vary much. The average annual rainfall in the study area considering Shillong station of IMD, is 6683.18 mm/annum. The area receives a fairly high rainfall throughout the year. Most of the precipitation occurs between June to September due to south-west monsoon originating from the Arabian sea. The months of April and May also receive a fair amount of rainfall of the order of 500 mm to 800 mm, , if it is compared with the rainfall of the same period in rest of India- although it constitutes only 20% of the total annual rainfall in the region. This orographic rain during the non-monsoon period, results from clouds originating in the Bay of Bengal that drifts towards the Bangladesh plains after hitting the Jaintia hills and rapidly rise to the upper atmosphere, where they swiftly cool down and result in heavy precipitation. Rainfall during the winter months, specially in the month of October is also high which is of the order of 343.5mm which is attributed to 'Retreating Monsoon', when moisture laden south-west monsoon winds get reflected from the High Himalaya ranges and on their way back, precipitate in Myanmar and other adjoining hilly areas. This implies that rainfall is well distributed throughout the year and non- monsoon months also contribute to the annual rainfall in the area. July is the wettest month, when rainfall down pouring on the area is as high as 1500 to 2000mm, which can be compared with the annual rainfall of some of the high rainfall eastern states of India.

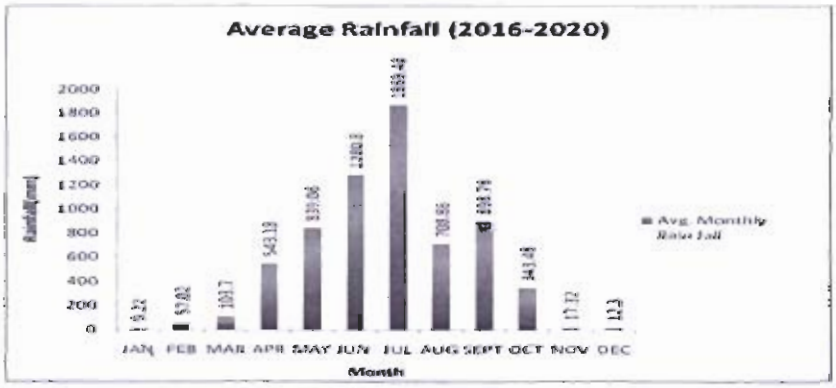

Fig. 7: Monthly variations of mean rainfall for the period 2016-2020

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Table 2: Rainfall Data in mm over a period of last 5 years till 2020 (Data Source: IMD)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	Annual RF	Monsoonal RF
2016	13.7	8.8	83.7	1026.9	661.2	796.4	2603.8	318.6	644.4	335.6	25.7	7.5	6526.3	4363.2
2017	0.6	214.4	313.4	887.4	395.9	1537.9	1433	1523.6	854	471.9	11.8	35.8	7679.7	5348.5
2018	3.6	18.1	67.7	264.6	691.5	1129.7	1431.7	746.6	617.5	73.9	6.1	14.9	5065.9	3925.5
2019	0.1	28.9	22.5	271.9	913.5	1474.5	2210.6	731.3	1016.6	508.3	25.8	3.3	7207.3	5433
2020	28.1	14.9	31.2	265.1	1533.2	1465.5	1668.2	224.2	1361.4	327.7	17.2	0.0	6936.7	4719.3
Average													6683.18	4757.9

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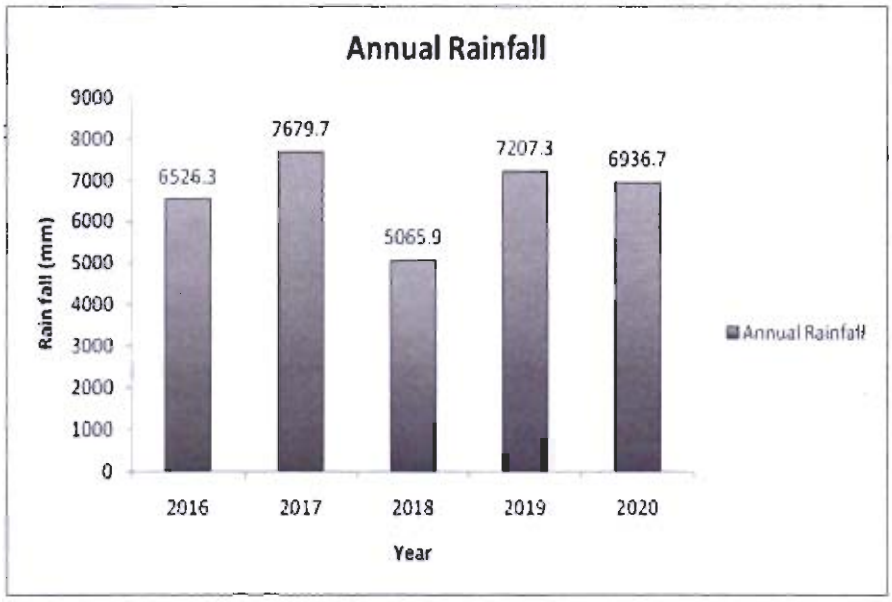

Fig 8: Annual rainfall for the period 2016-2020

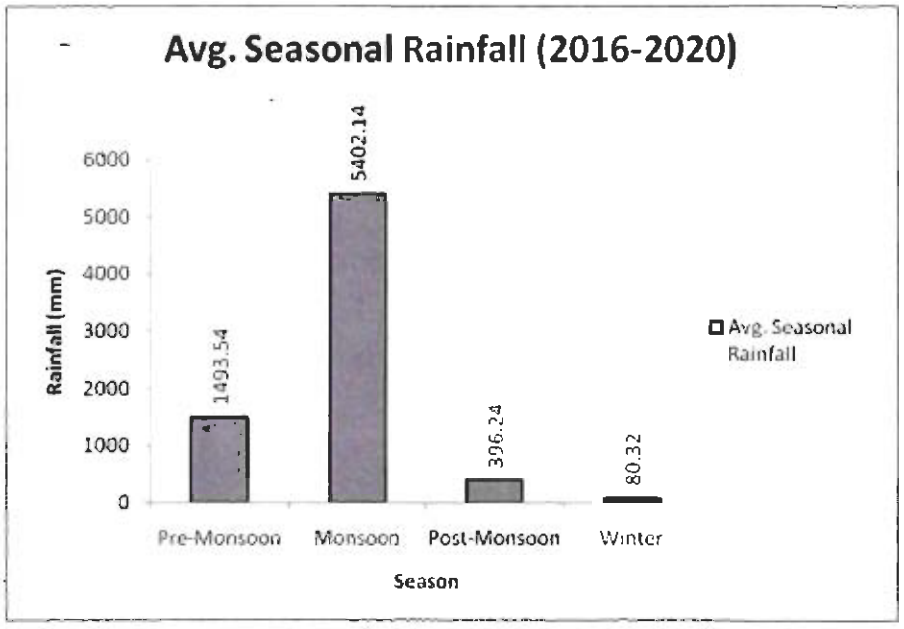

Fig 9: Seasonal variations of rainfall for the period of 2016-2020

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CHAPTER - III

GEOLOGY

Regional Geology

The state of Meghalaya covers an area of approximately 23,000 sq km. East Jaintia Hills District is located at the eastern most part of Meghalaya. It covers an area of 2040 sq. Kms . The district area falls mainly within the Shillong or Meghalaya Plateau which is constituted mainly of Precambrian rocks of gneissic composition in which granites, schists, amphibolits, calc-silicate rocks occur as inclusions of various dimensions. The gneisses form the Basement Complex for the overlying Shillong Group of rocks and is separated from the later by an unconformity indicated at places by the occurrence of a conglomerate bed.

These occur mostly as thick layers. Grainite Plutons occur as isolated patches in the district , intruding the Basement Gneissic complex and Shillong Group of rocks. The Granites occur as intrusive body in the Basement Gneissic complex. Both Porphyritic and fine-grained pink granite occur in the area.

The unconformably overlying Shella Formation of Jaintia Group consists of alteration of sandstone and limestone occurs in the south-central and south-western part of the district. The shelf facies of Barail Group, consists of fairly coarse grained sandstone, shale, carbonaceous shale with streaks and minor seams of coal and occupy the south-eastern part of the District.

The Tertiary sediments are thick, extensive and are divided into three groups, viz. a) the Khasi Group, b) the Jaintia Group and c) the Barail Group. The Cretaceous rocks of Mahadek Formation of the Khasi Group consist of feldspathic sandstone, conglomerate. The Jaintia Group is a calcareous facies and has been divided into two formations viz. Shella Formation and Kopili Formation. Mahadek Formation is overlain by Shella Formation of Eocene Age. Tertiary rocks of Jaintia Group consist of Shella and Kopili formations comprise of fossiliferous limestone, sandstone, coal, fireclay and shale having phosphatic nodules. Rengi Formation of Barail Group characterized by sandstone, carbonaceous shale with conglomerate and limestone is found at places which is unconformably overlain by Garo group consisting of coarse, feldpathic sandstone, pebble, conglomerate, clay, silty clay with a fossiliferous limestone horizon at the top.

