vedanta
transforming elements

Ref : HZL/RA/ENV/MoEF&CC/2022-23/463

28.05.2022

To,
The Deputy Director (S) /Scientist -C
Ministry of Environment, Forest & Climate Change,
Integrated Regional Office, A-209&218,Aranya Bhawan,
Jhalana Institutional area Jaipur-302004

Sub: Six monthly environmental compliance reports from October 2021 to March 2022.

Ref : Environment Clearances and Amendments	
1.	Environment Clearance vide No. : J-11015/267/2008-IA.II (M) Dtd. 11.12.2009.
2.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 05.03.2012
3.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 22.08.2014
4.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 12.12.2014
5.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 28.12. 2015
6.	Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 28.02. 2020

Sir / Madam,

Please find enclosed herewith the compliance status report of above referred Environmental Clearance granted by the Ministry of Environment, Forest and Climate Change for the period of **October 2021 to March 2022.** along with soft copy in a CD.

Hope you find this in order.

Thanking you,

Your faithfully

(Kishore Kumar S)
CEO Agucha IBU

CEO - IBU Agucha
Hindustan Zinc Limited
Rampura Agucha Mines
PO - Agucha
Distt. - Bhilwara (Raj.)

Cc to:

1. In-Charge (Zonal office)
   Central Pollution Control Board,
   Vithal Market, Paryavaran Parisar , E-5, Arera Colony,
   Bhopal, – 462 016 (MP)
2. Member Secretary
   Rajasthan Pollution Control Board
   4 Institutional Area, Jhalana Doogri,
   Jaipur (Raj) -302004
3. The Regional officer
   Rajasthan Pollution Control Board Regional Office,
   18, Azad Nagar, Pannadhay Circle Mining Engineer Office Road
   (Near Telephone Exc.) Bhilwara-311001

HINDUSTAN ZINC LIMITED RAMPURA AGUCHA MINE

MoEF Environmental Clearance for Expansion of Rampura Agucha Lead and Zinc Opencast and Underground Mining Project (from 5.00 to 6.15 mTPA) and Beneficiation Capacity of Beneficiation Plant (from 5.00 to 6.50mTPA) Env Clearance Vide No. J-11015/267/2008-IA.II (M) Dtd 11.12.2009

S. No.	Condition	Status
	A. Specific Conditions	
i	The project proponent shall obtain Consent to Establish and Consent to Operate from the Rajasthan State Pollution Control Board and effectively implement all the conditions stipulated therein	Consent to establish obtained from RSPCB. Consent to Operate granted by RSPCB vide File F(Mines)/Bhilwara(Hurda)/12(1)/2015-2016/1229-1233 dated 25/06/2019 for mining activity. RSPCB. Consent to Operate granted by RSPCB vide File F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500 dated 22/10/2019 for Beneficiation plant , and the conditions stipulated are implemented.
ii	The environmental clearance is subject to approval of the State Land use Department, Government of Rajasthan for diversion of agricultural land for non-agricultural use.	Land purchased within Mine Lease area and converted in name of HZL for mining.
iii	The project proponent shall ensure that no natural watercourse and/or water resources shall be obstructed due to any mining operations.	No natural watercourse or water resources are obstructed due to mining operations.
iv	The top soil shall temporarily be stored at earmarked site(s) only and it should not be kept unutilized for long. The topsoil shall be used for land reclamation and plantation.	Top soil utilized on waste dump for its stabilization and plantation.
v	The over burden generated during the mining operation shall be stacked at earmarked dump site(s) only and it should not be kept active for a long period of time and its phase-wise stabilization shall be carried out. The maximum height of the dump should not exceed 100m having 5 terraces as recommended by the Central Institute of Mining and Fuel Research, Dhanbad. The recommendations made by the Central Institute of Mining and Fuel Research, Dhanbad shall be effectively implemented. The over burden dump shall be scientifically vegetated with suitable native species to prevent erosion and surface run off. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment & Forests and its Regional Office located at Lucknow on six monthly basis	Amendment in this condition was granted in EC vide letter No J-11015/267/ 2008-I-A.II (M) dated 22nd August, 2014. The maximum height of the dump shall not exceed 140 m (in two lifts of 20m each). Waste dump vegetated fase manner. Waste dump are covered by applicable of geotextiles.
vi	The void left unfilled in an area of 25 ha shall be converted into water body. The higher benches of excavated void/mining pit shall be terraced	Will be complied during the mine closure.

	and plantation done to stabilize the slopes. The slope of higher benches shall be made gentler. Peripheral fencing shall be carried out along the excavated area.	
vii	Catch drains and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from mine working and over burden dump. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains should be regularly desilted particularly after monsoon and maintained properly. Garland drain (size, gradient and length) shall be constructed for both mine pit and over burden dump and sump capacity should be designed 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. Sump capacity should also provide adequate retention period to allow proper settling of silt material. Sedimentation pits should be constructed at the corners of the garland drains and desilted at regular intervals.	Garland drain of adequate size is constructed along the waste dump toe & mining pit, along with siltation pond that provides adequate retention time for settling of silts and rain water collection lined sumps of about 8.5 lakh CuM. The water collected is utilized for watering the mine area, roads, green belt development etc Annexure –VIII
viii	Dimension of the retaining wall at the toe of dump and OB benches within the mine to check run-off and siltation should be based on the rain fall data.	The retaining wall at the toe of the OB dump is constructed along with garland drain. Annexure VIII
ix	Regular monitoring of subsidence movement on the surface over working area and impact on water bodies/vegetation/ structures/ surrounding shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate measures shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil/suitable material.	A comprehensive assessment and monitoring of subsidence movement on the surface over working area is done by a dedicated team comprising of Rock mechanic engineers. There has been no subsidence or movement observed.
x	All the mine entries shall be above the highest flood level to avoid any anticipated flooding of mine from the surface water during the rainy season	The underground mine opening is at 392 mRL against highest flood level at Agucha reservoir of 391 mRL. Further, A peripheral bund is constructed around the mine pit for protection of the mine from flooding due to rain water.
xi	In areas where subsidence is anticipated in shallow mineral occurrence, such areas be identified and provided with garland drains to ensure draining of water and avoid ingress of the same in to the underground mine.	No subsidence is anticipated in the proposed area. Garland drain is already constructed as a safety measure to avoid ingress of water into underground mining.
xii	The project authorities shall check the possibility of existence of fault(s) before deciding about the thickness of safe barrier required to be maintained between the working	Mining activities are carried out as per Mine plan as approved by IBM. De-pillaring, if required shall be carried out after prior approval of the DGMS.

	face and the water bodies, if any, in consultation with the Director General Mines & Safety (DGMS). De-pillaring should also be carried out after taking prior approval of the DGMS.	
xiii	The project proponent shall carry out conditioning of the ore with water to mitigate fugitive dust emission, without affecting flow of ore in the ore processing and handling areas.	Water sprinklers are installed on conveyer belts, transfer points, and conditioning of ore is done during crushing to mitigate fugitive dust. Annexure- XXXII
xiv	The effluent from the ore beneficiation plant shall be treated to conform to the prescribed standards and the tailings slurry shall be transported through a closed pipeline to the tailing dam.	Tailings are being disposed through closed pipeline to the earmarked Tailing dam after necessary lime treatment. Annexure- XXXVI
xv	The decanted water from the tailing dam shall be re-circulated and there should be zero discharge from the tailing dam. Acid mine water, if any, shall be neutralized and reused within the plant.	Tailing dam water is completely reused in process plant and zero discharge is maintained. There is no acid mine drainage occurring in the mine.
xvi	Plantation shall be raised in an area of 670.7ha including a green belt of adequate width by planting the native species around ML area, OB dump, around tailing dam, around beneficiation plant, roads etc. in consultation with the local DFO / Agriculture Department. In addition, the township area shall also be adequately planted. The density of the trees should be around 1500 plants per ha. Green belt shall be developed all along the mine lease area in a phased manner and shall be completed within first five years.	Green belt developed all along the acquired mine lease area. Progressive plantation is being carried out on waste dump benches every year Seed spreading and geotextile laying is also carried out on waste dump slopes. As per latest drone-based study 684280.00 Nos of plants are exiting in 348 Ha. Plantation in remaining area will be completed by closure of mine. Additional plantation has been done in 37.70 ha in the township and along roadsides. Annexure –IX. Drone study attached (Annexure XXXVII).
xvii	Regular water sprinkling should be carried out in critical areas prone to air pollution and having high levels of SPM and RPM such as haul road, loading, unloading and transfer points and other vulnerable areas. It should be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central Pollution Control Board in this regard.	Water sprinkling is carried out by 4 Nos. of 40 KL water sprinkler on Haul roads to mitigate air pollution in mine area. Dust extraction system and Water sprinkling nozzles are installed at the crusher, transfer points and coarse stockpiles for dust suppression. The parameters of Ambient Air quality monitored are within the prescribed norm of CPCB. Annexure-X
xviii	The project authority should implement suitable conservation measures to augment ground water resources in the area in consultation with the Regional Director, Central Ground Water Board.	Till date 3 Nos. of anicuts have been constructed for groundwater augmentation in consultation with the CGWB. 4 anicults constructed in the area under MJSA. 8.7 MCM groundwater recharge work has been completed four blocks of Bhilwara district. (Annexure –XI). 8.72 MCM recharge report attached as annexure XXXVIII
xix	Regular monitoring of ground water level and quality shall be carried out in and around the project area (mine lease, beneficiation plant and tailing dam) by establishing a network of existing wells and installing new piezometers during the operation. The periodic monitoring	Regular groundwater monitoring is being done by piezometers and wells outside and inside the lease area. Report enclosed as Annexure -I

	[(at least four times in a year- pre-monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January); once in each season)] shall be carried out in consultation with the State Ground Water Board/Central Ground Water Authority and the data thus collected may be sent regularly to the Ministry of Environment and Forests and its Regional Office Lucknow, the Central Ground Water Authority and the Regional Director, Central Ground Water Board. If at any stage, it is observed that the groundwater table is getting depleted due to the mining activity; necessary corrective measures shall be carried out.	Six monthly reports are submitted to MoEF & CPCB. Quarterly report being sent to RSPCB, CGWA and CGWB.
xx	The project proponent shall ensure that no additional water is drawn for the expansion project. The additional requirement of water will be met out of the water saved by adopting water conservation measures.	No additional water is drawn. The additional requirement of water if any in future will be met out by water conservation measures.
xxi	Suitable rainwater harvesting measures on long term basis shall be planned and implemented in consultation with the Regional Director, Central Ground Water Board.	Various rainwater-harvesting measures are implemented including the construction of rainwater collection pond of about 1.5 Lakh cum in the township, collection sumps of 8.5 lakh CuM capacity to collect and reuse the rain. Annexure XII
xxii	Regular monitoring of groundwater quality around the tailing dam shall be carried out in consultation with Central Ground Water Authority and records maintained. It shall be ensured that the groundwater quality is not adversely affected due to the project	Groundwater quality is regularly monitored around the tailing dam through piezometers within ML area and wells inside as well as outside the lease area. The groundwater quality report is being submitted to MoEF, CPCB RSPCB, CGWA and CGWB on regular basis.
xxiii	Groundwater and surface water in and around the mine shall be regularly monitored at strategic locations for heavy metals such as Ni, Co, Cu, Zn and Cd. The monitoring stations shall be established in consultation with the Regional Director, Central Ground Water Board and State Pollution Control Board	Ground and surface water is regularly monitoring for heavy metals. Report enclosed as in point no xix.
xxiv	Vehicular emissions should be kept under control and regularly monitored. Measures shall be taken for maintenance of vehicles used in mining operations and in transportation of mineral. The vehicles should be covered with a tarpaulin and shall not be overloaded	Periodic preventive maintenance of vehicles is part of our operations. All the trucks are covered with tarpaulin while transportation of concentrates to the smelters and no overloading is allowed. Annexure -XIII
xxv	Blasting operation should be carried out only during the daytime. Controlled blasting should be practiced. The mitigative measures for control of ground vibrations and to arrest fly rocks and boulders should be implemented	Blasting operation is carried out with various mitigation measures as per DGMS guidelines to ensure the fly rocks are arrested. The vibrations monitored are well within the prescribed limits by DGMS.

xxvi	Drills shall either be operated with dust extractors or equipped with water injection system	Wet drilling system is adopted.
xxvii	Digital processing of the entire lease area using remote sensing technique should be done regularly once in three years for monitoring land use pattern and report submitted to Ministry of Environment and Forests and its Regional Office, Lucknow	Noted. The land use & land cover change study carried out in 2018. Copy already submitted on 28/05/2018. Annexure-XIV
xxviii	The tailing dam shall be lined by LDPE lining on the sides as the height of the dam is raised. The ultimate height of the dam shall be maintained to 51m and provided with garland drains. The disaster management plan for tailing dam shall be prepared and implemented	The sides of the tailing dam are lined with HDPE. As per letter No. Environment Clearance Amendment vide No. J-11015/267/2008-IA.II (M) dtd. 28.02. 2020 ultimate height shall be 74m. The present height of tailing dam is 60 meter. Garland drains are constructed around the tailing pond with pumping arrangement to collect any seepage and rainwater runoff back to tailing pond. Disaster management plan for the tailing pond is prepared and implemented. Annexure XV
xxix	The recommendations of the study report of NEERI, Nagpur on pollution vulnerability of aquifer shall be effectively implemented and action taken report submitted to the Ministry and its Regional Office, Lucknow on six monthly basis	Complied on the recommendations of NEERI i.e. network of piezometer established and report submitted on six monthly basis. Report enclosed as point no xix.
xxx	The project proponent shall regularly analyse the waste generated from the mining (at least once a year) for heavy metals such as Ni, Co, Cu, Pb, Zn and Cd and the data thus collected may be sent regularly to Ministry of Environment and Forests and its Regional Office, Lucknow. It should be ensured that the parameters conform to the prescribed norms	Being analyzed and report is submitted on six monthly basis. Annexure II
xxxi	The recommendations of the study report on blood lead levels of children to monitor levels of lead in human system carried out by National Institute of Occupational Health, Ahemdabad shall be effectively implement and action taken report submitted to the Ministry and its Regional Office, Lucknow on six monthly basis.	As recommended by the NIOH, regular health checkups are carried out for the mine personnel and regular health checkup organized in nearby villages to keep a track of the health status. Annexure XX
xxxii	Pre-placement medical examination and periodical medical examination of the workers engaged in the project shall be carried out and records maintained. For the purpose, schedule of health examination of the workers should be drawn and followed accordingly	Pre-placement medical examination and periodical medical examination of the employees are being carried out at regular interval as per the Mine Act.
xxxiii	Sewage treatment plant shall be installed for the colony. ETP shall also be provided for the workshop and the wastewater generated during mining operation	Sewage treatment plant of 425 KLD capacity in colony and 300 KLD in mine area operating efficiently. Oil & Grease Traps installed and water reused in process. Annexure XVI

xxxiv	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, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project	No construction labour housing is proposed in mining area. However, the sanitation and drinking water facility is provided to the workers, working at site.
xxxv	Acid mine water, if any, has to be treated and disposed of after conforming to the standard prescribed by the competent authority	No acid mine water generated & mine pit water is used in process plant.
xxxvi	The critical parameters such as RSPM (Particulate matter with size less than 10µm i.e., PM_{10} and with size less than 2.5µm i.e., $PM_{2.5}$), NOX in the ambient air within the impact zone, peak particle velocity at 300m distance or within the nearest habitation, whichever is closer shall be monitored periodically . Further, quality of discharged water shall also be monitored [(TDS, DO, PH and Total Suspended Solids (TSS)]. The monitored data shall be uploaded on the website of the company as well as displayed on a display board at the project site at a suitable location near the main gate of the Company in public domain. The circular No. J-20012/1/2006-IA.II(M) dated 27.05.2009 issued by Ministry of Environment and Forests, which is available on the website of the Ministry www.envfor.nic.in shall also be referred in this regard for its compliance	Monitoring of Ambient air at 3 locations inside mine and 3 locations outside the mine area is regularly carried out. Monitoring report is enclosed as Annexure III. Peak Particle velocity of blast vibration is being monitored for every blast & records are maintained. No effluent, treated or untreated, is discharged outside the project area as Zero discharge is maintained at all times. Monitoring data are displayed at Main Gate. Annexure XVII.
xxxvii	A Final Mine Closure Plan along with details of Corpus Fund should be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval	A Final Mine Closure Plan along with details of Corpus Fund will be submitted to the Ministry of Environment & Forests 5 years in advance of final mine closure for approval.

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HINDUSTAN ZINC LIMITEDRAMPURA AGUCHA MINE

MoEF Environmental Clearance Compliance to amendment in EC vide letter No J-11015/267/2008-I-A.II (M) dated 5 March, 2012

Sr. No	Condition	Status
i	In the environment clearance letter dated 11th December, 2009, in para number 1, the words "The mineral will be transported through the road." will be substituted by the words "The mineral will be transported through the rail".	Amendments granted by MoEF vide letter dated 28.12.2015 "The mineral will be transported both through road and rail". Railway line commissioned but not operative.
ii (a)	All the requisite prior clearance from the concerned authorities, as may be applicable to such project shall be obtained and the conditions, if any, stipulated there under shall be effectively implemented.	All the requisite prior clearance from the concerned authorities, as may be applicable to such project shall be obtained and the conditions, if any, stipulated there under shall be effectively implemented.
ii (b)	The project affected people whose land will be acquired for laying of the railway track shall be compensated as per the National / State Policy in this regard.	Compensation given to land owners done by RIICO, GOR as per the norms.
ii (c)	The company shall submit within 3 months their policy towards Corporate Environment Responsibility which should inter alia provide for (i) Standard operating process / process to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions, (ii) Hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the EC conditions and (iii) System of reporting of non compliance s / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders.	Policy towards Corporate Environment Responsibility enclosed.

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HINDUSTAN ZINC LIMITED RAMPURA AGUCHA MINE

MoEF Environmental Clearance Compliance to amendment in condition no (v) in EC vide letter No J-11015/267/2008-I-A.II (M) dated 22nd August, 2014

Specific Condition		
S.No	**Condition**	**Status**
i	The Open crack, whenever developed in the partially consolidated new dump mass, should be consolidated with proper filling/ leveling with the help of dozer/ compactors.	In such case, we shall consolidate with proper filling/ leveling with the help of dozer.
ii	Dump foundation preparation should be done by excavating and removing soil before dumping, to improve the frictional resistance at the base of dump. It should be filled with over burden containing stones.	Complied mining rock waste dump on exiting waste dump.
iii	There should not be any dumping in pool water or on slushy ground.	No dumping is done in water pooled / slushy ground
iv	Discontinuous dumping should be avoided to check water accumulation between two isolated dumps.	Dumping is done at a single earmarked area.
v	During rainy season, an officer should be deputed to go in and around the dump site every morning to see the effectiveness of drain. If any blockage is observed, immediately steps should be taken to make it effective.	Mining officer is always deputed during rainy season to ensure smooth flow of runoff water.
vi	The dump should be surveyed periodically to produce up-to-date and accurate dump geometry.	Survey team survey the dump once in a month to produce up-to-date and accurate dump geometry.
vii	The slope and stability monitoring by Radar should be done and its report should be sent to MoEF and its Regional Office every six – months.	Stability monitoring by Radar Report enclosed as Annexure VII
viii	The dump design should be reviewed by CIMFR or any other scientific agency after reaching dump height of 120m and its report sent to MoEF and its Regional office.	Complied. Waste dump design and slope stability is being reviewed yearly by CIMFR and report being submitted to MoEF Regional Office. Latest report is attached as Annexure XXI
ix	Waste dump has to be managed as per the guidelines of DGMS and quarterly monitoring report to be submitted to DGMS and regional office	Waste dump is being managed as per the DGMS guidelines and quarterly monitoring report shall be submitted to DGMS and regional office.
x	On stabilized dumps, more species such as Pongamia, Bombax ceiba, Tamarind, Arjun, Gravillea robusta and Amla to be planted.	Plantation of Pongamia, Bombax ceiba, Tamarind, Arjun, Gravillea robusta, Amla and other species has been done on stabilized dumps.
xi	The Radar monitoring system should satisfactorily sub- serve the dual objectives viz.(a) Investigative monitoring to provide an understanding of the slope behavior over time and typical response to external events (e.g. Precipitation and seasonal	The analyzed data is enclosed Annexure - VII

	fluctuations) and (b). Predictive Monitoring: To provide a warning of a change in behavior, enabling the possibility of limiting or intervening to prevent hazardous sliding. The data so analyzed should be provided with reference to the above.	
xii	Paved drains are to be provided to protect the slope surface against rain-cuts and seepage during rains to make a safe way to discharge top and surface water to the bottom of the dump. Constant vigilance on the condition of dumps with special reference to accumulation of water and development of cracks.	Paved drains are provided. Constant vigilance shall be given on the dump condition with special reference to water accumulation and development of cracks.
xiii	Regular Monitoring of above mentioned specific conditions shall be included in the monitoring plan and report submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office located at Lucknow on six monthly basis.	Regular monitoring of the above mention conditions conducted and report is enclosed. Annexure – XXI

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A) Additional Specific Conditions		
S.No.	**Condition**	**Status**
1.	PP shall ensure that the recommendation provided in study conducted by Indian Institute of Science, Bangalore shall be complied for increasing the height of the tailing dam.	Height raising of the tailing dam will be done as per the recommendations of Indian Institute of Science, Bangalore study.
2	The risk arising due to surface runoff during rainy season or otherwise, from the tailing area/heap, shall be assessed on regular basis and corrective measures shall be undertaken and reported to SPCBs.	Tailing Dam is always having freeboard and there is no risk of surface runoff from the area.
3	PP shall engage suitable agency for conducting subsidence study for increasing the depth of working from 1000 mbgl to 1500mbg. The report shall be submitted to Ministry within 6 months.	Study conducted by Central Institute of Mining & Fuel Research (CSIR- CIMFER).Copy of the study report "Numerical Modelling Studies for Subsidence predication at Rampura Agucha Mine, HZL" is submitted vide letter No. HZL/RAM/ENV/2020-2021/789 dated 28.08.2020. Repot cover page – XXXIII
4	No waste to be transported outside the mining lease area.	No waste is transported outside the lease area. If required to be done in future, necessary approvals will be taken.
B) Standard Conditions: **(As Ministry's O.M No 22-34/2018-IA.III dated 8.01.2019 and Ministry's O.M No 22-34/2018-IA.III dated 16.01.2020)** **I. Statutory compliance**		
1	This Environmental Clearance (EC) is subject to orders/ judgment of Hon'ble Supreme Court of India, Hon'ble High Court, Hon'ble NGT and any other Court of Law, Common Cause Conditions as may be applicable.	All applicable orders/ and Judgment will be complied.
2	The Project Proponent complies with all the statutory requirements and judgment of Hon'ble Supreme Court dated 2nd August, 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Ors before commencing the mining operations.	Till date no liability raised by state government. If raised any in future, same will be complied.
3	The State Government concerned shall ensure that mining operation shall not be commenced till the entire compensation levied, if any, for illegal mining paid by the Project Proponent through their respective Department of Mining & Geology in strict compliance of Judgment of Hon'ble Supreme Court dated 2nd August, 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India &Ors.	Till date no liability raised by state government. If raised any in future, same will be complied.

4	This Environmental Clearance shall become operational only after receiving formal NBWL Clearance from MoEF&CC subsequent to the recommendations of the Standing Committee of National Board for Wildlife, if applicable to the Project.	Not Applicable for our operations.
5	This Environmental Clearance shall become operational only after receiving formal Forest Clearance (FC) under the provision of Forest Conservation Act, 1980, if applicable to the Project.	Forest clearance not applicable as there is no forest land in Mine Lease area.
6	Project Proponent (PP) shall obtain Consent to Operate after grant of EC and effectively implement all the conditions stipulated therein. The mining activity shall not commence prior to obtaining Consent to Establish/ Consent to Operate from the concerned State Pollution Control Board/Committee.	Consent to Establish was granted by RSPCB vide letter No. F(Mines)/Bhilwara(Hurda)/1(1)2009-2010/4792 dtd 21/01/2010 (Copy attached as Annexure- XXXIV). Consents to Operate are valid till 28.02.2023. (Copies attached as Annexure -XXXV) There is no requirement of obtaining CTE & CTO afresh as this is an amendment in existing EC.
7	The PP shall adhere to the provision of the Mines Act, 1952, Mines and Mineral (Development & Regulation), Act, 2015 and rules & regulations made there under. PP shall adhere to various circulars issued by Directorate General Mines Safety (DGMS) and Indian Bureau of Mines from time to time.	Adherence to all provisions of Mines Act, MMDR Act and circulars of DGMS & IBM is ensured.
8	The Project Proponent shall obtain consents from all the concerned land owners, before start of mining operations, as per the provisions of MMDR Act,1957 and rules made there under in respect of lands which are not owned by it.	All the land is owned by HZL. Operations were started in the year 1991.
9	The Project Proponent shall follow the mitigation measures provided in MoEF&CC's Office Memorandum No. Z-11013/57/2014-IA. II (M), dated 29th October, 2014, titled "Impact of mining activities on Habitations-Issues related to the mining Projects wherein Habitations and villages are the part of mine lease areas or Habitations and villages are surrounded by the mine lease area"	No village and Habitation are part of mining lease area.
10	The Project Proponent shall obtain necessary prior permission of the competent authorities for drawl of requisite quantity of surface water and from CGWA for withdrawal of ground water for the project.	Water withdrawal permission form CGWA NOC vide letter No. 21-4(2)/WR/CGWA/2005-1205 dated 08/07/2013. Annexure XXIV. Renewal application of ground water withdrawal submitted to CGWB vide letter No. HZL/RAM/ENV/2018-2019/26 dated 04/04/2018. As annexure XXV
11	A copy of EC letter will be marked to concerned Panchayat / local NGO etc. if any, from whom suggestion/ representation has been received while processing the proposal.	Copy of EC letter was submitted to Panchayat in 2009.

12.	State Pollution Control Board/Committee shall be responsible for display of this EC letter at its Regional office, District Industries Centre and Collector's office/ Tehsildar's Office for 30 days.	Copy is marked to Rajasthan State Pollution Control Board.
13	The Project Authorities should widely advertise about the grant of this EC letter by printing the same in at least two local newspapers, one of which shall be in vernacular language of the concerned area. The advertisement shall be done within 7 days of the issue of the clearance letter mentioning that the instant project has been accorded EC and copy of the EC letter is available with the State Pollution Control Board/Committee and web site of the Ministry of Environment, Forest and Climate Change (www.parivesh.nic.in). A copy of the advertisement may be forwarded to the concerned MoEFCC Regional Office for compliance and record.	Copy of the advertisement was sent to MoEF &CC, Lucknow vide letter No HZL/RAM/Env/Exp/2009 Advertised in two News papers on 03.01.2010.
14	The Project Proponent shall inform the MoEF&CC for any change in ownership of the mining lease. In case there is any change in ownership or mining lease is transferred than mining operation shall only be carried out after transfer of EC as per provisions of the para 11 of EIA Notification, 2006 as amended from time to time.	Will inform as per EIA notification in case of any change in ownership or transfer of the mining lease.
15	In pursuant to Ministry's O.M. No 22-34/2018-IA.III dated 16.01.2020 to comply with the direction made by Hon'ble Supreme Court on 8.01.2020 in W.P. (Civil) No 114/2014 in the matter Common Cause vs Union of India, the mining lease holder shall after ceasing mining operations, undertake re-grassing the mining area and any other area which may have been disturbed due to other mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc.	Reclamation is carried out progressively for growth of flora and fauna.
II. Air quality monitoring and preservation		
16	The Project Proponent shall install a minimum of 3 (three) online Ambient Air Quality Monitoring Stations with 1 (one) in upwind and 2 (two) in downwind direction based on long term climatological data about wind direction such that an angle of 120° is made between the monitoring locations to monitor critical parameters, relevant for mining operations, of air pollution viz. PM10, PM2.5, N02, CO and S02 etc. as per the methodology mentioned in NAAQS Notification No. B-29016/20/90/PCI/I, dated 18.11.2009 covering the aspects of transportation and use of heavy machinery in the impact zone. The ambient air quality shall also be monitored at prominent places like office building, canteen etc. as per the site condition to ascertain the exposure characteristics	Three Online Ambient Air Quality Monitoring Stations are in place, 1 in upwind and 2 in downwind direction. Six Ambient air monitoring locations, three each in core and buffer zone each are selected in consultation with the SPCB. AAQ monitoring is carried out every fortnightly Data digitally displayed at main gate. Attached as Annexure-XXVI.

	at specific places. The above data shall be digitally displayed within 03 months in front of the main Gate of the mine site.	
17	Effective safeguard measures for prevention of dust generation and subsequent suppression (like regular water sprinkling, metalled road construction etc.) shall be carried out in areas prone to air pollution wherein high levels of PM 10 and PM2.5 are evident such as haul road, loading and unloading point and transfer points. The Fugitive dust emissions from all sources shall be regularly controlled by installation of required equipment's/ machineries and preventive maintenance. Use of suitable water-soluble chemical dust suppressing agents may be explored for better effectiveness of dust control system. It shall be ensured that air pollution level conform to the standards prescribed by the MoEFCC/ Central Pollution Control Board.	Water sprinkling is carried out by 4 Nos. of 40 KL water sprinkler on Haul roads to mitigate air pollution in mine area Annexure-X. Dust extraction system and Water sprinkling nozzles are installed at the crushers, transfer points and coarse stockpiles for dust suppression. Industrial roads are cleaned by using Truck mounted vacuum road sweepers. (Annexure-XXII) The parameters of Ambient Air quality monitored are within the prescribed norm of CPCB.
	III. Water quality monitoring and preservation	
18	In case, immediate mining scheme envisages intersection of ground water table, then Environmental Clearance shall become operational only after receiving formal clearance from CGWA. In case, mining operation involves intersection of ground water table at a later stage, then PP shall ensure that prior approval from CGWA and MoEFCC is in place before such mining operations. The permission for intersection of ground water table shall essentially be based on detailed hydro-geological study of the area.	Water intersection permission form CGWA NOC vide letter No Letter No. 21-4(2)/WR/CGWA/2005-1204 dated 8th July 2013. Annexure XXVII Renewal application was submitted vide letter No. HZL/RAM/Env/2016-2017/228 dated 28/04/2016. Annexure XXVIII
19	Regular monitoring of the flow rate of the springs and perennial nallahs flowing in and around the mine lease shall be carried out and records maintain. The natural water bodies and or streams which are flowing in an around the village, should not be disturbed. The Water Table should be nurtured so as not to go down below the pre-mining period. In case of any water scarcity in the area, the Project Proponent has to provide water to the villagers for their use. A provision for regular monitoring of water table in open dug wall located in village should be incorporated to ascertain the impact of mining over ground water table. The Report on changes in Ground water level and quality shall be submitted on six-monthly basis to the Regional Office of the Ministry, CGWA and State Groundwater Department/ State Pollution Control Board.	There is no perennial nallahs in and around mine lease. Not disturbed any village's natural water bodies or streams. Regular water monitoring carried out for open dug well / piezometers near mining area and water level and water quality report Quarterly to CGWA, GCWB & State Pollution Control Board. Drinking water is provided to the nearby villages through tankers. Report Submitted to MoEF&CC on six monthly basis. Attached as Annexure –I
20	Project Proponent shall regularly monitor and maintain records w.r.t. ground water level and	Ground water level and water quality monitoring done regular basis and report

	quality in and around the mine lease by establishing a network of existing wells as well as new piezo-meter installations during the mining operation in consultation with Central Ground Water Authority/ State Ground Water Department. The Report on changes in Ground water level and quality shall be submitted on six-monthly basis to the Regional Office of the Ministry,CGWA and State Groundwater Department/ State Pollution Control Board	submitted to CGWA, State Pollution Control Board and MoEF&CC on quarterly basis and six- monthly basis.
21	The Project Proponent shall undertake regular monitoring of natural water course/ water resources/ springs and perennial nallahs existing/ flowing in and around the mine lease and maintain its records. The project proponent shall undertake regular monitoring of water quality upstream and downstream of water bodies passing within and nearby/ adjacent to the mine lease and maintain its records. Sufficient number of gullies shall be provided at appropriate places within the lease for management of water. PP shall carryout regular monitoring w.r.t. pH and included the same in monitoring plan. The parameters to be monitored shall include their water quality vis-a-vis suitability for usage as per CPCB criteria and flow rate. It shall be ensured that no obstruction and/ or alteration be made to water bodies during mining operations without justification and prior approval of MoEFCC. The monitoring of water courses/ bodies existing in lease area shall be carried out four times in a year viz. pre- monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January) and the record of monitored data may be sent regularly to Ministry of Environment, Forest and Climate Change and its Regional Office, Central Ground Water Authority and Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board. Clearly showing the trend analysis on six-monthly basis.	There is no perennial nallahs in and around mine lease. Regular Monitoring of natural water resources around mining lease is carried out. Regular water monitoring carried out for open dug well / piezometers near mining area and water level and water quality report Quarterly to CGWA, GCWB & State Pollution Control Board. (Annexure- I (1, 2 & 3).
22	Quality of polluted water generated from mining operations which include Chemical Oxygen Demand (COD) in mines run-off; acid mine drainage and metal contamination in runoff shall be monitored along with Total Suspended Solids (TDS), Dissolved Oxygen (DO), pH and Total Suspended Solids (TSS). The monitored data shall be uploaded on the website of the company as well as displayed at the project site in public domain, on a display board, at a suitable location near the main gate of the Company. The circular No. J- 20012/1 /2006-IA.	Water generated from mining operations is utilized in Beneficiation Plant and zero discharge is maintained. There is no acid mine drainage occurring in the mine. Garland drains are constructed around the tailing dam and waste dump with collection sumps.