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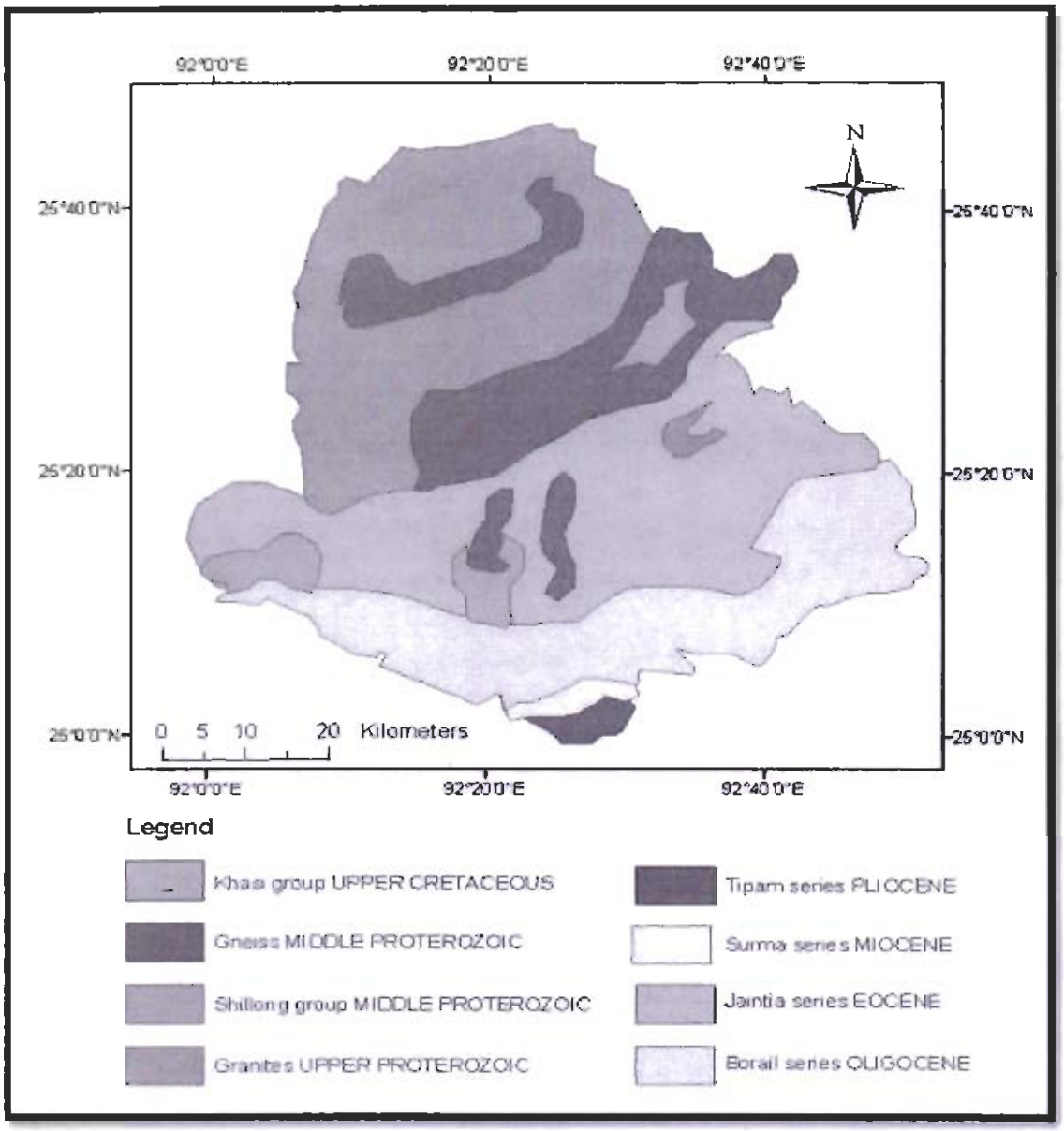

Fig 10: Geological map of Jaintia Hills (Source: Geological Survey of India, 1974)

Local Geology

The present study area falls under survey of India Toposheet No. 83C/SW (New) or 83C/8 (old) and located near village Thangskai (25°12'12.0" to 25°12'48.0" N to 92°23'0.00" to 92°23'18.0" E). The different lithounits of the area belong to Jaintia series of Eocene age. The limestone unit belongs to Sylhet stage of Jaintia series of middle Eocene age. Three bands of limestone occur in the area which are Known as Prang, Umlatdoh and Lakadong limestone bands. These are separated by Narpuh sandstone and; Lakadong sandstone. The

topmost limestone band i.e. Prang limestone occurs further south of the project area. Barail Group of Upper Eocene age unconformably overlies Jaintia Group and unconformably underlain by the Khasi group. The stratigraphy of the area is as follows.

Table 3: Stratigraphy of the area

Age	Group/Series	Formation/ Stage	Beds
Oligocene to Mid Miocene	Garo		Sandstone & Shale
---------- Unconformity----------			
Upper Eocene	Barail	Kopili Formation	Grey Shale with alternate layers of Sandstone & silltstone.
Lower to Middle Eocene	Jaintia Group	Shella Formation/Shyllet Stage	Shale Parang Limestone Narpuh Sandstone Umlatodh Limestone Lakadong Sandstone Lakadong Limestone
---------- Unconformity----------			
Upper Createaceous to Middle Cretaceous	Khasi Group		Arkosic sandstone (often Glauconitic & Uraniferous). Also contains grey shales, mudstones and calcareous sandstone

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CHAPTER-IV

HYDROGEOLOGY

Regional Hydrogeology

The regional or the hydrogeology of the district can be divided into three units, namely consolidated, semi consolidated and unconsolidated formations:

Consolidated formation: These include the oldest rock formation occupying about 1300 km^2 in the northern and western parts. Gneissic complex, quarzites etc constitute this unit. The depth of weathering varies from place to place and is 15 to 20m at places. The presence of substantial-weathered mantle is confined to their secondary porosities, which form excellent repository of ground water in hard rocks area. The storage and movement of ground water in hard rock is controlled by physiography, zone of weathering and interconnected weak planes. Ground water occurs under unconfined condition and in semi-confined condition in the interconnected secondary structural weakplanes/ features like joints, fractures etc of the underlying hard rocks.

Semi consolidated formation

These constitute the major part of the district covering *Amlarem* and *Khliehriat* blocks and covers two- thirds of the entire area. It ranges in age from late Cretaceous to Plio-Pleistocence. The Shella formation of the Jaintia group is the most conspicuous. Ground water in this formation occurs under unconfined to semi confined conditions due to primary porosities of the semi consolidated formations as well as in the secondary porosities like caverns, open fractures and joints. The formation shows both isolated hammocky topography to highly undulating topography with steeply rising hills and deep gorges. The karst topography is observed in areas of *Letein, Latyrk, Litang* etc. occupied by the cavernous limestone.

Unconsolidated formation

The unconsolidated formation is mainly represented by recent alluvium occurs near the southern fringe of the district and is the continuation of the alluvial plain of Bangladesh. It constitute about 67 km^2 representing about 2% of the total area.

The depth of shallow aquifer in the district ranges from 5 to 40 meters. The hydrogeological map has been shown in fig. 11.

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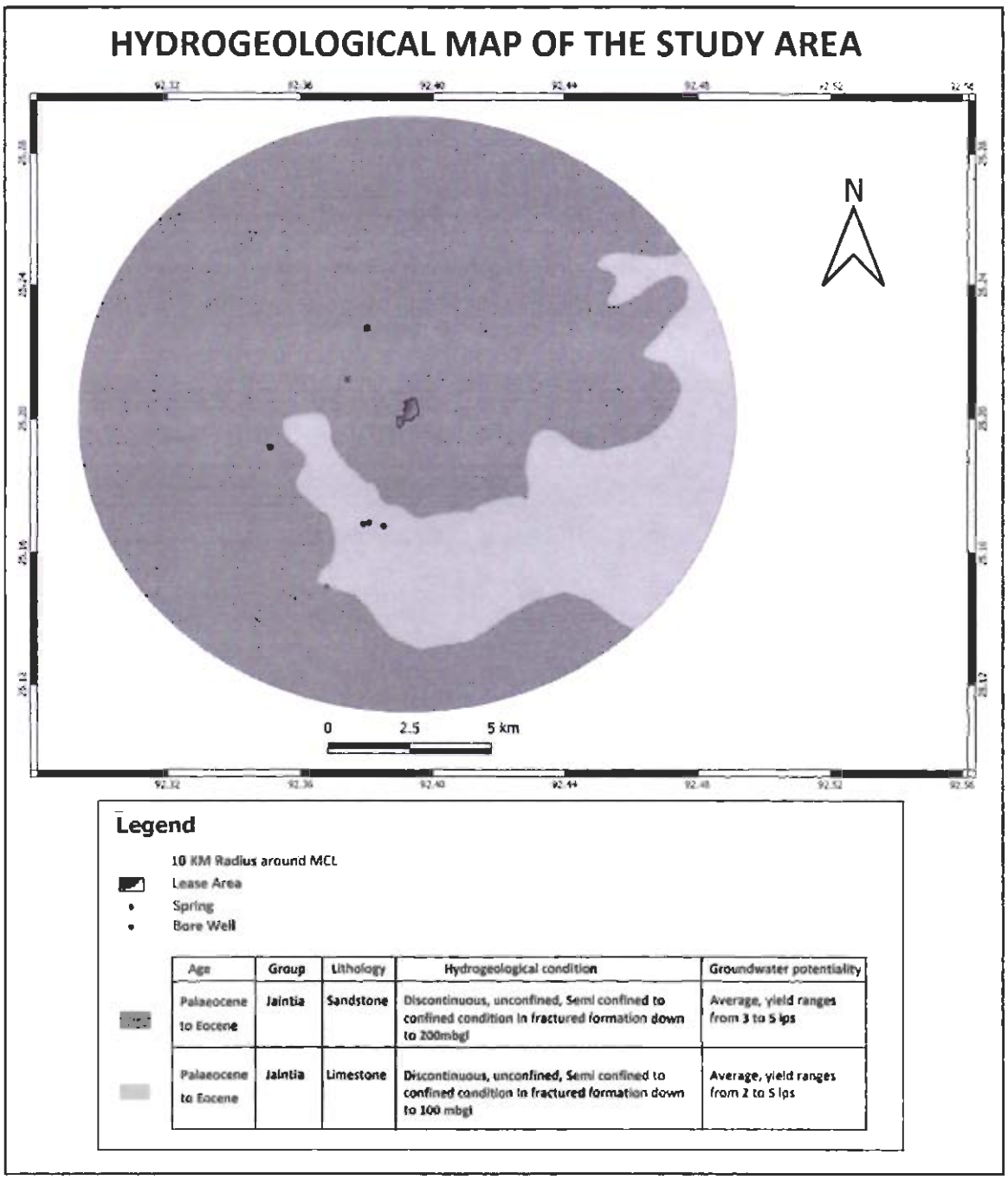

Age	Group	Lithology	Hydrogeological condition	Groundwater potentiality
Palaeocene to Eocene	Jaintia	Sandstone	Discontinuous, unconfined, Semi confined to confined condition in fractured formation down to 200mbgl	Average, yield ranges from 3 to 5 lps
Palaeocene to Eocene	Jaintia	Limestone	Discontinuous, unconfined, Semi confined to confined condition in fractured formation down to 100 mbgl	Average, yield ranges from 2 to 5 lps

Fig.11: Hydrogeological map of the study area (Source: CGWB)

(Map prepared by CGWS, Kolkata)

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This shallow aquifer occurs under unconfined to semi confined condition. Ground water from shallow aquifer is exploited through different types of ground water extraction structures such as dug wells.

The deeper aquifer occurs as semi-confined to confined condition where ground water is found in the fractured zone of consolidated Sandstone and Limestone. The drilled depth of exploratory wells tapping this aquifer ranges from 80.30 to 192m bgl. The number of fractures and its zones encountered varies in all the places which show the complexity of the hydrogeology of consolidated hard rock formation.

In the study area there are two groups of aquifers (CGWB reports) which is described below:

Aquifer I: It is the unconfined aquifer where the aquifer zones were tapped within 2 to 40 m depth and generally exhibits unconfined nature of the aquifer. The study area is highly undulating terrain and tapping of aquifer I (shallow aquifer) is not suitable.

Aquifer II : This is the deeper aquifer which occurs in the as semi confined to confined condition where ground water is found in the fractured zone of consolidated Sandstone and Limestone. One exploratory well with one observation drilled by CGWB at Khliehriat block down to 164.90m. The result of exploratory drilling and detail study in the area indicates that the two sets fracture zones encountered within 50 to 100 m & 100 to 150 mbgl. The number of fractures and zones of encountering fractures varies widely which show the complexity of the hydrogeology of the formation. The piezometric head in second group of aquifer ranges from 9.36 to 63.88 mbgl.

LOCAL HYDROGEOLOGY

In the lease area at least 20 number of boreholes was drilled for coring to estimate the quantity and quality of the limestone. The maximum depth drilled 60 m from the different benches / different reduced level, diameter of the bore being 57mm. Location map of selected core borings within the lease area - depicting lithological disposition and the lithological logs of the selected borehole were studied and the sub-surface diagrams presented in Fig 12 &13 respectively.

It was found that the overburden consisting of Narpuh sandstone with loose soil and limestone boulder ranges in thickness from 7.80 to 16 m , Umlatodh limestone 21 to 33m, Lakdong sandstone 4.80 m and Lakadong limestone 4.60 to 5.90 m. In almost all the boreholes there is an alternate layer of Sandstone & Limestone.

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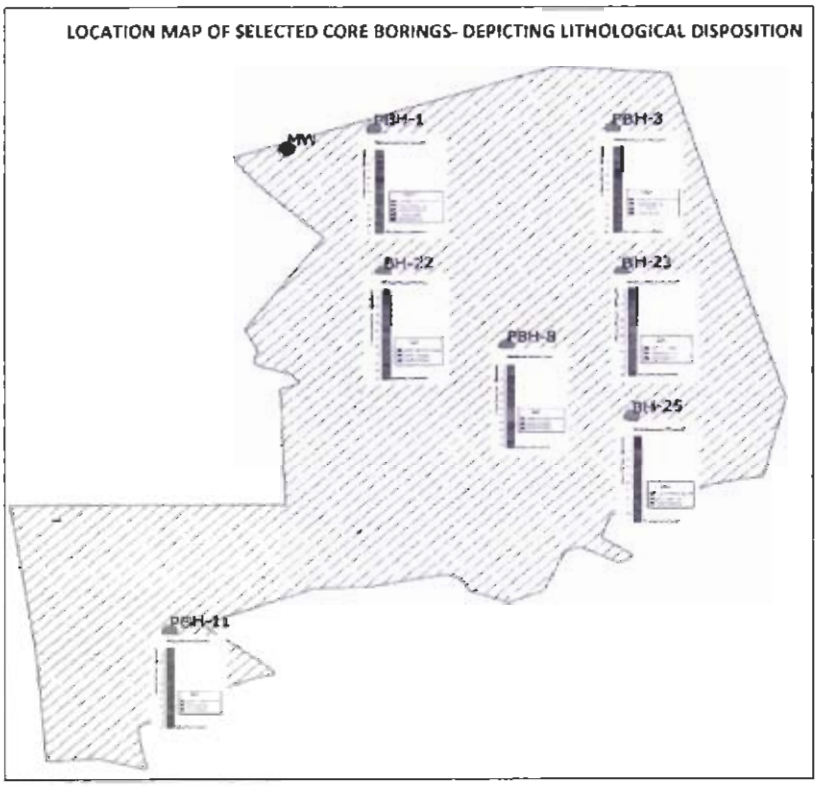

Fig 12 : LOCATION MAP OF SELECTED CORE BORINGS- DEPICTING LITHOLOGICAL DISPOSITION

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Subsurface geology of the selected core bores

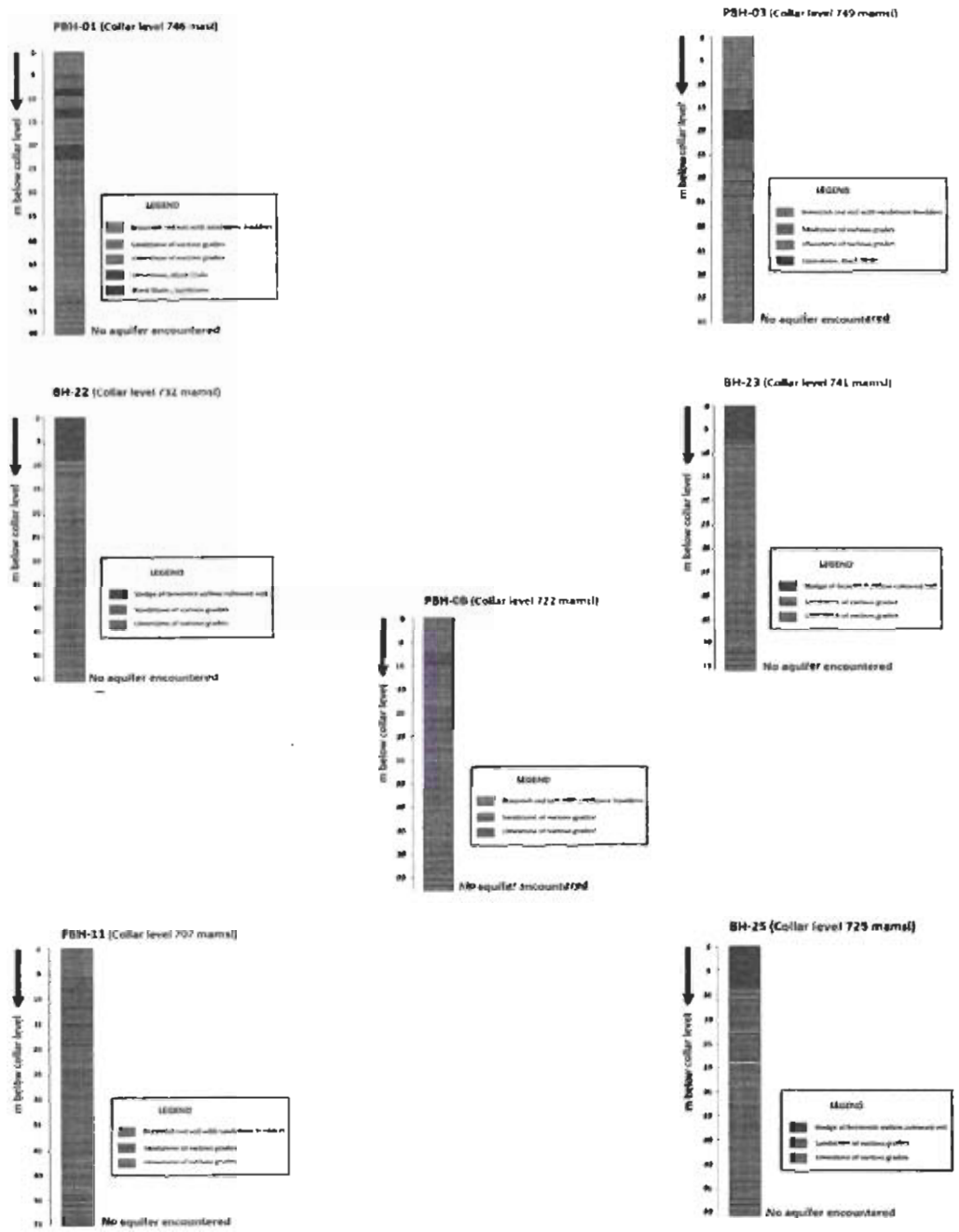

Fig 13: Sub-surface geology of the selected core bores

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It has been further reported by MCL that no water bearing fracture zones were encountered in any of the core bore holes drilled in the mining lease area down to the reduced level depth of 668 mamsl.

During the course of hydrogeological survey in the study area field traverse in the core area & in the buffer zone area of 10 Km radius was taken. Three bore wells were found in operation, the reported depth of the bore wells ranges from 80 m to 130 m below respective reduced levels and yield of one such bore well was measured and recorded as 1.5 lps (IOCL Petrol pump ,RL 483 mamsl) .Location of these bore wells shown in the hydrogeological map (Fig. 11) and the data is given in table 4.

Table 4: Details of bore wells and springs in and around Meghalaya Cement Factory, East Jaintia Hills District

Location	Co-ordinate	Toposheet No.	Type	Depth (m)	Water level Mbgl	RL mamsl
Lumshnong IOCL petrol pump	25^0 10' 08" 92^0 22' 50.5"	83C/8	Bore well	128	--	483
Meghalaya Mines & Minerals Ltd	25^0 10' 07" 92^0 22' 44"	do	do	106.80	--	481
Lumshnong J K Service station	25^0 10' 4.8" 92^0 23' 6.2"	do	do	NA	61	471
Dalmia Cement factory premises	25^0 11' 28.9" 92^0 21' 2.9"	do	do	80	45	704
Lumshnong Spring	25^0 08' 59.2" 92^0 22' 4.2"	do	Spring	--	--	282
Chiehruphi Petrol pump	25°12'42.1" 92°22'26.8"	do	Bore well	130	55	801
Nongsning	25^{0}14' 36" 92^0 22' 34"	do	No bore well/ dug well	--	--	--
Larseng	25^0 17' 00" 92 ^{0}23' 00"	Do	Spring	--	--	876
Umtyra	25^0 17' 07" 92^0 23' 03"	do	Spring	--	--	873
Thangskai	25^0 11' 44" 92^0 22' 40"	do	Spring	--	--	723

The entire lease area were surveyed by MCL for preparation of mine planning map, the map has been studied thoroughly, proposed mining was from 741mamsl RL of the lease area and the height of the present mine bench is 668 mamsl (RL) and no saturated fractures zones

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were encountered, this indicates absence of water saturated fractures in the difference of 73 m .

In the vicinity of the lease area no groundwater abstraction structures were also noticed, which suggests absence of water bearing fracture zones in the limestone and sandstone formation.

The table presented above also indicates that ground water level is at a depth far below the reduced level of the present lowest bench of the mining activity except for a few locations where cavity within the limestone might have been encountered which reflects an anomaly from the general ground water level scenario in the area. The findings at the ground level matches with the recorded borehole logs which indicate that no water bearing zone was encountered during the core drilling of approximately of 20 core boreholes. It is therefore expected that water bearing fractures are much below the present lowest bench of mining. This analytical inference can be further corroborated with the construction of a monitoring well close to the present mining area.