	II (M) dated 27.05.2009 issued by Ministry of Environment, Forest and Climate Change may also be referred in this regard.	
23	Project Proponent shall plan, develop and implement rainwater harvesting measures on long term basis to augment ground water resources in the area in consultation with Central Ground Water Board/ State Groundwater Department. A report on amount of water recharged needs to be submitted to Regional Office MoEFCC annually.	Garland drains are constructed around the tailing dam and waste dump with collection sumps of 8.5 lakh CuM capacity to collect and reuse the rain water. Collection pond of 1.5 lakh CuM has been constructed in the township. 3 Nos. of anicuts have been constructed for groundwater augmentation in consultation with CGWB. 4 aniculs constructed in the area under MJSA. 8.7 MCM groundwater recharge work has been completed in four blocks of Bhilwara district. Report attached (Annexure –XXXVIII)
24	Industrial waste water (workshop and waste water from the mine) should be properly collected and treated so as to conform to the notified standards prescribed from time to time. The standards shall be prescribed through Consent to Operate (CTO) issued by concerned State Pollution Control Board (SPCB). The workshop effluent shall be treated after its initial passage through Oil and grease trap	No waste water generation from mining. Water generated during mining intersection is used in sprinkling and beneficiation process. Water from tailing dam is recycled back to the Beneficiation Plant and zero discharge is maintained. Annexure-V. Oil & Grease traps are installed near work shop and water reused in beneficiation process. Annexure XVIII
25	The water balance/water auditing shall be carried out and measure for reducing the consumption of water shall be taken up and reported to the Regional Office of the MoEF&CC and State Pollution Control Board/Committee.	Water balance attached as annexure XXIX
IV. Noise and vibration monitoring and prevention		
26	The peak particle velocity at 500m distance or within the nearest habitation, whichever is closer shall be monitored periodically as per applicable DGMS guidelines	Peak particle velocity monitoring done as per guidelines. Annexure-XXIII
27	The illumination and sound at night at project sites disturb the villages in respect of both human and animal population. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night. PPs must ensure that the biological clock of the villages is not disturbed; by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day /night hours.	Lights are installed in a manner so that no disturbance to the villagers. Noise levels are also within prescribed limits. Annexure- IV
28	The Project Proponent shall take measures for control of noise levels below 85 dBA in the work environment. The workers engaged in operations of HEMM, etc. should be provided with ear plugs /muffs. All personnel including laborers working in dusty areas shall be provided with protective respiratory devices along with adequate training, awareness and information on safety and health	PPEs like ear plugs / muffs, dust masks, safety goggles, safety shoes etc. provided to all workers/ personals/ laborers. Adequate trainings provided to all concerned and toolbox talks are carried out before starting work. Noise monitoring done as per guideline report attached as per Annexure –IV

	aspects. The PP shall be held responsible in case it has been found that workers/ personals/ laborers are working without personal protective equipment.	
	V. Mining plan	
29	The Project Proponent shall adhere to the working parameters of mining plan which was submitted at the time of EC appraisal wherein year-wise plan was mentioned for total excavation i.e. quantum of mineral, waste, over burden, inter burden and top soil etc.. No change in basic mining proposal like mining technology, total excavation, mineral & waste production, lease area and scope of working (viz. method of mining, overburden & dump management , OB & dump mining, mineral transportation mode, ultimate depth of mining etc.) shall not be carried out without prior approval of the Ministry of Environment, Forest and Climate Change, which entail adverse environmental impacts, even if it is a part of approved mining plan modified after grant of EC or granted by State Govt. in the form to Short Term Permit (STP), Query license or any other name.	Working as per mining plan. There is no changes in mining technology scope of work, method of mining, overburden & dump management, OB & dump mining, mineral transportation mode, ultimate depth of mining. As per the latest MoEF&CC O.M. No. 22-44/2018-IA.III dated 14.05.2020, production will not be extended beyond EC approved quantity.
30	The Project Proponent shall get the Final Mine Closure Plan along with Financial Assurance approved from Indian Bureau of Mines/Department of Mining & Geology as required under the Provision of the MMDR Act, 1957 and Rules/ Guidelines made there under. A copy of approved final mine closure plan shall be submitted within 2 months of the approval of the same from the competent authority to the concerned Regional Office of the Ministry of Environment, Forest and Climate Change for record and verification.	Progressive Mine Closure Plan is part of approved Mining Plan. Final Mine Closure Plan along with details of Corpus Fund will be got approved from IBM and copy of the same will be submitted to MoEF&CC well in advance of final mine closure.
31	The land-use of the mine lease area at various stages of mining scheme as well as at the end-of-life shall be governed as per the approved Mining Plan. The excavation vis-a-vis backfilling in the mine lease area and corresponding afforestation to be raised in the reclaimed area shall be governed as per approved mining plan. PP shall ensure the monitoring and management of rehabilitated areas until the vegetation becomes self-sustaining. The compliance status shall be submitted half-yearly to the MoEFCC and its concerned Regional Office.	Land use of mine lease area, excavation and afforestation and reclamation are done as per approved mining plan.
	VI. Land reclamation	
32	The Overburden (OB) generated during the mining operations shall be stacked at earmarked OB dump site(s) only and it should not be kept active for a long period of time. The physical parameters of the	Overburden burden is stacked at earmarked Waste Dump site. Physical parameters maintain as per mining plan and DGMS guidelines and circulars.

	OB dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by D.G.M.S w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of top soil/OB dumps. The topsoil shall be used for land reclamation and plantation.	The topsoil is used for land reclamation and plantation. In current FY there is no top soil generation.
33	The reject/waste generated during the mining operations shall be stacked at earmarked waste dump site(s) only. The physical parameters of the waste dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of waste dumps.	Overburden burden is stacked at earmarked Waste Dump site. Physical parameters maintain as per mining plan and DGMS guidelines and circulars. stability monitoring by Radar Report enclosed as Annexure –VII
34	The reclamation of waste dump sites shall be done in scientific manner as per the Approved Mining Plan cum Progressive Mine Closure Plan.	Reclamation of waste dump site as per mining plan.
35	The slope of dumps shall be vegetated in scientific manner with suitable native species to maintain the slope stability, prevent erosion and surface run off. The selection of local species regulates local climatic parameters and help in adaptation of plant species to the microclimate. The gullies formed on slopes should be adequately taken care of as it impacts the overall stability of dumps. The dump mass should be consolidated with the help of dozer/ compactors thereby ensuring proper filling/ leveling of dump mass. In critical areas, use of geo textiles/ gee-membranes / clay liners / Bentonite etc. shall be undertaken for stabilization of the dump.	Slopes of waste dumps are stabilized and vegetated in scientific manner using geotextile and with native and arid zone seeds (like *Acacia nitolica ,Ziziphus Jojoba ,Prosopis cineraria, Alkanna Tinctoria, Capparis decidua, Gundi, Salvadorapersica* spread on waste dump slopes. Aloe Vera and Vetiver grass planted during laying of geotextiles Annexure XXX
36	The Project Proponent shall carry out slope stability study in case the dump height is more than 30 meters. The slope stability report shall be submitted to concerned regional office of MoEF&CC.	Waste dump design and slope stability is being reviewed yearly by CIMFR and report being submitted to MoEF&CC Regional Office. Latest report enclosed as Annexure XXI.
37	Catch drains, settling tanks and siltation ponds of appropriate size shall be constructed around the mine working, mineral yards and Top Soil/OB/Waste dumps to prevent run off of water and flow of sediments directly into the water bodies (Nallah/ River/ Pond etc.). The collected water should be utilized for watering the mine area, roads, green belt development, plantation etc. The drains/ sedimentation sumps etc. shall be de-silted regularly, particularly after monsoon season, and maintained properly	Garland drains of adequate size are constructed along the waste dump toe & mining pit, along with lined collection sumps of about 8.5 lakh CuM . The water collected is utilized for various purposes. De-silting sump and drains are de-silted on regular basis. Annexure –VIII
38	Check dams of appropriate size, gradient and length shall be constructed around mine pit and OB dumps to prevent storm run-off and sediment flow	Garland drains of adequate size are constructed along the waste dump toe & mining pit, along with lined collection sumps of

	into adjoining water bodies. A safety margin of 50% shall be kept for designing of sump structures over and above peak rainfall (based on 50 years data) and maximum discharge in the mine and its adjoining area which shall also help in providing adequate retention time period thereby allowing proper settling of sediments/ silt material. The sedimentation pits/ sumps shall be constructed at the corners of the garland drains.	about 8.5 lakh CuM . The water collected is utilized for various purposes. De-silting sump and drains are de-silted on regular basis. Annexure –VIII
39	The top soil, if any, shall temporarily be stored at earmarked site(s) within the mine lease only and should not be kept unutilized for long. The physical parameters of the top soil dumps like height, width and angle of slope shall be governed as per the approved Mining Plan and as per the guidelines framed by DGMS w.r.t. safety in mining operations shall be strictly adhered to maintain the stability of dumps. The topsoil shall be used for land reclamation and plantation purpose.	The topsoil has been utilized for land reclamation and plantation. At present no top soil dump at site.
	VII. Transportation	
40	No Transportation of the minerals shall be allowed in case of roads passing through villages/ habitations. In such cases, PP shall construct a 'bypass' road for the purpose of transportation of the minerals leaving an adequate gap (say at least 200 meters) so that the adverse impact of sound and dust along with chances of accidents could be mitigated. All costs resulting from widening and strengthening of existing public road network shall be borne by the PP in consultation with nodal State Govt. Department. Transportation of minerals through road movement in case of existing village/ rural roads shall be allowed in consultation with nodal State Govt. Department only after required strengthening such that the carrying capacity of roads is increased to handle the traffic load. The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly. Vehicular emissions shall be kept under control and regularly monitored. Project should obtain Pollution Under Control (PUC) certificate for all the vehicles from authorized pollution testing centers.	Ore transportation is being done within acquired land and not passing through any village / habitation. Regular water sprinkling is done on haul roads (Annexure X). Industrial roads are cleaned using truck mounted vacuum Road Sweepers(Annexure-XXII). Periodic preventive maintenance of vehicles is part of our operations. All the trucks are covered with tarpaulin while transportation of concentrates to the smelters. PUC certificate is ensured for every truck prior to entry in the premises. Annexure XIII
41	The Main haulage road within the mine lease should be provided with a permanent water sprinkling arrangement for dust suppression. Other roads within the mine lease should be wetted regularly with tanker-mounted water sprinkling system. The other areas of dust generation like crushing zone, material transfer points, material yards etc. should invariably be	Regular water sprinkling is done on haul roads (Annexure X). Dust extraction system and Water sprinkling nozzles are installed at the crushers, transfer points and coarse stockpiles for dust suppression. Industrial roads are cleaned by using Truck mounted vacuum road sweepers. (Annexure-XXII) The parameters of Ambient

	provided with dust suppression arrangements. The air pollution control equipments like bag filters, vacuum suction hoods, dry fogging system etc. shall be installed at Crushers, belt-conveyors and other areas prone to air pollution. The belt conveyor should be fully covered to avoid generation of dust while transportation. PP shall take necessary measures to avoid generation of fugitive dust emissions.	Air quality monitored are within the prescribed norm of CPCB.
	VIII. Green Belt	
42	The Project Proponent shall develop greenbelt in 7.5m wide safety zone all along the mine lease boundary as per the guidelines of CPCB in order to arrest pollution emanating from mining operations within the lease. The whole Green belt shall be developed within first 5 years starting from windward side of the active mining area. The development of greenbelt shall be governed as per the EC granted by the Ministry irrespective of the stipulation made in approved mine plan.	Green belt developed all along the acquired area.
43	The Project Proponent shall carryout plantation/ afforestation in backfilled and reclaimed area of mining lease, around water body, along the roadsides, in community areas etc. by planting the native species in consultation with the State Forest Department/ Agriculture Department/ Rural development department/ Tribal Welfare Department/ Gram Panchayat such that only those species be selected which are of use to the local people. The CPCB guidelines in this respect shall also be adhered. The density of the trees should be around 2500 saplings per Hectare. Adequate budgetary provision shall be made for protection and care of trees.	Green belt developed all along the acquired area. Progressive plantation is being carried out on waste dump benches every year. Seed spearing and geotextile laying is also carried out on waste dump slopes. As per latest drone-based study 684280.00 Nos. of plants in existing in 348.0 Ha. Additional plantation has been done in 37.70 ha in the township and along roadside. Density of the plantation will be increased in phase manner. (Annexure –IX). Drone survey on assessment of plantation done by M/s SKYLARK DRONES (report attached as Annexure -XXXVII.)
44	The Project Proponent shall make necessary alternative arrangements for livestock feed by developing grazing land with a view to compensate those areas which are coming within the mine lease. The development of such grazing land shall be done in consultation with the State Government. In this regard, Project Proponent should essentially implement the directions of the Hon'ble Supreme Court with regard to acquisition of grazing land. The sparse trees on such grazing ground, which provide mid-day shelter from the scorching sun, should be scrupulously guarded/ protected against felling and plantation of such trees should be promoted.	Hindustan Zinc Ltd. is carrying out various work for livestock and agriculture development under its flagship project named “Samadha” in collaboration with BAIF (National level Origination)
45	The Project Proponent shall undertake all precautionary measures for conservation and protection of endangered flora and fauna and	Not applicable there is not Shedule-1 species in mining area

	Schedule-I species during mining operation. A Wildlife Conservation Plan shall be prepared for the same clearly delineating action to be taken for conservation of flora and fauna. The Plan shall be approved by Chief Wild Life Warden of the State Govt.	
46	And implemented in consultation with the State Forest and Wildlife Department. A copy of Wildlife Conservation Plan and its implementation status (annual) shall be submitted to the Regional Office of the Ministry.	Not applicable There is not Shedule-1 species in mining area
IX. Public hearing and human health issues		
47	The Project Proponent shall appoint an Occupational Health Specialist for Regular as well as Periodical medical examination of the workers engaged in the mining activities, as per the DGMS guidelines. The records shall be maintained properly. PP shall also carryout Occupational health check-ups in respect of workers which. are having ailments like BP, diabetes, habitual smoking, etc. The check-ups shall be undertaken once in six months and necessary remedial/ preventive measures be taken. A status report on the same may be sent to MoEFCC Regional Office and DGMS on half-yearly basis.	Appointed Occupational Health Specialist. Regular as well as Periodical medical examination of the workers are carried out as per Mines Act. Copy of the return submitted to DGMS is attached as annexure –XXXI
48	The Project Proponent must demonstrate commitment to work towards 'Zero Harm' from their mining activities and carry out Health Risk Assessment (HRA) for identification workplace hazards and assess their potential risks to health and determine appropriate control measures to protect the health and wellbeing of workers and nearby community. The proponent shall maintain accurate and systematic records of the HRA. The HRA for neighborhood has to focus on Public Health Problems like Malaria, Tuberculosis, HIV, Anaemia, Diarrhoea in children under five, respiratory infections due to bio mass cooking. The proponent shall also create awareness and educate the nearby community and workers for Sanitation, Personal Hygiene, Hand washing, not to defecate in open, Women Health and Hygiene (Providing Sanitary Napkins), hazard of tobacco and alcohol use. The Proponent shall carryout base line HRA for all the category of workers and there after every five years.	We are committed for Zero Harm from our mining activities. Various studies have been done for health risk assessment regarding identification and control measures for work place hazards. Regular health check-ups of nearby community are done through “Deepak Foundation” (Annexure-XX) and awareness sessions are also conducted.
49	The Proponent shall carry out Occupational health surveillance which be a part of HRA and include Biological Monitoring where practical and feasible, and the tests and investigations relevant to the exposure (e.g. for Dust a X-Ray chest; For Noise	Biological monitoring and tests and investigations relevant to the exposure are carried out and record maintain by Occupational health team. No manganese and chromium mining so Mn & Cr monitoring not

	Audiometric; for Lead Exposure Blood Lead, For Welders Full Ophthalmologic Assessment; for Manganese Miners a complete Neurological Assessment by a Certified Neurologist, and Manganese (Mn) Estimation in Blood; For Inorganic Chromium- Fortnightly skin inspection of hands and forearms by a responsible person. Except routine tests all tests would be carried out in a Lab accredited by NABH. Records of Health Surveillance must be kept for 30 years, including the results of and the records of Physical examination and tests. The record of exposure due to materials like Asbestos, Hard Rock Mining, Silica, Gold, Kaolin, Aluminium, Iron, Manganese, Chromium, Lead, Uranium need to be handed over to the Mining Department of the State in case the life of the mine is less than 30 years. It would be obligatory for the State Mines Departments to make arrangements for the safe and secure storage of the records including X-Ray. Only conventional X-Ray will be accepted for record purposes and not the digital one). X-Ray must meet ILO criteria (17 x14 inches and of good quality).	applicable. Blood lead monitoring is done on regular basis.
50	The Proponent shall maintained a record of performance indicators for workers which includes (a) there should not be a significant decline in their Body Mass Index and it should stay between 18.5 - 24.9, (b) the Final Chest X-Ray compared with the base line X-Ray should not show any capacities ,(c) At the end of their leaving job there should be no Diminution in their Lung Functions Forced Expiratory Volume in one second (FEV1),Forced Vital Capacity (FVC), and the ratio) unless they are smokers which has to be adjusted, and the effect of age, (d) their hearing should not be affected. As a proof an Audiogram (first and last need to be presented), (e) they should not have developed any Persistent Back Pain, Neck Pain, and the movement of their Hip, Knee and other joints should have normal range of movement, (f) they should not have suffered loss of any body part. The record of the same should be submitted to the Regional Office, MoEF&CC annually along with details of the relief and compensation paid to workers having above indications.	Periodical medical examination of the workers are carried out as per DGMS guidelines and records are maintained.
51	The Project Proponent shall ensure that 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.	Dust masks are provided to all workers/ personals/ laborers. Adequate trainings provided to all concerned and toolbox talks are carried out before starting of work.

52	Project Proponent shall make provision for the housing for workers/ labors or shall construct labor camps within/ outside (company owned land) with necessary basic infrastructure/ facilities like fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche for kids etc. The housing may be provided in the form of temporary structures which can be removed after the completion of the project related infrastructure. The domestic waste water should be treated with STP in order to avoid contamination of underground water.	No construction labor housing is proposed in mining area. However, the sanitation and drinking water facility is provided to the workers, working at site. Sewage Treatment Plants are also installed at mining area and township.
53	The activities proposed in Action plan prepared for addressing the issues raised during the Public Hearing shall be completed as per the budgetary provisions mentioned in the Action Plan and within the stipulated time frame. The Status Report on implementation of Action Plan shall be submitted to the concerned Regional Office of the Ministry along with District Administration.	All the issues raised during Public Hearing in the year 2009 were addressed.
	X. Corporate Environment Responsibility (CER)	
54	The activities and budget earmarked for Corporate Environmental Responsibility (CER) as per Ministry's O.M No 22-65/2017-IA. II (M) dated 01.05.2018 or as proposed by EAC should be kept in a separate bank account. The activities proposed for CER shall be implemented in a time bound manner and annual report of implementation of the same along with documentary proof viz. photographs, purchase documents, latitude & longitude of infrastructure developed & road constructed needs to be submitted to Regional Office MoEF&CC annually along with audited statement.	Separate Cost center and GL account are maintained. Activities proposed for CER will be implemented in time bound manner.
55	Project Proponent shall keep the funds earmarked for environmental protection measures in a separate account and refrain from diverting the same for other purposes. The Year wise expenditure of such funds should be reported to the MoEFCC and its concerned Regional Office.	Environmental funds are earmarked for environment work only. Separate Cost center and GL account are maintained. Environmental expenditure is reported on six monthly basis enclosed as Annexure -VI
	XI. Miscellaneous	
56	The Project Proponent shall prepare digital map (land use & land cover) of the entire lease area once in five years purpose of monitoring land use pattern and submit a report to concerned Regional Office of the MoEFCC.	The land use & land cover change study carried out in 2018. Copy already submitted on 28/05/2018. Annexure-XIV
57	The Project Authorities should inform to the Regional Office regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Being operational unit, condition is not applicable.

58	The Project Proponent shall submit six monthly compliance reports on the status of the implementation of the stipulated environmental safeguards to the MOEFCC & its concerned Regional Office, Central Pollution Control Board and State Pollution Control Board.	Compliances report submitted to MOEF&CC & Regional Office, Central Pollution Control Board and State Pollution Control Board. Environment statement submitted on 22nd September 2021. Annexure-XIX.
59	A separate 'Environmental Management Cell' with suitable qualified manpower should be set-up under the control of a Senior Executive. The Senior Executive shall directly report to Head of the Organization. Adequate number of qualified Environmental Scientists and Mining Engineers shall be appointed and submit a report to RO, MoEF&CC.	Environment Management Cell has been set up having adequate qualified Executives and a Senior executive who reports to Location Head directly.
60	The concerned Regional Office of the MoEF&CC shall randomly monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the MoEF&CC officer(s) by furnishing the requisite data / information / monitoring reports.	Noted

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Hindustan Zinc Limited
Rampura Agucha Mines
PO - Agucha
Distt. - Bhilwara (Raj.)

scale and nature of the issue, the concern is escalated to different level right up to the Board of the company and also the shareholders of the company in the general body meetings.

The compliances to Environment Clearance and all environmental licenses are reviewed and monitored regularly and reports are submitted to the respective regulatory authorities at every unit, by a dedicated environmental professional, who reports directly to the unit head. The compliance is periodically reviewed and audited by Corporate Environment Department, which reports to the top management of the company. A Corporate Sustainability Committee, chaired by the CEO of the company, oversees all sustainability issues including Environment, Safety and Health and also reviewing any policy matters.

Any non-compliances/show cause/notices/complaints received from regulatory authority or any stakeholder is addressed jointly by the unit and corporate environment department. Such issues are also reported and the actions taken are reviewed by the top management every month. Further, all show cause, complaint letters and notices from any stakeholder, along with the action taken report is submitted to the Board Of Directors of the company every quarterly. All major concerns are reported to the stakeholders through the annual general body meetings of the company.

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HINDUSTAN ZINC

HINDUSTAN ZINC

Health, Safety & Environment (HSE) Policy

Hindustan Zinc is committed to conduct all business activities in a responsible manner, which ensures the health and safety of our stakeholders and the environment. In order to achieve that, we shall:

- Ensure Zero Harm to personnel and environment.
- Demonstrate visible HSE leadership that HSE is our core value.
- Comply with all HSE rules, regulations, obligations and requirements and will strive to go beyond compliance to the relevant requirements and shall continually improve our HSE management systems.
- Incorporate appropriate HSE Criteria[i] for all business decisions for selection of plant, technology, contractors and personnel.
- Identify and evaluate HSE risks for all activities[ii] and take actions to eliminate /mitigate risks and hazards.
- Encourage, train, equip and empower personnel, including contractors & contract employees, to adopt a healthy and safe working approach both on and off the job. The HSE performance of individual personnel shall decide his career advancement.
- Conserve natural resources and eliminate waste through reduction, recycling and reuse methods, which are environment-friendly and energy-efficient.

Health, Safety & Environment (HSE) Guiding Principles:

- Management shall demonstrate its strong commitment towards HSE at all times.
- All injuries, occupational illnesses and adverse environmental incidents are preventable.
- Reporting and investigation of all incidents is an obligation.
- We are responsible and accountable for preventing injuries, occupational illnesses and adverse environmental incidents.
- We are empowered and obligated to stop any job being carried out in an unsafe manner.
- HSE values shall never be compromised.
- Adherence to HSE management system is a condition of employment.

We personally commit to applying the policy & principles for building positive HSE culture at Hindustan Zinc and report wherever applicable.

i - these criteria are applicable to the product distribution and logistics/entire product life cycle from extraction to product distribution and logistics

ii - the policy is not only applicable to our existing operational sites/new projects but also all the due-diligence, mergers and acquisitions and non-managed operations / licensees / third-party manufacturers / joint ventures / outsourcing partners

Arun Misra

Date: 1st August, 2020

Arun Misra
CEO, Hindustan Zinc

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Annexures Table

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HINDUSTAN ZINC LIMITED
RAMPURA AGUCHA MINE

WELL WATER ANALYSIS REPORT-October-2021 to March 2022

S. No	1		2		3		4		5		6		7		8		9		10		11	
Code	WW-10		ww-22		GWD		WW-13		HP-1		WW-15		WW-16		WW-23		PRK-1		KOT-1		WW-14	
Month	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22
pH	7.90	7.80	7.40	7.85	7.70	7.60	7.80	7.70	7.70	7.60	7.90	7.80	7.40	7.55	7.90	7.70	7.90	7.90	7.90	7.75	7.60	7.55
Alkalinity	348	290	250	310	371	390	267	220	347	324	382	275	340	332	354	335	314	320	390	413	367	382
Chlorides	47	45	40	51	140	109	46.00	48	60	65	67	73	142	66	76	80	167	189	147	120	76	44
Sulphate	347	275	64	70	162	143	68	72	170	201	87	102	175	189	74	82	191	222	182	165	62	78
CN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	0.006	0.005	0.007	0.007	0.008	0.009	0.008	0.006	0.008	0.008	0.008	0.007	0.007	0.008	0.007	0.009	0.009	0.009	0.007	0.008	0.008	0.008
Zn	0.070	0.080	0.090	0.008	0.110	0.100	0.100	0.080	0.090	0.110	0.060	0.070	0.120	0.130	0.100	0.120	0.100	0.140	0.120	0.100	0.120	0.110
Fe	0.120	0.130	0.070	0.100	0.100	0.110	0.100	0.120	0.120	0.140	0.100	0.120	0.100	0.130	0.070	0.140	0.120	0.130	0.110	0.120	0.090	0.100
Cd	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cu	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

All figures are in mg/l except pH

HINDUSTAN ZINC LIMITED

RAMPURA AGUCHA MINE

PIEZOMETER WATER ANALYSIS REPORT October 2021 to March 2022

S. No.	1		2		3		4		5		6		7		8	
Code	P		H		EI		GI		II		K		A		Adm	
Months	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22	Nov-21	Feb-22
pH	7.90	7.85	7.90	7.70	7.80	7.50	7.40	7.65	7.80	7.70	7.40	7.80	7.60	7.50	7.90	7.65
Alkalinity	347	323	382	401	374	380	334	378	495	460	390	324	269	310	340	430
Chlorides	174	189	149	145	187	201	167	192	147	137	151	170	171	201	160	291
Sulphate	146	202	391	365	349	374	389	402	341	390	224	290	329	342	373	324
CN	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pb	0.008	0.007	0.009	0.008	0.009	0.010	0.009	0.010	0.008	0.007	0.007	0.008	0.009	0.009	0.010	0.010
Zn	0.100	0.090	0.120	0.130	0.110	0.120	0.140	0.120	0.110	0.090	0.130	0.120	0.120	0.110	0.100	0.110
Fe	0.110	0.120	0.110	0.130	0.120	0.140	0.130	0.110	0.120	0.110	0.140	0.150	0.110	0.130	0.110	0.130
Cd	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001
Cu	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Co	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ni	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
As	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ca	50	47	72	56	67	72	56	49	42	57	39	59	42	54	49	54
Mg	31	33	40	47	39	55	31	29	39	40	24	35	25	44	27	43

All figures are in mg/l except pH

HINDUSTAN ZINC LTD
RAMPURA AGUCHA MINE
WELL WATER LEVEL MONITORING
(Below the ground level in meters)

Months	W-10	W-22	W-13	W-14	W-15	W-16	W-23	GWD	PRK-1	KOT-1
Oct-21	3.96	2.10	3.04	3.96	3.65	6.40	2.28	4.87	2.56	3.65
Nov-21	4.26	1.92	3.65	4.57	3.35	9.14	2.43	4.26	2.43	4.57
Dec-21	4.57	1.88	4.26	5.48	3.90	15.24	3.35	4.80	2.59	5.79
Jan-22	4.85	2.10	3.90	4.90	4.30	12.45	4.30	5.10	4.00	6.30
Feb-22	5.20	2.70	4.30	5.70	4.90	13.40	4.95	6.20	3.70	6.70
Mar-22	5.70	3.30	4.90	6.30	5.20	14.20	5.40	6.70	4.30	7.00

Annexure - II

Analysis of Waste Dump Rocks

Location : Waste Dump

Element	Range		
Pb	0.0002%	-	0.0005%
Zn	0.0700%	-	0.0815%
Cu	0.0005%	-	0.0027%
Cd	0.0001%	-	0.0005%
Ni	0.0020%	-	0.0042%
Co	0.0010%	-	0.0025%

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Location		Mine Site						Main Gate						Mine Tower					
month/ year	Fortnight	SPM (µg/m3)	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_x (µg/m3)	CO (µg/m3)	SPM (µg/m3)	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_x (µg/m3)	CO (µg/m3)	SPM (µg/m3)	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_x (µg/m3)	CO (µg/m3)
Oct-2021	I st	244.06	72.25	30.03	6.20	8.40	380.00	238.16	61.31	28.78	5.50	8.20	435.00	258.75	62.97	28.643	4.10	7.70	325.00
	II nd	236.92	69.60	30.77	4.30	14.79	340.00	156.64	75.27	27.22	4.92	14.42	380.00	214.92	70.97	25.57	4.88	14.34	350.00
Nov-2021	I st	299.21	74.14	34.60	5.10	7.70	355.00	327.26	81.93	29.02	3.30	8.20	353.00	268.76	69.64	28.88	4.40	6.80	354.00
	II nd	324.46	88.21	37.51	4.20	15.88	270.00	322.53	80.66	31.67	3.89	15.21	290.00	243.56	74.10	30.94	3.84	14.06	240.00
Dec-2021	I st	186.89	75.16	35.25	5.56	13.14	370.00	155.27	70.29	29.36	3.52	13.13	340.00	165.16	69.20	32.57	3.62	13.72	370.00
	II nd	193.21	78.20	39.27	2.49	13.18	320.00	220.43	76.22	36.07	5.01	13.19	360.00	215.24	78.85	34.55	3.78	13.83	310.00
Jan-2022	I st	145.59	56.08	27.24	3.71	11.47	340.00	129.75	60.34	30.22	2.64	11.02	360.00	135.83	64.30	26.98	1.99	12.86	310.00
	II nd	167.86	62.83	26.58	3.43	14.19	370.00	127.14	70.10	35.57	3.80	14.36	370.00	182.58	83.93	29.43	3.64	10.33	340.00
Feb-2022	I st	173.38	66.41	37.99	2.36	10.63	360.00	167.71	66.14	41.64	2.62	14.79	340.00	203.74	73.55	30.13	2.47	14.99	330.00
	II nd	244.18	76.44	32.11	3.97	13.43	320.00	287.68	69.83	33.75	3.44	11.31	340.00	208.35	70.99	31.61	3.98	13.11	410.00
Mar-2022	I st	166.58	69.89	30.60	4.20	15.54	360.00	201.37	73.90	35.52	4.37	15.43	360.00	198.19	76.94	33.09	2.72	17.71	380.00
	II nd	188.51	73.62	34.99	4.77	12.14	310.00	193.62	80.63	33.73	3.27	13.41	360.00	201.87	71.06	33.06	2.76	12.21	370.00

Location-month/ Year	Fortnight	Agucha village						Kothiya village						Bherukhera village					
		SPM (µg/m3)	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_x (µg/m3)	CO (µg/m3)	SPM (µg/m3)	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_x (µg/m3)	CO (µg/m3)	SPM (µg/m3)	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_x (µg/m3)	CO (µg/m3)
Oct-2021	I st	173.61	56.84	24.88	3.20	10.20	310.00	160.33	57.24	28.78	2.40	8.80	310.00	148.41	53.70	24.65	2.10	8.10	255.00
	II nd	152.16	62.42	25.50	2.83	12.66	280.00	153.23	75.07	33.11	2.12	11.94	290.00	167.98	59.67	23.65	0.88	10.32	270.00
Nov-2021	I st	172.66	53.99	29.02	3.30	10.20	276.00	160.13	60.14	29.14	2.20	7.40	265.00	154.67	58.86	24.85	3.30	8.40	245.00
	II nd	207.99	73.33	31.07	4.75	14.08	240.00	178.43	74.51	24.67	4.37	12.23	190.00	157.49	56.89	24.83	4.13	12.60	210.00
Dec-2021	I st	110.26	61.03	24.04	4.19	11.70	320.00	151.59	56.96	18.02	2.36	8.04	210.00	137.94	60.56	27.88	3.17	13.19	190.00
	II nd	147.20	64.87	24.98	3.02	12.62	220.00	100.27	56.15	24.63	3.60	11.12	210.00	137.90	51.43	25.16	3.41	11.72	230.00
Jan-2022	I st	130.04	51.80	24.29	2.88	10.18	240.00	108.10	41.76	23.62	3.68	11.94	210.00	100.93	43.43	21.16	3.64	9.51	220.00
	II nd	214.46	68.17	30.28	3.51	11.09	310.00	133.55	72.76	34.36	3.67	11.81	340.00	125.24	55.91	24.65	3.34	11.26	260.00
Feb-2022	I st	153.13	57.88	22.81	2.62	11.27	210.00	140.15	57.21	19.68	2.32	10.35	230.00	158.05	56.97	22.21	3.65	9.31	270.00
	II nd	170.44	64.58	22.57	4.05	13.62	260.00	130.99	61.23	26.32	3.30	11.88	310.00	149.58	55.57	22.99	2.66	10.51	270.00
Mar-2022	I st	148.23	64.25	25.17	2.34	14.03	210.00	128.77	53.55	26.01	3.81	13.63	230.00	136.14	60.71	25.73	5.18	11.44	210.00
	II nd	157.54	64.82	19.47	3.90	11.22	250.00	162.01	59.09	25.55	3.38	10.56	240.00	121.84	60.56	24.50	4.44	9.22	210.00

All figures are in (µg/m3)

STACK MONITORING SPM

Month-Yr	Fortnight	Pr Crusher (SPM)	S. Crusher (SPM)	New Pr Crusher (SPM)
Oct-2021	I st	37.50	35.24	30.21
	II nd	27.78	31.35	24.49
Nov-2021	I st	24.00	31.03	34.57
	II nd	17.05	25.38	19.57
Dec-2021	I st	29.58	20.17	15.25
	II nd	22.91	29.05	40.09
Jan-2022	I st	37.91	41.61	33.77
	II nd	18.58	44.04	27.44
Feb-2022	I st	29.76	31.53	30.51
	II nd	29.28	14.36	28.04
Mar-2022	I st	33.98	26.39	38.21
	II nd	31.12	23.72	17.14

All figures are in (mg/m3

DG SET STACK MONITORING

Month	CO (mg/Nm3)	Particular Matter, (mg/Nm3)	NOx, (ppm)	NMHC (mg/Nm3)
Nov-21	105	53.75	276	35
Jan-22	108	35.41	262	29
Mar-22	123	55.74	265	39

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Annexure-IV

S. No.	Area of Monitoring	NOISE LEVEL AT WORK ENVIRONMENT IN dB(A)						Equipment Condition
		Oct-21	Nov-21	Dec-21	Jan-2022	Feb -2022	Mar-2022	
1.	BENEFICIATION PLANT							
	a. Mill Ambient	76.30/66.90	74.30/64.70	73.20/66.20	76.30/68.30	77.10/68.50	74.30/67.20	Day/ Night
	b. Mill- Grinding Area	80.40	82.30	82.40	83.20	84.30	81.40	Plant is in running condition.
	c. Operators cabin mill area	77.20	78.40	80.20	76.40	76.30	76.50	--do--
	d. Flotation cell area	78.30	77.40	81.20	80.10	79.30	80.10	--do--
	e. AFM's cabin cell area	75.30	80.10	78.30	79.30	74.50	78.40	--do--
	f. Shift engineer's room	72.30	76.40	75.30	77.30	75.30	72.30	--do--
	g. Control room	79.10	72.30	73.40	82.30	76.20	76.40	--do--
	h.Work Shop	77.30	78.20	75.50	78.30	76.30	75.50	--do--
2	PRIMARY CRUSHER							
	a. Primary Crusher I Control Room	73.4/66.80	74.5/65.30	73.2/68.50	74.30/65.10	75.30/67.30	74.50/65.40	Day/ Night
	b. Primary Crusher II Control Room	72.1/65.00	77.20/64.50	71.90/66.70	76.50/64.60	73.90/64.90	74.50/63.90	Day/ Night
3	SEC./TERT. CRUSHER							
	a. Shift Room Sec. Crusher	74.50/63.20	74.00/64.30	77.1/64.9	75.60/66.30	74.90/65.20	73.90/64.30	Day? Night
	b. Secondary crusher control room	75.40	75.30	78.30	72.30	75.1	76.50	Plant is in running condition.
	Ambient Mine Pit	74.3/68.3	75.4/65.3	72.3/65.30	72.9/67.5	72.10/67.20	77.40/69.60	Day/ Night
4	Village monitoring							
	Agucha	50.10/40.2	49.10/43.30	51.10/40.20	49.20/39.50	48.30/44.30	49.40/42.30	Day/ Night
	Bherukhera	51.00/43.10	46.50/40.60	48.50/39.10	52.30/43.30	47.40/41.20	47.50/42.30	Day/ Night
	Kothiya	48.20/41.20	49.10/39.70	49.40/41.80	49.30/43.80	48.40/42.30	48.30/43.60	Day/ Night

DG set Noise Monitoring			
	Month	Location	Noise level(dB)
1	Nov-2021	DG set Operator's room	73.60
		DG set Hall	99.80
2	Jan -2022	DG set Operator's room	75.60
		DG set Hall	97.80
3	Mar-2022	DG set Operator's room	75.70
		DG set Hall	98.20

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Annexure - V

Env. Sump water analysis (Oct-2020 to March 2021)

Prameter	Oct-2021	Nov-2021	Dec-2021	Jan-2022	Feb-2022	Mar-2022
pH	7.4	7.5	7.9	7.8	7.7	7.7
Oil & Grease	2.5	2.7	3.4	3.0	2.5	2.4
Alkalinity	289	310	544	731	532	643
Chlorides	351	431	467	562	812	731
Hardness	711	654	852	948	791	965
TDS	900	778	702	1103	1056	1187
Pb	0.02	0.01	0.01	0.01	0.01	0.01
Zn	1.3	1.3	1.8	1.9	1.6	1.8
Fe	0.12	0.11	0.15	0.10	0.11	0.12
Cd	0.01	0.01	0.01	0.01	0.01	0.01

All value are in mg/l except pH

Remarks : Collected Water is pumped to reclaim reservoir and recycled back to plant for reuse. Zero discharge is maintained.