Springs play a major role in managing the water resources in the area. They serve as a major source of water supply for drinking water and other uses. Spring discharge is controlled by climate (timing and amount of precipitation), land use, vegetation, and geomorphology of the recharge zone. Geologically, the springs monitored in the area are of gravity type. The host rock of these springs is mainly fractured/ fissured sandstones. The spring discharge were measured during the course of survey and it was observed the discharge approximately 30 lps . It has also been reported that the discharge of springs has been increased during monsoon season and gradually decreases in post-monsoon and pre-monsoon

Depth to water Level

During the course of survey, an attempt was made for systematic well inventory around the study area covering 10 Sq.km. But in the area there is no dug well and bore well for monitoring, only there were three bore wells in the road side petrol pump water levels in the bore wells were measured, the depth to water level varies from 45 to 61 mbgl.

It has also been revealed from the report of CGWB, there is only dug well in the extreme southern most corner of the district (Umkiang 25°03'41" 92°22'49) and two piezometres

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one in extreme northern part of the district and other one is located in north western part of the district.

The recent study of CGWB further reveals that in the near vicinity of the study area in toposheet No 83 C/8 (Grid B1) there is no existing exploratory well, dug well or bore well for periodical monitoring.

Ground Water Resources

Dynamic Groundwater Resources of East Jaintia Hills district has been estimated based on the methodology recommended by Groundwater Estimation Committee. The resources computed for the groundwater year 2020. In the present resource estimation, the smallest administrative unit considered for resource estimation is district, since block-wise data is not available and the area with more than 20% slope has been excluded for the recharge computation. Hence the study area has been excluded for groundwater resource assessment.

The overall scenario of ground water resource of East Jaintia distict as on 2020 is given below:

1.	Annual extractable ground water resource (Ham)	:	17726.92
2.	Ground water extraction for irrigation use (Ham)	:	0
3.	Ground water extraction for industrial use (Ham)	:	4
4.	Ground water extraction for domestic use (Ham)	:	171.06
5.	Annual groundwater allocation for domestic as on 2025	:	208.68 ham
6.	Net Groundwater availability for future use	:	17514.24 ham
7.	Stage of groundwater extraction	:	0.98 %

As per ground water resource estimation 2020, the stage of ground water development is just 0.98 % and there is no utilization of ground water for irrigation in this area. All the irrigation schemes in the district are dependent upon the surface water resources. Therefore, there is enough scope for future development of ground water in the district to bring more area under irrigation practice. At present the irrigation practice by utilizing ground water (constructing bore well) is not accepted by villagers due to small land holding, high cost for construction and running of a well compared to production outcome. Another major obstacle in accelerating ground water irrigation is the absence of power lines in most of the cultivated/cultivable area.

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Present source of water supply

At present daily requirement of water was calculated based on the information furnished by the MCL authority for their different uses ie. domestic purpose, cement plant and industrial cooling, CPP, plantation and dust suppression in the mines area and found it is about 1355m^3/day, the entire quantity of water is presently being pumped from a perennial nala Umtyrng flowing west to east along the northern boundary of the lease area, Umtyrng nala joins Umlunar river 2.5 km further east. Umlunar is a tributary of Lukha river. The intake point of water from the Lunar river is approximately 5km from the water treatment plant.

The area is also very sparsely populated hence exploitation of groundwater for irrigation and drinking purposes is not being practiced in large scale in the core and buffer zone of the study area, except in few locations.

From the field study and available borehole logs (core drilling logs) it is also apparent that construction of bore well is not feasible to meet the huge demand. In the lean months also surface water source can sustain the demand for different uses as mentioned above.

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Annex – III

Chapter-V

HYDROGEOCHEMICAL ANALYSIS

The development projects are planned for social benefits. The development and environment are two sides of the same coin. Mining and water resources projects are no exceptions. Lime Stone mines are concentrated in an around Khlieriat Block. Thus, the large-scale mining activities may affect the quality of water resources. Hence keeping this in view a detailed chemical quality study of water resources in the area was undertaken for safe water and environment.

The water samples from one surface water resource, five groundwater structures and rainwater were collected during field survey to study the water quality as well as hydro-geochemistry of water in the area. The samples were subjected for analysis for both major and minor parameters viz. pH, Total dissolved solids, Conductivity, Sodium, Calcium, Potassium, Manganese, Chloride, Sulphate, Carbonate, Bicarbonate, Iron, Total Hardness and Total Alkalinity. In order to study the chemical quality, ground water samples were also analyzed for Arsenic. Detail results of water samples are given in the Table no 5.

Groundwater Quality Assessment

Groundwater quality depends upon the lithological and chemical composition of the aquifers, climatic conditions, to which they are subjected at the time of formation, quantity of water available and its rate of circulation, the activities of microorganism, temperature and pressure condition. The complex dissolution and decomposition processes have resulted in the diverse hydro-chemical condition in groundwater occurring in the area.

Total five nos. of groundwater samples were analysed for different physicochemical parameters. In present study, the pH of ground water samples at all the sampling points was found to be slightly alkaline ranges from 6.69 to 8.16, except spring water collected at Lumshnong. The alkaline pH of water samples near limestone mining and cement manufacturing sites found in present study may be due to the weathering of calcium carbonate rocks and minerals present in limestone of this area. The total dissolved solids in groundwater within the study area varies from 42 mg/l to 378 mg/l and electrical conductivity ranges from 70 to 631 μ S/cm at 25° C. Iron content ranges from 0.12 to 1.79 mg/l. Manganese content of ground water samples at all the sampling points were found below 0.05 mg/l. The chloride content varies from 7 to 26 mg/l. Calcium content in

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groundwater ranges from 20 to 77 mg/l. Magnesium content varies from 6 to 36 mg/l. Total alkalinity value ranges between 11 to 160 mg/l. Total hardness value varies from 74 to 341 mg/l. Total arsenic content of ground water samples at all the sampling points were found below 0.01 mg/l. The values of other major parameters are shown in the table 5 .

Suitability of Ground Water for Drinking

The pH of groundwater shows that groundwater collected from bore wells were slightly alkaline in nature. Spring water collected from Lumshnong Spring is slightly acidic in nature. As per the BIS drinking water standard (IS 10500:2012), groundwater collected from bore wells as well as spring is suitable for drinking purpose. As per the BIS drinking water standard (IS 10500:2012), the acceptable limit for pH value is from 6.5 to 8.5. At all the sampling points TDS values were found within the acceptable limit of 500 mg/l as per BIS drinking water standard(IS 10500:2012). The calcium content in all groundwater samples has been found within acceptable limit of BIS drinking water standard i.e. 75 mg/l except the borewell located beside Meghalaya Mines & Minerals Ltd. but that is also within the permissible limit of 200 mg /l in absence of alternate source. Chloride values were found within the acceptable limit of 250mg /l as per the BIS drinking water standard (IS 10500:2012). Magnesium values in all ground water samples were found within the acceptable limit of 30 mg/l as per BIS drinking water standard(IS 10500:2012) except except the borewell located beside Meghalaya Mines & Minerals Ltd but that is also within the permissible limit of 100 mg /l in absence of alternate source. Manganese content was found within the acceptable limit of 0.1 mg /l as per the BIS drinking water standard. Sulphate values were found within the acceptable limit of 200mg /l as per the BIS drinking water standard in all the ground water sampling points. Total alkalinity ranges within the acceptable limit of 200 mg /l as per the BIS drinking water standard. In most of the samples total hardness values were found higher than the acceptable limit of 200mg /l but all the sampling points were within the permissible limit of 600 mg /l in absence of alternate source as per the BIS drinking water standard. The Iron content of water collected from Starway petrol pump was exceeding the acceptable limit of BIS drinking water standard i.e. 0.3 mg/L. In other sampling points Iron content was within the acceptable limit of BIS drinking water standard. Total arsenic content in all the groundwater samples were found within the acceptable limit of BIS drinking water standard that is 0.01 mg/l.

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Annex- III

Table 5: Ground water samples analysis results

Sample ID	Latitude	Longitude	Location	Type	pH	TDS (mg/l)	Conductivity (µmhos/cm)	Ca (mg/l)	Na (mg/l)	K (mg/l)	Mg (mg/l)	Mn (mg/l)	SO_4 (mg/l)	Cl (mg/l)	CO_3 (mg/l)	HCO_3 (mg/l)	Total Alkalinity (mg/l)	Total Hardness (mg/l)	Fe (mg/l)	As (mg/l)
W_1	25° 10' 08" N	92° 22' 50.5" E	IOCL petrol pump, Lumshnong	Bore Well	7.76	288	498	69	2.3	1	28	<0.05	78.7	17	0	185	152	290	0.16	<0.01
W_2	25° 10' 07" N	92° 22' 44" E	Beside Meghalaya Mines & Minerals Ltd	Bore Well	8.09	378	631	77	1.03	1.1	36	<0.05	146.3	13	0	167	137	341	0.15	<0.01
W_3	25° 08' 59.2" N	92° 22' 4.2" E	Lumshnong —	Spring	6.69	42	70	20	1.2	20	6	<0.05	2.5	7	0	14	11	74	0.29	<0.01
W_4	25° 10' 4.8" N	92° 23' 6.2" E	J. K. Service station, Lumshnong	Bore Well	8.16	236	413	45	1.8	1.9	27	<0.05	2.5	26	0	195	160	227	0.12	<0.01
W_5	25° 12' 01" N	92° 22' 14" E	Highway Star Petrol Pump, Thangskai	Bore Well	8.1	250	433	52	4.7	2.1	25	<0.05	6.25	9	0	185	152	231	1.79	<0.01

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Gibbs Diagram

Rock-water interaction behavior is important to evaluate the weathering, ion exchange process, and dissolved constituent that consequences in the groundwater quality. Gibbs (1970) proposed a diagram that is widely used to recognize the functional sources of the dissolved chemical element of the water and the effect of hydrogeochemical processes, such as precipitation dominance, evaporation dominance, and rock–water interaction dominance. The reaction between groundwater and aquifer minerals has a significant role in groundwater quality which is useful to assume the genesis of water. Gibbs ratio is calculated using the following equation.

Gibbs ratio I for anion = $(Cl^-) / (Cl^- + HCO_3^-)$

Gibbs ratio II (for cation) = $(Na^+ + K^+) / (Na^+ + K^+ + Ca^{2+})$

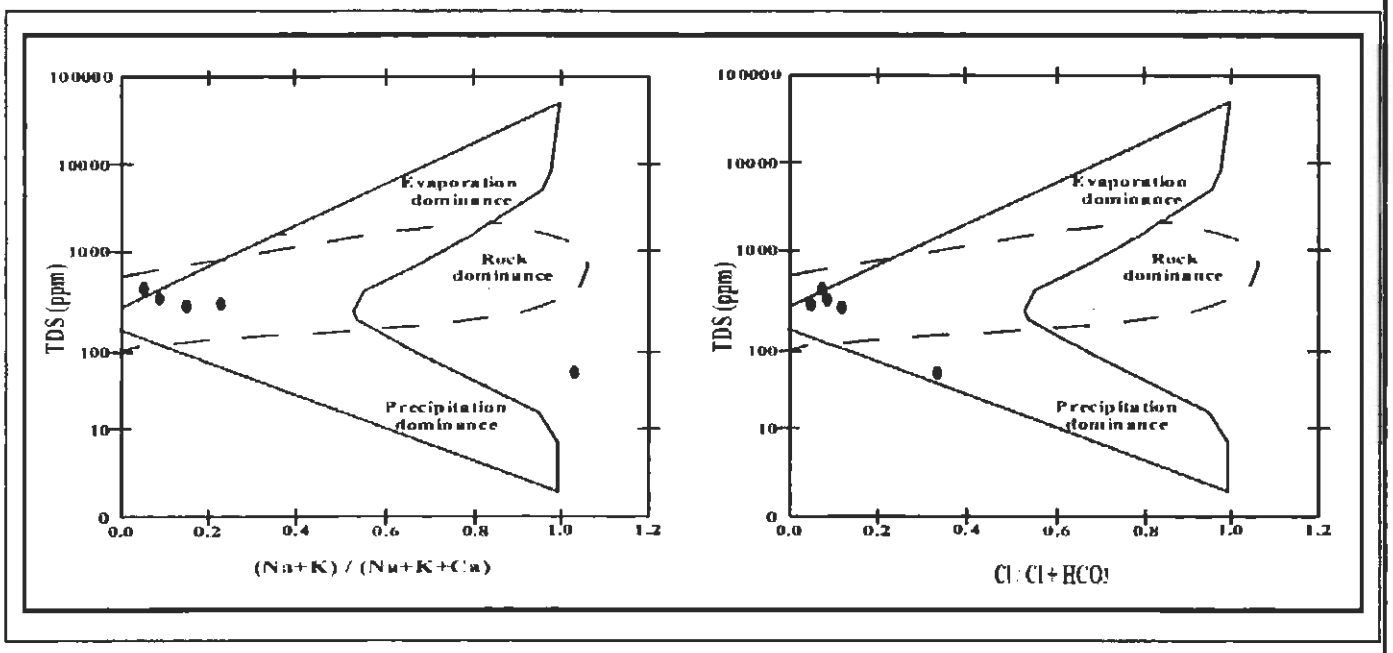

Fig 14: Gibbs diagram showing major processes controlling groundwater chemistry

In the present study the Gibbs diagram based on TDS and the concentration of cations and anions; it shows that most of the cations and anions in groundwater of deeper aquifer have a rock-dominance and spring water (Shallow aquifer) have a Precipitation dominance origin. This

characteristic indicates the dissolution of ions in groundwater through the interaction between groundwater and rock or soil precipitation is more dominant than any other sources.

Water Quality of Surface Water (River Water)

One sample of surface water was collected from Lunar river. The samples were subjected for analysis for both major and minor parameters viz. pH, Total dissolved solids, Conductivity, Sodium, Calcium, Potassium, Manganese, Chloride, Sulphate, Carbonate, Bicarbonate, Iron, Total Hardness and Total Alkalinity. The pH of surface water is 7.79. So this result indicates that surface water is slightly alkaline in nature. All the analyzed parameters are within the acceptable limit of BIS drinking water standard (IS 10500:2012) except Iron content.

Table 6 : Surface Water quality details

Items	Details
Sample ID	W6
Latitude	25°14'5.22"N
Longitude	92°24'51.36"E
Location	Lunar River near pump house
pH	7.79
TDS (mg/L)	134
Conductivity (µmhos/cm)	205
Ca (mg/L)	36
Na (mg/L)	<1
K (mg/L)	<1
Mg (mg/L)	5
Mn (mg/L)	<0.05
SO_4 (mg/L)	<2.5
Cl (mg/L)	11
CO_3 (mg/L)	0
HCO_3 (mg/L)	12
Total Alkalinity	10
Total Hardness	110
Fe (mg/L)	0.71

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Water Quality of Rain Water

One sample of rain water was collected at MCL Guest House. The samples were subjected for analysis for both major and minor parameters viz. pH, Total dissolved solids, Conductivity, Sodium, Calcium, Potassium, Manganese, Chloride, Sulphate, Carbonate, Bicarbonate, Iron, Total Hardness and Total Alkalinity. All the analyzed parameters are within the acceptable limit of BIS drinking water standard(IS 10500:2012).

Table 7 : Rain Water quality details

Items	Details
Sample ID	WR
Latitude	25°12'15.86"N
Longitude	92°22'46.76"E
Location	MCL Guest House
pH	7.19
TDS (mg/L)	32
Conductivity (µmhos/cm)	55.1
Ca (mg/L)	17
Na (mg/L)	<1
K (mg/L)	<1
Mg (mg/L)	<2
Mn (mg/L)	<0.05
SO_4 (mg/L)	<2.5
Cl (mg/L)	6
CO_3 (mg/L)	0
HCO_3 (mg/L)	14
Total Alkalinity	11
Total Hardness	47
Fe (mg/L)	0.15

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Annex- III

CHAPTER -VI

LIMESTONE MINING AND GROUNDWATER

Mining of Limestone for Cement Industry

Regional

Limestone is a non-metallic sedimentary rock and is a raw ingredient for the manufacturing of cement- an important construction material. Mining industry in India is a very important industry essential for the economic development of the country. India is the second largest cement producing country in the world after China. Next to coal, limestone is the most abundantly found and extracted mining material in Meghalaya.. The state of Meghalaya accounts for about 9% of the total limestone resources of India. However Meghalaya contributes 12% of cement grade limestone in the country. Limestone is found in the southern fringe of the state, extending for about 200km from Jaintia Hills in the East to Garo Hills in the West. Jaintia Hills contributes, 55% of the total limestone reserves in the state.

Upper Sylhet Limestone member (stage) of Shella Formation has been targeted for limestone resources, majorly belonging to Cement (Blendeble and Benificiable) grade. Limestone occurs as thick layered bedded deposits with alternate bands of sandstones of the same Sylhet stage. There is huge demand of Limestone of any grade in the state both for the domestic requirements and also outside the state. .

Local

The information collected from MCL, reveals that the general orientation of the pits is in NE-SW direction. The existing working pits are located in the central, south eastern part & SW boundary of the lease area. The lowest level of the existing mine pit is 668 mamsl (RL). From the results of the boreholes & surface exposures it was established that entire lease area is limestone bearing and depth wise extension was proved up to 643.20 mamsl (RL). The reduced level for the lowest bench for the present Mining Plan shall be 661.2 mamsl (RL.). The bottom RL and depth of boreholes cannot be decided now as it depends upon the continuity of the

MEGHALAYA CEMENT THANGSKAI

mineralised zone and it will be decided during the course of drilling. So, the depth of the borehole may vary as per the continuity of mineralized zone.

The entire lease area surveyed for preparation of mine planning map by MCL, has been studied thoroughly. The initial highest RL of the lease area was 758 mamsl but the commencement of mining which started from 741 mamsl after topographical treatment and removal of over burden. The reduced level of active mining started from 741mamsl which is still in progress. The present lowest reduced level of mining base has gone down to 668 mamsl, and no bore hole log indicates that saturated fractures zones were encountered. This indicates absence of water saturated fractures in the difference of 73 m.

Groundwater

Very little information is available on hydrogeology of either the buffer zone or even the zone surrounding the buffer zone of the study area. There is no groundwater structure in the form of bore well or dug well exist in and around the mining lease area. Therefore the depth to groundwater level could not be ascertained in the core zone of the study area. In the buffer zone (10km radius) bore wells exist specially close to some of the petrol pumps in the area. But even after best efforts, water level within the bore wells could be measured only in three bore wells out of five bore wells where attempts were made. Since aquifers (water bearing layer) in this undulating topography with hard sedimentary rocks beneath the ground surface, are localized in nature and cannot be extended regionally. However, considering the hydrogeological set up of the area, it can be inferred that the groundwater level, is well below the present lowest mining level of 668 mamsl. Groundwater is not likely to be encountered, within the present Mining Plan of 661.2 mamsl (RL.). Quality of ground has been chemically analysed and except a slightly higher pH value, all other parameters are within the desirable limit as per Bureau of Indian Standards. Higher pH values are generally expected in any terrain, where mining for limestone is underway. This also indicates that there is no trace of 'acid mine drainage' which is a common feature in a mining area.

However, construction of a monitoring well will establish the inference drawn about the depth of groundwater level in the mining lease hold area. This monitoring well can be used for

MEGHALAYA CEMENT LTD. THANGSKAI

Annex-III

recording both depth to water level and water quality analyses periodically and the data generated can be placed before the regulating agencies like Indian Bureau Of Mines, Central Pollution Control Board and Central Ground Water Authority. The location of such a monitoring well has been shown to GM (Mines), MCL during the field level study and marked on the mine plan map (Fig. 15) provided for the study of consultants from Centre for Ground Water Studies. The design of the monitoring well is required to be as follows;

i) Depth of the well 200 meters or depth of water saturated zones whichever is less

ii) Diameter : 6 inches (150 mm)

iii) Blank pipe 1 meter above ground level

iv) Casing (150 mm dia.) down to the depth of 30 m to 40 m below ground level and below which bore hole remaining uncased.