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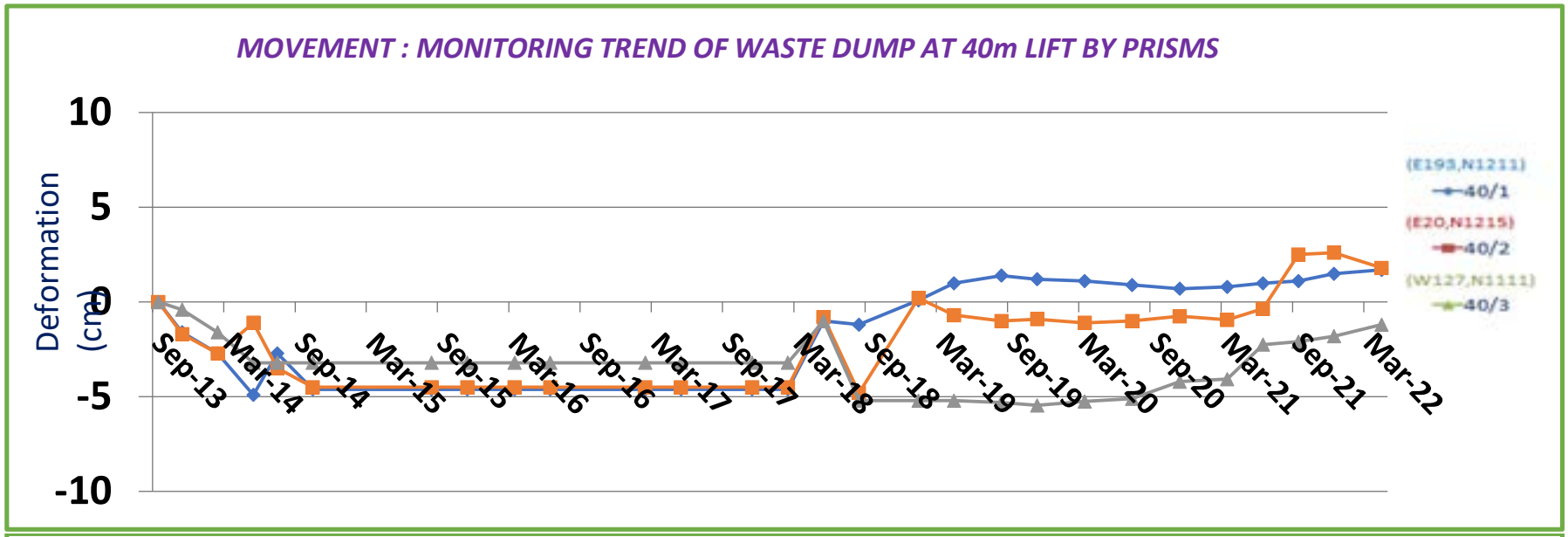
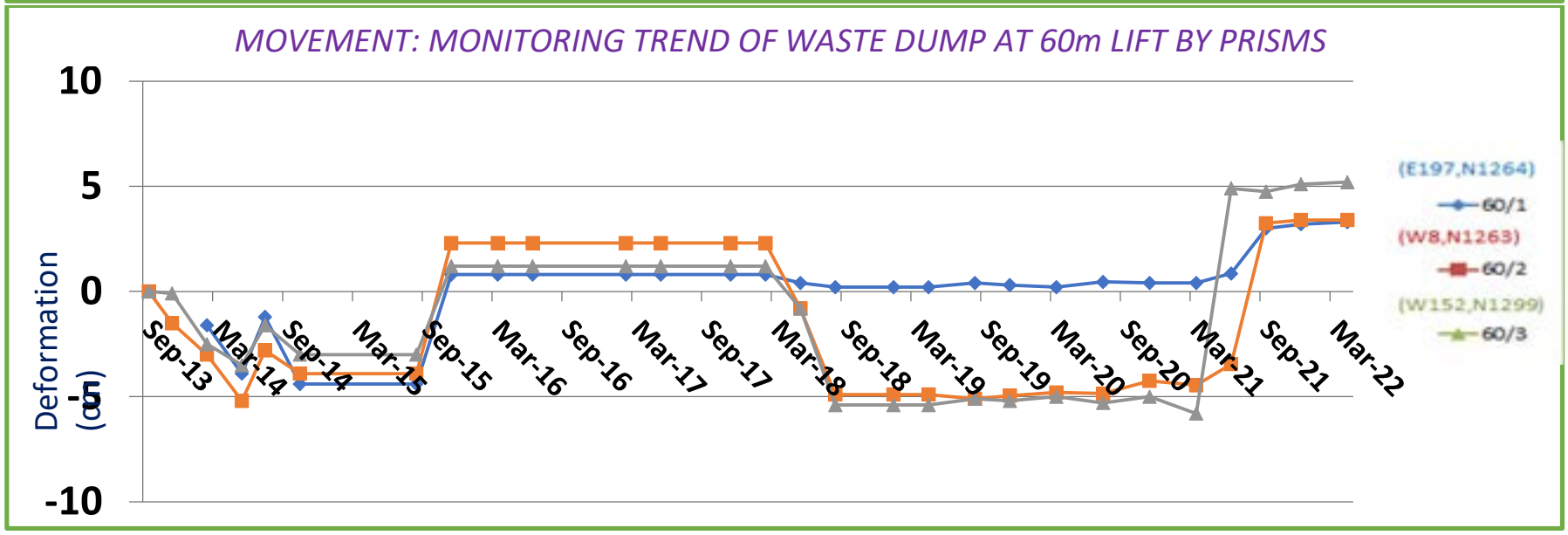
Annexure -VI

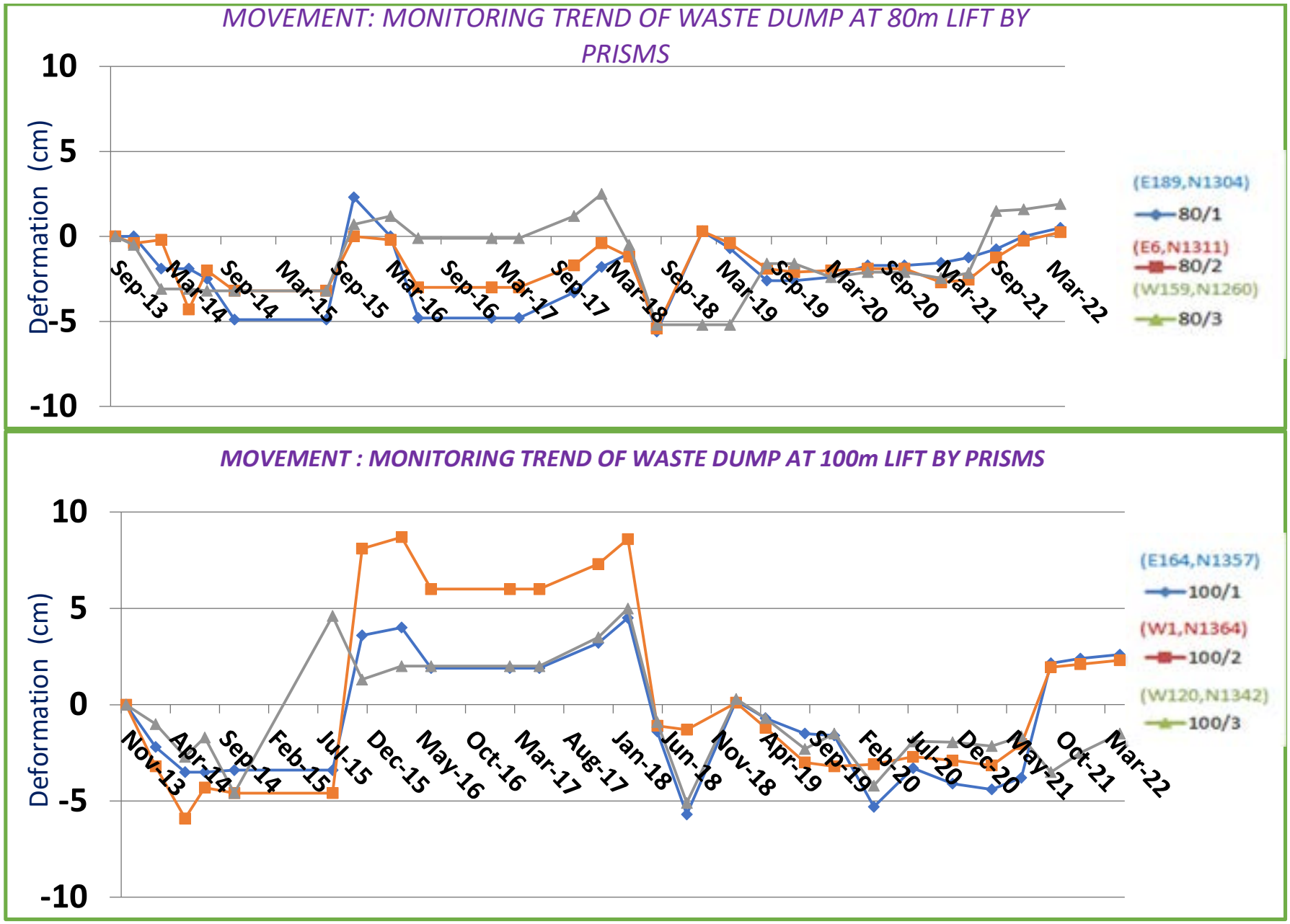
ENVIRONMENTAL EXPENDITURE DETAILS

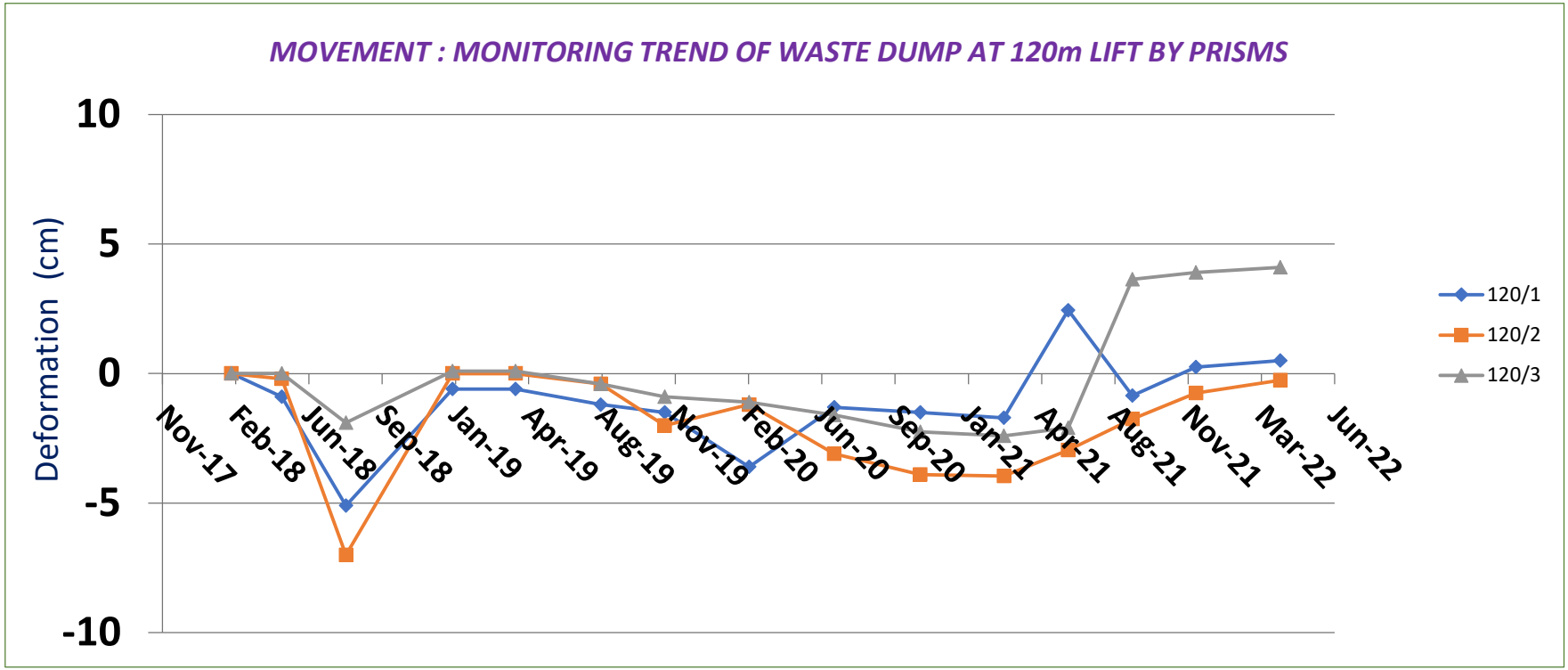
Particulars	2021-22					
	October 2021 to March 2022					
Expenditure	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22
	29.98	52.74	44.64	31.21	26.41	7.38
TOTAL Rs (Lacs)	192.37					

Dump Slope monitoring Data: Radar & pillar-prism Monitoring data for MOEF_ May 2022

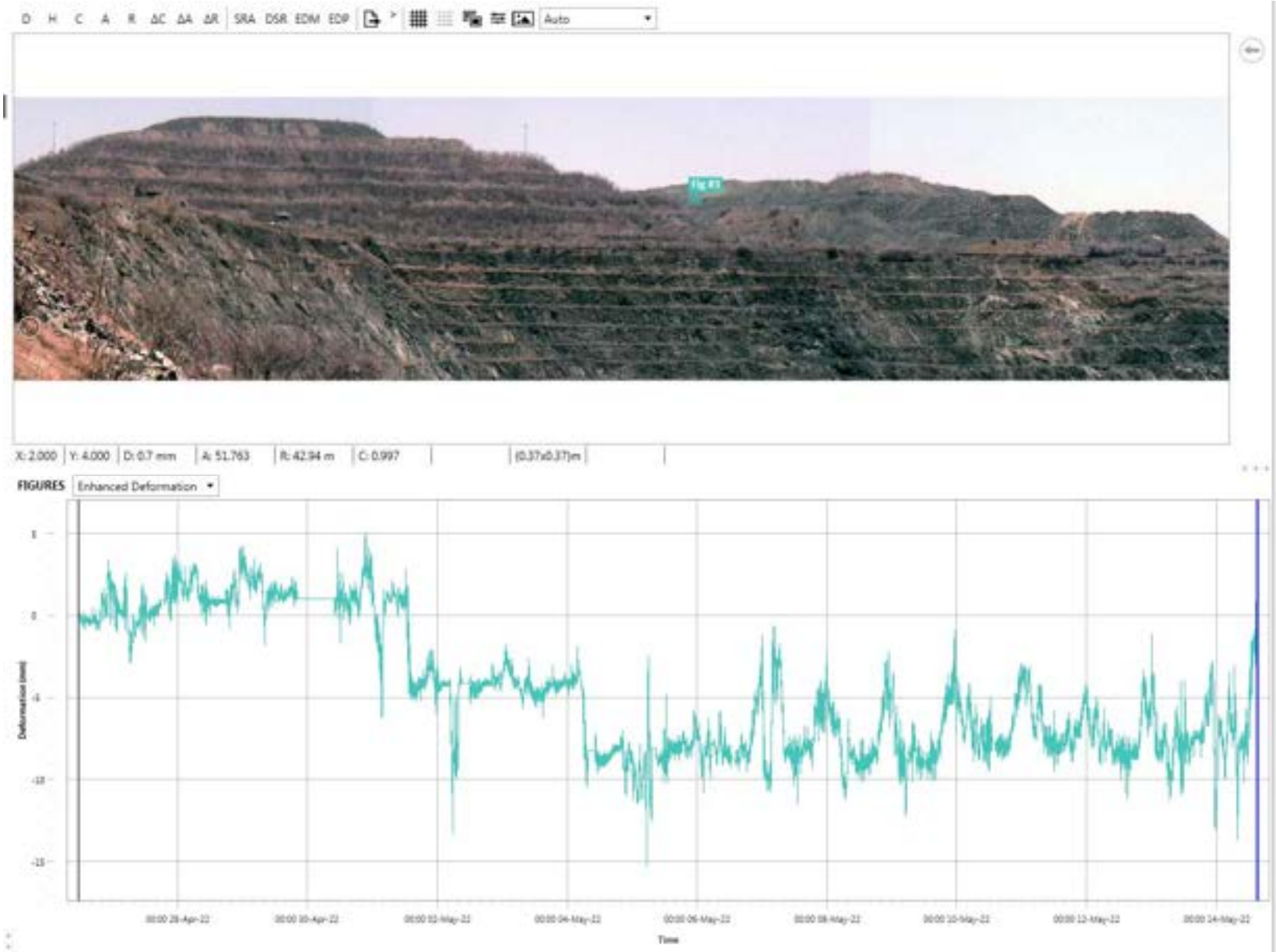

MOVEMENT : MONITORING TREND OF WASTE DUMP AT 40m LIFT BY PRISMS
Deformation (cm)
10
5
0
-5
-10
Sep-13
Mar-14
Sep-14
Mar-15
Sep-15
Mar-16
Sep-16
Mar-17
Sep-17
Mar-18
Sep-18
Mar-19
Sep-19
Mar-20
Sep-20
Mar-21
Sep-21
Mar-22
(E193,N1211)
40/1
(E20,N1215)
40/2
(W127,N1111)
40/3


MOVEMENT: MONITORING TREND OF WASTE DUMP AT 60m LIFT BY PRISMS
Deformation (cm)
10
5
0
-5
-10
Sep-13
Mar-14
Sep-14
Mar-15
Sep-15
Mar-16
Sep-16
Mar-17
Sep-17
Mar-18
Sep-18
Mar-19
Sep-19
Mar-20
Sep-20
Mar-21
Sep-21
Mar-22
(E197,N1264)
60/1
(W8,N1263)
60/2
(W152,N1299)
60/3


MOVEMENT: MONITORING TREND OF WASTE DUMP AT 80m LIFT BY PRISMS
Deformation (cm)
10
5
0
-5
-10
Sep-13
Mar-14
Sep-14
Mar-15
Sep-15
Mar-16
Sep-16
Mar-17
Sep-17
Mar-18
Sep-18
Mar-19
Sep-19
Mar-20
Sep-20
Mar-21
Sep-21
Mar-22
(E189,N1304)
80/1
(E6,N1311)
80/2
(W159,N1260)
80/3
MOVEMENT : MONITORING TREND OF WASTE DUMP AT 100m LIFT BY PRISMS
Deformation (cm)
10
5
0
-5
-10
Nov-13
Apr-14
Sep-14
Feb-15
Jul-15
Dec-15
May-16
Oct-16
Mar-17
Aug-17
Jan-18
Jun-18
Nov-18
Apr-19
Sep-19
Feb-20
Jul-20
Dec-20
May-21
Oct-21
Mar-22
(E164,N1357)
100/1
(W1,N1364)
100/2
(W120,N1342)
100/3


MOVEMENT : MONITORING TREND OF WASTE DUMP AT 120m LIFT BY PRISMS
Deformation (cm)
10
5
0
-5
-10
Nov-17
Feb-18
Jun-18
Sep-18
Jan-19
Apr-19
Aug-19
Nov-19
Feb-20
Jun-20
Sep-20
Jan-21
Apr-21
Aug-21
Nov-21
Mar-22
Jun-22
120/1
120/2
120/3

Slope Stability Radar monitoring on waste Dump Area


D H C A R ΔC ΔA ΔR SRA DSR EDM EDP Auto
X: 2.000 Y: 4.000 D: 0.7 mm A: 51.763 R: 42.94 m C: 0.997 (0.37x0.37)m
FIGURES Enhanced Deformation
Deformation (mm)
Time

Annexure – VIII

Garland Drain Photo

Annexure – IX

Plantation

40KL Water sprinkler

Annexure XI

Anicut Photos

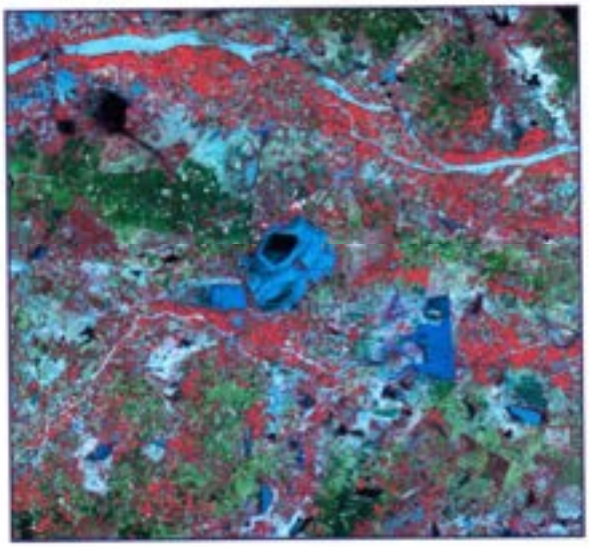
Annexure -XII

Pond Photo

Annexure-XIII

Truck covered with tarpaulin

Land use mapping by digital processing of 15 km. radius of Rampura-Agucha mine, district Bhilwara using remote sensing techniques and showing the changes in land use during last three years



Sponsor: Hindustan Zinc Limited, Rampura-Agucha Mine, Bhilwara

Studied by:

Estb: 1988

Studied for:

Hydro-Geosurvey Consultants Private Limited
C-103, Shastri Nagar, Jodhpur- 342003
Phone: - 0291-2431754
Web: www.hydrogeosurvey.com, E-mail: - hydro.geosurvey@yahoo.com

March, 2018

Annexure -XV

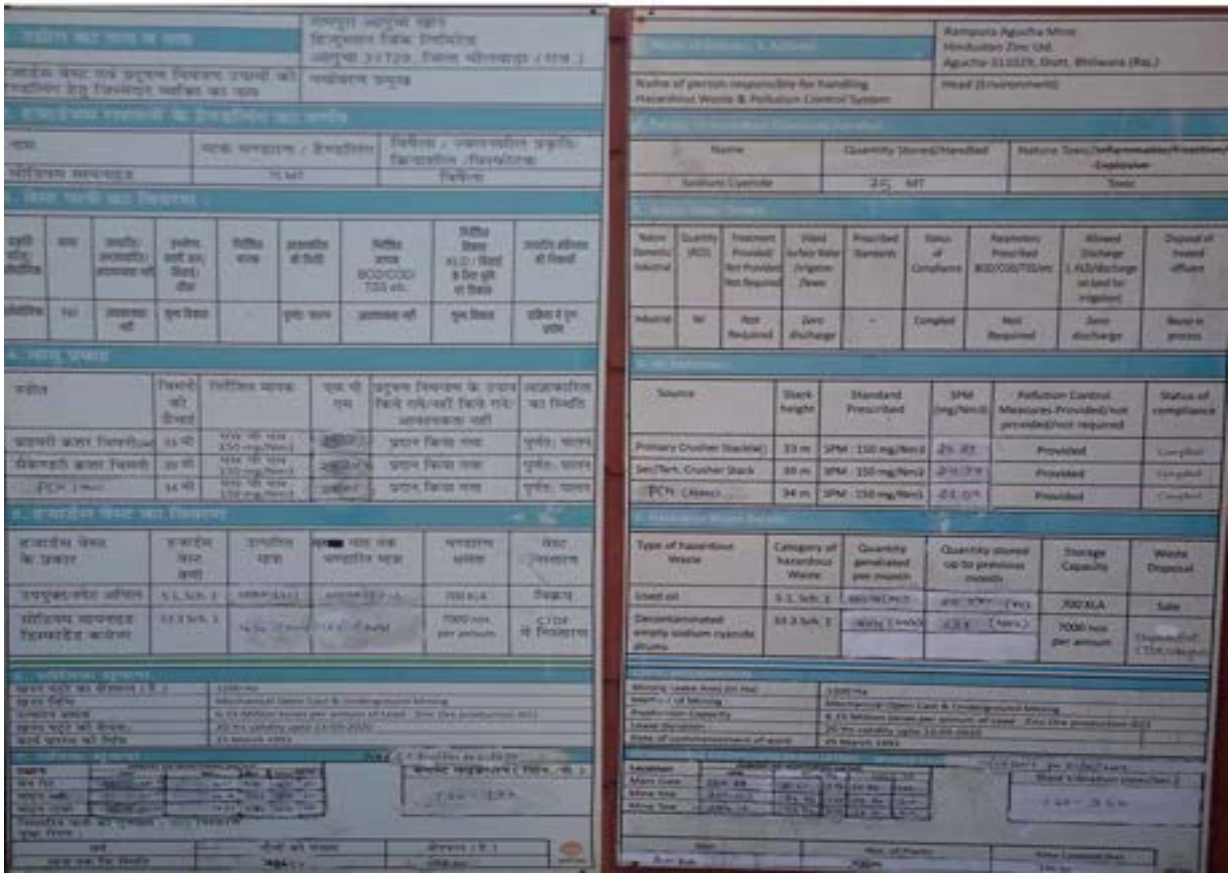
HDPE laying in tailing dam

Annexure-XVI

STP (300KLD) in plant premises

STP (425KLD) in plant premises

Annexure -XVII



Display board at Main gate

Oil trap

vedanta
transforming elements

HZL/RAM/ENV/2021-2022/137

September 22, 2021

Member secretary
Raj. Pollution Control Board
4, Institutional Area
Jhalan Doongri
JAIPUR

Sub : Environment Statement of Rampura Agucha Mine for year 2020-2021.

Ref: CTO granted vide order No 2019-2020/Mines/9959 dated 25/06/2019.
CTO granted vide order No 2019-2020/CPM/5547 dated 22/10/2019.
EC granted vide letter No J-11015/267/2008-IA.II (M) dated 11.12.2009

Sir/Madam,

Please find enclosed herewith the environmental statement for financial year ending on 31st March 2021.

Thanking you

Yours truly,

(Vinod Kumar)
Director (SBU)
RA Mine

Director, Hindustan Zinc Limited
Rampura Agucha Mine
PO- Agucha
Distt. - Bhilwara (Raj.)

cc to: Regional Officer : for kind information please
Raj. State Pollution Control Board
18, Azad Nagar, Pannadhay Circle,
Mining Engineer Office Road (Near Telephone Exchange)
Bhilwara (Raj.)

The Deputy Director (S) /Scientist -C,
Ministry of Environment, Forest & Climate Changes,
Integrated Regional Office, A-209&218,Aranya Bhawan,
Jhalana Institutional area Jaipur-302004

The Director,
Ministry of Environment, Forest and Climate Change
Regional Office, Kendriya Bhawan,5th floor, Sector- H, Aliganj
LUCKNOW (UP) - 226024

Hindustan Zinc Limited
Rampura Agucha Mines, P.O. Agucha, Dist. Bhilwara (Rajasthan) - 311 022
M +91-9001296956-57, F +91-1483 229012 www.hzlindia.com

Registered Office : Yashad Bhawan, Udaipur (Rajasthan) 313 004
CIN No. L27204RJ1966PLC001208

O/C Environment

vedanta
transforming for good

HINDUSTAN ZINC
Zinc & Silver of India

Quarterly report

January '22 to March '22

Submitted to:

HINDUSTAN ZINC LTD. – Rampura Agucha Mines

Submitted By:

Deepak Foundation

April 2022

Abbreviations

ASHA	Accredited Social Health Activist
ANC	Ante-Natal Care
AWW	Anganwadi Workers
BHO	Block Health Officer
BMI	Body Mass Index
BPL	Below Poverty Line
CHC	Community Health Center
HH	House Hold
HB	Hemoglobin
IEC	Information, Education and Communication
IFA	Iron- folic acid tablet
MHU	Mobile Health Unit
NCD	Non-Communicable Disease
OPD	Out-Patient Services
PHC	Primary Health Center
RBS	Random Blood Sugar

Table of Contents

Project: Mobile Health Services to improve the Health and Nutritional profile of underprivileged communities -A Corporate Social Responsibility Initiative

1.0 Introduction:

Hindustan Zinc Limited is committed to contributing to the quality of life and social well-being of the communities where it operates. The business model clearly states that "our social license to operate come not only from the Government but from the communities surrounding our operations. Our growth has true meaning when it creates betterment opportunities for the people around us.

Hindustan Zinc Ltd is already running its Zinc smelter plant at Zawar, Chanderiya and Rampura Agucha Mines in Rajasthan. To support the healthcare of people in the villages around the plant, the Hindustan Zinc initiated provision of quality healthcare services in selected villages. Mobile Health Units have been envisaged to provide preventive, promotive and curative health care in inaccessible areas and difficult terrains. Taking health care to the doorsteps is the principle behind this initiative and is intended to reach underserved areas. The Mobile Health units not only look after the curative and referral aspects but also render behavioral changes and awareness to promote healthy lifestyles by supporting existing healthcare programs, improving access to essential health services, providing a link for referral services, community health education and health promotion, identification and referral of severely malnourished children among others.

Based on the needs assessed on the 'health' portfolio in the villages and past experience of healthcare service provision in these selected regions, it is planned to extend the project in partnership with Deepak Foundation to provide basic healthcare facilities through Mobile Medical Unit that will cater to all the needs mapped.

1.1 Objective: To improve the health care service accessibility and awareness on key health and nutrition issues through a Mobile Health Unit in the underserved population of selected villages.

1.2 Location: The Mobile Health Unit is currently providing medical services in 26 selected villages nearby Rampura Agucha Mines.

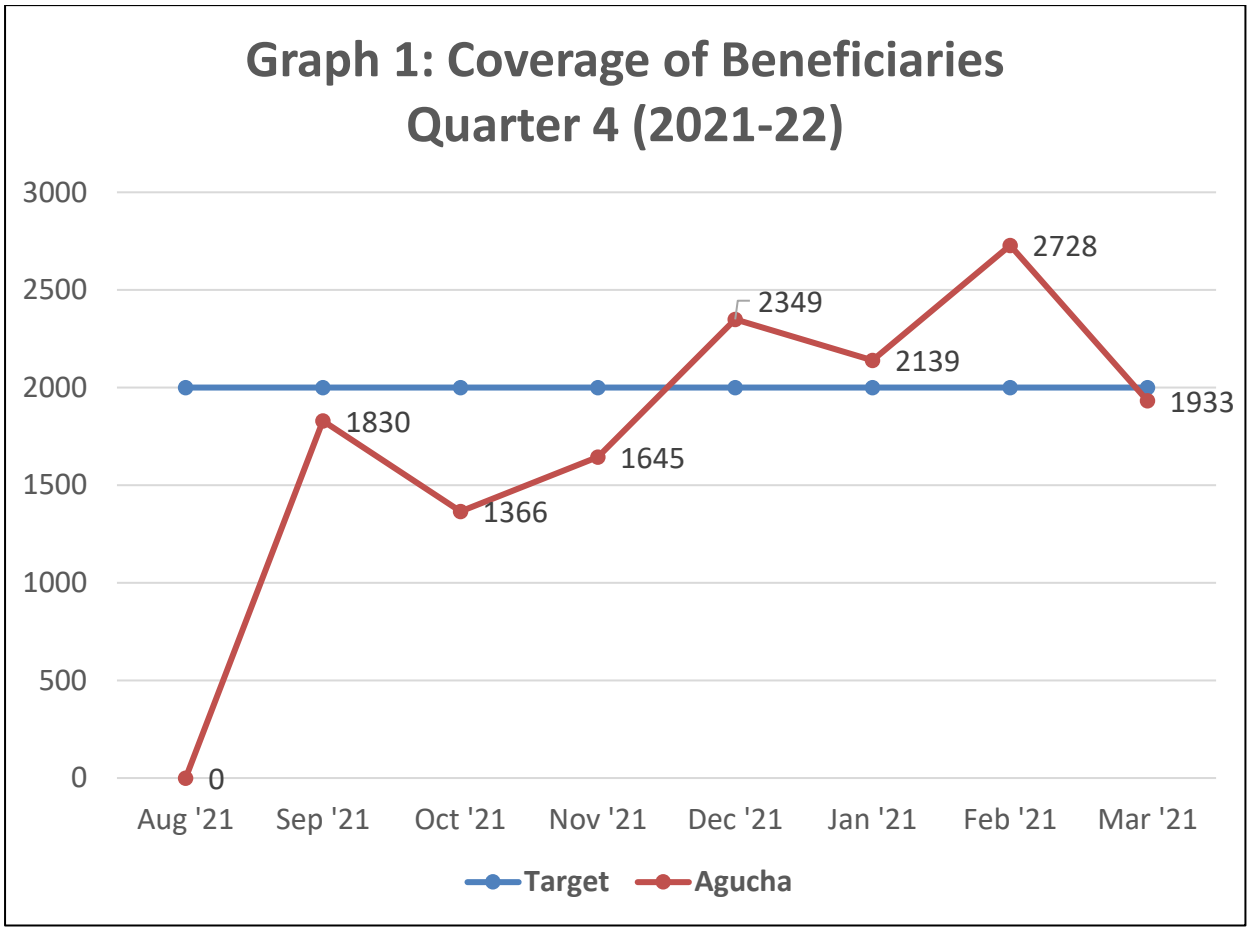
1.3 Methodology:

1. Monthly plans are made to cover villages twice a month.
2. Daily counseling is conducted as per the emerging needs of the community.
3. Awareness Session on key topics
4. HB checkups of adolescent girls at all the schools

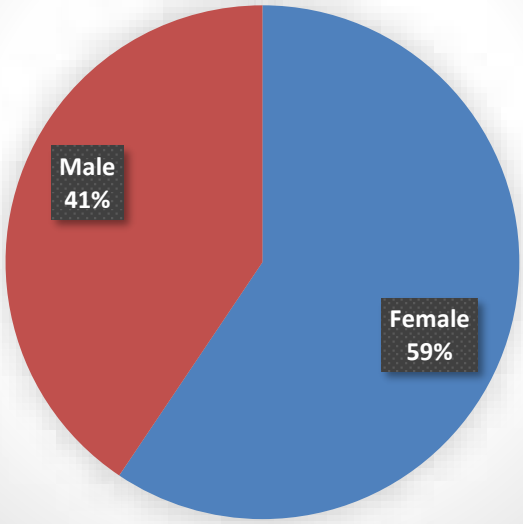
2.0 Activity report

The activities are undertaken in three months – Jan 2022 to Mar 2022 are as follows

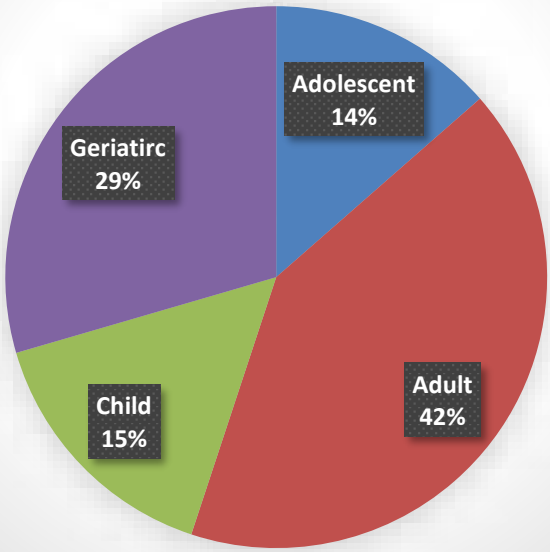
- **Total Beneficiaries:** The mobile health unit covered a total of 6800 beneficiaries during regular OPD, health camp, awareness session and daily counseling under.
- **OPDs**: The unit attended 4361 patients from January 2022 to March 2022 (**Graph 2, 3 & 4**)
- **IEC/Counseling**: A total of 1262 beneficiaries were counseled individually as well as in group, on topics related to personal hygiene and non-communicable diseases.
- **Awareness Session**: Counselled 1032 beneficiaries under different sessions
- **Health Camp**: **Health Camp**: Specialized health camp has been organized at Badla village comes under Rampura Agucha Mines, Bhilwara.



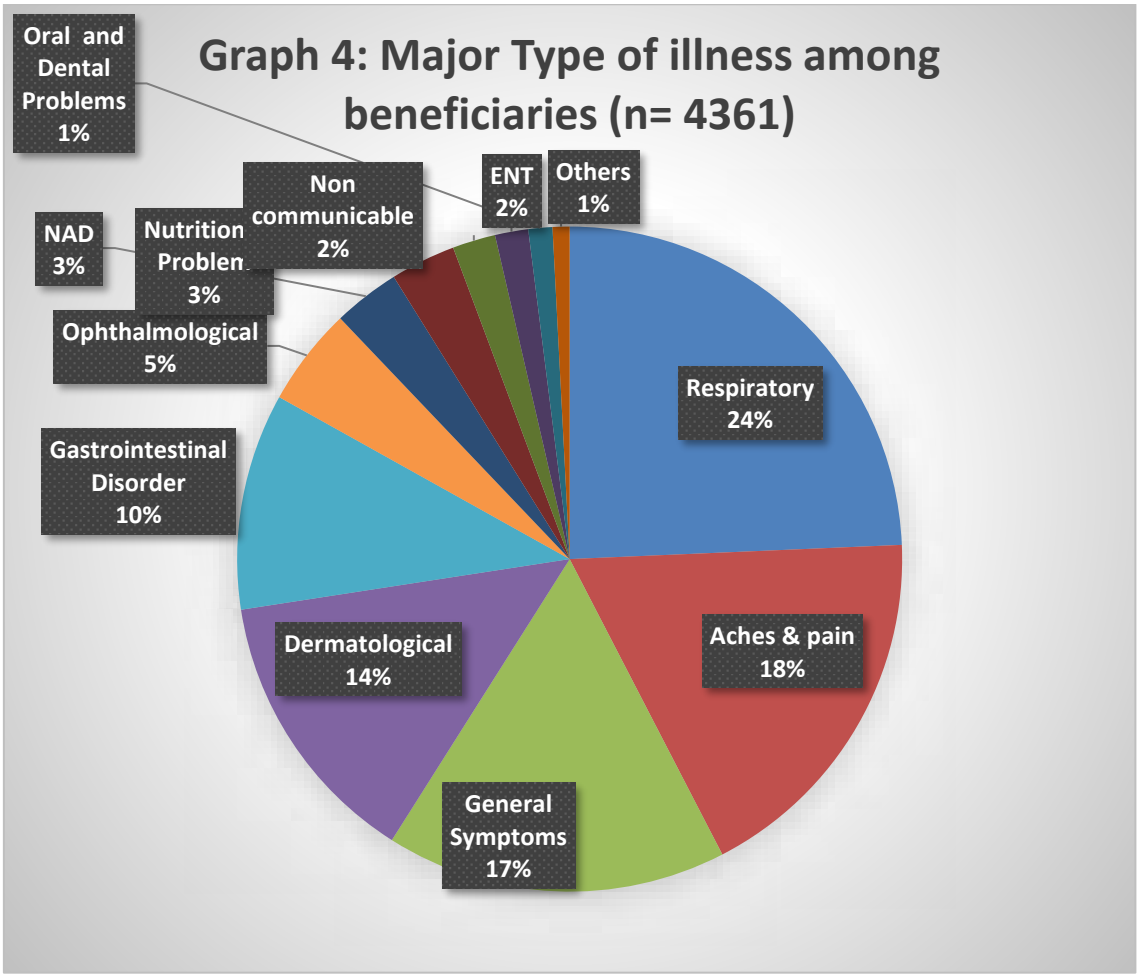
Graph 2: Gender wise distribution of beneficiaries (n= 4361)



Graph 3: Age wise distribution of beneficiaries (n= 4361)



Looking at the disease load (**Graph 4**) over a period of three months, Respiratory diseases were found to be very common (24%), followed by Aches and Pains problems (18%), Dermatological issues (14%) and Gastrointestinal Disorder (10%).



Note: ENT is ear, nose, and throat

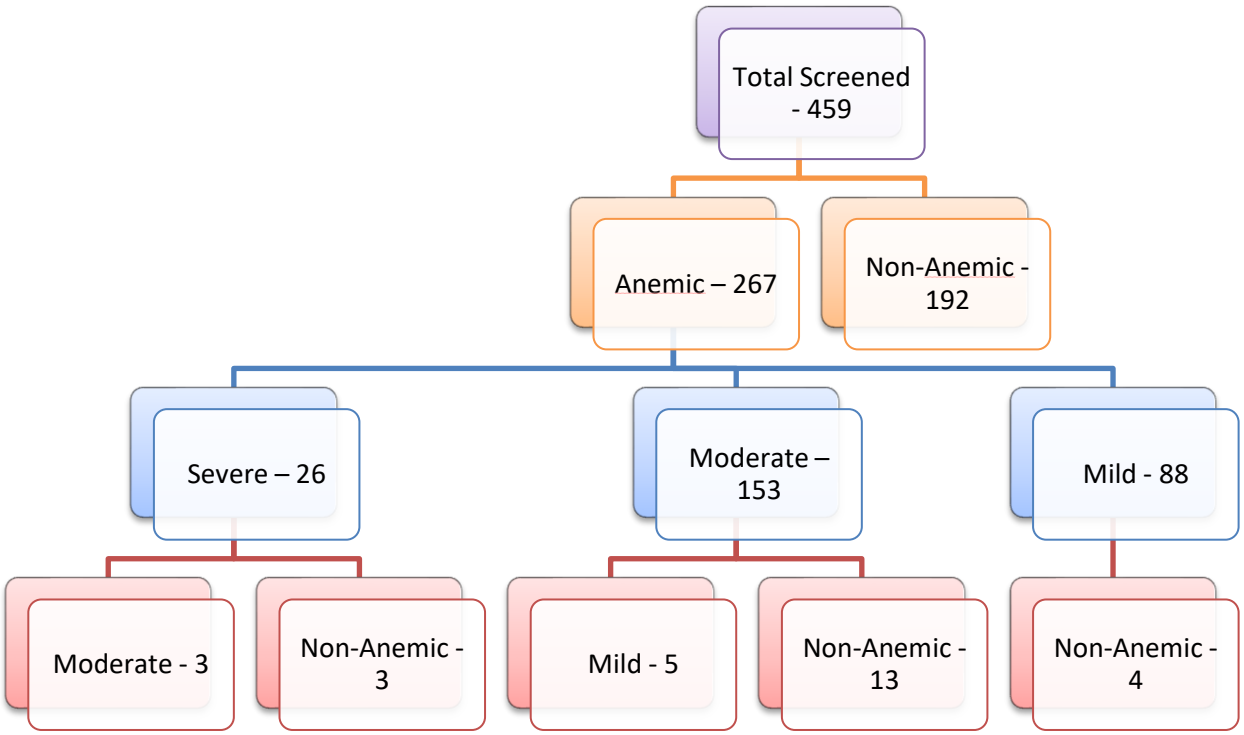
Others include Infectious Diseases, Gynecological, and Urogenital

2.1 Adolescent Program

Adolescence is the period of most rapid growth second to childhood. The physical and physiological changes that occur in adolescents place a great demand on their nutritional requirements and make them more vulnerable to anemia. Anemia in adolescence causes reduced physical and mental capacity and diminished concentration in work and educational performance and also poses a ***major threat to future safe motherhood in girls***.

The purpose behind introducing this intervention among adolescent is to improve their hemoglobin level by tracking them and providing them proper guidance about the requirement of nutrition during adolescent age, proper hygiene at the time of mensuration, symptoms, and ill effects of anemia and prevention of the same. Under this program, the hemoglobin level of adolescents in the respective villages will be screened, which will lead to a group of anemic adolescents. They will be monitored till their status turns into non-anemic and relevant supplements will be provided along with regular counseling using different IEC materials to promote them to take iron rich food to improve their HB level.

Total of ***459 adolescent girls has been screened*** in selected villages. Out of which ***267 found anemic.***



Follow up - Anemic Girls for Hemoglobin Check and Medicine Distribution

3.0 Health Camp conducted in Badla

Mobile Health Unit (MHU) has been functional into selected villages for almost seven months. After looking into the disease pattern, it was realised that community needs attention on some specific disease. Team of specialist doctor was invited for Health camps at Badla village of Bhilwara district. Team comprises of Dermatologist, Orthopedic, Ophthalmologist and General Physician along with paramedical staff to provide necessary support in the camp. Below are the details of Health Camp.

Details of Mega Camp

Table No.: 1
Total No. of Beneficiaries by Gender

Gender	Badla, Agucha
Female	76
Male	66
Grand Total	**142**

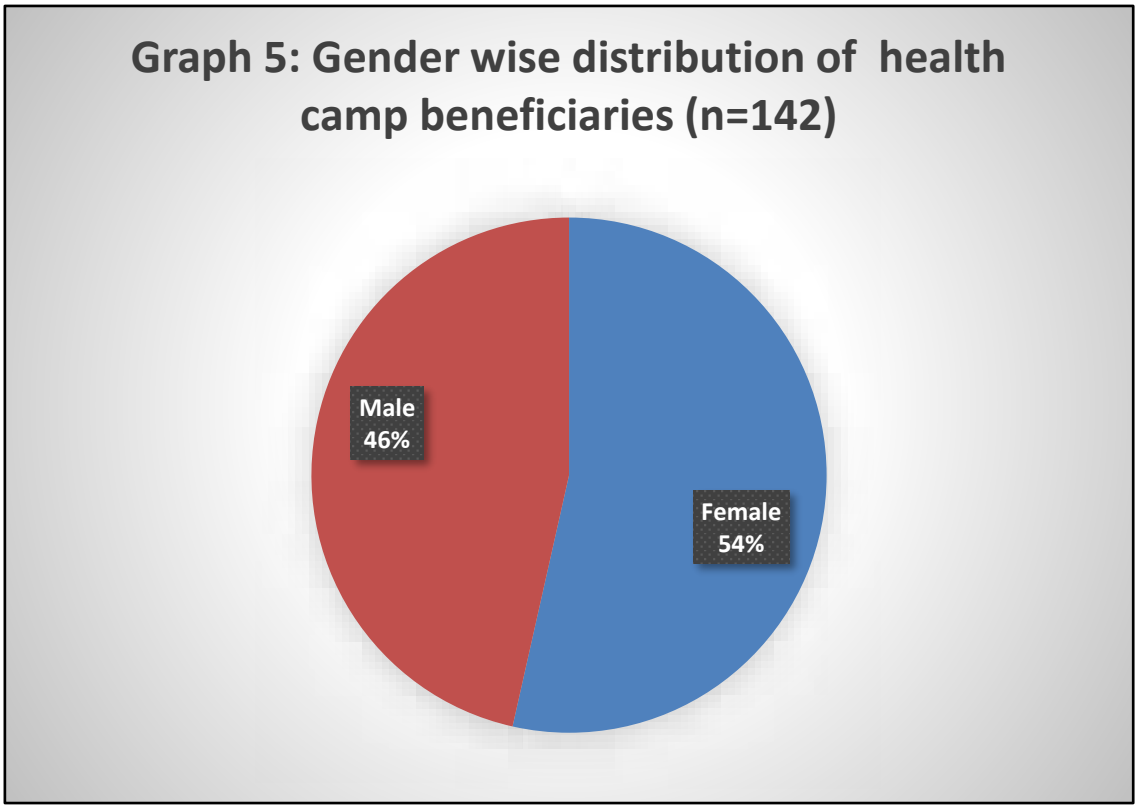


Table No.: 2 Total No. of Beneficiaries by Age Category	
Gender	**Badla**
Adolescent	21
Adult	110
Child	11
Grand Total	**142**

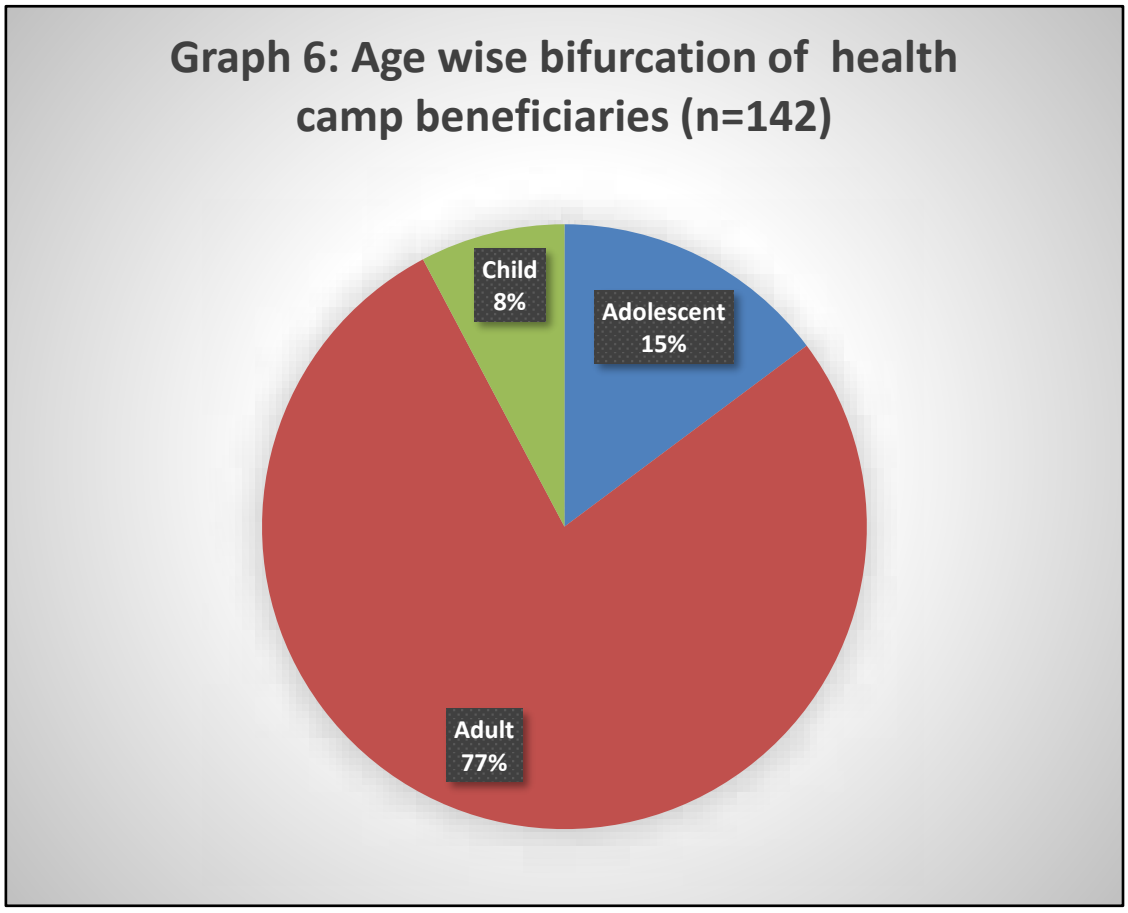
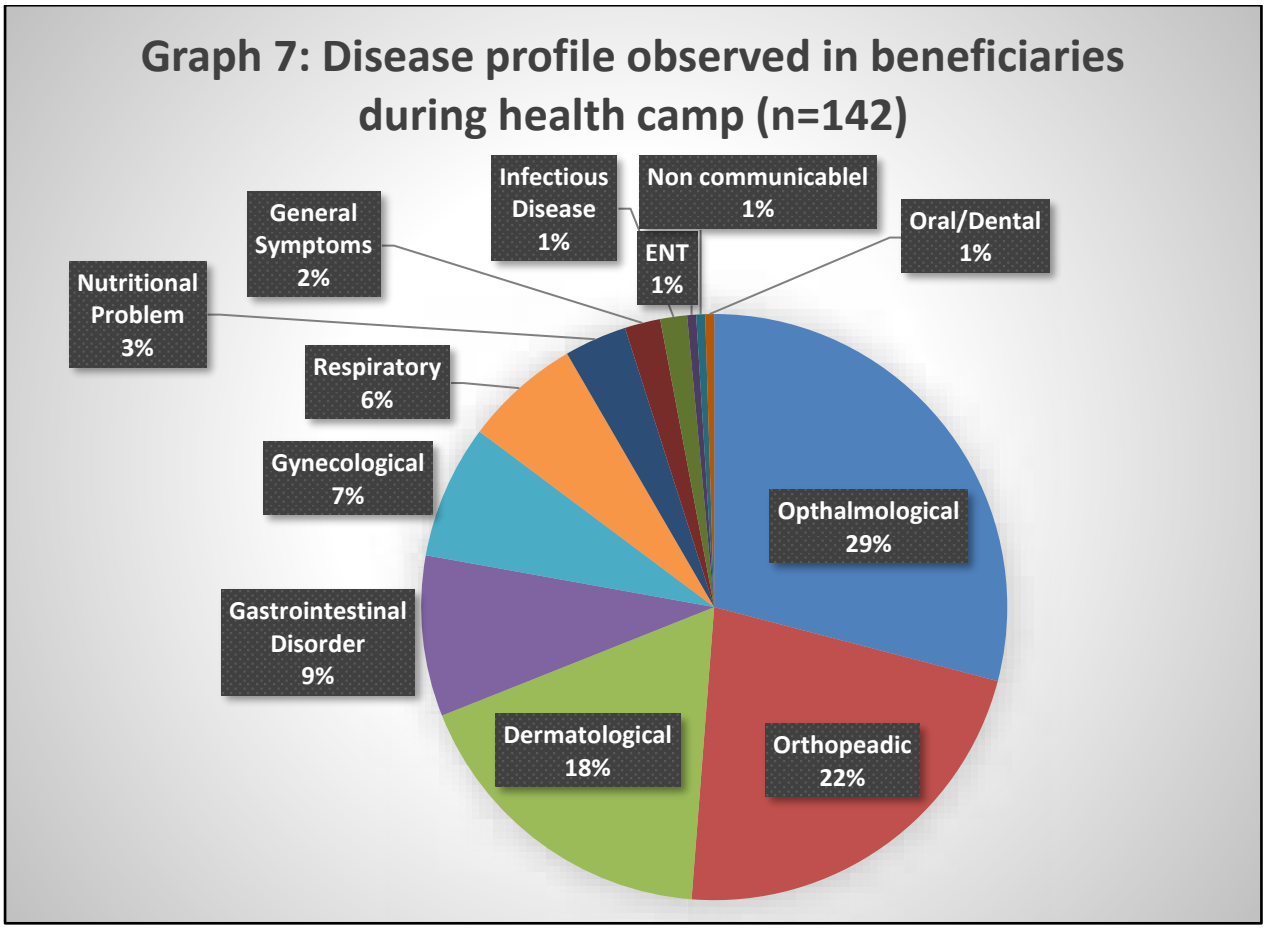


Table No.: 3
Diagnosis Profile of beneficiaries in Agucha

	Adolescent		Adult		Child		Grand Total
Disease Profile	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	
Dermatological	4	1	10	18	2	1	**36**
ENT	0	1	0	0	0	0	**1**
Gastrointestinal Disorder	0	2	8	5	2	1	**18**
General Symptoms	2	0	2	0	0	0	**4**
Gynecological	0	0	15	0	0	0	**15**
Infectious Disease	0	0	1	1	1	0	**3**
Non communicable	0	0	1	0	0	0	**1**
Nutritional Problem	1	0	3	2	1	0	**7**
Opthalmological	2	7	25	24	0	1	**59**
Oral/Dental	0	0	1	0	0	0	**1**
Orthopeadic	0	4	29	11	0	1	**45**
Respiratory	0	1	3	7	2	0	**13**
Grand Total	**9**	**16**	**98**	**68**	**8**	**4**	**203**



4.0 Glimpses of the Activities Undertaken in three months

Celebrated National Girl Child Day

Celebrated World Cancer Day

Session on World TB Day

OPD Services, Telemedicine and Medicine Distribution

Health Camp at Badla village

CSIR-Central Institute of Mining and Fuel Research, Dhanbad

(Council of Scientific and Industrial Research)

Project Title	:	Study on Slope Stability Condition of Rampura Agucha Mine and Dump, HZL.
CIMFR Project No.	:	SSP/360/2018-19
Sponsor	:	HZL
Project Co-ordinator	:	V. K. Singh, Chief Scientist (Ex)
Project Leaders	:	J. K. Singh, Chief Scientist
Project Collaborator	:	Mr. A. Kumar, Scientist Dr. S.K. Roy, Scientist Dr. Ritesh Kumar, Scientist Mr. Rakesh Kumar Singh, Mr. M. Kumar, Mr. U.K. Thakur & Mr. B.L. Sharma.

April 2020

Note:

1. The report is meant only for internal use of the sponsor and it should not be published in full or part by the sponsor or any of its staff members. It should not be communicated or circulated to outside parties except concerned Government department. CIMFR reserves the right to publish the results in a general way for the benefit of the industry without disclosing the name of the sponsor.
2. Recommendations stipulated in the report should be implemented under the supervision of a competent agency and strictly be followed.

28/04/2020

Project Leader
(J. K. Singh)
Chief Scientist
Slope Stability

28/04/2020

HOS & HORG
(J. K. Singh)
Chief Scientist & HORG
Slope Stability

CSIR-CIMFR Authorised Signatories

28/04/2020

(P. K. Mishra)
Sr. Principal Scientist & HOS
Project Monitoring

(RVK Singh) 01/05/2020
Chief Scientist & HORG
Business Development & Industrial Liaison

Introduction

The importance of safe, properly designed and scientifically engineered slope is well known. The benefit of an openpit operation largely depends on the use of the steepest slopes possible, which should not fail during the life of the mine. So, the design engineer is faced with the two opposite requirements, stability and steepness, in designing the deep openpit slopes. Steepening the slopes, thereby reducing the amount of material to be excavated, can save a vast sum of money. At the same time excessive steepening may result into slope failure leading to loss of production, extra stripping costs to remove failed material, reforming of benches, rerouting of haul roads and production delays. The Directorate of Mines Safety may even close the mine, in case unsafe conditions are created. Therefore, it is necessary that a balance between economics and safety should be achieved.

The slope stability and slope monitoring studies are not yet included as an integral part of the total pit design in India. The subject gets importance only when slope failure takes place putting in danger the entire mining operations or when a failure is impending. But the mine management of Agucha Mine entrusted the slope stability and slope monitoring studies to CIMFR, in consultation with DGMS, along with the slope steepening. It shows the scientific and technical aptitude of the mine management for the safe and economic mining.

Rampura Agucha mining complex is situated in Tehsil Hurda, District Bhilwara in Rajasthan and connected by road from Gulabpura railway station on Delhi-Udaipur railway line.

The orebody has been proved for a strike length of 1.7 km. with 109.34 million tonnes of ore reserve and resource. The deposit is being mined with Shovel dumper combination. The overall pit slope is currently planned with 35° on footwall side and 42° on the hanging wall. The current pit depth is 390 m with bottom bench of zero mRL. Presently there is no mining operation in open pit, however pit slope monitoring is being continued in order to take care of safety of opencast as well as underground mining and other operations nearby.

The report deals with the assessment of slope stability condition at Agucha Mine and dump during the year 2018-19.

The stability of slopes depends on the geological structures, geomechanical properties of the slope materials and groundwater condition in the mine. A more justified and suitable remedial measure can be planned for any critical slope after sensitivity analysis.

The rock discontinuities were mapped by the resident geologist and validated by CIMFR at the freshly exposed benches of the pit as per the norms of International Society of Rock Mechanics (ISRM 1978). Geotechnical mapping was undertaken to determine the critical orientation of structural discontinuities. The freshly exposed slope materials were tested at CIMFR to determine any significant changes in the properties because any significant change will influence the slope steepening exercise. The slope monitoring was done to determine any movement in and around the mine and dump.

Physical Characterisation of the Discontinuities

The geotechnical mapping was done by the resident geologist on the exposed benches. CIMFR validated the collected data in the field. The objective was to detect any unfavourably oriented persistent discontinuity in the freshly exposed slope mass, which can influence the stability of the slope standing after slope steepening exercise. The mapping did not reveal such structure in the freshly exposed slope mass.

Geo-mechanical Properties

The engineering properties of the litho units in freshly exposed slope face were tested to determine any significant changes in the properties. Because the significant changes in the properties influence the slope stability of steeper slopes. The testing revealed that the properties of the freshly exposed slope mass is same as that of the previously tested values, which were used for optimum slope design. It may however be prudent to continue the testing of freshly exposed slope mass for any significant changes in the engineering properties. Fresh sampling and

testing should be done to verify any change in the soil/ rock characteristic at different stages of mining. The updated geotechnical parameters are used for stability analysis to determine the stability condition of the slopes during different stages of mining. It helps to accommodate the changes by suitably modifying the slope design. It will help to detect any unfavorable conditions at different stages of mining at the earliest possible. The remedial measures can be taken well in advance without any loss to men and machineries.

Mine and Dump Drainage

The benches should be properly levelled. The heap of muck should not be left on the benches. The rainwater will collect between the toe of the bench and the muck. The water will seep to deeper levels through cracks. The hydrostatic pressure will increase behind the slope, which may cause slope failure in due course of time. The muck should be cleaned and the gradient of the bench should be such that the rainwater flows to lower level in a planned way.

The mine management has planned to make garland drains/ bunds and bench collector drains in the mine. However, the drains/ bunds are planned to be constructed with special care to the weak and weathered lithological units of the mine. These drains in weak and weathered zone must be kept effective. The drain should be of the size to contain the rainwater of the catchment area and free from silt and debris. It should be kept effective.

The drainage must always be directed away from the excavated pit. All the benches or at least alternate benches should have an effective toe drains. These drains should be interconnected to drain out the rainwater into the mine sump. This is necessary to avoid the flow of rainwater on the benches of the precarious litho units, which affect their slope stability. All the drains should be kept clear of soil debris and effective for the free flow of water. The discontinuance of the pre- monsoon preparation at any location will jeopardise the whole effort of maintaining designed slopes.

There should not be unplanned water flowing channels on the benches of the mines, which may run across few benches. The benches should be provided with bench drains to collect the rainwater. It will help to arrest the momentum of fast moving water as soon as it meets the

garland drain or drain of other bench. It should not be allowed to flow down to lower benches in an uncontrolled manner. The slope of the upper most benches should be well graded so that the rainwater goes to the valley side and not in the mine.

The entry of the rainwater from the northern end of the footwall of the pit has been checked by making a bund at the mouth / entry point/ start point of the haul road. The entry of rainwater of the adjacent catchment area should be checked by garland drain/ bund depending up the topography of the area.

At few locations it may not be possible to divert the rain/ seepage water away from the pit, in that case a proper drain pattern should be developed to divert the water into the pit sump. The water should not be allowed to enter into the pit from many channels or left uncontrolled. By guiding the flow of water in a fixed channel erosion/ failure of soil/ clays can be checked. The unchecked erosion may lead to failure in these soil slopes in due course of time.

Sub-horizontal drain holes drilled into the slope face can be very effective in reducing water pressures near the seepage zone. It should be inclined at an angle of five deg. to facilitate free flow of water. The holes may be drilled at the interval of 5m or even closer in the area of requirement. A pipe should be inserted into the hole to prevent caving. The pipe is perforated or slotted to allow water to drain into it. This water will freely flow out of the slope under the gravity. It will improve the stability condition of slopes. The following sub-horizontal holes are effective in the bench slope.

Sl No	Month	Area	HW/FW	mRL	No of Holes	N/S	E/W	Z/mRL	Hole Depth
5	NOV-2015	S-5 (S)	HW	360mRL	1	S-451.32	E-721.46	360.30	100.77
					1	S-450.65	E-721.53	360.32	100.29
					1	S-449.28	E-720.84	360.34	100.69
					1	S-555.48	E-614.22	361.18	100.34
					1	S-558.92	E-614.45	361.21	101.17
					1	S-559.86	E-614.38	361.14	97.26
9	MAR-2016	S4	HW	210mRL	1	S-651.95	E-325.88	209.81	100.00
		Ramp	FW	180mRL	1	N-647.00	E-159.02	180.80	100.00
		Ramp	FW	180mRL	1	N-648.13	E-159.52	180.80	100.00
		Ramp	FW	180mRL	1	N-649.40	E-159.76	180.40	100.00

HORIZONTAL HOLE DETAILS in 2017-18						
HOLE NO	DEPTH	CASING	N/S	E/W	RL	DATE OF DRILLING
1	100.9458	3.6	N-587.57	E-569.78	320.13 mRL	11 April 2017
2	100.514	3.5	N-478.54	E-644.28	320.10mRL	11 April 2017
3	100.2346	3.7	N-475.26	E-646.04	319.79mRL	11 April 2017
4	100.641	3.5	N-615.45	E-541.49	310.26mRL	14 May 2017
5	97.5422	3.6	N-615.30	E-541.32	310.14mRL	14 May 2017
46	101.022	3.6	N 639.2201	E 576.9097	331.00mRL	04 October 2017
47	100.9966	3.5	N 554.8813	E 664.578	331.17 mRL	05 October 2017
48	100.26	3.6	N 538.5584	E 671.3667	330.97mRL	06 October 2017
57	100.7934	3.6	N 654.4727	E 481.3891	291.87 mRL	14 November 2017
58	100.26	3.6	N 629.9021	E 503.4513	291.42mRL	15 November 2017
73	100.1838	3.6	N 669.2445	E 453.9323	278.42 mRL	19 December 2017
74	97.847	3.7	N 584.8226	E 527.2184	279.91mRL	20 December 2017
75	96.704	3.3	N 624.9913	E 496.0597	281.10mRL	21 December 2017
76	100.9204	3.5	N 640.2306	E 482.2159	281.43mRL	23 December 2017
77	101.276	3.6	N 652.7714	E 469.6828	281.21 mRL	24 December 2017

The groundwater is likely to be present at various stages of pit development. 200 mm dia depressurization holes are drilled at surface, on footwall side, Hanging wall side, south across of pit and in-pit at 240 mRL and at footwall 366 mRL., The following de-pressurisation holes are available in the field. As soon as benches are taking final shape, advance-pumping borcholes should be located on lower benches for more effective advance pit dewatering.

RAM Reference	Area	Diameter (mm)	Hole coordinate			Total Hole Depth	Pump Depth
			Easting	Northing	Level		
FW-5	Footwall	200	-290.749	389.1716	395.344	280	165
FW-4		300	-288.509	406.6101	394.5771	250	170
FW-3		200	-283.585	432.4879	395.5617	250	140
FW-2		300	-268.219	475.547	395.9831	300	180
FW-1		300	-271.366	523.6365	397.1367	300	175
FW-8		200	-293.092	297.9466	394.2964	250	150
FW-9		200	-293.092	297.9466	394.2964	300	150
FW-10		200	-297.137	260.0581	394.2441	300	160
HW S- 10	Hang wall South	200	719.5336	-549.085	381.6597	300m	no pump
HW S- 9		200	736.3627	-505.28	381.5443	300m	no pump
HW S-8		200	770.7632	-439.566	382.0639	300m	no pump
HW S-7		200	788.2154	-396.905	382.0412	300m	no pump
HW S-6		300	864.2075	-261.069	380.6063	300m	no pump
HW S-5		300	866.2058	-183.555	380.2014	150m	no pump
HW S-4		300	866.6772	-99.2262	381.4573	300m	150m
HW N-25	Hangwall North	200	874.0667	44.3036	383.3434	300m	180
HW N-24		200	875.8058	95.6745	383.8025	300m	170
HW N-23		200	883.3706	162.5701	384.023	300m	210
HW N- 22		200	875.5585	187.3812	384.2293	300m	200
HW N-21		300	870.6087	227.1129	384.2181	300m	150
HW N-20		200	865.0505	256.8628	384.1975	300m	no pump
HW N-19		300	851.2509	294.6044	384.6086	300m	200
HW N-18		200	842.6937	321.5851	384.5972	300m	no pump
HW N-17		300	826.0143	367.5951	385.495	300m	200
HW N-16		300	823.8102	405.1051	386.1844	220m	no pump
HW N-15		300	834.2513	426.8778	386.0202	300m	200
HW N-14		300	828.4029	458.89	385.8167	300m	180
HW N-13		300	820.09	483.7475	385.8984	300m	210
HW N-12		300	809.5273	510.9489	385.4936	300m	220
HW N-11		300	800.7824	533.3444	385.6768	300m	200
HW N-10		300	789.2551	562.6051	386.3938	300m	220
HW N-9		300	779.3143	584.3189	386.221	300m	220
HW N-8		300	770.3439	602.629	386.3574	150m	140
HW N-7		300	760.238	631.4697	386.714	300m	180
HW N-6		300	733.4017	678.3848	386.2636	300m	160

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HW N-5		300	720.9251	702.6615	386.8758	300m	220
HW N-4		300	697.9528	722.5213	388.0278	300m	no pump
HW N-3		300	675.633	743.3517	388.9216	300m	no pump
HW N-2		300	654.9147	758.6027	389.264	300m	no pump
HW N-1		300	623.6079	789.6098	390.3405	300m	no pump
BH-1	HW (Beyond Waste Dump)	200	804.2718	848.6914	386.8391	300m	no pump
BH-2		300	839.726	843.652	386.0978	300m	160
BH-3		300	884.6845	875.6011	386.4324	300m	170
BH-24		300	879.9717	893.1632	386.2174	300m	150
BH-25		300	871.9622	912.1199	386.2913	300m	150
BH-26		300	854.5497	943.0866	386.4555	250m	180
BH-4		300	972.4053	293.7742	384.6721	300m	150
BH-5		200	977.1601	323.1639	384.5139	hole jaam	no pump
BH-6		200	965.0682	356.205	384.9563	200m	no pump
BH-7		300	953.091	408.5018	384.9115	250m	150
BH-8		200	958.2362	424.2117	384.5256	60m	no pump
BH-9		300	963.2216	455.1807	384.6935	300m	200
BH-10		300	942.8235	465.9094	386.3996	300m	180
BH-11		200	934.1046	513.8465	385.4714	220m	150
BH-12		200	944.1067	533.0436	385.4041	200m	160
BH-13		300	929.7688	561.2824	385.7308	160m	120
BH-14		200	943.5704	572.6062	385.859	200m	150
BH-15		300	927.0508	615.0502	385.5938	160m	170
BH-16		200	957.1403	649.8399	385.4196	240m	160
BH-17		200	949.9003	675.3548	385.5552	250m	150
BH-18		300	923.2753	650.9462	385.7562	300m	160
BH-19		200	914.1179	681.4057	385.5016	300m	180
BH-20		200	941.7511	707.1684	385.7951	200m	no pump
BH-21		200	913.8931	730.6833	386.4344	60m	no pump
BH-22		300	901.977	778.36	386.1074	200m	180
BH-23		200	903.0086	823.6372	386.1265	70m	60

The following piezometers are installed towards footwall side only to measure the water level in different geo-mining conditions.

Sr. No.	Piezometer No.	Location	Depth (m)	RL (m)
1	PM-3	S-400	150	373.1
2	PM-19	S-400	190	390.2
3	PM-43	S-400	108	378.5
4	PM-34	S-350	205	378.5
5	PM-30	S-300	190	384.7
6	PM-26	S-250	135	380
7	PM-9	S-200	160	390
8	PM-20	S-100	184	390
9	PM-33	S-100	83	391
10	PM-32	S-100	150	391
11	PM-16	NS-00	160	391
12	PM-44	N-120	106	382
13	PM-13	N-200	207	382
14	PM-31	N-300	175	393
15	PM-39	N-500	193	395
16	PM-40	N-575	103	395

It should regularly be measured by piezometers to know the changes in the groundwater condition during different phases of the mine development. The mine management is taking observation of the water level fluctuation in a few boreholes dug for this purpose. It gives information about the water level at any point of time. It helps in keeping the working benches dry and adverse effect of the ground water pressure can be minimised. The number of deep boreholes should be increased for advance pit dewatering. More sub-horizontal drain holes should be drilled to depressurise the slope mass, especially near the seepage zones.

All around the periphery of dump, a collector drain/ bund should be formed to divert the rainwater away from the dump. The dump top should be properly levelled with a slope to avoid water retention on dump top/ dump benches and to prevent the rainwater flowing along slope. The drains should be kept clear of soil debris and effective for the free flow of water. It should be done well before the onset of monsoon. The discontinuance of the pre- monsoon preparation at any location will jeopardise the whole effort of maintaining the designed slopes.