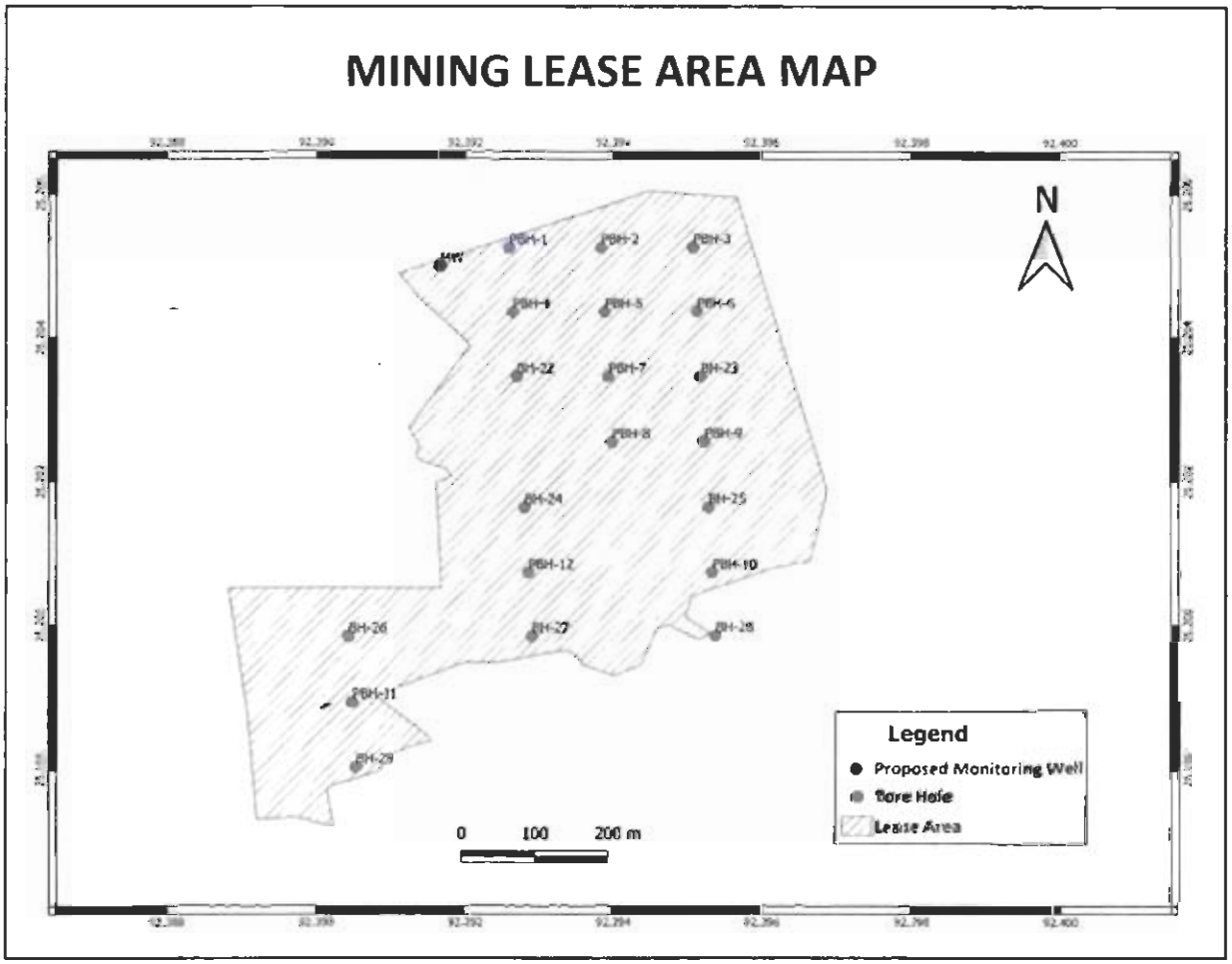

Fig 15 : Mining lease area map showing location of proposed monitoring well

MEGHALAYA CEMENT LTD THANGSKAI

Annex- III

CHAPTER -VII

CONCLUSIONS AND RECOMMENDATIONS

This report is an outcome of Hydrogeological Survey conducted by a team of consultants from Centre for Ground Water Studies, Kolkata during the period, from 06.07.2021 to 09.07.2021 in the village Thangaskai in Khelarihat block of East Jaintia Hill district in the state of Meghalaya. The study area was divided in two parts i) a core area comprising 2km radius of the mining leasehold area and 10 km radius surrounding the core area.

The main objective of the study was to ascertain hydrogeological regime prevailing in the area and to analyse the hydrogeological and hydrochemical factors that may be closely associated with the mining of limestone that is operative in full swing. Field level investigations coupled with collection of required data, following detailed technical discussions with the officials of Meghalaya Cement Limited during the visit and citing and incorporating relevant literature from secondary sources of repute during pre-field visit and post-field visit form the basis for the preparation of this report.

All the parameters associated with Hydrogeological Survey, have been dealt with in this report. Undulating tableland geomorphic feature enhances surface run off component and does not allow water received from rainfall much scope to go underneath to supplement groundwater reservoir. Drainage is structurally controlled as manifested in the form of parallel to sub-parallel geometric configuration. The area is a very high rainfall area, with average annual rainfall being 6683.18 mm per annum where noticeable rainfall occurs even during the non-monsoon months. It experiences fairly pleasant climate. Geologically study area comprises sedimentary rocks which belong to Shylhet stage of Shella formation belonging to Jaintia group of Tertiary age. Here Limestones alternate with sandstone bands of various thickness. Hydrogeologically, the set up is a semi-consolidated units which get dissected at places with fractures and fissures which may or may not be saturated with water. Hydrochemical analyses reveals that water in both bore wells and streams have not been affected, due to mining in the area, except a higher pH value which is a common feature of any Limestone terrain. Analyses

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using Gibbs diagram indicates that the water is mainly of rock-dominance origin except the spring water which is precipitation-dominance origin.

The information collected from MCL, reveals that the general orientation of the pits is in NE-SW direction. The existing working pits are located in the central, south eastern part & SW boundary of the lease area. The lowest level of the existing mine pit is 668 mamsl (RL). .However, considering the hydrogeological set up of the area, it can be inferred that the groundwater level, is well below the present lowest mining level of 668 mamsl. Groundwater is not likely to be encountered, within the present Mining Plan of 661.2 mamsl (RL.)

Construction of a monitoring well is recommended which will establish the inference drawn about the depth of groundwater level in the mining lease hold area. This monitoring well can be used for recording both depth to water level and water quality analyses results, periodically and the data generated can be placed before the regulating agencies like Indian Bureau Of Mines, Central Pollution Control Board and Central Ground Water Authority.

MEGHALAYA CEMENT LTD. THANGSKAI

Annex-III

Field Photographs

Fig:16 MCL mining lease area

Fig 17: Chyrtong water falls

Fig:18 Lumshnong Spring

Fig:19 Pump house beside Lunar river

Fig:20 Pump house beside Umparthi river

Fig:21 River water settling tank

MEGHALAYA CEMENT LTD THANGSKAI

Fig:22 Water level measurement at J K Service station, Lumshnong

Fig:23 Bore well beside Meghalaya Mines & Minerals Ltd.

Fig:24 Water level measurement at J K Service station, Lumshnong

Fig:25 Sample collection from Lunar river

Fig:26 Water level measurement at Chiehruphi Petrol pump

Fig:27 Sample collection from Lumshnong Spring

Annex - IV

POLLUTION TESTING STATION

LADTHALABOH, JAINTIA HILLS

Name of Licence Holder:-
M/s JASPER I SLONG
Ladthalaboh, Jaintia Hills
Jowai - 793150

LICENCE NO. Com/Trans/74/2004/5
DATE OF ISSUE :- 21ST March, 2005

Book No. 66 **Sl No.** 6662 **Date** 01-11-2021

SMOKE EMISSION TEST REPORT
(DIESEL DRIVEN VEHICLES)

The Vehicle No ML 04 A 3210 is tested for emission level and reading is as under.

Type of Vehicle other than agriculture tractors		Notifiedf Standard of Maximum smoke density			Actual Reading	
		Light absorption co- efficient	Hatidye Units	Bosch Unit	Light absorption co- efficient	Hatidye Units
1.	Full load at 60 to 70% of maximum engine rated rmp declared by the manufacture. or	3.25	75	5.2		56.06
2.	Free acceleration	2.45	65	5.2		

Certified that the vehicle meets the emission standard fixed unde Rule 115 (2) of the Central Motor Vehicles Rules 1989. This Certificate is valid 01-05-2022

Com/ Trans/PTS (JIS)/44/2005/74,dated: 17.05.2017

Authorised Signature
Seal of the Testing Station

MEGHALAYA CEMENT LTD. THANGSKAI

Annex - IV

POLLUTION TESTING STATION

LADTHALABOH, JAINTIA HILLS

Name of Licence Holder:-
M/s JASPER I SLONG
Ladthalaboh, Jaintia Hills
Jowai - 793150

LICENCE NO. Com/Trans/74/2004/5
DATE OF ISSUE :- 21ST March, 2005

Book No. 66 **Sl No.** 6661 ***Date*** 01-11-2021

SMOKE EMISSION TEST REPORT
(DIESEL DRIVEN VEHICLES)

The Vehicle No ML 04 A 3216 is tested for emission level and reading is as under.

	Type of Vehicle other than agriculture tractors	Notifiedf Standard of Maximum smoke density			Actual Reading	
		Light absorption co- efficient	Hatidye Units	Bosch Unit	Light absorption co- efficient	Hatidye Units
1.	Full load at 60 to 70% of maximum engine rated rmp declared by the manufacture. or	3.25	75	5.2		54.07
2.	Free acceleration	2.45	65	5.2		

Certified that the vehicle meets the emission standard fixed unde Rule 115 (2) of the Central Motor Vehicles Rules 1989. This Certificate is valid 01-05-2022

Com/ Trans/PTS (JIS)/44/2005/74,dated: 17.05.2017

Authorised Signature
Seal of the Testing Station

MEGHALAYA CEMENT LTD. THANGSKAI

Annex- IV

POLLUTION TESTING STATION

LADTHALABOH, JAINTIA HILLS

Name of Licence Holder:-
M/s JASPER I SLONG
Ladthalaboh, Jaintia Hills
Jowai - 793150

LICENCE NO. Com/Trans/74/2004/5
DATE OF ISSUE :- 21ST March, 2005

Book No. 66 **Sl No.** 6665 **Date** 01-11-2021

SMOKE EMISSION TEST REPORT
(DIESEL DRIVEN VEHICLES)

The Vehicle No ML04A7614 is tested for emission level and reading is as under.