The gradient along the floor of the dump should be properly maintained.for free flow of water. The rainwater blocked on different levels and different portions of the dumps will percolate at the bottom of the dump. So, every attempt should be made to make a proper gradient

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of the dump floor. It will facilitate an effective seepage/ flow of water retained in dumps as well as run-off of rainwater to the drains. The drains should be effectively maintained to divert the drained water away from the dump. If this drainage system is not effectively achieved then the dumps may fail due to increase in saturation at the bottom of the dumps and subsequently cause a failure.

The dump floor of soil which forms the base of the external dump should be excavated and removed before dumping to improve the frictional resistance at the base of the dump. It should be filled with OB consisting of stones. It will facilitate the passage of water through the dump floor, thus preventing accumulation of water at the base of dump. Alternatively, the dump floor of hard rock, which forms the base of dump, should be ripped or blasted to a depth of one to two metres, before dumping to improve the frictional resistance at the base of the dump. It will also facilitate the passage of water through the dump floor down to the competent rock strata, thus preventing accumulation of water at the base of dump.

The presence of any well compacted elevated road or any other civil structure near the (external) dump acts as a barrier. It checks the flow of the collected water, near the dump toe, across the road. It is advisable not to construct the road near the dump toe. If it is unavoidable then the road should be located at a minimum distance of 100m from the existing effectively stabilised toe of the dump. The Hume pipes/ culvert should be provided at an interval of each 50m for effective drainage of water across it. The Hume pipes/ culverts should be regularly cleaned to keep them effective. Otherwise the dump would get saturated and may lead to a failure. Alternatively the level of the road should be lower than the toe of the dump.

Mining & Dump Condition and Few Suggestions

The dump mass should be maintained in drained condition. These dumps are likely to be safe with good drainage. Water entry should be checked from entering in to the toe of the dump by providing suitable drainage. The foundation of the external dump should be gneiss. The top soil should be removed and spread at the top of dump for plantation.

Attention must be paid to avoid entry of rain/ surface water in the slope by providing suitable drainage in and around the dump, failing which the slope can become unstable. It should be taken up well before the onset of monsoon.

The importance of the method of construction of dumps is considered to be an important factor in spoil pile stability. Controlled placement of spoil is required to ensure that weak top layer is not dumped at the base of the dump. The clay contains a lot of swelling minerals. It swells too much after coming in contact of water, which may cause failure of slope material lying over them. The top soil of overburden can be selectively dumped separately and should not be put within dumps or at base of dumps. There should not be any dumping in water bodies/ ponds.

Whenever any crack is detected on the existing dump, dozing should be done for proper leveling of the dump. It will consolidate the dump material also and the cracks would also be filled up. The entry of rainwater to the open cracks would also be checked due to closure of the cracks.

The crest of any pit and any civil construction/ installation should be located at a minimum distance equal to the dump height from the effectively stabilized toe of the dump. The distance should be considered in the direction through which it is the minimum.

Proper cleaning/ de-silting and leveling of the drains would be necessary to keep the drains effective. The drains at critical locations may be cemented. It would make the drain more effective. The cleaning would be easy. It would also check the rain water seepage through the drain itself.

The discontinuous dumping should be avoided for better dump slope stability. These depressions/ gaps between the dumps will get filled with rainwater. It may surcharge/liquefy the foundation of the dump, which may result in to failure of the overlying dump material.

The rainwater may percolate through the interspaces between the loose dumped soils, if the slope of the dumps is not proper. The uncontrolled entry of water in the dumps may cause liquefaction of the dumps. It is very difficult to make high dumps with steep slopes because the spoil starts flowing like a liquid under its own weight. With continued dumping the dump height increases and with excess addition of water, slope deformation occurs. The dump slope will quickly flatten to relatively low slope angle.

Proper leveling and compaction of the dumped material should be done with the help of dozer and compactor. It will help to consolidate the dumped material and will minimise the infiltration of water inside the dumps. The upper slope surface, immediately behind the crest, is an area of considerable potential danger. The water, which is allowed to pond in this area, will almost certainly find its way into the slope through cracks and fissures. Grading of this surface will enhance run- off of any collected water.

The vegetation is certainly the best method of slope surface protection, as they will bind the surface together. In turn, it will reduce surface erosion considerably and will tend to inhibit the entry of water into the slope. The biological reclamation of the dumps should also be done by planting the local self-sustaining plants on the final dumps. It increases the stability of dumps.

The 20m high external dump has been placed at about 30m distance from the pit crest (390mRL) towards South Across zone. It is a dead weight over standing slope mass. It adds to instability. No dumping should be done near the pit crest.

The ground profile between the toe of dump (towards south across side) and road (near water reservoir) leading to Agucha village has been properly levelled for quick run-off of the rain water away from the dump foundation. Improper drainage at the dump foundation level towards south across would result in to yielding of the foundation due to liquefaction by the stagnant water between dump toe and road.

The In-house (HZL) geotechnical team should be consulted by the production team for their suggestion to meet the safety requirement of the mine.

Slope Monitoring

The monitoring information is used for variety of crucial functions including safety control, evaluation of current mining plans and future slope design. With the precise nature of the monitoring system at Agucha mine, it provides an active input into mine planning. The early identification of movement zones allows steps to be taken to minimise the impact of mining on stability by the implementation of corrective measures and at the same time provides for optimum ore extraction. The system contrasts strongly with more common 'passive' systems that frequently only record the occurrence of an event for subsequent post-mortem examination. The active monitoring system permits early and confident decision making by management both for safety purposes and for optimum excavation sequencing.

Objectives and Importance of Slope Monitoring

The main objective of slope monitoring study is to detect any instability well in advance so that any damage to men and machineries can be avoided. If the failure is unavoidable then it can be brought down in a predictable manner. If any instability is detected in the early stage then it can be stabilised by applying the suitable remedial measure. If the instability is detected at a later stage then it will be very difficult to check the instability.

The relevance of slope monitoring is recognised considering the increasing trend of steeper slopes and deeper mines. All geotechnical investigations aimed at collecting input design parameters, however complete, involve an inherent risk of inaccuracy. Furthermore, the overall design being based mainly on experience, empirical methods such as rock mass classifications or limit equilibrium stability analyses don't take into account the time dependent behaviour (stability) of slopes. Hence, any attempt of slope stability analyses and evaluation need to be supported by a sound slope monitoring programme in order to ensure the safe and smooth mining operations.

The slope failure never occurs suddenly. It gives sufficient signs to understand that the slope is unstable and it can fail. Generally, the first obvious sign of instability is exhibited by the

formation of tension cracks on the crest of the slopes. It must be treated as warning of instability (Barton, 1971).

It should be noted that the order of movement near failure are large, of the orders of metres, and not millimeters (Kennedy, 1971). The real hazard is not only the detection of movement in the slope, but it is the accelerated rate movement which causes failure.

As soon as any movement is detected generally a question is asked regarding the rate of movement at which men and machinery should be removed. Actually the rate of movement near failure will depend on many factors including rock soil type, water pressure behind the slope, type of discontinuity along which failure is occurring etc. For each specific condition an empirical norm has to be established and then only it is possible to have an exact idea of rate of movement during failure which is not so easy. So, it is only the rate of acceleration of the movement, which can clearly tell the time to remove the men and machinery (Brawner, 1970).

Brawner (1970) from studies on over 200 slides in soil and rock concluded that complete failure has not occurred in less than 24 hours when the rate of movement was less than 25 mm per day with the exception of slides triggered by earthquake.

Monitoring Systems

The slope monitoring techniques vary widely ranging from simple visual observations of signs of potential instability such as slope bulging, surface fretting and the formation of tension cracks to the use of somewhat complex instrumentation. The scale of the mining operation, ore transport system and the nature and location of the potential slope failure decides the application of a particular technique.

Survey based methods can be used for absolute monitoring, that is determining the movement of a point or points relative to some datum believed to be outside the zone of potential deformation. These include:

(a) Total station – Precise level based monitoring,

(b) Tension crack monitors.

Other monitoring methods that may find future and more widespread application include:

(a) Global Positioning Systems,

(b) Computerised Total station monitoring,

(c) 3D Terrestrial Laser Scanner Method

(d) Slope stability radar.

Whichever is the technique used for slope monitoring, the objective is to predict future slope instability by appropriate interpretation of Displacement - Time data and analyses of failure mechanism. The slope monitoring based on standard surveying techniques have found wide acceptance because of the ability to remotely monitor a wall following the establishment of targets. Use of Total Station techniques along with angular measurements have become most popular because of the perceived advantage of only having to monitor from one location.

The slope stability radar technology provides complete slope face coverage from a remote location without need of reflective prisms. This mobile system can easily be moved into a pit to provide high-precision monitoring of a slope face up to 850 m away. Customized software processes the radar data to display slope movement and acceleration on a high-resolution CCD camera image. The unit can provide continuous coverage in all weather conditions, including dust and fog, and can be monitored via radio link and the Internet from remote locations. The SSR is deployed at Rampura Agucha mine. It is being used for slope monitoring by the mine management.

Monitoring observation

The slope materials are inherently weak in the mine. The consequences of slope failures can be very devastating when men or heavy earth moving machines come/ work close to an unstable zone. The slope failure can cause severe disruption to the complete mining operations.

The objective of monitoring is to detect possible slope instability so that appropriate remedial measures can be taken in time. The main concern is the protection of men and equipment.

Over the last few years, the technology for monitoring has improved considerably both in precision and cost effectiveness. Survey based monitoring systems are by far the most widely applied methods of pit slope monitoring. Effective monitoring based on survey methods require meticulous planning, a recognition of instrument precision, measurement repeatability.

The principal monitoring activity is measuring movement. The precise monitoring instrument used at Agucha mine is Total Station.

The slope monitoring study was conducted on quarterly basis, i.e. four times in a year by CIMFR. The changes of two monitoring observations give the data related with movement on the installed stations. The slope monitoring was conducted on the monitoring stations erected along the crest of the footwall. The base station is located in the stable zone of the hangwall side of the mine for setting the instrument.

- **Open pit mine:**
  - Total number of visible and accessible monitoring stations which were made available for monitoring during the visit of November 2019 is 236. 87 stations are located towards hangwall side and 149 stations are towards footwall side of the mine.
  - The following changes were observed among the stations made available for the monitoring purpose.
    - The maximum change of 16.8 cm has been observed at N/775 of 360mRL bench, 10.7 cm at N575 of 280mRL and 9.4 cm at N/700 of 350mRL bench, towards hangwall side.
    - 54 numbers stations are showing change between 3.0 cm to 6.9 cm in footwall side during the visit.
    - 18 cm and 9.4 cm have been observed respectively at S/50 of 366mRL and S/350 of 390mRL bench of footwall side.
  - The monitoring should be done departmentally on daily basis in the zone of movement to check any impending failure. It should also be supplemented by SSR.

- **Dump:**

Total 43 stations were made available for the monitoring purpose. The maximum change of 9.4 cm has been observed at W/120 and W/1075, 8.1 cm at W/400 during the observation of November 2019.

More movement may occur in near future on the monitoring stations and/ or on rest part of the pit. It may get momentum any time and may cause a big failure. The continuous mining operation, blasting and changes in groundwater conditions continuously disturb the existing stress condition in the field. The whole system tries to come into equilibrium by stress redistribution and adjustment, which may result into movement of the slope any time.

The development of any tension crack on different benches formed in weak slope material should be observed. The iron rods (with serial numbers) should be installed across the crack to measure the movement with the help of tape, if possible daily/ weekly. If the persistence of the crack is in two or more benches and the trend of the movement is continuously increasing, i.e. accelerating, then it is a matter of concern because it may cause large scale failure. The tension cracks should be filled with weathered rockmass and sealed with clay to prevent the entry of water, which may cause failure.

It is prudent to continue the monitoring of the slope regularly. It will be helpful to make use of remedial measures as soon as any movement is detected to check the impending failure. If the movement is continued for a year, it will be very difficult to control the instability by applying any remedial measure thereafter. World over, the scientists recommend that remedial measures should be adopted as soon as movement starts or even before. The monitoring should be continued to detect the on-set of any major movement, which in-turn will be helpful in applying a suitable remedial measure for the critical slope timely. A long-term association between HZL and CIMFR can only achieve it.

Conclusion and Recommendations

Open pit mine:

- Total number of visible and accessible monitoring stations which were made available for monitoring during the visit of November 2019 is 236. 87 stations are located towards hangwall side and 149 stations are towards footwall side of the mine.
- The following changes were observed among the stations made available for the monitoring purpose.
  - The maximum change of 16.8 cm has been observed at N/775 of 360mRL bench, 10.7 cm at N575 of 280mRL and 9.4 cm at N/700 of 350mRL bench, towards hangwall side.
  - 54 number stations are showing change between 3.0 cm to 6.9 cm in footwall side during the visit.
  - 18 cm and 9.4 cm respectively have been observed at S/50 of 366mRL and S/350 on 390mRL bench of footwall side.

Dump:

- Total 43 stations were made available for the monitoring purpose. The maximum change of 9.4 cm has been observed at W/120 and W/1075, and 8.1 cm at W/400 during the observation of November 2019.
- The external dump, placed towards South Across zone, is a dead weight over standing slope mass. Cracks were present along the crest of first tier of this dump before the recent dozing operation. The reopening of cracks should be regularly observed, especially during rainy season.
- The level of the ground between the toe of dump (south across side) and road (near water reservoir) leading to Agucha village should be regularly maintained for quick run-off of the rain water away from the dump foundation. Poor drainage at the dump foundation level would result in to yielding of the foundation due to liquefaction by stagnant water between dump toe and road.
- The monitoring should be done departmentally on daily basis in the zone of movement to check any impending failure. It should also be supplemented by SSR.
- The rock mass is weak, weathered and fractured. Constant vigil should be kept in these parts of the pit. It is advisable to continue slope monitoring to detect the onset of failure so that early and effective stabilisation measures can be taken at the earliest. If the instability is unavoidable then it can be brought down in a predictable manner. The iron pegs should be installed along old and new cracks to monitor opening of the crack.
- The lithology is highly weathered and fractured towards southern part, especially southwest part, of the footwall. The monitoring has revealed progressive change in data. It indicates impending failure.
- Location of monitoring stations should be shown on working plan and made available to CIMFR.
- The broken station should be reinstalled. The stations should be installed in such a way that it cover the whole pit and dump.
- The monitoring stations are installed only towards footwall side at different levels. Stations should also be installed towards hangwall side.
- No heap of muck should be left on the benches. The muck should be cleaned and the gradient of the bench should be such that the rainwater flows to lower level in a planned way.
- The mine and dump should have an effective garland drain/ bund, all around, to collect run-off rainwater before it reaches the mine slopes and dump toe. The drains should be steeply graded to promote rapid water movement and minimise the chances of ponding. It is essential that these drains should be kept clear of silt and debris. The benches should have toe drains. These drains should be again interconnected to drain out the rainwater into the mine sump.

The mine management should continue advance pit dewatering. Besides the existing boreholes for pumping, more boreholes should be drilled for dewatering.

- More sub-horizontal drainage and advance pit dewatering holes should be installed for depressurisation of adverse groundwater pressure, especially where seepage has been observed.
- The groundwater regime is likely to be present at various stages of pit development. Its measurement should be continued by installing piezometers. It is also recommended that the grid of piezometer stations should be expanded.
- During the rainy season, one person should be deputed to go in and around the mine in the morning to see any development of tension crack.

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PIT

Table 1: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 390 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
N/675	1286.281	-0.1	+0.1	-0.2	-0.5
N/650	1279.263	-0.2	0.0	-0.3	-0.5
N/600	1260.210	-0.2	-0.1	-0.3	N.V
N/575	1255.757	-0.1	+0.3	-0.1	-0.6
N/550	1254.826	-0.2	+0.1	-0.1	-0.7
N/500	1251.294	-0.1	0.0	-0.5	-1.2
N/475	1245.527	-0.2	+0.2	-0.7	-1.6
N/425	1235.057	-0.2	+0.2	-0.4	-1.0
N/400	1229.828	-0.2	+0.2	-0.5	-1.1
N/300	1205.676	-0.2	+0.3	-0.4	-1.2
N/250	1190.508	-0.3	+0.2	-0.4	-1.2
N/175	1169.167	-0.3	+0.4	-0.3	-1.1
N/75	1132.917	-0.3	+0.2	-0.2	-1.0
N/50	1128.066	-0.5	+0.1	-0.1	-0.8
N/25	1123.771	-0.4	+0.3	-0.2	-1.0
NS00	1120.169	-3.2	-2.9	-3.0	-4.0
S/25	1116.391	-0.4	+0.4	-0.4	-1.1
S/50	1113.655	-0.2	+0.7	-0.2	N.V
S/75	1109.964	-0.7	0.0	-0.7	N.V
S/100	1106.514	-0.6	+0.3	-0.6	N.V
S/125	1104.099	-0.6	+0.1	-1.7	-4.0
S/175	1108.839	-0.7	-0.1	-1.8	-3.8
S/200	1111.569	-0.9	-0.6	-1.6	-4.6
S/225	1115.711	-0.6	-0.3	-1.6	-2.8
S/250	1116.993	-0.6	0.0	-1.2	-2.7
S/275	1121.490	-0.4	+0.3	-1.1	-2.9
S/300	1124.947	-0.5	+0.5	-1.2	-2.7
S/325	1128.194	-15.1	N.V	N.V	+3.6
S/350	1137.185	-1.9	-2.9	-6.8	-9.4
S/400	1160.522	-0.8	-0.1	-0.9	-2.2

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 1 contd : Changes in Horizontal Distance from hangwall Base Station for F/W Pillars.
(Monitoring stations are located on 390M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
S/425	1169.705	-0.7	0.0	-1.0	-2.1
S/450	1177.498	-0.6	+0.2	-0.7	-2.2
S/475	1184.466	-0.5	+0.1	-0.7	-2.3
S/500	1190.170	-0.7	0.0	-0.6	-2.5
S/525	1197.167	-0.5	+0.1	N.V	N.V
S/550	1206.498	-0.6	+0.2	-0.5	-2.3
S/575	1213.167	-0.7	0.0	-0.9	-0.3
S/600	1216.148	-0.4	+0.4	-0.5	-1.3
S/625	1218.553	-0.2	+0.5	-0.4	-1.4
S/650	1223.945	-0.5	+0.2	-0.1	-1.6
S/800/	1241.538	-0.7	-0.1	+25.2	N.V
S/825/370	1247.862	-0.8	-0.4	-1.1	-5.8
S/810/360	1237.093	-0.8	-0.1	N.V	-4.8
S/775/360	1226.714	-0.7	-0.2	-1.3	+3.2
S/770/350	1209.790	-0.9	-0.2	-1.1	N.V
S/810/350	1220.781	-0.5	-0.1	-0.8	-3.4
S/805/350	1207.160	-0.8	0.0	-0.8	-2.8
S765/350	1199.102	-0.8	-0.2	-1.0	-3.8
S/775/280	1100.801	-0.8	+0.1	-1.2	-2.4
S/725/275	1089.225	-0.5	+0.4	-1.0	-1.4
S/650/270	1086.037	-0.3	+0.6	-0.9	-1.0
S/575/270	1070.241	-0.5	+0.4	-0.9	-1.4
S/700/230	992.765	-0.6	+0.6	-1.1	-1.1
S/685/230	994.045	-0.5	+0.6	-1.2	-1.1
S/620/220	968.641	-0.5	+0.8	-1.0	-1.1
S/610/220	966.414	-0.9	+0.7	-1.4	-1.4

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 2: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 366 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
S/250	1085.630	-0.7	+0.1	-1.3	-2.6
S/200	1078.232	-0.7	+0.3	-1.5	-3.0
S/150	1071.999	-0.8	-0.2	-2.6	-5.0
S/100	1071.267	-0.7	-0.1	-3.3	-6.9
S/50	1075.261	-0.8	-0.3	-7.0	-18.0
NS/00	1086.345	-0.6	+0.2	-0.5	-1.2
N/50	1092.905	-0.5	+0.2	-0.5	-1.2
N/150	1137.815	-0.5	0.0	-0.7	-1.5
N/275	1171.290	+0.5	+1.1	+0.2	-0.4

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 3: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 354 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
N/400	1128.782	0.0	+0.6	-0.8	-1.4
N/500	1161.289	-0.1	+0.3	-0.5	N.V
N/600	1194.011	-0.3	+0.2	-0.5	-0.7
(Monitoring stations are located on 342 M RL bench)					
N/475	1140.948	-0.3	+0.2	-0.8	-1.3
N/410	1116.325	-0.2	+0.3	-0.7	-1.3

N/300	1080.614	N.V	+0.6	-0.6	-1.6
(Monitoring stations are located on 330 M RL bench)					
Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
N/600	1165.483	-0.2	+0.2	-0.6	-0.7
N/500	1129.650	-0.2	+0.4	-0.7	-1.1
N/475	1126.809	0.0	+0.5	-0.7	-1.2
N/450	1116.086	-0.3	+0.3	-0.8	-1.3
N/400	1100.375	-0.2	+0.1	-1.2	-1.7
N/300	1066.725	-0.5	+0.2	-1.2	-2.2
N/250	1051.388	-0.6	+0.1	-1.0	-2.1
N/100	1019.723	-0.4	+0.4	-1.0	-1.9
S/100	1021.503	-0.6	+0.2	-2.2	-4.2
S/200	1029.769	-0.6	+0.2	-2.0	-3.6
S/400	1071.803	-0.7	+0.2	-1.6	-3.2
S/500	1119.450	-0.4	+0.7	-0.9	-2.2
S/600	1141.624	-0.6	+0.3	-0.9	-2.2
(Monitoring stations are located on 340 M RL bench)					
N/50/340	1058.040	-0.4	N.V	-0.5	-1.2
(Monitoring stations are located on 310 M RL bench)					
S/300	1044.087	N.V	+0.8	N.V	-2.3
N/25	985.721	-0.8	-0.3	-2.4	-4.0
N/100	995.726	-0.5	+0.4	-1.2	2.0
N/175	1006.147	-0.6	+0.4	-1.6	-2.8

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 4: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars.
(Monitoring stations are located on 290 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
S/100	942.521	-0.5	+0.2	-2.2	-3.8
NS/00	957.476	-0.8	+0.1	-2.3	-4.0
N/100	972.517	-0.6	+0.2	-1.6	-2.5
N/300	1018.625	-0.1	+0.4	-1.3	-2.0
(Monitoring stations are located on 270 M RL bench)					
N/350	1018.180	-0.2	+0.4	-1.4	-2.1
(Monitoring stations are located on 260 M RL bench)					
N/350	1001.423	-2.0	+0.5	-1.7	-2.6
N/300	987.209	-0.4	+0.3	-2.1	-3.0
N/200	953.537	-0.7	+0.2	-2.2	-3.2
N/100	935.345	-0.5	+0.4	-2.0	-3.0
NS/00	922.464	-0.7	+0.1	-2.8	-4.6
S/100	907.552	-0.5	0.0	-2.3	-3.7
S/200	915.569	-0.8	+0.2	-2.4	-3.7
S/300	932.675	-0.8	0.0	-1.9	-3.1
S/400	969.240	-0.7	+0.3	-1.7	-2.7
S/500	1010.580	-0.9	+0.1	-1.6	-2.7
(Monitoring stations are located on 220 M RL bench)					
S/300	886.294	-0.4	+0.5	-2.3	-3.1
S/200	868.264	-0.5	+0.7	-2.4	-3.2
S/100	860.585	-0.9	+0.2	-2.6	-3.9
NS/00	875.405	-0.9	+0.1	-2.9	-4.2
N/100	889.488	-0.6	+0.3	-2.4	-3.0
N/200	910.230	-0.7	-0.1	-2.8	-4.3
N/400	972.914	-0.4	+0.3	-1.9	-0.2
N/500	1013.926	-0.3	+0.2	-1.5	-1.8

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 5: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 190 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
S/325	829.306	-0.9	+0.7	-2.2	-3.1
S/350	839.227	-0.5	+0.4	-2.1	-2.9
S/425	866.094	-0.3	+0.6	-2.0	-2.4
(Monitoring stations are located on 180 M RL bench)					
S/425	853.539	-0.6	+0.6	-2.0	-2.8
S/400	837.148	-0.8	+0.2		
S/300	810.945	-0.6	+0.2	-2.5	-3.2
S/75	816.637	-1.1	-0.1	-3.1	-4.3
S/25	822.594	N.V	+0.4	-3.2	-4.1
N/400	929.018	-0.1	+0.3	-2.5	-3.2
(Monitoring stations are located on 170 M RL bench)					
N/450	943.230	-0.3	+0.1	-2.3	-2.5
N/400	923.938	-0.4	0.0	-2.8	-3.0
N/300	899.240	-0.3	0.0	-3.1	-3.5
N/250	870.586	-0.3	+0.4	-3.0	-3.4
S/100	769.728	-1.3	+0.2	-3.5	-4.5
S/200	782.330	-0.9	0.0	-3.0	-4.1
S/300	800.034	-0.8	+0.4	-2.5	-3.5
(Monitoring stations are located on 160 M RL bench)					
S/250	776.941	-1.2	+0.1		
S/50	767.187	-0.9	0.0	-3.6	-4.8
N/175	833.543	-0.6	+0.6	-2.9	-3.7
N/275	868.114	-0.8	+0.5	-3.3	-3.8
N/375	906.789	-0.3	+0.1	-2.7	-2.9
(Monitoring stations are located on 140 M RL bench)					
N/375	892.259	-0.8	+0.2	-3.1	-3.1
N/325	864.978	-0.6	+0.1	-3.1	3.5

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 6: Changes in Horizontal Distance from hangwall Base Station for F/W Pillars. (Monitoring stations are located on 100 M RL bench)

Station No	Horizontal Distance in meter. April 2019	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
S/50	536.174	-	-	-2.9	-3.2
S/150	514.209	-	-	-0.7	-2.6
S/250	516.026	-	-	-0.7	-2.6
S/300	526.476	-	-	-0.3	-1.8
S/400	553.163	-	-	-0.3	-1.7
S/500	598.758	-	-	-0.4	-1.3
(Monitoring stations are located on 80 M RL bench)					
S/325	505.774	-	-	-0.6	-2.4
S/250	493.722	-	-	-0.3	-2.4
S/150	493.181	-	-	-0.8	-3.2
(Monitoring stations are located on 70 M RL bench)					
S/200	478.597	-	-	-0.8	-2.1
S/300	485.722	-	-	-0.2	N.V
S/350	500.327	-	-	-0.2	-2.0
(Monitoring stations are located on 90 M RL bench)					
N/100	575.054	-	-	-0.7	-3.3
N/150	589.115	-	-	-1.1	-3.0
N/175	599.364	-	-	-1.3	-2.8
N/200	614.903	-	-	-1.6	-3.1
N/200	633.136	-	-	-0.9	-2.4
N/200	660.286	-	-	-0.7	-2.3
(Monitoring stations are located on 340 M RL bench)					
S/25	206.246	-	-	N.V	N.V
S/275	102.882	-	-	+1.0	+0.7
(Monitoring stations are located on 160 M RL bench)					
S/245	587.279	-	-	-1.2	-3.4
S/325	596.396	-	-	-0.5	2.9
S/375	609.051	-	-	-0.5	-2.6

(Monitoring stations are located on 170 M RL bench)					
S/425	626.639	-	-	-0.5	-1.9
S/485	662.245	-	-	-0.5	-1.6
S/400	628.382	-	-	N.V	-2.5

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 7: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars.

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
N/850	1079.481	+0.2	-0.5	-1.0	-1.4
N/825	1080.326	+0.1	-0.7	-1.3	-2.1
N/750	1074.429	-0.1	-0.9	-2.3	-4.2
N/725	1076.972	0.0	-0.8	-2.0	-3.6
(Monitoring stations are located on 360 M RL bench)					
N/575	1110.064	-0.1	-1.1	-2.2	-2.9
N/625	1117.785	-0.1	-1.0	-2.0	-2.5
N/650	1093.372	+0.1	-0.8	-1.6	-2.3
N/700	1061.799	-0.2	-0.7	-2.1	-3.2
N/725	1058.302	-0.3	-1.3	-3.4	-6.7
N/775	1060.770	0.0	-0.8	-2.6	-16.8
N/800	1065.492	+0.1	-0.6	-1.6	-2.5
N/850	1068.669	+0.2	-0.4	-1.1	-1.6
N/875	1065.320	+0.3	-0.3	-0.1	N.V
N/925	1045.069	+0.3	-0.2	-0.5	-0.5
(Monitoring stations are located on 350 M RL bench)					
N/875	1049.968	+0.1	-0.4	-0.9	-1.0
N/775	1049.858	0.0	-0.8	-2.2	-3.7
N/700	1047.736	-0.6	-1.5	-4.7	-9.4
S/400	1019.083	+0.1	-1.0	-2.2	-3.1
(Monitoring stations are located on 340 M RL bench)					
N/450	1077.351	+0.1	-1.1	-2.3	-3.3

N/525	1082.133	+0.2	-1.0	-2.3	-3.1
S/175	969.599	-0.1	-1.1	-2.7	-4.1
S/200	971.056	-0.1	-1.1	-2.5	-3.9
S/275	1059.386	+0.1	-1.2	-2.6	-3.6
S/300	988.732	0.0	-1.0	-2.3	-3.5

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 8: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars. (Monitoring stations are located on 360 M RL bench)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal distance in cm.			
		January 2019	April 2019	August 2019	November 2019
S/500	1028.800	+0.2	-0.8	-0.9	-2.6
S/650	1043.452	0.0	-1.0	-1.8	-2.2
S/700	1051.904	-0.1	-1.3	-1.2	-2.6
S/750	1058.332	+0.3	-0.6	-1.4	-1.6
S/800	1070.657	+0.3	-0.5	-1.2	N.V
(Monitoring stations are located on 330 M RL bench)					
S125	961.236	-0.1	-1.1	-2.6	-3.9
(Monitoring stations are located on 320 M RL bench)					
N/150	932.405	-0.2	-1.2	-2.7	-4.2
N/100	925.838	-0.1	-1.2	-2.7	-4.1
(Monitoring stations are located on 310 M RL bench)					
N/250	937.220	-0.1	-1.0	-2.8	-4.4
N/200	932.800	+0.1	-0.8	-2.3	-3.7
(Monitoring stations are located on 300 M RL bench)					
N350	945.824	+0.1	-0.8	-2.5	-4.3
N/300	943.207	+0.1	-0.8	-2.5	-3.9
(Monitoring stations are located on 290 M RL bench)					
N/425	946.101	+0.1	-0.8	-3.2	-4.7
(Monitoring stations are located on 280 M RL bench)					
N/625	934.326	-0.2	-0.8	-2.6	-5.7
N/575	931.288	-0.1	-0.9	-3.7	-10.7
N/475	941.314	0.0	-0.7	-3.0	-4.9

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 9: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars.
(Monitoring stations are located on 270 M RL bench)

Station No.	Horizontal distance in meter. October 2018	Change in Horizontal distance in cm.			
		January 2019	April 2019	August 2019	November 2019
N/825	961.368	+0.4	-2.0	-1.1	-1.6
N/625	933.253	+0.3	-2.0	-1.7	-2.8
(Monitoring stations are located on 260 M RL bench)					
N/750	928.315	+0.5	0.0	-1.4	-1.8
N/725	920.922	+0.2	-0.4	-1.7	-2.4
S/100	862.646	0.0	-1.0	-3.0	-4.7
S/200	867.709	0.0	-1.0	N.V	N.V
S/300	883.112	-0.2	-1.0	-3.1	-4.5
(Monitoring stations are located on 250 M RL bench)					
S/350	888.108	-0.1	-1.1	-3.1	-4.2
S/125	855.611	+0.1	-1.2	-3.2	-4.7
S/75	854.076	0.0	-1.0	-3.4	-4.9
N/25	861.149	0.0	-0.8	-3.2	-4.4
(Monitoring stations are located on 240 M RL bench)					
S/750	867.567	+0.1	-0.3	N.V	-3.0
(Monitoring stations are located on 220 M RL bench)					
S/550	854.993	+0.3	-0.4	-2.4	-3.0
S/625	868.426	+0.5	-0.4	-2.1	-3.0
(Monitoring stations are located on 200 M RL bench)					
S/325	838.663	+0.4	-0.8	-3.4	-4.7
S/250	822.848	+0.3	-0.8	-3.4	-5.0
S/150	812.072	+0.3	-0.7	-3.5	-4.8
S/100	808.974	+0.2	-0.6	-3.4	-4.9
S/50	810.541	+0.3	-0.6	-3.3	-4.9
N/50	815.699	+0.1	-0.3	-2.8	-4.3

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 10: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars. (Monitoring stations are located on 190 M RL bench)

Station No.	Horizontal distance in meter. October 2018	Change in Horizontal distance in cm.			
		January 2019	April 2019	August 2019	November 2019
S/225	810.354	+0.4	-1.0	-3.6	-4.9
S/150	801.476	+0.3	-0.8	-2.9	-4.6
S/75	799.918	+0.2	-1.0	-3.2	-4.5
(Monitoring stations are located on 180 M RL bench)					
N/100	800.522	+0.1	-1.1	-3.5	-4.9
N/50	796.751	0.0	-1.1	-3.4	-5.0
S/50	791.809	+0.3	-0.6	-3.3	-4.6
S/125	791.716	+0.2	-0.8	-3.2	-4.4
(Monitoring stations are located on 160 M RL bench)					
S/50	744.854	0.0	-0.4	-3.4	-5.0
S/150	744.267	+0.2	-0.9	-4.1	-5.7
S/225	756.040	-0.2	N.V	-4.1	N.V
(Monitoring stations are located on 130 M RL bench)					
N/300	695.734	+0.3	-0.3	-4.1	-5.9
N/125	730.924	+0.4	-0.3	-3.9	-5.7
N/75	723.088	+0.3	-0.1	-3.5	-5.8
S/25	717.473	+0.4	-0.5	-3.7	-5.5
S/125	715.982	+0.8	-0.9	-4.7	-6.1
N/225	-	-	564.338	-2.2	-4.1

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 11: Changes in Horizontal Distance from Footwall Base Station for H/W Pillars. (Monitoring stations are located on 100 M RL bench)

Station No.	Horizontal distance in meter. April 2019	Change in Horizontal distance in cm.	
		August 2019	November 2019
S/250	664.644	-1.4	-2.8
S/375	714.150	-1.3	-2.0
(Monitoring stations are located on 70 M RL bench)			
S/250	640.877	-1.4	-3.2
S/125	585.044	-2.1	-4.4
N/100	542.254	-2.7	-4.9
N/250	471.825	-2.4	-4.5
(Monitoring stations are located on 80 M RL bench)			
N/225	489.339	-2.3	-4.7
(Monitoring stations are located on 50 M RL bench)			
N/175	486.365	-2.4	-5.0
N/75	526.262	-2.5	-5.0
S/25	544.145	-2.7	-5.2
S/100	562.848	-2.7	-4.8
(Monitoring stations are located on 30 M RL bench)			
S/150	567.966	-3.1	-5.7
S/100	543.203	-2.3	-6.0
S/30	526.064	-2.7	-5.6
N/160	474.559	-2.1	-4.5

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

DUMP

Table 12: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 435 M RL Dump)

Station No.	Horizontal distance in meter. January 2019	Change in Horizontal distance in cm.		
		April 2019	August 2019	November 2019
W/300	311.608	N.V	N.V	N.V
W/500	170.017	N.V	N.V	N.V
W/675	228.265	N.V	N.V	N.V
(Monitoring stations are located on 475 M RL Dump)				
W/450	287.441	N.V	N.V	N.V
W/600	303.168	N.V	N.V	N.V
W/700	364.045	N.V	N.V	N.V
(Monitoring stations are located on 535 M RL Dump)				
W/400	437.048	-2.6	-2.6	-8.1
W/600	437.207	-1.9	-2.1	-6.0
W/700	512.789	-1.8	-1.6	N.V
(Monitoring stations are located on 520 M RL Dump)				
W/500	385.813	-1.5	-1.6	-5.3
W/650	435.882	-3.0	-3.2	N.V
W/800	532.654	-2.3	-2.5	-4.2
W/900	593.313	-1.6	-1.4	-1.8
W/950	647.070	N.V	N.V	N.V

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 13: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 475 M RL Dump)

Station No.	Horizontal distance in meter. April 2019	Change in Horizontal distance in cm.	
		August 2019	November 2019
W/410	288.018	0.0	+0.7
W/1275	350.840	0.0	+1.4
W/925	389.229	+3.0	N.V
W/540	294.132	N.V	+6.5
W/725	524.227	+3.0	+1.9
W/640	312.389	0.0	-6.8
(Monitoring stations are located on 495 M RL Dump)			
Station No.	Horizontal distance in meter. August 2019		
W/695	402.203	N.V	N.V
W/835	475.288	N.V	N.V

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 14: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 515 M RL Dump)

Station No.	Horizontal distance in meter. October 2018	Change in Horizontal distance in cm.			
		January 2019	April 2019	August 2019	November 2019
E/130	1668.464	+0.7	0.0	0.0	-1.9
E/170	1703.150	+0.5	-0.6	-0.1	-2.8
E/10	1737.702	+0.8	+0.1	+0.2	-0.9
W/40	1759.657	+0.7	+0.3	+0.1	-1.0
W/100	1782.147	+0.5	-0.3	-0.2	-1.5
(Monitoring stations are located on 495 M RL Dump)					
W/120	1743.351	+0.5	-0.6	-0.5	-9.4
E/110	1637.058	+0.8	-0.1	0.0	-1.9
E/165	1611.521	+0.5	-0.2	-0.3	-6.5
E/500	1450.291	N.V	-1.2	-1.3	-4.3
E/600	1502.015	N.V	-2.3	N.V	-2.1
(Monitoring stations are located on 475 M RL Dump)					
W/15	1656.298	+0.5	-0.6	-0.4	-2.6
W/160	1699.168	+0.3	-0.3	-0.2	-2.1
E/700	1478.575	N.V	N.V	-0.3	-2.4
E/560	1442.519	N.V	N.V	-1.9	-6.6
E/465	1420.321	N.V	N.V	N.V	N.V
(Monitoring stations are located on 455 M RL Dump)					
N/600	1500.874	N.V	N.V	N.V	N.V
E/188	N.V	N.V	N.V	N.V	N.V
E/190	1518.000	+0.6	+0.5	+0.1	N.V
W/150	1645.517	+0.3	-0.4	-0.3	-3.2
W/10	1614.675	+0.4	-0.4	+0.3	N.V
N/500	1552.578	N.V	N.V	N.V	N.V
N/350	1750.174	N.V	N.V	N.V	N.V
TD/N/985	1691.123	+0.1	-0.5	-0.7	-5.8
TD/N/875	1627.604	+0.1	N.V	-1.0	-3.8
TD/N/780	1572.003	-0.1	-0.1	-1.0	-5.1
(Monitoring stations are located on 435 M RL Dump)					
E/200	1463.852	N.V	N.V	N.V	N.V
E/20	1557.634	N.V	N.V	N.V	N.V
W/125	1600.171	+0.5	-0.1	N.V	-5.6

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 16: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 495 M RL Dump)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
N/2000	506.831	-0.6	N.V	N.V	N.V
N/2050	521.418	0.0	N.V	N.V	N.V
N/2150	537.322	+0.1	N.V	N.V	N.V
N/2315	-	602.768	N.V	N.V	N.V
(Monitoring stations are located on 475 M RL Dump)					
N/2250	528.978	+0.2	-0.7	N.V	N.V
N/2150	489.317	+0.1	-1.2	N.V	N.V
N/1950	458.873	+0.3	-0.7	N.V	N.V
(Monitoring stations are located on 455 M RL Dump)					
N/2050	429.939	+0.3	-0.7	-0.7	-0.4
N/1875	426.161	+0.3	-0.4	-0.4	+0.4
TD/N/1480	-	539.181	N.V	N.V	N.V
N/2375	-	561.920	N.V	-1.3	-1.6
(Monitoring stations are located on 445 M RL Dump)					
TD/W/1650	603.522	Broken	-	-	-
TD/W/1550	550.939	Broken	-	-	-
TD/W/1450	514.474	Broken	-	-	-
W/1590	564.358	Broken	-	-	-
W/1525	544.770	Broken	-	-	-
(Monitoring stations are located on 435 M RL Dump)					
N/1875	374.690	+0.1	-1.0	-0.9	-0.6
N/2100	399.191	+0.2	-0.7	-0.6	-0.5
N/2335		497.828		-0.9	-0.8
(Monitoring stations are located on 420 M RL Dump)					
TD/W/1645	489.208	Broken	497.814	N.V	N.V
TD/W/1570	487.665	Broken	561.907	N.V	N.V

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

Table 17: Changes in Horizontal Distance from NWM 1.
(Monitoring stations are located on 445 M RL Dump)

Station No.	Horizontal Distance in meter. October 2018	Change in Horizontal Distance in cm.			
		January 2019	April 2019	August 2019	November 2019
TDN/1045	553.488	Broken	-	-	-
TDN/900	417.592	Broken	-	-	-
TDN/725	302.163	Broken	-	-	-
TDN/560	295.317	Broken	-	-	-
TDN/425	373.361	Broken	-	-	-
Table 1: Changes in Horizontal Distance from NWM 2. (Monitoring stations are located on 475 M RL Dump)					
W/1100	341.836	-	-	-	-
W/1200	447.663	-	-	-	-
W/1225	339.978	-	-	-	-
(Monitoring stations are located on 455 M RL Dump)					
W/1075	292.854	Broken	294.983 (new)	+0.4	-9.4
W/1150	295.195	Broken	298.131 (new)	N.V	+1.5
W/1275	297.943	Broken	-	-	-
W/1120	-	-	250.837	N.V	+0.9
W/1300	-	-	307.250	N.V	-1.1
(Monitoring stations are located on 435 M RL Dump)					
W/1050	239.065	Broken	-	-	-
W/1375	288.558	Broken	-	-	-
W/875	-	-	364.296	N.V	N.V
W/1380	-	-	292.254	N.V	+4.3
W/780	-	-	312.018	N.V	+5.6
W/600	-	-	185.980	N.V	-6.4
W/1260	-	-	254.990	N.V	N.V
(Monitoring stations are located on 430 M RL Dump)					
W/450	-	-	185.776	N.V	-3.8

Note: "+" and "-" signs indicate increase and decrease in the Horizontal Distance respectively. N.V. stands for "Not Visible".

30/4/2020

Annexure -XXII

Blast vibration data (Monitoring at UG)							
S.no	Date	Blast location (stope)	Monitoring location	Radial distance (m)	MCPD (kg)	PPV (mm/s)	Frequency (Hz)
1	13-Oct-21	-330L_N285	-280L_N127	170	190	1.9	138
2	17-Oct-21	-305L_N352	-280L_N127	260	200	2.0	120
3	22-Oct-21	-330L_S262	-280L_S330	110	145	3.2	80
4	24-Oct-21	-180L_S82 C	-280L_S330	320	180	1.2	168
5	29-Oct-21	-305L_S562	-280L_S330	210	170	2	120
6	3-Nov-21	-255L_S142	-280L_S330	220	200	2.0	120
7	13-Nov-21	-280L_N532 A	-280L_N127	400	145	1.6	160
8	17-Nov-21	-330L_S367	-280L_S330	90	108	3.4	90
9	21-Nov-21	-205L_S97 B	-280L_S330	240	165	2.5	112
10	25-Nov-21	-255L_N22	-280L_N127	130	180	2.9	108
11	2-Dec-21	-330L_N270	-280L_N127	178	72	0.9	141
12	10-Dec-21	-305L_S187	-280L_S330	161	138	2.4	175
13	23-Dec-21	-305L_S307	-280L_S330	149	84	2.9	115
14	31-Dec-21	-280L_N487 A	-280L_N127	360	78	0.5	155
15	9-Jan-22	-305L_S52	-305L_S330 Substation	210	170	2	120
16	14-Jan-22	-255L_N8	-305L_N195 Substation	220	200	2.0	120
17	19-Jan-22	-330L_N457 B	-305L_N195 Substation	400	145	1.6	160
18	24-Jan-22	-355L_N337 B	-305L_N195 Substation	90	108	3.4	90
19	30-Jan-22	-355L_S247	-305L_S330 Substation	240	165	2.5	112
20	8-Feb-22	205L_S225 B	-305L_S330 Substation	140	188	3.3	140
21	16-Feb-22	-305L_S577	-305L_S330 Substation	240	155	2.5	156
22	23-Feb-22	-280L_N487 B	-305L_N195 Substation	290	190	1.9	138
23	26-Feb-22	-330L_N457 C	-305L_N195 Substation	260	200	2.0	120
24	8-Mar-22	-330L_S517	-305L_S330 Substation	200	145	3.2	80
25	16-Mar-22	-380L_N157	-305L_S330 Substation	350	108	1.4	120
26	21-Mar-22	-330L_S67	-305L_S330 Substation	240	165	2.5	112
27	30-Mar-22	-305L_S607	-305L_S330 Substation	260	180	2.1	138
28	31-Mar-22	-355L_N397 B	-305L_N195 Substation	240	170	2	120
29	06-Apr-22	-330L_N487 A	-305L_N195 Substation	450	156	1.9	80
30	16-Apr-22	-330L_S547	-305L_S330 Substation	320	220	3.1	100
31	18-Apr-22	-330L_S52	-305L_S330 Substation	360	210	2.4	103
32	23-Apr-22	-355L_N397 C	-305L_N195 Substation	280	208	2.4	120

Peak particle velocity

Member Secretary

भारत सरकार
केन्द्रीय भूमि जल प्राधिकरण
जल संसाधन मंत्रालय

Government of India
Central Ground Water Authority
Ministry of Water Resources

CGWA/IND/Proj/2013-5 -R

No.21-4(2)/WR/CGWA/2005- 1205

Dated :- 08 JUL 2013

To,

M/s Hindustan Zinc Ltd.,
Rampur Agucha Mine
PO Agucha, District Bhilwara-311029
Rajasthan

Sub:- Renewal of NOC for ground water withdrawal to M/s Hindustan Zinc Ltd., in respect of their existing mining project at Rampura Agucha Mine, Kotri Block, District Bhilwara, Rajasthan – reg

Sir,

Kindly refer to letter No. HZL/RAM/ENV/2013 dated 25.2.2013 on the above cited subject. Based on recommendations of Regional Director, CGWB, Western Region, Jaipur vide his office letter No. TS/21B(5)/CGWA/WR/05-07-119-30 dated 22.3.2013 and subsequent letter dated 2.5.2013 and further deliberations on the subject, the further renewal of NOC issued vide this office letter of even no. dated 13.5.2008, is hereby accorded to **M/s Hindustan Zinc Ltd., in respect of their existing mining project at Rampura Agucha Mine, Kotri Block, District Bhilwara, Rajasthan**. The renewal is however subject to the following conditions:-

1. The firm may continue to abstract **11,700 m^3/day** of ground water through existing radial wells/tubewells only. No additional ground water abstraction structures to be constructed for this purpose without prior approval of the CGWA.
2. Monitoring of the ground water extraction through wells to be continued through water meter by the industry at its own cost on regular basis, at least once in a month. The ground water quality to be monitored twice in a year during pre monsoon and post monsoon periods
3. **M/s Hindustan Zinc Ltd.,** shall, in consultation with the Regional Director, Central Ground Water Board, Western Region, Jaipur implement ground water recharge measures as proposed for augmenting the ground water resources under intimation to this office.

West Block - 2, Wing - 3, Sector - 1, R.K. Puram, New Delhi - 110066
Tel : 011-26175362, 26175373, 26175379 • Fax : 011-26175369
Website : www.cgwb.gov.in, www.mowr.gov.in

4. The firm shall continue to execute ground water regime monitoring programme in and around the project area through piezometers on regular basis in consultation with the Central Ground Water Board, Western Region, Jaipur.
5. The ground water monitoring data in respect of S.No. 2 & 4 to be submitted to Central Ground Water Board, Western Region, Jaipur on regular basis at least once in a year.
6. The firm shall ensure proper recycling and reuse of waste water after adequate treatment.
7. Action taken report in respect of S.No. 1 to 6 may be submitted to CGWA within one year period.
8. The renewal is liable to be cancelled in case of non-compliance of any of the conditions as mentioned in S.No. 1 to 7.
9. This renewal is valid for five years from date of issuance of this letter. Upon review of status of compliance of the above conditions after five years, decision for revalidation of approval will be considered.

Member Secretary

Copy to:

1. The Member Secretary, Rajasthan Pollution Control Board, 4, Institutional Area, Jhalana Doongri, Jaipur.
2. The Regional Director, Central Ground Water Board, Western Region, Jaipur for information and necessary action. This has reference to your letter No. TS/21B(5)/CGWA/WR/05-07-119-30 dated 22.3.2013 and subsequent letter dated 2.5.2013.
3. The District Collector, Bhilwara District, Rajasthan.
4. TS to Chairman, CGWB, NH-IV, Faridabad.
5. Guard File 2013-14.

Member Secretary

vedanta
transforming elements

HZL/RAM/ENV/2018-19/26

Date: April 4, 2018

To,

The Regional Director,
Central Ground Water Board,
Western Region,
6-A, Jhalana Doongri,
JAIPUR

Sub: Request for renewal of Ground water withdrawal from existing Radial well at Banas River bed for M/s Hindustan Zinc Limited Rampura Agucha Mine.

Ref: CGWA letters dated 08/07/2013 regarding renewal of NOC vide No. 21-4(2)WR/CGWA/2005-1205 dated 08/07/2013.

Sir,

As per the condition No. 9 of the above mentioned NOC, "the renewal is valid for five years from date of issuance of the letter. Upon review of status of compliance of the conditions after five years, decision for revalidation of approval to be considered."

Accordingly, renewal form and compliance status of the conditions are attached herewith. It is to submit further that compliance of all the conditions stipulated in the NOCs is ensured.

Therefore it is humbly requested that this renewal for existing permission of drawl of 11700m3 /day ground water from the existing radial well to enable us to run our mine and beneficiation plant. We have deposited the processing fees of Rs. 500/- through "bharatkosh.gov.in" vide transaction reference No. 0404180001535 dated 04.04.2018. Copy of the same is attached herewith.

Your Faithfully

04/04/2018

(Rajendra Prasad Dashora)
Site President

CC to: Member Secretary,
Central Ground Water Authority
West Block-2, Wing-3
Sector-1, R.K. Puram,
NEW DELHI-110066

केन्द्रीय भूजल प्राधिकरण
पश्चिमी क्षेत्र, जयपुर
प्राप्त दि. 04/4/18
डायरी दि.....

O/C Env.

Hindustan Zinc Limited
Rampura Agucha Mines, P.O. Agucha, Dist. Bhilwara (Rajasthan) - 311 022
M +91-9001294956-57, F +91-1483 229012 www.hzlindia.com

Registered Office : Yashad Bhawan, Udaipur (Rajasthan) 313 004
CIN No. L27204RJ1966PLC001208

Member Secretary

भारत सरकार
केन्द्रीय भूमि जल प्राधिकरण
जल संसाधन मंत्रालय

Government of India
Central Ground Water Authority
Ministry of Water Resources

CGWA/IND/Proj/2013-6 -R

No.21-4(2)/WR/CGWA/2005- 1204

Dated :- 05 JUL 2013

To,

M/s Hindustan Zinc Ltd.,
Rampur Agucha Mine
PO Agucha, District Bhilwara-311029
Rajasthan

Sub:- Renewal of NOC for ground water withdrawal to M/s Hindustan Zinc Ltd., in respect of their existing mining project at Rampura Agucha Mine, Village Agucha, Tehsil Hurda, District Bhilwara, Rajasthan – reg

Sir,

Kindly refer to letter No. HZL/RAM/ENV/2013 dated 25.2.2013 on the above cited subject. Based on recommendations of Regional Director, CGWB, Western Region, Jaipur vide his office letter No. TS/21B(5)/CGWA/WR/05-07-119-30 dated 22.3.2013 and subsequent letter dated 2.5.2013 and further deliberations on the subject, the further renewal of NOC issued vide this office letter of even no. dated 6.8.2008, is hereby accorded to **M/s Hindustan Zinc Ltd., in respect of their existing mining project at Rampura Agucha Mine, Hurda Block, District Bhilwara, Rajasthan**. The renewal is however subject to the following conditions:-

1. The firm may continue to abstract **250 m³/day** of ground water from mine pit. No additional ground water abstraction structures to be constructed for this purpose without prior approval of the CGWA.
2. Monitoring of the ground water extraction through wells to be continued through water meter by the industry at its own cost on regular basis, at least once in a month. The ground water quality to be monitored twice in a year during pre monsoon and post monsoon periods.
3. **M/s Hindustan Zinc Ltd.,** shall, in consultation with the Regional Director, Central Ground Water Board, Western Region, Jaipur implement ground water recharge measures as proposed for augmenting the ground water resources under intimation to this office.
4. The firm shall continue to execute ground water regime monitoring programme in and around the project area through piezometers on regular basis in consultation with the Central Ground Water Board, Western Region, Jaipur.

West Block - 2, Wing - 3, Sector - 1, R.K. Puram, New Delhi - 110066
Tel : 011-26175362, 26175373, 26175379 • Fax : 011-26175369
Website : www.cgwb.gov.in, www.mowr.gov.in

5. The ground water monitoring data in respect of S. No. 2 & 4 to be submitted to Central Ground Water Board, Western Region, Jaipur on regular basis at least once in a year.
6. The firm shall ensure proper recycling and reuse of waste water after adequate treatment.
7. Action taken report in respect of S.N o. 1 to 6 may be submitted to CGWA within one year period.
8. The renewal is liable to be cancelled in case of non-compliance of any of the conditions as mentioned in S. No. 1 to 7.
9. This renewal is valid for three years from date of issuance of this letter. Upon review of status of compliance of the above conditions after five years, decision for revalidation of approval will be considered.

Member Secretary

Copy to:

1. The Member Secretary, Rajasthan Pollution Control Board, 4, Institutional Area, Jhalana Doongri, Jaipur.
2. The Regional Director, Central Ground Water Board, Western Region, Jaipur for information and necessary action. This has reference to your letter No. TS/21B(5)/CGWA/WR/05-07-119-30 dated 22.3.2013 and subsequent letter dated 2.5.2013.
3. The District Collector, Bhilwara District, Rajasthan.
4. TS to Chairman, CGWB, NH-IV, Faridabad.
5. Guard File 2013-14

Member Secretary

CGWA NOC

vedanta

Ref.: HZL/RAM/Env/2016-17/

April 28, 2016

To,
The Regional Director,
Central Ground Water Board,
Western Region, 6A, Jhalana Doongari, Jaipur- 17

Sub.: Renewal of NOC for Ground water intersection from mine pit.

Ref: CGWA renewal letter No 21-4(2)/WR/CGWA/2005-1204 dated 08/07/2013 for ground water intersection & withdrawal of 250 m^3/day ground water from the mine pit.

Sir,

Please find herewith the renewal application for NOC of ground water intersection & withdrawal of 250 m^3/day from the mine pit.

Thanking you,

Yours Sincerely,

(Praveen Jain)
Location Head (Rampura Mine)

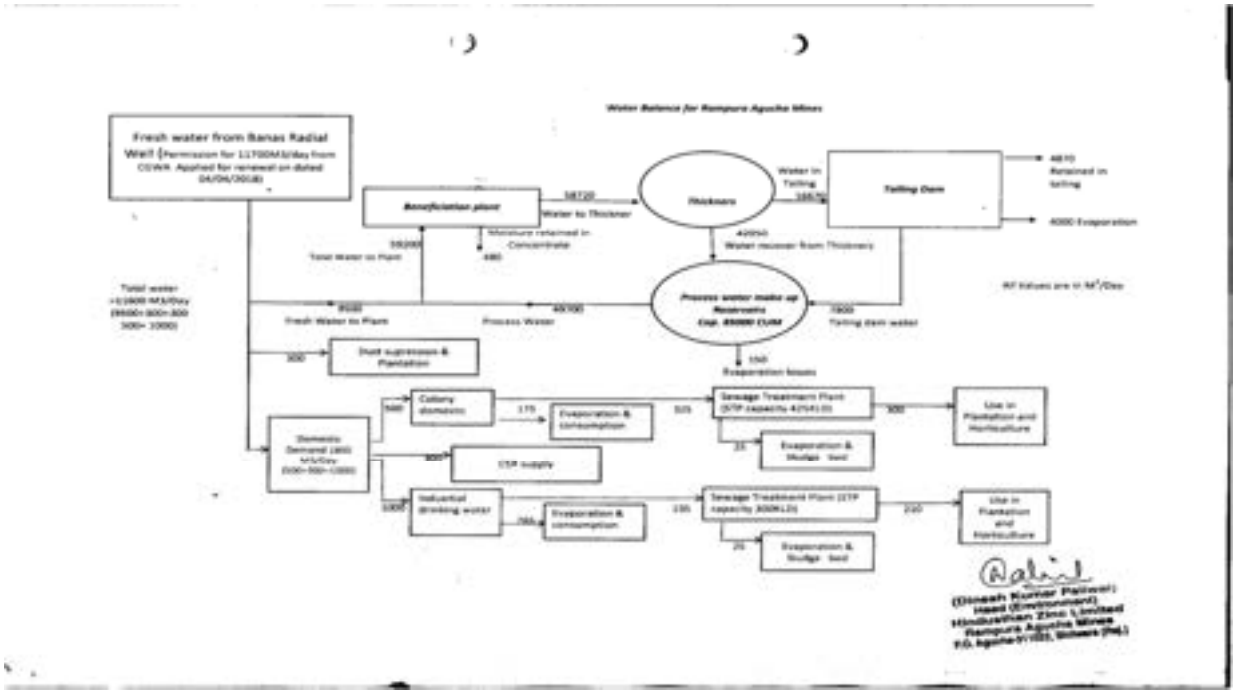
VP & Location Head
Hindustan Zinc Limited
Rampura Agucha Mine
PO Agucha, Dist. Bhilwara (Raj.)

Cc: Member Secretary,
Central Ground Waters Authority
West Block-2, Wing-1
Sector-1, R.K. Puram,
NEW DELHI-110066

O/C

Hindustan Zinc Limited
Rampura Agucha Mine, P.O. Agucha, Dist-Bhilwara – 311029
Tel.: (91-01483)225837,229018 Fax: (91-01483)229012,www.hzlindia.com
Registered Office: Yashad Bhawan, Udaipur (Rajasthan) - 313 004

CGWA renewal application



Water Balance

Annexure XXX

Geotextiles

vedanta
transforming for good

HINDUSTAN ZINC

Mine code: 270020

RA Mine/VTC/F.18/2022 / 2269-2271 Dated: 17.01.2022

To

1. The Director General of Mines Safety
Office of DGMS
Barwa Road
DHANBAD
JHARKHAND
PIN: 826001

2. The Dy Director General of Mines Safety
Office of DGMS, North Zone
Room No 201-3, Block –B, CGO Complex
HAPUR ROAD, KAMLA NEHRU NAGAR
GAZIABAD – UP
PIN: 201002

3. The Director of Mines Safety
Office of DGMS
Anasagar Link Road
AJMER,RAJASTHAN
PIN: 305001

Sub. : Submission of Annual Return in **Form "T"** for the year 2021

Sir,

Please find enclosed the Annual Return Form "T" for the year ending 31st December- 2021, in respect of Rampura Agucha Lead and Zinc Underground Mine of Hindustan Zinc Limited.

Enclosed as above

Thanking you

Sincerely yours

(Sachin M. Deshmukh)
"Mine Manager"

Mine Manager
Hindustan Zinc Limited
Rampura Agucha
Lead and Zinc Underground Mines
Post-Agucha
Distt.-Bhilwara

Hindustan Zinc Limited
Rampura Agucha Mines, P.O. Agucha, Distt. - Bhilwara (Rajasthan) - 311 022
M +91-9001294956-57, F +91-01483 229012 www.hzlindia.com

Registered Office: Yashad Bhawan, Udaipur (Rajasthan) - 313 004
CIN: L27204RJ1966PLC001208

O/C

[FORM – T]

[See Rule 29P (i)]

Annual Return for the year ending on the 31st December – 2021

1. Name of Mines	Rampura Agucha Lead and Zinc Underground Mine.
2. Postal address of Mines	M/S Hindustan Zinc Limited, Rampura Agucha Mines P.O. Agucha – 311022 Dist. Bhilwara (RAJ.)
3. Date of opening of Mine	15.01.2010
4. Date of closing (if closed)	Not applicable
5. Situation of Mine (District/State)	Bhilwara/Rajasthan
6. Name of Owner, Postal address	Sh. Arun Misra CEO & Whole time Director. Hindustan Zinc Limited Yashad Bhawan, UDAIPUR – 313004

7. Number of person medically examined:

Type of ME	Number of persons required to be Medically examined during 2021		Number of persons Medically examined during 2021	
	OWN	CONT	OWN	CONT
IME	As per requirement		0	577
PME	165	544	165	544

8. Number of persons declared Medically unfit: NIL

9. Categorization of the persons Declared unfit: NIL

Certified that the information has been given above, is correct to the best of my knowledge.

Date:17.01.2022

Signature: .....
Name : (Sachin M. Deshmukh)
Designation: **"Mine Manager"**

Hindustan Zinc Limited
Rampura Agucha
Lead and Zinc Underground Mine
Post-Agucha-311022
Distt.-Bhilwara (Raj.)

Covered conveyer belt

vedanta
transforming elements

HZL/RAM/ENV/2020-21/789 Dated : 28.08.2020

To,
The Director,
Ministry of Environment, Forest and Climate Change,
Regional Office (Central Region),
Kendriya Bhawan,
5th Floor, Sector "H", Aliganj,
Lucknow – 226024

Subject: Submission of study report in in compliance of the EC amendment No: J-11015/267/2008-IA.II(M) dated 28.02.2020 of M/s Hindustan Zinc Limited in the mine lease area of 1200 Ha located in village Agucha, Tehsil Hurda, District Bhilwara, Rajasthan.

Sir,

Additional specific condition No. 3 in the above mentioned amendment letter is read as below:

"PP shall engage suitable agency for conducting subsidence study for increasing the depth of working from 1000mbgl to 1500mbgl. The report shall be submitted to Ministry within 6 months."

In compliance of this condition, study has been conducted by Central Institute for Mining & Fuel Research (CSIR-CIMFR). Copy of the study report "Numerical Modelling Studies for Subsidence Prediction at Rampura Agucha Mine, HZL" is attached herewith for perusal please.

Thanking You,

Yours faithfully,

(Sajal Singh)
SBU Director,

Director, Agucha SBU
Hindustan Zinc Limited
Rampura Agucha Mine
PO- Agucha
Distt. - Bhilwara (Raj.)

CC: **The Member Secretary,**
IA – Division (Non-Coal Mining)
Vayu Block, 3rd Floor, Indira Paryavaran Bhawan,
Ministry of Environment, Forest & Climate Change
Jorbagh Road, New Delhi-110003.

Hindustan Zinc Limited
Rampura Agucha Mines, P.O. Agucha, Dist. Bhilwara (Rajasthan) - 311 022
M +91-9001294956-57, F +91-1483 229012 www.hzlindia.com

Registered Office : Yashad Bhawan, Udaipur (Rajasthan) 313 004
CIN No. L27204RJ1966PLC001208

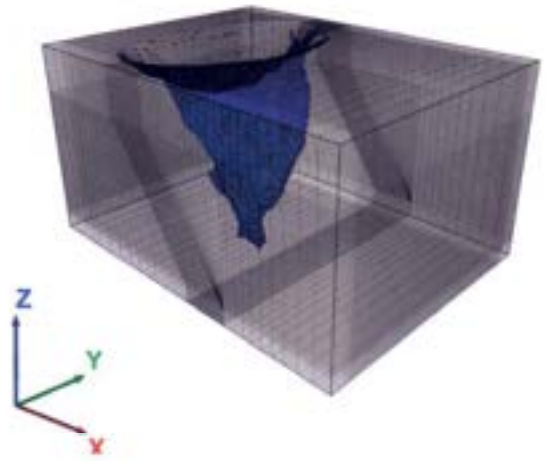
O/C Env.

CENTRAL INSTITUTE OF MINING & FUEL RESEARCH
(Council of Scientific & Industrial Research)
Barwa Road, Dhanbad – 826 001, Jharkhand
Nagpur Research Center, Unit-1
17/C, Telenkhedi Area, Civil Line, Nagpur 440001, Maharashtra

Report on

Numerical Modelling Studies for Subsidence Prediction at Rampura Agucha Mine, HZL

PO No.: 2353084587 / 5100027984 Date:07.04.2020



Proj. No. SSP/N/493/2020-2021

July – 2020

Subsidence study report cover page

Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695Fax: 0141-5159697
website: www.rpcb.nic.in
Registered

File No F(Mines)/Bhilwara(Hurda)/1(1)/2009-2010/ 4792
Order No 2009-2010/Mines/401 **Date:** 21/1/2010

M/s Hindustan Zinc Limited
(Rampura Agucha Mine), P.O.- Agucha, Bhilwara,
District :Bhilwara

Sub: Grant of Consent to Establish under section 21(4) of Air (Prevention & Control of Pollution) Act, 1981 and under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 for your **Major Mineral** Mine at near Village-**Agucha**, Tehsil-**Hurda**, District- **Bhilwara (M.L.No.-1/2000**).

Ref: (i) Your applications dated 22/11/2009
(ii) Received on 27/11/2009

Sir,

In view of the details submitted vide your above referred applications/ documents, the **Consent to Establish** under section 21(4) of Air (Prevention & Control of Pollution) Act,1981 and under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 is hereby granted for carrying mining activities. This consent is subject to the following stipulations:-

1 That this consent is being granted in favour of **M/s. Hindustan Zinc Limited,** a Mine of **Major Mineral** having **M.L.No.-1/2000** in an area measuring **1200** Hectares at/near Village-**Agucha** ,Tehsil-**Hurda**,District-**Bhilwara**.

2 That this consent is valid for a period from **18/01/2010** to **17/01/2013 , or commencement of production whichever is earlier.**

3 That this consent is valid for following mining activities :-

	Mineral	Permitted Mining Capacity
1	LEAD ZINC ORE MINING	6.150 MILLION TONNES PER ANNUM
2	BENEFICIATION PLANT FOR LEAD - ZINC ORE	6.500 MILLION TONNES PER ANNUM

4 That you shall achieve following standards in ambient air in mine area / mining activities.

Pollutant	Standards for Ambient Air	Standards for mining activity
SPM	500 µg/M³	SPM = 600 µg/M³ (To be measured between 3 to 10 meters from mining activity)
SO_2	120 µg/M³	
NO_x	120 µg/M³	
CO	5000 µg/M³	

CTE

Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695Fax: 0141-5159697
website: www.rpcb.nic.in
Registered

File No **F(Mines)/Bhilwara(Hurda)/1(1)/2009-2010/**

Order No 2009-2010/Mines/401 **Date:**

5 That the Mining unit shall maintain zero discharge status of waste water from the premises. No trade effluent shall be discharged inside/outside mine premises.

6 That the occupier/operator of mine shall ensure that all the conditions imposed in the Environmental Clearance granted by the **Ministry of Environment & Forests, Goverment of India.** , vide letter No J-11015/267/2008-IA.II (M) dated 11/12/2009 shall be strictly complied with.

7 That the occupier/operator of mine shall ensure that all the conditions imposed in the permission of Central Ground Water Authority granted vide its letter No **21-4(2)/WR/CGWA/2008-632 & 21-4(2)/WR/CGWA/05-417** dated **06/08/2008 & 13/05/2008** shall be strictly complied.

8 That you shall not operate the mine without obtaining **Consent to Operate** from the Board.

9 That this **Consent to Establish** is for mining of product as mentioned above in **M.L.No.-1/2000** and a separate **Consent to Establish** is required to be taken for Mineral Separation Plant/process if any and for any addition/ modification/ alteration or change in process.

10 That the lessee shall develop plantation in atleast 33% of the total lease area to maintain ambient air quality around the mine and the Action Plan for plantation submitted by you, shall be implemented.

11 That you will implement all the pollution control measures as per EIA/EMP Report.

12 That the top soil shall be stored at earmarked site only shall be utilized for plantation on reclaimed OB dumps.

13 The ovrburden generated during mining shall be stacked at earmarked site as per Approved Mining Plan & as per recommendations of Central Institute of Mining & Fuel Research, Dhanbad. The over burden dump shall be reclaimed by plantation of suitable native plant species.

14 Catch drains/ Siltations ponds of appropriate size shall be constructed to arrest silt and sediments flows from mine pits & overburden dumps. Garland drains of adequate size, properly designed shall be constructed arround the mine pit & dump yard. Garland drain should be provided with siltation pond.

15 Regular monitoring of subsidence, vibration shall be carried out & if any subsidences is observed appropriate measures be undertaken to avoid any loss of life and material and be reported to Board.

16 That the HZL shall carryout conditioning of mined ore with water to mitigate fugitive dust emission.

17 That Ore Beneficiation plant effluent shall be treated upto prescribed standards & tailing slurry shall be transported in close pipe line to talling dam.

18 That all other general conditions (1 to 21) enclosed as **Annexure** shall be strictly complied with.

Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695Fax: 0141-5159697
website: www.rpcb.nic.in
Registered

File No **F(Mines)/Bhilwara(Hurda)/1(1)/2009-2010/**

Order No 2009-2010/Mines/401 **Date:**

19 That this Consent is subject to the conditions as stated above and general conditions as stated in Annexure. Further, the mining unit will comply with the provisions of the Air (Prevention & Control of Pollution) Act, 1981 & Water (Prevention & Control of Pollution) Act, 1974 and any such conditions as may be specified from time to time by the State Board under the provisions of the aforesaid Acts.

This bears approval of the competent authority.

Encl: As Above

Yours Sincerely

Group Incharge-Mines

Copy To:-

1 Director, Department of Mines & Geology, Government of Rajasthan,Udaipur..
2 Mining Engineer, Department of Mines & Geology, Government of Rajasthan, Bhilwara.
3 Regional Officer, Regional Office, Rajasthan State Pollution Control Board, Bhilwara- please ensure compliance of Consent Conditions.
4 Master File, Consent to Establish, Group Mine, Rajasthan State Pollution Control Board, Jaipur.

Group Incharge-Mines

Annexure

Consent to Establish under Air & Water Acts - Mining Units

General Conditions:-

1. That this consent shall be subject to the condition that you shall operate the mining activities in the area as per the mining right allowed by the Mining Department in the Mining Lease only.

2. That this consent shall be subject to the directions/orders passed in various Mining/Environment related Writ Petitions by Hon'ble High Court and the Hon'ble Supreme Court.

3. That you shall provide the necessary infrastructure facilities including equipment for the monitoring of ambient air in accordance with the directions given to you by the Pollution Control Board's officials from time to time.

4. That Mining Unit shall undertake the phased restoration, reclamation and rehabilitation of lands as per established practices & procedures (provisions of Mine Closure Plan in case of Major Minerals) affected by prospecting or mining operations and shall complete this work before the conclusion of such operations and the abandonment of prospects or mines.

5. That overburden shall be stored in a systematic manner that it does not obstruct the natural drainage pattern of the area. It may be used for back filling. The land shall be identified for disposal of overburden at environmentally compatible site.

6. That Mining unit shall strictly comply with the Mining Plan and Eco Friendly Mining Plan as submitted to & approved by the competent authority. (Eco Friendly Mining Plan for Minor Mineral & mining plan for Major minerals & marble, Granite Mines).

7. That the water spray and sprinkling system so installed should always be maintained in order to utilize the same for dust suppression.

8. That the domestic effluent if any, shall be treated and disposed of with properly designed septic tank followed by soak pit as per prescribed standard.