Type of Vehicle other than agriculture tractors		Notifiedf Standard of Maximum smoke density			Actual Reading	
		Light absorption co- efficient	Hatidye Units	Bosch Unit	Light absorption co- efficient	Hatidye Units
1.	Full load at 60 to 70% of maximum engine rated rmp declared by the manufacture.	3.25	75	5.2		51.08
	or					
2.	Free acceleration	2.45	65	5.2		

Certified that the vehicle meets the emission standard fixed unde Rule 115 (2) of the Central Motor Vehicles Rules 1989. This Certificate is valid 01-05-2022

Com/ Trans/PTS (JIS)/44/2005/74,dated: 17.05.2017

Authorised Signature
Seal of the Testing Station

MEGHALAYA CEMENT THANGSKAI

Annex- IV

POLLUTION TESTING STATION

LADTHALABOH, JAINTIA HILLS

Name of Licence Holder:-
M/s JASPER I SLONG
Ladthalaboh, Jaintia Hills
Jowai - 793150

LICENCE NO. Com/Trans/74/2004/5
DATE OF ISSUE :- 21ST March, 2005

Book No. 66 **Sl No.** 6664 **Date** 01-11-2021

SMOKE EMISSION TEST REPORT
(DIESEL DRIVEN VEHICLES)

The Vehicle No ML 04 A 7615 is tested for emission level and reading is as under.

Type of Vehicle other than agriculture tractors		Notifiedf Standard of Maximum smoke density			Actual Reading	
		Light absorption co- efficient	Hatidye Units	Bosch Unit	Light absorption co- efficient	Hatidye Units
1.	Full load at 60 to 70% of maximum engine rated rmp declared by the manufacture. or	3.25	75	5.2		49.13
2.	Free acceleration	2.45	65	5.2		

Certified that the vehicle meets the emission standard fixed unde Rule 115 (2) of the Central Motor Vehicles Rules 1989. This Certificate is valid 01-05-2022

Com/ Trans/PTS (JIS)/44/2005/74,dated: 17.05.2017

Authorised Signature
Seal of the Testing Station

MEGHALAYA CEMENT LTD. THANGSKAI

Annex- IV

POLLUTION TESTING STATION

LADTHALABOH, JAINTIA HILLS

Name of Licence Holder:-
M/s JASPER I SLONG
Ladthalaboh, Jaintia Hills
Jowai - 793150

LICENCE NO. Com/Trans/74/2004/5
DATE OF ISSUE :- 21ST March, 2005

Book No. 66 **Sl No.** 6663 **Date** 01-11-2021

SMOKE EMISSION TEST REPORT
(DIESEL DRIVEN VEHICLES)

The Vehicle No ....ML 04 A 7616.... is tested for emission level and reading is as under.

	Type of Vehicle other than agriculture tractors	Notifiedf Standard of Maximum smoke density			Actual Reading	
		Light absorption co- efficient	Hatidye Units	Bosch Unit	Light absorption co- efficient	Hatidye Units
1.	Full load at 60 to 70% of maximum engine rated rmp declared by the manufacture. or	3.25	75	5.2		49.08
2.	Free acceleration	2.45	65	5.2		

Certified that the vehicle meets the emission standard fixed unde Rule 115 (2) of the Central Motor Vehicles Rules 1989. This Certificate is valid ..01-05-2022.....

Com/ Trans/PTS (JIS)/44/2005/74,dated: 17.05.2017

MEGHALAYA CEMENT THANGSKAI

Authorised Signature
Seal of the Testing Station

Annex- V

GOVERNMENT OF INDIA
MINISTRY OF COMMERCE & INDUSTRY
PETROLEUM AND EXPLOSIVES SAFETY ORGANISATION(PESO)
(Formerly Department of Explosives)
House No. 216, 2nd Floor, above IDBI, Chandmari,
Guwahati, Assam Guwahati 781021
Tele: 2652783 Fax: 2652503
Email: dyceeguwahati@explosives.gov.in

No:A/EC/MG/P3/5(A271)

Dated : 02/04/2019

0 2 APR 2019

To,
M/s Meghalaya Cements Ltd.,
Thangskai, East Jaintia Hills
Town/Village - East Jaintia Hills
Distt. EAST JAINTIA HILLS. State. Meghalaya. Pincode-793210

Subject: **Licence to possess for use of Ammonium Nitrate from a store house attached to explosives manufacturing unit (ANFO) situated at Survey No.:Umpeh Area, Village/Town. Village: Lumshnong, Distt. EAST JAINTIA HILLS, State Meghalaya Licence No.: A/EC/MG/P3/5(A271) granted in Form P-3 of Ammonium Nitrate Rules, 2012 - Renewal regarding**

Sir(s),

Reference to your letter No.: 14539 dated: 08/03/2019, the subject licence duly renewed upto 31/3/2022 and issued in Form P-3 of Ammonium Nitrate Rules, 2012 is forwarded herewith, Please acknowledge receipt of the licence.

For further renewal of licence, please submit the following documents so as to reach this office on or before 31/3/2022

- Application in Form R-1 duly filled in and signed.
- Licence fees for one to five years in the form of demand draft drawn on any Nationalized Bank in favour of Jt. Chief Controller of Explosives, Kolkata payable at Kolkata.
- Original licence with approved plan.
- In this connection, please also refer to Rule 36 of Ammonium Nitrate Rules, 2012.
- Six copies of colour passport size photographs duly signed by the occupier (as defined under Rule 2 (O) of Ammonium Nitrate Rules,2012) 'in front' by 'black color indelible ink'.(if not submitted).

Enclosures :

Yours faithfully,

(Dinesh Singh)
Dy. Controller of Explosives
For Dy. Chief Controller of Explosives
उप मुख्य विस्फोटक नियंत्रक
गुवाहाटी

Copy Forwarded to:

1. District Magistrate, EAST JAINTIA HILLS (Meghalaya) for information

For Dy. Chief Controller of Explosives,
Guwahati

(For more information regarding status, fees and other details, please visit our web site http://peso.gov.in)

Received Original Copy

Received 4/4/19

MEGHALAYA CEMENT LTD. THANGSKAI

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Annex- V

LICENCE FORM P-3
(See Sr.No.-3 of Schedule I and rule 35
of Ammonium Nitrate Rules,2012)

Licence to possess for use of Ammonium Nitrate from a store house attached to Explosives Unit (ANFO)

License No. : A/EC/MG/P3/5(A271)
Annual Fee Rs: 1000/-

1. Licence is hereby granted to : M/s. Meghalaya Cements Ltd. (Occupier : Ramesh Kumar Parcek)
   Thangskai, East Jaintia Hills, Town/Village - East Jaintia Hills
   District-EAST JAINTIA HILLS, State-Meghalaya, Pincode - 793210
   Phone -, Email-, Fax-
2. Status of licence holder: Company
3. Licence is valid only for the following purpose : **Licence** to possess for use of Ammonium Nitrate from a store **house attached to explosives manufacturing unit (ANFO)**
4. Licence is valid for the following quantity of Ammonium Nitrate:

Name and Description	Quantity at a time (Kg.)	Quantity of Ammonium Nitrate to be purchased in a financial Year (Kg.)
Ammonium Nitrate (Solid)	40000	480000

5. The licensed premises shall conform to the following drawing(s):
   Drawing No : A/EC/MG/P3/5(A271) dated : 13/06/2014
6. The Licensed premises are situated at following address:
   Survey No. Umpeh Area , Town/Village : Village: Lumshnong
   Police Station : Lumshnong **District : EAST JAINTIA HILLS** State : Meghalaya
   PinCode : 793210 **Phone :** **E-Mail : mines@topcem.in** Fax :
7. The licensed premises consist of following facilities :
   Consist of one store house .
8. The licence is granted subject to the provision of Explosives Act 1884 as amended from time to time and the Ammonium Nitrate Rules, 2012 framed there under and the conditions, additional conditions and Annexures.
   (i) Drawings (showing site, constructional and other details) as stated in serial No. 5 above.
   (ii) Conditions and Additional Conditions of this licence signed by the license issuing authority.
9. This licence shall remain valid till 31st day of March 2019

This licence is liable to be suspended or revoked for any violation of the Explosives Act 1884 or Ammonium Nitrate Rules, 2012 framed there under or the conditions of this license,if the licensed premises are not found conforming to the description shown in the plans and annexure attached hereto.

The Date: 13/06/2014

Joint Chief Controller of Explosives
East Circle office, Kolkata

Amendments :
- Change in Authorized Signatory/Occupier/Partners/Directors dated : 26/08/2015
- Change in Authorized Signatory/Occupier/Partners/Directors dated : 04/03/2019

Endorsement for renewal of licence:

Date of Renewal	Date of Expiry	Signature of licensing Authority
02/04/2019	31/03/2022	उप मुख्य विस्फोटक नियंत्रक गुवाहाटी

Statutory Warning : Misuse of Ammonium Nitrate shall constitute serious criminal offence under the law.

MEGHALAYA CEMENT LTD. THANGSKAI

Annex - V

Conditions

The following are the conditions of licence number A/EC/MG/P3/5(A271) to Licence to possess for use of Ammonium Nitrate from a store house attached to explosives manufacturing unit (ANFO) in Form P-3 [Sr. No. -3] granted by the Chief Controller or Controller of Explosives.

1. The Ammonium Nitrate shall be possessed only in the licensed storehouse or melt storage tank shown in the approved plan attached with the License.
2. The quantity of Ammonium Nitrate in the premises or any part thereof shall not exceed at any one time the quantity for which License has been issued.
3. Spilled or sweepings of Ammonium Nitrate the waste Ammonium Nitrate collected from sweeping or spilled shall be destroyed by the License holder and account thereof shall be maintained indicating the quantity of the Ammonium Nitrate destroyed.
4. The License holder and every person employed shall take all due precautions for prevention of accidents by fire or explosion in the licensed premises and for preventing unauthorized person from having access to licensed premises and shall abstain from any act from whatsoever which tends to cause or explosion and is not reasonably necessary for the purpose of works related thereto.
5. No additions and alterations shall be carried out in the licensed premises without a previous sanction in writing of the Licensing Authority. Such additions and alterations so sanctioned shall be shown in the amended plan attached to the License.
6. The License holder shall appoint a competent person to supervise the operations shall be conducted under the supervision of the competent person.
7. Free access to the licensed premises shall be given at all reasonable times to any inspecting or sampling officer and all facilities shall be offered to the officer for ascertaining that the provisions of the Act and these rules and the safety conditions are duly observed.
8. If the License Issuing authority or the inspecting officer informs in writing, the holder of the License to execute any repairs or to make any additions or alterations to the licensed premises or carry out recommendations, which are in the opinion of such authority may pose unacceptable risk and therefore the same is necessary for the safety or security of the premises or persons, the holder of the License shall execute the recommendations and report compliance within the period specified by such authority.
9. Accidents by fire or explosion and losses, shortage or theft of Ammonium Nitrate shall be immediately reported to the nearest police station and the District Authority.
10. License holder shall maintain records in the prescribed forms specified in Schedule II Part 3 to ensure accountability, identification and traceability of Ammonium Nitrate and shall produce such records on demand to authority specified in rule 50.
11. The License holder shall submit monthly returns of AN received, sold /used/stolen or short received and destroyed in the form prescribed in Form R-9 of Part 3 of Schedule II so as to reach Licensing Authority and District Authority within 10th day of every succeeding month.