9. That Air Emissions shall conform to the standards prescribed under the Environment (Protection) Act, 1986.

10. That noise level shall be kept as detailed below and under no circumstances, it shall exceed the prescribed limit:-

    a. Day time (6.0 AM to 9.0 PM) - 75 dB A (leq)
    b. Night time (9.0 PM to 6.0 AM) - 65 dB A (leq)

11. That this consent should not be treated as NOC or approval for mining in forest area, if any, falling in the lease and relevant permission under provisions of the Forest (Conservation) Act, 1980 shall be obtained from the competent authority.

4, इन्स्टीट्यूशनल एरिया, झालाना डूंगरी, जयपुर
4, Institutional Area, Jhalana Doongri, Jaipur
Phone : 2709980, 2705731, 2707285 PBX 2711263, 2711329, 2711831, 2707938
Fax : 2710647, 2709980, 2704578

12. That for Diesel Generator Set, acoustic enclosure/acoustic treatment shall be provided to meet the prescribed norms w.r.t. noise as per the Gazette Notification of Ministry of Environment & Forests dated 02.01.99. Adequate stack height with D.G. Sets shall also be provided and maintained. Noise from the Diesel Generator Sets shall be controlled by providing an acoustic enclosure or by treating the room acoustically. The acoustic enclosure/acoustic treatment of room should be designed for minimum 25 dB (A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher. The measurement for Insertion Loss may be done at different points at 0.5 metre from the acoustic enclosure/room and then averaged. The Diesel Generator Sets should also be provided with proper exhausts muffler with Insertion Loss of minimum 25 dB (A). The stack height for the Diesel Generator Sets shall be as notified under the EP Act,1986.

13. That the Industry shall comply with provisions of the Manufacture, Storage and Import of Hazardous Chemicals Rules,1989 and the Hazardous Waste (Management & Handling)Rules,1989 and related amendments, as applicable.

14. That this consent is valid, subject to fulfillment of all the other statutory requirements in other Law/Acts/Rules as applicable.

15. That the industry shall submit quarterly compliance of all the above stated conditions to this office.

16. That the unit shall submit Water Cess returns in case the water consumption is more than 10 KLD under provisions of the Water (Prevention & Control of Pollution) Cess Act, 1977 and as amended from time to time.

17. That notwithstanding anything contained in this letter of consent, the State Board hereby reserves to it, the right and power under section 21(6) of the Air (Prevention & Control of Pollution) Act, 1981 & under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 to review anyone/or all the conditions imposed here-in-above and to make such variations as deemed fit for the purpose of Air Act & Water Act.

18. That this consent, under no circumstances, be construed as conferment of any property or any interest in the lease area. It is only confined for the purpose of regulation of provisions of the Air Act & Water Act

19. That any incorrect information submitted in the consent application form shall make the industry liable for legal action under section 38 of the Air Act & under section43of the Water Act.

20. That in case of failure to comply with any of the consent conditions stated as above, the consent issued to the industry shall automatically stand revoked without any notice.

21. That this Consent will not exempt you from any legal action for the past violations, if any, of the Act/Rules/Notifications/Circulars etc.

(Group Incharge-Mines)

Head Office (Mines)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695Fax: 0141-5159697

Registered

File No F(Mines)/Bhilwara(Hurda)/12(1)/2015-2016/1229-1233

Order No 2019-2020/Mines/9959 **Date:** 25/06/2019

Unit Id : 11,060

M/s Hindustan Zinc Limited

(Rampura Agucha Mine), P.O.- Agucha, Bhilwara,

District :Bhilwara

Sub: Grant of Consent to Operate under section 21(4) of Air (Prevention & Control of Pollution) Act, 1981 and under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 for your **Major Mineral** Mine at near Village-**Agucha**, Tehsil-**Hurda**, District- **Bhilwara (M.L.No-1/2000).**

Ref: (i) Your applications dated 30/10/2017
(ii) Received on 30/10/2017

Sir,

In view of the details submitted vide your above referred applications/ documents, the **Consent to Operate** under section 21(4) of Air (Prevention & Control of Pollution) Act,1981 and under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 is hereby granted for carrying mining activities. This consent is subject to the following stipulations:-

1 That this consent is being granted in favour of **M/s. Hindustan Zinc Limited,** a Mine of **Major Mineral** having **M.L.No.- 1/2000 in an area measuring** 1200.0000 **Hectares** at/near Village-**Agucha** ,Tehsil-**Hurda**,District-**Bhilwara.**

2 That this consent is valid for a period from **01/03/2018** to **28/02/2023**

3 That this consent is valid for following mining activities :-

	Mineral	Permitted Mining Capacity
1	Lead & Zinc Ore Mining	6.1500 MILLION TONNES PER ANNUM

4 That the project proponent will comply with the Standard as prescribed vide the Ministry of Environment, Forest and Climate Change notification no. GSR 826(E) dated 16th November, 2009 with respect to National Ambient Air Quality standards.

Head Office (Mines)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695Fax: 0141-5159697

Registered

File No F(Mines)/Bhilwara(Harda)/12(1)/2015-2016/1229-1233

Order No 2019-2020/Mines/9959 **Date:** 25/06/2019

Unit Id : 11,060

5 That this consent to establish/consent to operate is only for carrying out mining of mineral/ore and not for any processing/beneficiation or crushing/grinding of ore/mineral for which a separate application for consent to establish and/or consent to operate should be submitted. The project proponent is required to obtain seprate consent to establish and consent to operate for carrying out mining of other minerals(s), if any or processing/beneficiation of such mineral(s) and for any addition/modification/alteration or change in process.

6 That this **Consent to Operate** is for mining / processing / beneficiation of product as mentioned above in **M.L.No.-1/2000** and a separate **Consent to Operate** is required to be obtained for any other Mineral mining/ processing/ beneficiation Plant/process if any and for any addition/ modification/ alteration or change in process.

7 **That the mine shall comply with all the conditions of the Environmental Clearance letter no. J-11015/267/2008-IA.II (M) dated 11/12/2009 issued by Ministry of Environment and Forest, Government of India.**

8 **That this consent to operate is valid for Lead & Zinc Ore Mining @ 6.15 million TPA. For any change in product and/or increase in capacity/lease area, the mine has to seek fresh Environmental Clearance, consent to establish & consent to operate.**

9 **That plantation shall be developed so as to cover at least 33% of the total land use for mining and allied activities as given in Approved Mining Plan and shall be maintained at all the time to maintain ambient air quality around the mine.**

10 **That mining operations shall be restricted to above ground water table and should not intersect ground water table. In case of working below the ground water table, prior approval of the Ministry of Environment, Forest& Climate Change and Central Ground Water Authority shall be obtained.**

11 **That the Mine shall comply with all the conditions of NOC granted by CGWA vide letter no. 21-4(258)WR/CGWA/2008-472 dated 28.04.2011.**

12 **That haul roads should be regularly graded and compacted. Regular water sprinkling should be carried out on haul roads to minimize dust generations.**

13 **That adequate measure shall be taken for control of fugitive emissions from the areas prone to air pollution.**

14 **That the total water consumption shall not exceed 2200 KLD without prior consent of the Board and permission from CGWA.**

15 **That the mine shall dispose its domestic waste water in scientific manner to avoid water pollution in and around the lease area.**

Head Office (Mines)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695Fax: 0141-5159697

Registered

File No **F(Mines)/Bhilwara(Hurda)/12(1)/2015-2016/1229-1233**

Order No 2019-2020/Mines/9959 **Date:** **25/06/2019**

Unit Id : 11,060

16 **That no discharge of effluent shall be made within or outside the premises.**

17 **That the mine shall install suitable flow measuring devises/meters on the intake sources of the water and daily record of ground water abstraction and water consumption shall be maintained.**

18 **That the mine shall comply with provision of Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008.**

19 **That the mine shall install adequately designed rain water harvesting structure for prevention and recharge of ground water in and around the lease area.**

20 **That the mine shall not allow making any obstacles to any natural water flow i.e. natural nallah/steam carrying rain water to any water body.**

21 **That the mine shall not allow unauthorized disposal of any solid waste on land inside or outside the premises.**

22 **That this consent to operate shall be subject to compliance of direction/order passed by Courts of Law in the matter, if any.**

23 That all other general conditions enclosed as **Annexure** shall be strictly complied with.

24 That this Consent is subject to the conditions as stated above and general conditions as stated in Annexure. Further, the mining unit will comply with the provisions of the Air (Prevention & Control of Pollution) Act, 1981 & Water (Prevention & Control of Pollution) Act, 1974 and any such conditions as may be specified from time to time by the State Board under the provisions of the aforesaid Acts.

25 That the grant of this **Consent to Operate** is issued from the environmental angle only, and does not absolve the project proponent from the other statutory obligations prescribed under any other law or any other instrument in force. The sole and complete responsibility, to comply with the conditions laid down in all other laws for the time-being in force, rests with the industry/ unit/ project proponent.

26 That the grant of this **Consent to Operate** shall not, in any way, adversely affect or jeopardize the legal proceedings, if any, instituted in the past or that [illegible] instituted against you by the State Board for violation of the provisions of the [illegible] the Rules made thereunder.

Head Office (Mines)

Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695Fax: 0141-5159697

Registered

File No **F(Mines)/Bhilwara(Harda)/12(1)/2015-2016/1229-1233**

Order No 2019-2020/Mines/9959 **Date:** **25/06/2019**

Unit Id : 11,060

This bears approval of the competent authority.

Encl: As Above

Yours Sincerely

Group Incharge-Mines

Copy To:-

1 Director, Department of Mines & Geology, Government of Rajasthan, Shastri Circle, Udaipur..
2 Regional Officer, Regional Office, Rajasthan State Pollution Control Board, Bhilwara - please ensure 100 percent compliance or standard norms and monitor time to time
3 Mining Engineer, Department of Mines & Geology, Government of Rajasthan, Bhilwara
4 Master File .

Signature valid
Digitally signed by
Date:

Group Incharge-Mines

Valid Mine CTO

Head Office (CPM)

Rajasthan State Pollution Control Board

4, Institutional Area, Jhalana Doongari, Jaipur-302 004

Phone: 0141-5159600,5159695 Fax: 0141-5159697

Registered

File No : F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500

Order No : 2019-2020/CPM/5547 **Date:** 22/10/2019

Unit Id : 11060

M/s Hindustan Zinc Limited

(Rampura Agucha Mine), P.O.- Agucha, Bhilwara, ,

District:Bhilwara

Sub: **Consent to Operate** under section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974 and under section 21(4) of Air (Prevention & Control of Pollution) Act, 1981.

Ref: Your application for Consent to Operate dated 30/10/2017 and subsequent correspondence.

Sir,

Consent to Operate under the provisions of section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974 (hereinafter to be referred as the Water Act) and under section 21 of the Air (Prevention & Control of Pollution) Act, 1981, (hereinafter to be referred as the Air Act) as amended to date and rules & the orders issued thereunder **is hereby granted** for your **Lead Zinc Ore Beneficiation plant** situated at **PO- Agucha, District- Bhilwara Agucha Tehsil:Hurda District:Bhilwara** , Rajasthan, subject to the following conditions:-

1 That this Consent to Operate is valid for a period from **01/03/2018** to **28/02/2023** .

2 That this Consent is granted for manufacturing / producing following products / by products or carrying out the following activities or operation/processes or providing following services with capacities given below.

Particular	Type	Quantity with Unit
Beneficiation for Lead Zinc Ore	Activity	6.50 MILLION TONNES PER ANNUM

3 That this consent to operate is for existing plant, process & capacity and separate consent to establish/operate is required to be taken for any addition / modification / alteration in process or change in capacity or change in fuel.

4 That the sources of air emmissions along with pollution control measures and the emission standards for the prescribed parameters shall be as under:

Sources of Air Emmissions	Pollution Control Measures	Prescribed	
		Parameter	Standard

Head Office (CPM)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695 Fax: 0141-5159697

Registered

File No : F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500
Order No : 2019-2020/CPM/5547 Date: 22/10/2019
Unit Id : 11060

Primary Crusher New(750TON/HR)	ADEQUATE STACK HEIGHT , Bag Filter , WATER SPRAYERS , WET SCRUBBER , WITH ADEQUATE STACK HEIGHT	Particulate Matter	150 mg/Nm3
Primary Crusher Old(700TON/HR)	ADEQUATE STACK HEIGHT , Bag Filter , WATER SPRAYERS , WET SCRUBBER , WITH ADEQUATE STACK HEIGHT	Particulate Matter	150 mg/Nm3
Secondary Crusher(500TON/HR)	ADEQUATE STACK HEIGHT , Bag Filter , WATER SPRAYERS , WET SCRUBBER , WITH ADEQUATE STACK HEIGHT	Particulate Matter	150 mg/Nm3
Two DG Sets(5MW EACH)	ACOUSTIC ENCLOSURE , SAFE STACK HEIGHT AS PER ER IV	CO Particulate Matter NOx NMHC	150 mg/NM3 75 mg/NM3 710 ppm 100 mg/NM3

5 That the **Lead Zinc Ore Beneficiation plant** will comply with the standards as prescribed vide MOEF notification No. GSR 826(E) dated 16th November, 2009 with respect to National Ambient Air Quality Standards.

Head Office (CPM)

Rajasthan State Pollution Control Board

4, Institutional Area, Jhalana Doongari, Jaipur-302 004

Phone: 0141-5159600,5159695 Fax: 0141-5159697

Registered

File No : F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500

Order No : 2019-2020/CPM/5547 Date: 22/10/2019

Unit Id : 11060

6 That this consent to operate is valid for operation of Lead Zinc Ore Beneficiation plant of 6.5 Million Ton Per Annum capacity. The industry has to seek fresh consent to establish for any change in product/by product/process/service/activity and modification/alteration.

7 That total capital investment as on 30.09.2017 as per the C.A. certificate submitted by you is Rs. 846.09 Crore which includes the cost of Land, Building, Plant & Machinery and miscellaneous assets.

8 That the industry shall comply with all the conditions of Environmental Clearance (E.C.) issued by the Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India, vide letters no. J-11015/267/2008-IA.II(M) dated 11.12.2009.

9 That Hazardous Waste as defined under schedule IV of Hazardous & others Waste (Management, and Transboundary Movement) Rules, 2016 shall not be used as raw material without obtaining prior registration & authorization from the State Board.

10 That total water consumption/requirement for lead Zinc Ore Benification Plant shall not exceed to 9500 KLD which will be met from Banas Radial Wells.

11 That the industry shall comply with all the conditions of CGWA permission/NOC issued by Central Ground Water Authority, Ministry of water resource Govt of India vide letter no. 21-4(2)/WR/CGWA/2005-1205 dated 08.07.2013.

12 That water flow meters shall be provided and maintained at all suitable points to measure quantity of water received form Banas redial wells and water consumption for different purposes. Record of the same shall be maintained on daily basis.

13 That waste water generated from tailing dam will be reused/recycled completely in mill/process.

14 That the industry shall take utmost precaution to cater seepage from tailing dam and ensure complete recycle of seepage water in process only.

15 That the industry shall explore & carry out some scientific and technical study with reputed experienced organization in the field for catering of seepage from tailing dam.

16 That the industry shall get renewed NOC for abstraction of ground water from CGWA and submit to the State Board.

17 That the industry shall re-circulate the decanted water from the tailing dam and shall maintain Zero Discharge Status from tailing dam.

18 That the effluent from the ore beneficiation plant shall be treated to confirm to the prescribed standards and the tailing slurry shall be transported through a closed pipeline to the tailing dam.

19 That the industry shall maintain the stability and safety of the tailing dam as assessed by CWPRS and NIRM.

Signature valid

Head Office (CPM)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695 Fax: 0141-5159697

Registered

File No : F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500
Order No : 2019-2020/CPM/5547 Date: 22/10/2019
Unit Id : 11060

20 That no waste water (domestic & trade effluent) will be discharged inside or outside the factory premises in to a stream or well or sewer or on land in any case and complete zero discharge status shall be maintained.

21 That separate energy meter & hour meter shall be provided and maintained at all the air pollution control measures and record of daily running hours of pollution control measures and daily energy consumption shall be maintained in log book.

22 That for the control of fugitive emission guidelines / code of practice as issued by CPCB will be followed.

23 That at least four ambient air quality monitoring stations shall be established and maintained for PM-10, PM- 2.5, SOx & NOx monitoring.

24 That the industry shall maintain stack of adequate height at crusher and air pollution control measures shall be operated regularly and efficiently to achieve the prescribed emission standards as per condition no.4.

25 That adequate infrastructure facility for stack emission monitoring shall be maintained at the stack of crushers.

26 That stack of adequate height as per norms and acoustic enclosure shall be maintained with two DG Sets of 5 MW KVA each.

27 That no additional source of air emission shall be installed without prior consent from the State Board.

28 That all the raw materials and products shall be stored in closed sheds.

29 That cemented roads shall be provided and maintained properly inside the premises to minimize fugitive emissions due to vehicular movement.

30 That water sprinkling and cleaning of haul roads by vacuum cleaner shall be done regularly to control the fugitive emissions generated due to vehicular movement.

31 That dust suppression system shall be maintained to minimize fugitive dust emission in Lead Zinc Ore handing area & at various transfer points and closed conveyor belts shall be used for the transfer of material to reduce the fugitive emissions.

32 That the industry shall maintain dust collection and extraction system to control fugitive dust emissions at all the transfer points & loading/unloading areas.

33 That regular monitoring of ground water particularly in respect to heavy metals shall be carried out by establishing adequate numbers of peizeometric well around tailing dam.

34 That adequate arrangements shall be made to avoid flow of pollutants along with rain water.

Head Office (CPM)
Rajasthan State Pollution Control Board
4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695 Fax: 0141-5159697

Registered

File No : F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500
Order No : 2019-2020/CPM/5547 Date: 22/10/2019
Unit Id : 11060

35 That the industry shall carryout effluent sampling/stack monitoring/ambient air quality monitoring and submit quarterly analysis report from the State Board laboratory/laboratory recognized by Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India.

36 That industry shall comply with the provisions of Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2016 & Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 (as notified under Environment (Protection) Act, 1986 and record of daily hazardous waste generation and its disposal shall be maintained.

37 That the precautions/measures shall be taken for minimization of exposure to the workers involved in handling/processing of the lead and lead bearing material.

38 That the unit shall periodically examine their workers at least once in year for lead level in blood as well as urine. Persons with higher lead levels (greater than 40 µg/dl) should be shifted immediately to non-lead activity areas and given special medical treatment till the lead levels come back to acceptable level.

39 That the industry shall install and maintain adequately designed rain water harvesting structure for recharge of ground water in and around the area.

40 That the plantation of local species in the 33% of total area of the project shall be carried out & maintained.

41 That the industry shall get policy renewed from time to time under Public Liability Insurance Act (PLIA) and submit its copy to the Board.

42 That the industry shall obtain Environmental Clearance from competent authority under EIA Notification dated 14.09.2006 before establishing any such activity which attracts Environmental clearance under EIA Notification dated 14.09.2006.

43 That the industry shall submit the quarterly compliance report of all the above conditions to the State Board.

44 That, not withstanding anything provided hereinabove, the State Board shall have power and reserves its right, as contained under section 27(2) of the Water Act and under section 21(6) of the Air Act to review anyone or all the conditions imposed here in above and to make such variation as it deemed fit for the purpose of Air Act & Water Act.

45 That the grant of this Consent to Operate is issued from the environmental angle only, and does not absolve the project proponent from the other statutory obligations prescribed under any other law or any other instrument in force. The sole and complete responsibility to comply with the conditions laid down in all other laws for the time-being in force, rests with the industry/ unit/ project proponent.

Head Office (CPM)

Rajasthan State Pollution Control Board

4, Institutional Area, Jhalana Doongari, Jaipur-302 004
Phone: 0141-5159600,5159695 Fax: 0141-5159697

Registered

File No : F(CPM)/Bhilwara(Hurda)/2(1)/2019-2020/2498-2500
Order No : 2019-2020/CPM/5547 Date: 22/10/2019
Unit Id : 11060

46 That the grant of this **Consent to Operate** shall not, in any way, adversely affect or jeopardize the legal proceeding, if any, instituted in the past or that could be instituted against you by the State Board for violation of the provisions of the Act or the Rules made thereunder.

This **Consent to Operate** shall also be subject, besides the aforesaid specific conditions, to the general conditions given in the enclosed Annexure. The project proponent will comply with the provisions of the **Water Act and Air Act** and to such other conditions as may, from time to time , be specified, by the State Board under the provisions of the aforesaid Act(s). Please note that, non compliance of any of the above stated conditions would tantamount to revocation of **Consent to Operate** and project proponent / occupier shall be liable for legal action under the relevant provisions of the said Act(s).

This bears the approval of the competent authority.

Yours Sincerely

Group Incharge[CPM]

(A): **Copy To:-**

1 Regional Officer, Regional Office, Rajasthan State Pollution Control Board, Bhilwara to inspect the unit and verify the compliance of consent conditions and submit the complete report with water analysis report of piezometric well including all parameters and all metals within 30 days.
2 Master File.

Group Incharge[CPM]

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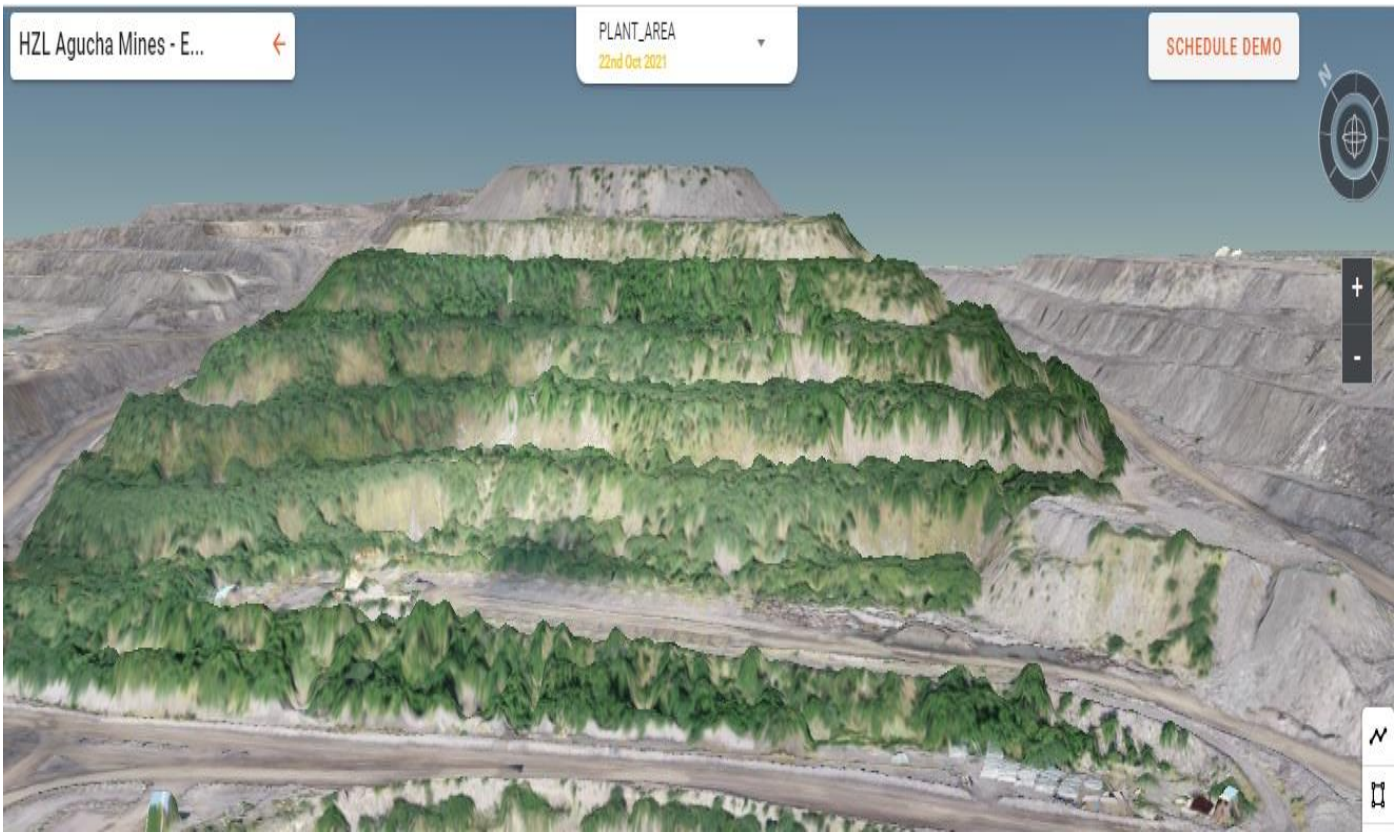
Valid Beneficiation plant CTO

Tailing close pipe line



Evaluation of Greenbelt
at Rampura Agucha Mines
of M/s Hindustan Zinc Limited

DOCUMENT DETAILS

Client Name	Hindustan Zinc Limited
Title	Drone survey on assessment of plantation index at Rampura Agucha Mines -HZL
Project Code	HZL/Agucha/Plant/ Ver. 1
Date of Submission	08/03/2022
Comments	-

SIGNATURES

Skylark Drones Pvt. Ltd.

……..

Skylark Drones Private Limited

IKP EDEN, 16, Bhuvanappa layout,

Tavarekere Main Road, Bengaluru,

Karnataka, India - 560029

Hindustan Zinc Limited

…….

Hindustan Zinc Limited

Rampura Agucha Mines,

Agucha, Dist. Bhilwara

Rajasthan - 311022

HINDUSTAN ZINC LIMITED

Hindustan Zinc is India's largest and world's second largest zinc-lead miner. With more than 50 years of operational experience, HZL gives highest priority to safety of people and conservation of scarce natural resources through technology and innovation.

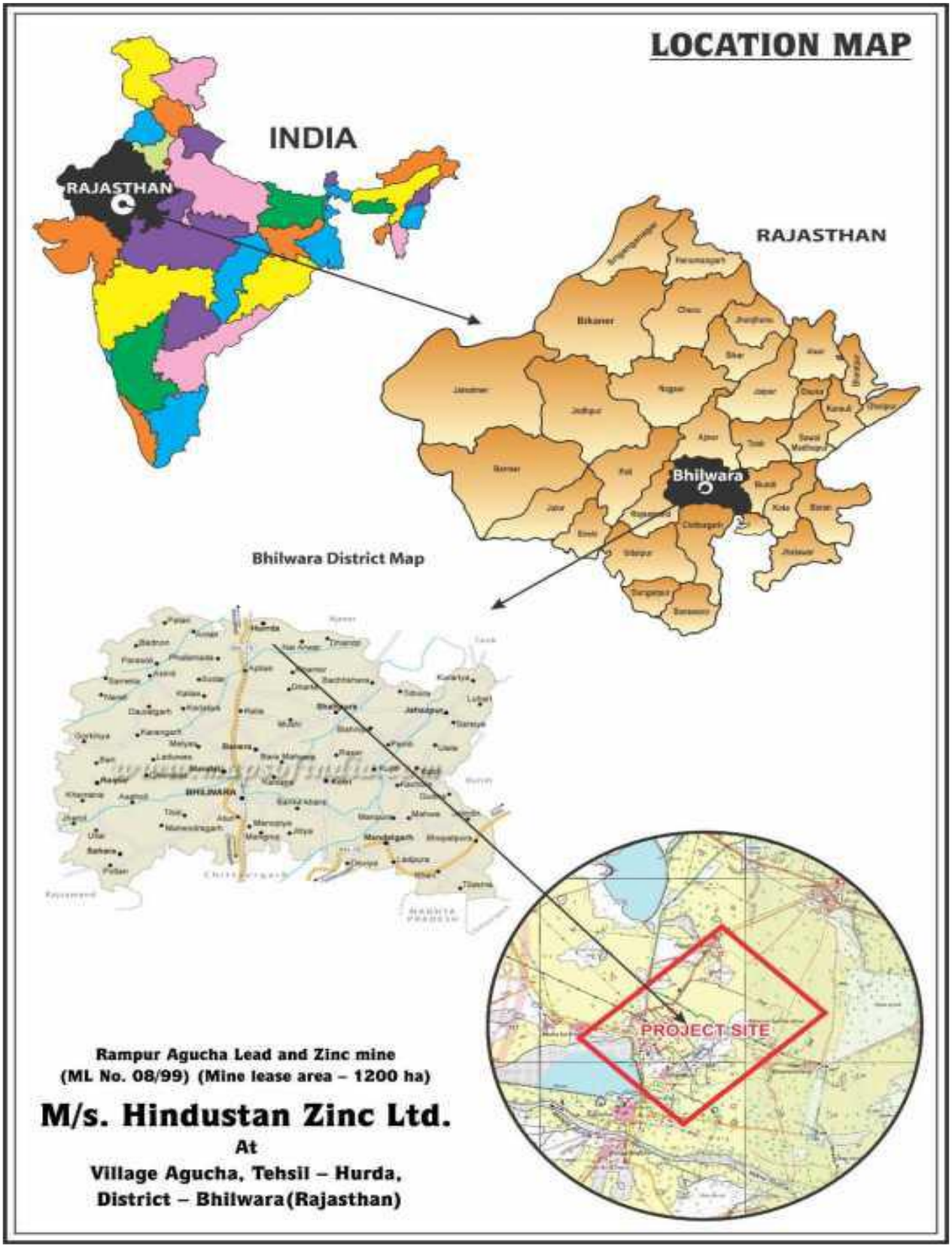
HZL is continually prioritising and emphasising the need to ensure compliance and improve social and environmental performance.

Hindustan Zinc's operations comprise lead-zinc mines, hydrometallurgical zinc smelters, lead smelters, pyro metallurgical lead-zinc smelter as well as sulphuric acid and captive power plants in northwest India with facilities at Rampura Agucha, Chanderia, Dariba, Kayad and Zawar in the state of Rajasthan, along with zinc-lead processing and refining facilities and a silver refinery at Pantnagar in the state of Uttarakhand.

Rampura Agucha is presently having mining and beneficiation capacity of 6.15 and 6.50-million-ton ore production and beneficiation. It is an ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 & SA 8000:2014 certified Mines.

Commissioned in the year of 1991 and it is located in Bhilwara district at 225 km North of Udaipur (Rajasthan). This Under Ground Mines are having a world class deposit with good mineralogy leading to higher recovery and resultant low cost of production. Location co-ordinates of the existing Mines are 25° 50' 00" N and 74°44' 15" E. The altitude of the site is about 390m above Mean Sea Level (MSL). Geographically, the study area is covered by Survey of India (SOI) Toposheets No. 45 K/9, 45 K/10, 45 K/13 and 45 K/14.

Rampura Agucha Mines are located on a flat plain approximately mid-way between Udaipur and Jaipur. The gradient is generally from west to east but locally slopes decrease in elevation to the north and south. The Mines area is located 9 km away from Gulabpura in Southeast direction and is well connected by an all-weather road. Gulabpura is located about 67 km away from Bhilwara and 72 km from Ajmer on Bhilwara-Ajmer section of NH-79. Gulabpura and Bijainagar towns are also connected with a broad-gauge rail line on western railway linking Ajmer and Khandwa via Chittorgarh. The airport at Dabok near Udaipur and at Sanganer near Jaipur are the nearest airports at distances of approximately 200 km and 225 km respectively



SKYLARK DRONES - Unlocking the Economic potential of skies!

WHO ARE WE?

Skylark Drones is a technology company that is building the core infrastructure for the global drone ecosystem. Today, our platform empowers Fortune 500 companies with drone analytics, service providers with secure execution of flights and manufacturers with regulatory airspace compliance.

OUR MISSION

Is to Unlock the Economic potential of the skies! We envision a world where people and businesses do meaningful work from an open and connected sky; work that propels human productivity forward and fundamentally alters the way our worksites and cities function

OUR ACCOMPLISHMENTS

Today, our platform empowers Fortune 500 companies with drone analytics, service providers with secure execution of flights and manufacturers with regulatory airspace compliance. We are building ground-breaking AI technologies that transform petabytes of spatial drone data into actionable business insights so our customers can keep abreast with change

By helping create institutions like DICE, we are committed to leading regulatory efforts to secure airspace and build technology that democratizes safe and compliant access to Indian skies

To establish drone technology as a universal layer of the enterprise stack, we are adopting a long-term 'builder's view'- by engaging with businesses to discover problems, quantify value and craft solutions

AGENDA OF THE PROJECT AND FOCUS

The project area commissioned in 1991 as opencast and now is underground mines. From its commissioning stage many species of tree are planted in the various locations of project area. Therefore, the aim of the tree inventory was to assess the qualitative as well as quantitative arboreal cover of the project area. In additional to this, another was to access density of trees on various location of overburden by Drone survey.

INTRODUCTION OF DRONES

Drones are emerging technology with several potential applications in monitoring and assessment of forests. FSI has introduced drones in its activities on pilot basis and methodology for application of drones in forest boundary demarcation is being standardized.

DELIVERABLES OF DRONE SURVEY

- High resolution photography and videography of plantation/greenbelt with 3D mapping.
- Estimation of area under plantation within acquired/lease area and township
- Geo referenced mapping of the area
- Density of plantation area in acquired/lease area and township
- Identify total plantation no. in lease area and township

TEAM ON GROUND

Following personnel were involved in this task from the Client side and Skylark side

Mr. Dineshkumar Paliwal	Environment Head-Agucha Mines.
Mr. Mukhtar Ah. Chat	Business Excellence-Lead Safety Innovations
Mr. Prakash Sharma	Environment team -RAM.
Mr. Gaurav Kumar	Environment team-RAM
Ms. I. V. Kousie	Operations Head – Skylark Drones
Mr.Tamilvanan	Key Accounts Manager – Skylark Drones
Ms.Nagalakshmi	Sr.GIS Analyst -Skylark Drones
Ms.Sangini	GIS Analyst – Skylark Drones

Mentor:

Mr. Manoj Soni-Head Business Excellence-HZL

ACKNOWLEDGEMENT

With immense pleasure, we are submitting this Report as an output of the study conducted to estimate the vegetation density and number of trees within the Plant area of Agucha Mines, Rajasthan.

We would especially like to thank **Mr. Vinod Kumar**, SBU Director Rampura Agucha Mines and Mr. **Manoj Soni**, Head – Business Excellence for providing us the platform to perform.

In addition to this we express our profound thanks to the HZL officers, **Mr. Pradeep Singh**, Head – HSE for providing his valuable guidance during the study.

We are also thankful to **Mr. Mukhtar Ah. Chat**, Business Excellence Cell, **Mr. Dinesh Kumar Paliwal**, Head Environment – RA Mines and **Mr. Prakash Sharma & Mr. Gaurav Kumar**, RA Mines Environment Team Members for their continuous support and coordination during the field studies and other related work execution to make this successful. It is necessary to indicate here that without their support, the effectiveness of this study is questionable.

Sr. Management team

Skylark Drones

TABLE OF CONTENTS

1. INTRODUCTION

1.1 GENERAL

This report presents information about the vegetation and tree count in the Plant area of Agucha Mines of HZL.

The scope of work, methodology adopted, and the results of this task are summarised in this document.

1.2 SCOPE OF WORK

The Plant area of Agucha Mines comprises of an area of 1013 hectares (acquired area), out of which 30 to 35% is said to be covered under vegetation. The objective is to estimate the vegetative cover with a scientific approach.

The scope of work includes the following:

- Estimation of area under plantation within the lease boundary
- Estimation of density of plantation within the lease boundary.
- Count of the number of trees within the lease boundary.
- Similar exercise done for township which is located at around 7 kms from mining location. Separate report is prepared for the study of plantation index assessment.

2. INPUTS FOR THE TASK

The inputs considered for this study are:

- Orthomosaic captured from Drone Survey – For the first two items in the scope of work
- Data collection survey on sampling areas with varied densities to get the number of trees in that area, which would help to scale up for the remaining areas – For the third item in the scope of work

3. METHODOLOGY

Methodology adopted for the task can be briefly categorised as follows:

1. Extraction of vegetation areas
2. Sampling data collection
3. Calculation and summary

3.1 EXTRACTION OF VEGETATION AREAS

Vegetation areas are extracted as polygons by using the orthomosaic. While extracting, the polygons are classified as very low dense, low to medium dense and high dense depending on the canopy of trees seen from the image. Polygons selections among different sections was uniformly distributed to avoid any mis calculation of data.