For Joint Chief Controller of Explosives
East Circle office, Kolkata

MEGHALAYA CEMENT LTD. THANGSKAI

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Annex-VI

MEGHALAYA CEMENTS LIMITED

Village –Thangskai, P.O.-Lumshnong, District- East Jaintia Hills,
Meghalaya, PIN – 793210.

Expenditure Incurred for Socio-Economic Development under CSR activities for 31.05 Ha Mines Project

From **01st April'2021 to 30th September'2021.**

Sl.No	Heading	Amount in Rs.
1.	Emphasis on Education	66,000.00
2.	Encouraging/Felicitation program for Students.	39,500.00
3.	Polio Immunization Camps, family planning, etc.	378,929.00
4.	Infrastructure development of Hospitals / Schools	282,378.00
5.	Cement Distribution Programme.	1,784,273.00
6.	Plant Distribution programme	5,076.00
7.	Donation to Churches, Road & House Repairing etc.	41,200.00
8.	Drinking water supplying scheme.	71,606.00
9.	Village development funds.	187,500.00
10.	Corona Pandamic	00.00
	Gross Total	**2,856,462.00**

For **MEGHALA CEMENTS LIMITED**

MEGHALAYA CEMENT LTD THANGSKAI

(Authorized Signatory)

Annex - VII

Meghalaya cements limited

Thangskai , Meghalaya

UPSTREAM WATER ANALYSIS REPORT FOR THE YEAR 2021-22 (Near toilet area)

Name of the Mine:- **SOUTH KHLIEHJRI LIMESTONE MINES**

14.10.2021

Sl. No.	Parameters	Obtained Values in						Average	Permissible Limit
		Apr'2021	May'2021	Jun'2021	Jul'2021	Aug'2021	Sep'2021		
1	pH	7.2	6.9	7.3	7.1	7.4	7.1	7.17	6.5 – 8.5
2	Dissoled Oxygen (mg/lit)	12.3	12.6	11.8	12.4	12.6	11.9	12.27	-
3	Total Dissolve Solids (mg/Lit)	158	147	169	172	163	172	163.50	<500
4	Conductivity (mg/Lit)	158	176	184	139	161	172	165.00	-
5	Total Hardness (mg/ Lit)	236	248	272	247	214	268	247.50	<300
6	Calcium Hardness (mg/Lit)	162	149	172	168	173	159	163.83	<200
7	Magnesuim Hardness (mg/Lit)	83	77	72	81	73	68	75.67	<100
8	Alkalinity (mg/Lit)	72	69	73	64	59	66	67.17	<200

Prepared By

Arti Singh

Checked & Verified By

Ujjwal Anurag

MEGHALAYA CEMENTS THANGSKAI

Annex - VII

Meghalaya cements limited

Thangskai , Meghalaya

DOWNSTREAM WATER ANALYSIS REPORT FOR THE YEAR 2021-22 (Southern side of reject dump)

Name of the Mine:- **SOUTH KHLIEHJRI LIMESTONE MINES**

Date:-14.10.2021

Sl. No.	Parameters	Obtained Values in						Average	Permissible Limit
		Apr'2021	May'2021	Jun'2021	Jul'2021	Aug'2021	Sep'2021		
1	pH	7.4	7.6	7.2	7.3	7.4	7.2	7.35	6.5 – 8.5
2	Dissoled Oxygen (mg/lit)	11.65	11.58	12.5	10.67	13.48	12.76	12.11	-
3	Total Dissolve Solids (mg/Lit)	139	172	147	128	155	134	145.83	<500
4	Conductivity (mg/Lit)	176	141	171	168	147	152	159.17	-
5	Total Hardness (mg/ Lit)	213	228	264	247	261	259	245.33	<300
6	Calcium Hardness (mg/Lit)	136	145	128	176	147	169	150.17	<200
7	Magnesuim Hardness (mg/Lit)	76	84	79	81	76	78	79.00	<100
8	Alkalinity (mg/Lit)	89	84	69	75	72	81	78.33	<200

Prepared By

Arti Singh

Checked & Verified By

Ujjwal Anurag

MEGHALAYA CEMENTS LTD. THANGSKAI

Annex - VII

Annex- VIII

MEGHALAYA CEMENTS LIMITED

Six Monthly Ambient Air Quality Survey Report, South Khliehjeri Limestone Mine (31.05 Ha), 2021-2022

Pollutants	Location	Apr' 2021	May' 2021	Jun' 2021	Jul' 2021	Aug' 2021	Sep' 2021	Avg.	Permissible Limits for Rural Areas (By MSPCB 24 hrs Monitoring)
Particulate Matters PM10 (µg/m3)	A1. North -East (Near Soil Dump)	72.96	69.48	68.51	61.58	63.26	61.29	**66.18**	100 $\mu g/m^3$
	A2. North - West(Near Haul Road)	76.43	71.26	64.18	58.46	55.61	58.67	**64.10**	100 $\mu g/m^3$
	A3.Southern side (Near Lease Boundary)	68.69	64.09	59.87	53.91	49.84	51.97	**58.06**	100 $\mu g/m^3$
Particulate Matters PM2.5 (µg/m3)	A1. North -East (Near Soil Dump)	46.74	44.20	41.59	38.56	33.17	32.78	**39.51**	60 $\mu g/m^3$
	A2. North - West(Near Haul Road)	51.69	50.34	48.79	44.67	41.09	38.59	**45.86**	60 $\mu g/m^3$
	A3.Southern side (Near Lease Boundary)	41.91	38.79	35.42	33.82	29.42	27.48	**34.47**	60 $\mu g/m^3$

Prepared By

(Arti Singh)

MEGHALAYA CEMENTS LTD. THANGSKAI

Checked & Verified By

(Ujjwal Anurag)

Annex - VIII

Annex- VIII

MEGHALAYA CEMENTS LIMITED

Six Monthly Ambient Air Quality Survey Report,
South Khliehjeri Limestone Mine (31.05 Ha), 2021-2022

Pollutants	Location	Apr' 2021	May' 2021	Jun' 2021	Jul' 2021	Aug' 2021	Sep' 2021	Avg.	Permissible Limits for Rural Areas (By MSPCB 24 hrs Monitoring)
SO_2	A1. North -East (Near Soil Dump)	12.61	14.35	13.59	14.08	13.26	11.40	**13.22**	80 $\mu g/m^3$
	A2. North - West(Near Haul Road)	09.54	11.16	09.04	11.37	13.68	14.07	**11.48**	80 $\mu g/m^3$
	A3.Southern side (Near Lease Boundary)	08.92	09.42	11.49	09.31	08.62	09.31	**09.51**	80 $\mu g/m^3$
NOx	A1. North -East (Near Soil Dump)	09.61	08.27	10.12	11.34	09.21	07.95	**09.41**	80 $\mu g/m^3$
	A2. North - West(Near Haul Road)	11.34	10.39	06.24	04.28	06.68	08.28	**07.87**	80 $\mu g/m^3$
	A3.Southern side (Near Lease Boundary)	07.48	08.44	07.59	06.16	06.19	7.66	**07.25**	80 $\mu g/m^3$

Prepared By

(Arti Singh)

Checked & Verified By

(Ujjwal Anurag)

MEGHALAYA CEMENTS LTD. THANGSKAI

Annex-VIII

Annexure-IX

SOUTH KHLIEHJARI LIMESTONE MINE

Information on Afforestation for the period April,2021 to September,2021

1	Name of the Mine	South Khliehjari Limestone Mine
2	Owner's Name	M/s Meghalaya Cements Limited
3	District / State	East Jaintia Hills/Meghalaya
4	Mineral Worked	Limestone
5	Category of the Mine	A

Afforested during the quarter ENDING June (1st April to 30th June 2021)

No. of trees planted		Area covered (in ha.)		No. of trees survived		Survival rate	
WML	OML	WML	OML	WML	OML	WML	OML
1	2	3	4	5	6	7	8
295	Nil	0.235	N/A	230	N/A	77.96%	N/A

Afforested during the quarter ENDING September (1st July to 30th September, 2021)

No. of trees planted		Area covered (in Ha.)		No. of trees survived		Survival rate	
WML	OML	WML	OML	WML	OML	WML	OML
1	2	3	4	5	6	7	8
50	Nil	0.0375	N/A	39	N/A	78.00%	N/A

Cumulative at the end 30th September, 2021

No. of trees planted		Area covered (in Ha.)		No. of trees survived		Survival rate	
WML	OML	WML	OML	WML	OML	WML	OML
1	2	3	4	5	6	7	8
2350	1194	1.2152	0.4523	1799	890	76.55%	74.54%

Note: - WML- within Mining Lease; OML- Outside Mining Lease

MEGHALAYA CEMENT THANGSKAI

Umesh Kumar
Mines Manager

Annex- X

M/s MEGHALAYA CEMENTS LIMITED

Vill- Thangskai, P.O - Lumshnong
East Jaintia Hills, Meghalaya-793210

Expenditure incurred against Enviromental Protection Measures of South Khliehjari during the year 2020-21 (from April,2021 to September,2021)			
1	2	3	4
Sl no	**Head**	**Subhead**	**Total Expenditure incurred (in lakh)**
1	**Plantation**	**Pre plantation cost to develop the area for ready for plantation** i. Dumping & dozing of soil to make the area plain ii. Spreading of Topsoil **Sappling & Plantation cost** **Maintenance cost** i. Manuring ii. Watering in (26 days) iii. Watching (one permanent labour Rs 9000/-per month) iv. Fencing	2.25
2	**Dust suppression**	Cost against Water sprinkler used in hoal roads & loading point & unloading point	12.37
3	**Preparation of Retaining wall, Checkdam, Siltation Tanks and Garland drains**	Maintenance of Siltation Tanks -(2 no)	0.73
		Contruction of Retaing wall (160 m)	
		Preparation of Garland drains (160 m)	
5	**PPE supply to mine workers**	Nose Mask Ear Muffs Safety Shoe	0.23
6	**Water Treatment**	Captial investment for Water Treatment Plant Recurring cost for water treatment	0.80
7	**Maintenance of Effluent Treatment Plant**	Chemical consumption for treatment of effluents (lime , bleaching powder, alum etc.) Power cost Manpower cost	
8	**Dump Compaction**	Compection of dumps by compactor	1.5
		Total	**17.88**

MEGHALAYA CEMENT THANGSKAI