- Very low dense – Density is very sparse (5 to 15% tree cover)
- Low Dense – Density is sparse (15-40% tree cover)
- Medium Dense – Density is more than low but less than high (40-70% tree cover)
- High Dense – Density is high (more than 70% tree cover)

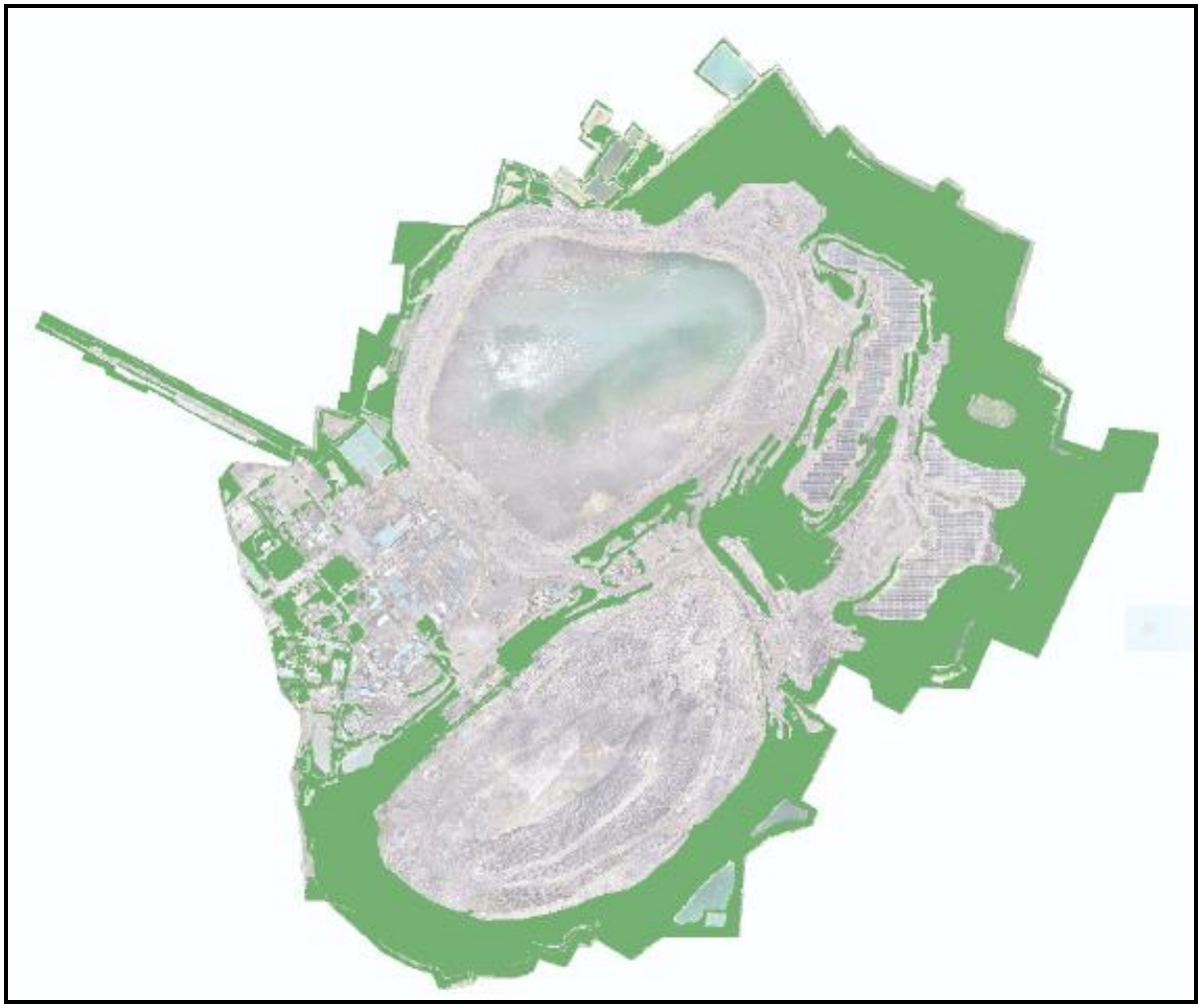


Fig-1 Screenshot showing the full vegetation cover

Fig-2 Screenshot showing vegetation with density classification

3.2 SAMPLING DATA COLLECTION

As the scope of work includes estimating the total number of trees within the acquired area, it is highly challenging to count the trees from the Orthomosaic. Hence few sampling areas were selected from the vegetation polygons which has a good sample of all types of density. About 8 to 10% of total area under each category was selected as sampling area. Physical counting of trees was carried out at the site for the sampling areas to verify the numbers accordingly and the results were tabulated.

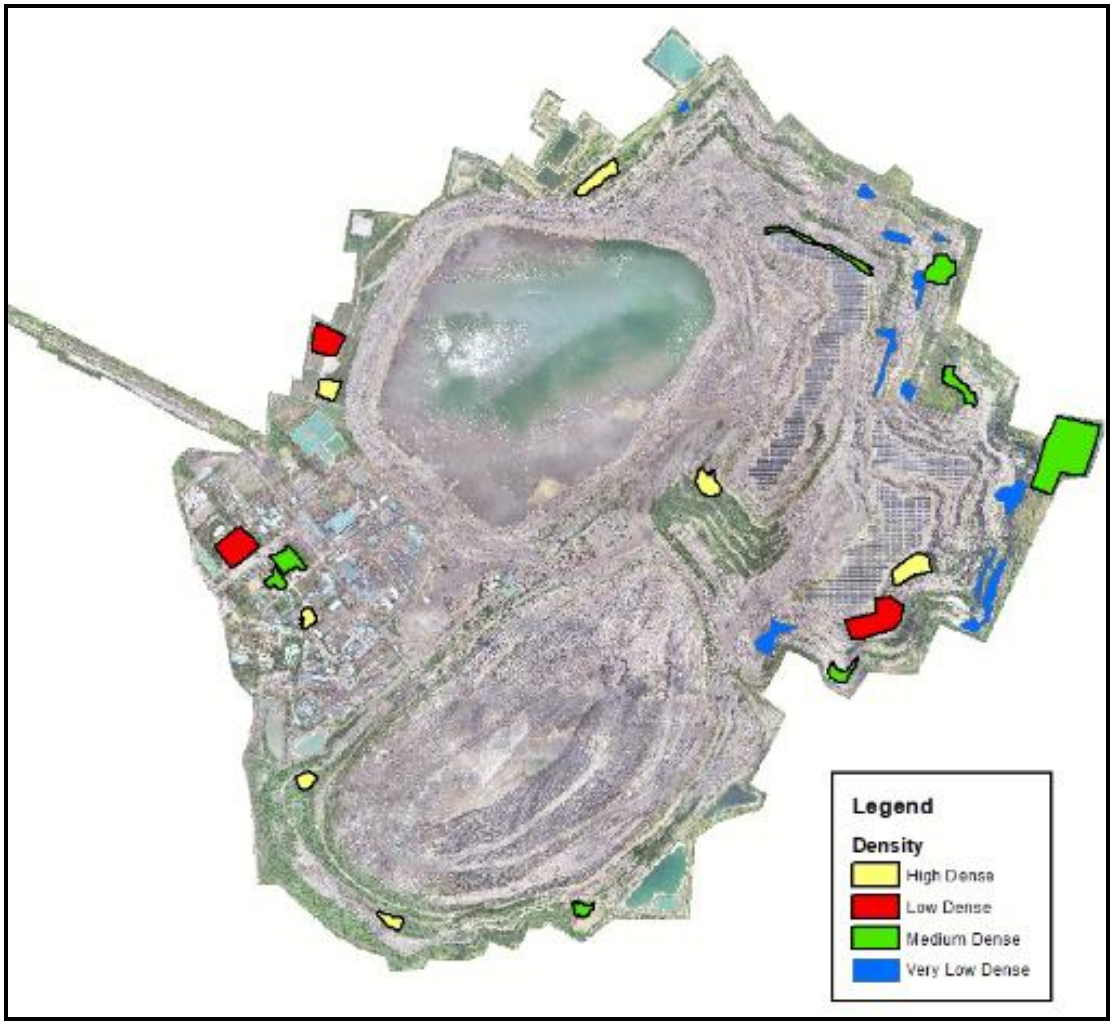


Fig-3 Screenshot showing distribution of sampling polygons for different densities

Density Type	No.of polygons	Total Area
Very Low	11	7.5
Low	3	6
Medium	9	12.5
High	6	6.6

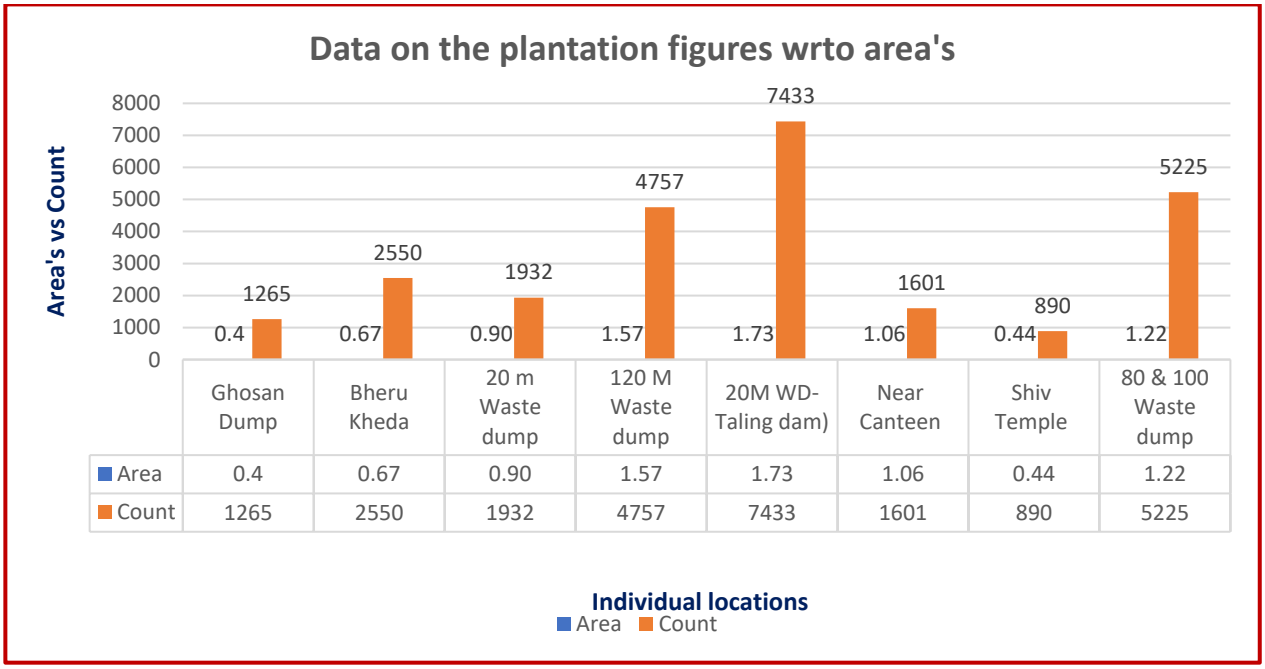


Fig-4 Plantation Index of polygons

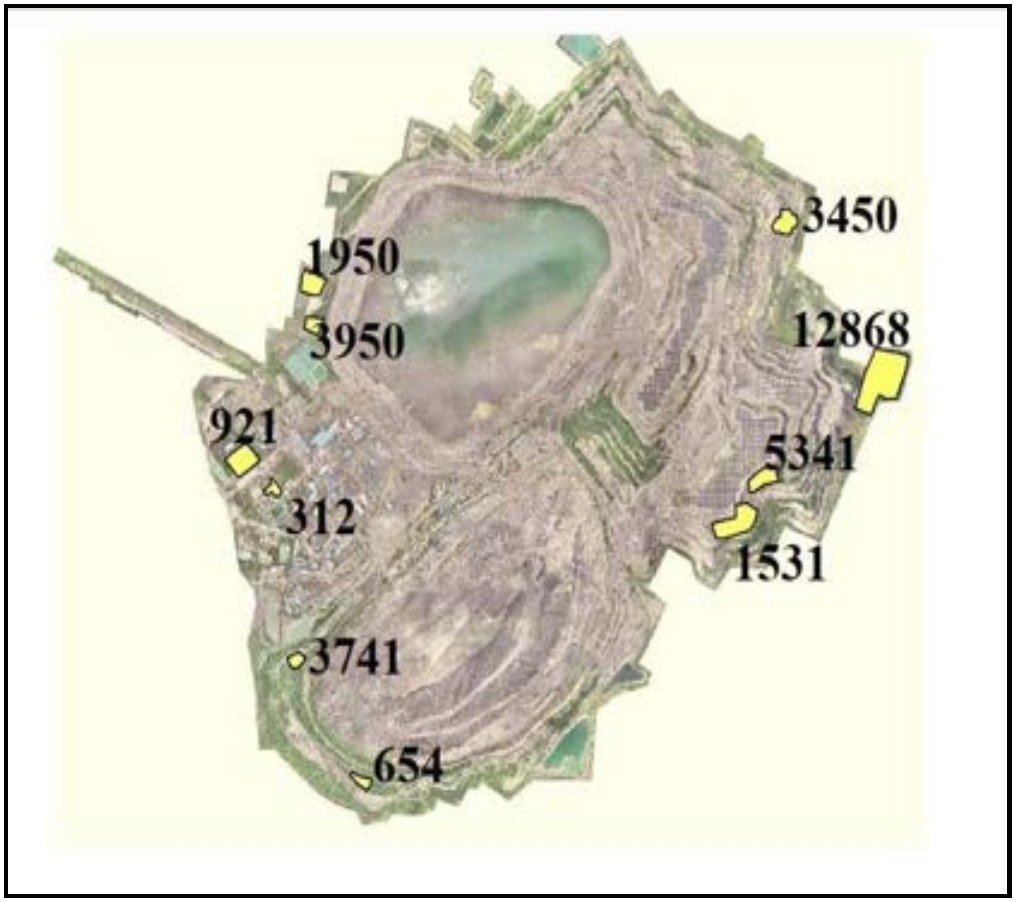


Fig-5 Orthomosaic overview on Plantation index. of sampling polygons

Pictures taken during field exercise of plantation counting for sampling purpose

Fig-6 80 Meter polygons counting

Fig-7 20 Meter polygons counting

Fig-8 Gossan dump polygons counting

3.3 CALCULATION AND SUMMARY

Based on the field exercise and from the vegetation areas delineated from The Orthomosaic, the results are tabulated as follows:

Density of Vegetation of Sampling Area							
Very Low Dense		Low Dense		Medium Dense		High Dense	
Area in ha	No. of Trees	Area in ha	No. of Trees	Area in ha	No. of Trees	Area in ha	No. of Trees
7.5	745	6	4402	12.5	28735	6.6	27234

Table -1: Details of Sampling area

Density of Vegetation of Actual Area							
Very Low Dense		Low Dense		Medium Dense		High Dense	
Area in ha	No. of Trees	Area in ha	No. of Trees	Area in ha	No. of Trees	Area in ha	No. of Trees
65	6,460	76	55,760	127	2,91,950	80	3,30,110

Table -2: Details of Total area and number of plants.

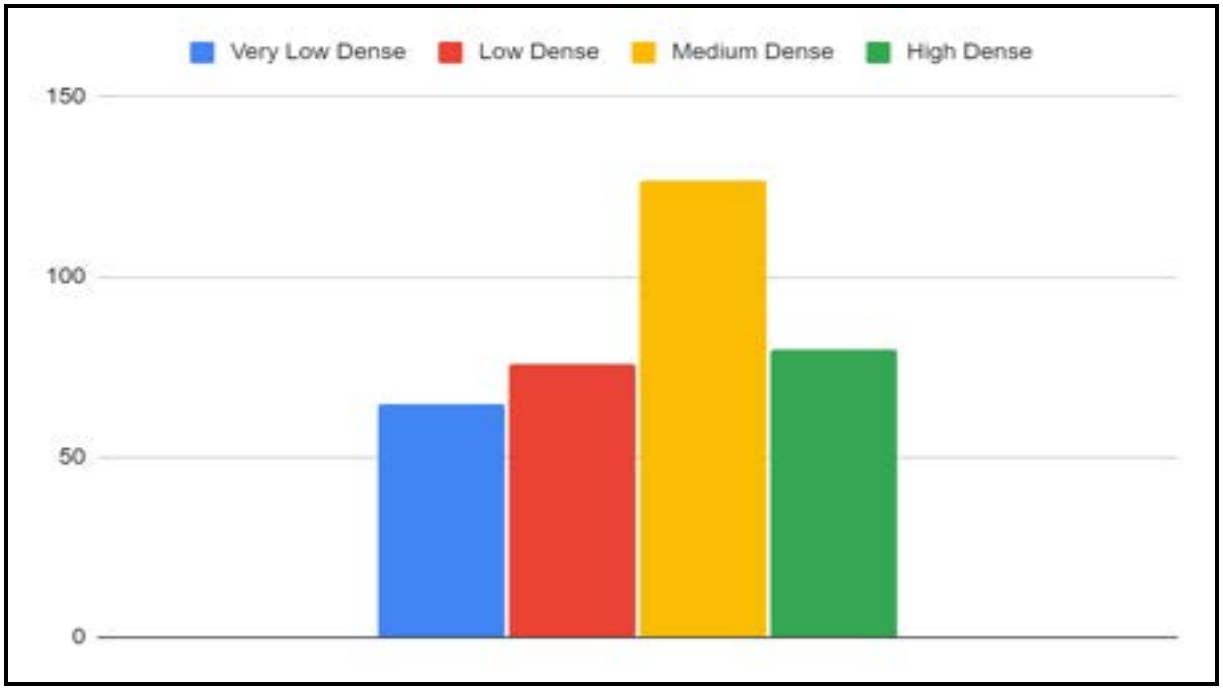


Chart-1 Density wise area

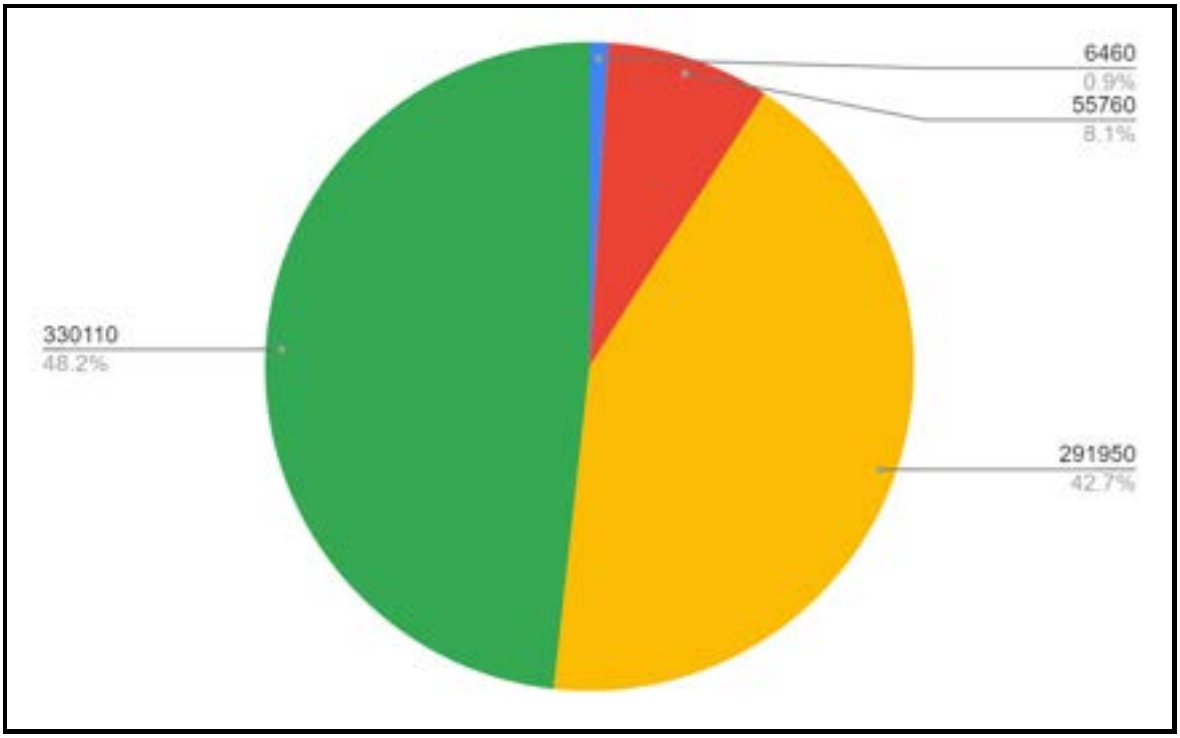


Chart-2 Density wise plantation nos.

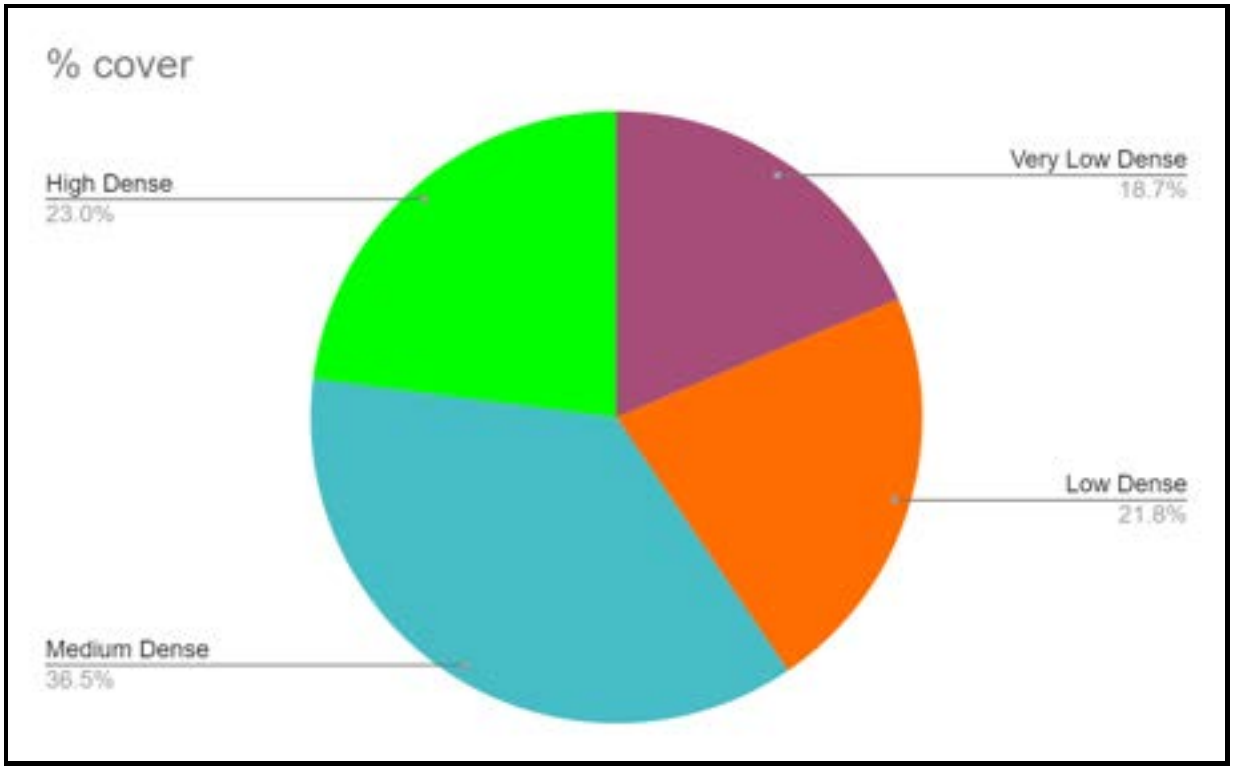
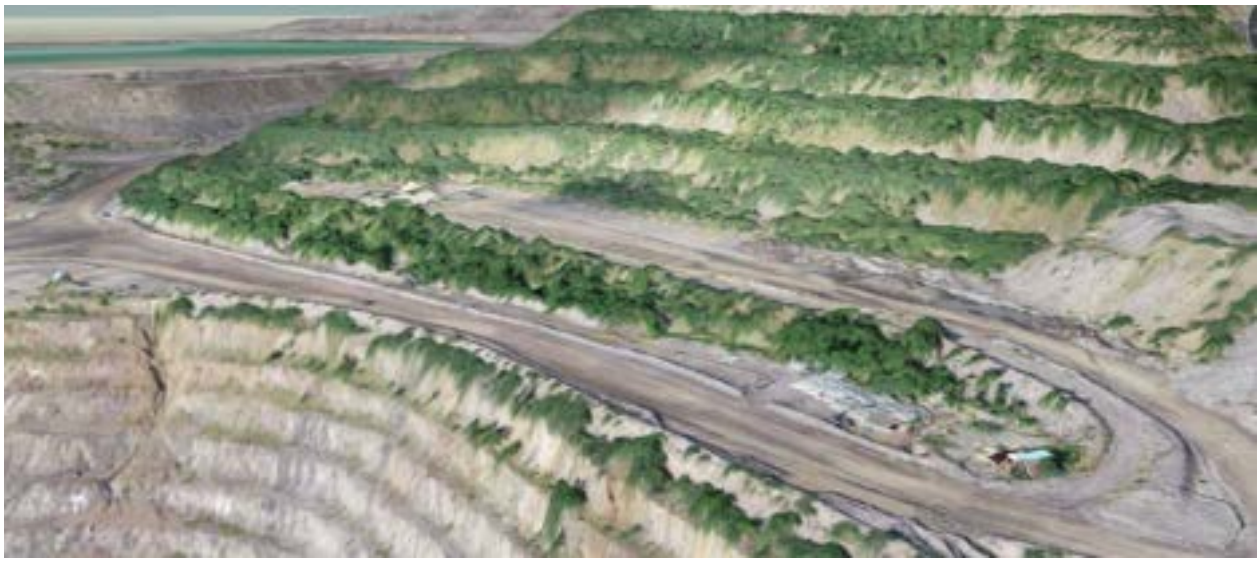


Chart-3 Percentage wise Plantation cover

Density Type	Area in hectares	Percentage cover
Very Low	65	18.7
Low	76	21.8
Medium	127	36.5
High	80	23

Details	Number	Unit
Total Area of Interest	1013	Ha.
Area Under vegetation	348	Ha.
Percentage of vegetation	34.35	%
Total number of plants	6,84,280	No.

4. 3D VIEW AND DRONE PHOTOGRAPHS



5. SYNOPSIS:

The total vegetation area at agucha Mining location is **348** hectares out of acquired area of **1013** hectares and the total lease area is **1200** hectares.

After drone exercise and investigation, the total area found under vegetation is **34.35 %** of the acquired area which is falling under the govt. norms

Through this survey total number of plantations came out to be **6.84** lakhs covering all type of vegetation.

6. CLOSURE REMARKS FROM HZL:

Thanks Skylark team for conducting the plantation index exercise through Drone. Looking forward for your Incessant support in future also whenever required.

The report is satisfactory and valuable to us.

Dinesh Kumar Paliwal

Head Environment-Agucha Mining location

-End of Report-

REPORT
ON
GROUNDWATER RECHARGE INTERVENTIONS
At Hurda, Jahazpur, Kotri, Shahpura Blocks of Bhilwara district (Rajasthan)

by

M/s Hindustan Zinc Limited

Rampura Agucha Mine Complex
Hurda, Bhilwara
[Category : Over Exploited (non-notified area), Water Quality Type : Fresh]

Implementing Agency

G D Consultants

143, 1st Floor, City Plaza, Banipark,
Jaipur-302016 (Rajasthan)
Ph: 0141-4029848, e-mail- shekharb827@gmail.com

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FOREWORD

M/s Hindustan Zinc Limited, Rampura-Agucha Mine Complex Bhilwara, Rajasthan under its Environment Policy and in pursuance of statutoryobligations, implemented a Ground Water Recharge Intervention in Hurda, Shahpura, Jahazpur and Kotri blocks of Bhilwara district, Rajasthan to achieve a recharge potential to the tune of 8.67 mcm/Annum.

Total 84 village ponds were developed in terms of deepening, bunds strengthening, treatment of catchment area. Apart from that total 358 recharge shafts were installed in developed village ponds out of which 61, 112, 80 and 105 recharge shafts have been installed in Hurda, Shahpura, Kotri and Jahazpur blocks respectively

I would like to deliver my sincere thankfulness to Dr, Arijit Dey EX.X OIC, CGWB (WR), Jaipur for their guidance of subject matter valuable inputs and time to time supervision on the project.

.We genuinely appreciate the effort made by M/s GD Consultant, Jaipur for implementation of this ground water recharge project in a scientific manner. I would also like to appreciate the entire team especially deputed for this project to monitor and quality control by HZL (RAM). The team of M/s HZL, RAM comprises Mr. Dinesh Kumar Paliwal-Environment Head, M K Arha, Mr. Srinivasa Kannan Manivannan,. We amazed by the unimaginable results of this project with respect to rising water levels and advantage of nearby villagers.

I am hopeful that, this recharge intervention will motivate all groundwaterusers to join hands to conserve and recharge Ground water as much as they can under their CSR and statutory compliances for future generations.

(Vinod Kumar)

Director, Agucha SBU

M/s Hindustan Zinc Limited, Rampura, Agucha Mine Complex Bhilwara, Rajasthan

ACKNOWLEDGEMENTS

M/s GD Consultants, Jaipur is grateful to management of Hindustan Zinc Limited for awarding the work order to Implementation of "Groundwater Recharge Interventions" in Hurda, Shahpura, Jahazpur and Kotri blocks of Bhilwara district, Rajasthan.

We would also like to express our gratitude to the crucial role of the senior officials of M/s. Hindustan Zinc Ltd., Mr. Rajendra Prasad Dashora— then Director (Agucha SBU) and then Director Mr. Sujal Shah for their valuable guidance and suggestions in completing the entire work successfully.

We are also thankful to Mr. Dinesh Kumar Paliwal- Environment Head, then civil head Mr,. S N. Gupta, Present head Mr. MK Arha, Mr. Srinivasa Kannan Manivannan (Manager Civil), Mr. Dalpat Singh Chouhan (Head CSR) Mr. Nishant N (Security at external affairs) for invaluable help and guidance during the entire project.

I would like to deliver my sincere thankfulness to Dr, Arijit Dey EX.X OIC, CGWB (WR), Jaipur for their guidance of subject matter valuable inputs and time to time supervision on the project.

A special thanks goes to my team mate, Mr. Aqueel Ahmed Khan, Mr. Vijay Pal Samota, Sitaram Lamba, Sanjay Singh Adhikari, and Lalit Bhatt who helped us to compile there port and gave valuable suggestion at various stages of project synthesis.

I have to appreciate the guidance given by Dr.Manoj Kumar, Scientist & In-Charge, GISC entre, FRI and Dr.Ajanta Goswami, Associate Professor, Department of Earth Sciences, IIT, Roorkee for their valuable inputs in data analysis and presentation of the facts.

For M/s. **GD Consultants**

1.0 Introduction

M/s. Rampura Agucha Mine (RAM), a unit of Hindustan Zinc Limited (HZL),in pursuance of guideline dated-16.11.2015 issued by Central Ground Water Authority (CGWA), adopted 84 village ponds in Hurda, Jahazpur, Kotri and Shahpura blocks of Bhilwara district, Rajasthan to achieve a recharge potential of more than 8.54 MCM/annum,through artificial recharge in terms of development of village pondsandinstallation of groundwater recharge structures.

Also, M/s. HZL in pursuit of its commitment to natural resource conservation and statutory obligationhired M/s GD Consultants,Jaipur (Rajasthan) for the assessment of subsurface water resources and to further investigate the scope of artificial recharge to meet the statutory obligation requirement ofthe CGWA. The preliminary field-based survey and investigations were done by theexpert members of GD consultants for the assessment of groundwater recharge potentials and exploring possible ways for achieving the same. A detailed report was submitted by GD consultants to HZL (RAM) for achieving the objectives to meet the statutory obligation requirement of CGWA which got approval on 23rd May 2019 for the implementation of the observations and recommendations made in the report (Annexure I).

The present report provides details of various activities implementation regarding the Compliance of the above-mentioned approval letter and subsequent instructions provided by CGWB, WR (such as instructions through a letter dated 10th August 2020).

1.1 Sourcesfor extracting groundwater

M/s.HZL(RAM) is drawing groundwater through radial wells, situated over the Banas river bed in Hurda, Jahazpur, Kotri and Shahpura blocks (Figure 1).Thedetails of pond locations and various associated attributes such as available surface water resources in the adjoining area, hydrogeological features, lineament, and geology are presented in Figure 2 to 5.

As per the NOC given to HZL (RAM), the permissible limit to withdraw groundwater is 11700cum/day.The water is being transported through pipeline from the radial well to HZL's project site of RAM mining complex. For easy and smooth transportation of

water M/s. HZL (RAM) has provided two pumping stations which are located near radial well and at Shahpura.

1.2 Brief about the project

M/s. HZL (RAM) in compliance of statutory obligation of NOC accorded by the CGWA opted to develop existing village ponds in terms of enhancement of storage capacity by desilting, treatment of catchment area and installation of recharge shafts. The entire interventions are being carried out in pursuance of the instruction provided by the CGWA, time to time. The instructions and recommendations of CGWA were received for its implementation by letters mentioned below.

(a) Approval letter dated 23/05/2019

(b)Letter dated 10/08/2020

M/s HZL (RAM) in pursuance of statutory obligation of letter dated 23/05/2019 (letter by the CGWA) was instructed to implement recharge intervention to the tune of 8.67 mcm/annum by enhancing the storage capacity of 88 village ponds and through installation of recharge shafts.Atotal number of 413 recharge shafts were recommended for installation to enhance the ground water potential. Till now, M/s HZL (RAM) has developed 84 village ponds and has completed the installation of 356 recharge shafts.

1.3 About present recharge interventions by HZL (RAM)

Following the recommendations of CGWA, HZL (RAM) was supposed to enhance recharge potential by 200% of groundwater withdrawal. The recommendation was based upon the fact that the area falls under “Over Exploited” category proposed by Ground Water Resource Estimation Committee (GEC-2015), Ministry of Water Resources, River Development & Ganga Rejuvenation, Government of India.

Total 84 number of existing village ponds were treated by HZL (RAM) to enhance their storage capacity. Ponds were excavated to remove silt deposition. Further, strengthening of bunds were done together with the installation of recharge shafts in ponds. The ponds were developed in Hurda, Jahazpur, Kotri and Shahpura blocks of

district Bhilwara. Out of total 84 ponds, 13 ponds were developed in Hurda, 29 in Jahazpur, 20 in Kotri and 22 in Shahpura block.

The ponds were selected for development with a scientific approach. The site selection criteria are discussed ahead under section 1.5. By desilting and installation of recharge shafts M/s. HZL (RAM) ensured to maximize the natural infiltration by removing the top mostaquitard layer of subsurface material. Installation of recharge shafts facilitated the surplus water to be disseminated with the groundwater.The block wise representation of ponds developed for the purpose of enhancing storage capacity and block wise distribution of installed shafts for enhancing ground water recharge is provided in Table 1.

Table 1. Distribution of ponds and shafts in different blocks developed by M/s HZL (RAM)

Name of Block	Ponds developed	Recharge shafts installed
Hurda	13	61
Jahazpur	29	105
Kotri	20	80
Shapura	22	112
Total	**84**	**358**

1.4 Location of the project area showing recharge sites with geological features

M/s. HZL (RAM) is situated in village Rampura-Aagucha, Tehsil Hurda of Bhilwara district, Rajasthan. Development of ponds for the enhancement of storage capacity and installation of recharge shafts were carried out in four blocks of Bhilwara district namely Hurda, Jahazpur, Kotri and Shahpur. The four blocks are spread between 74.400 – 75.460 E longitude and 25.149 – 25.934 N latitude (Figure. 1).

Location of ponds, surface water bodies of the region, hydrogeological features and geological features showing fault, joint, and fracture, etc. in the blocks of Hurda, Jahazpur, Kotri and Shahpur are shown in Figures 2 to 5.

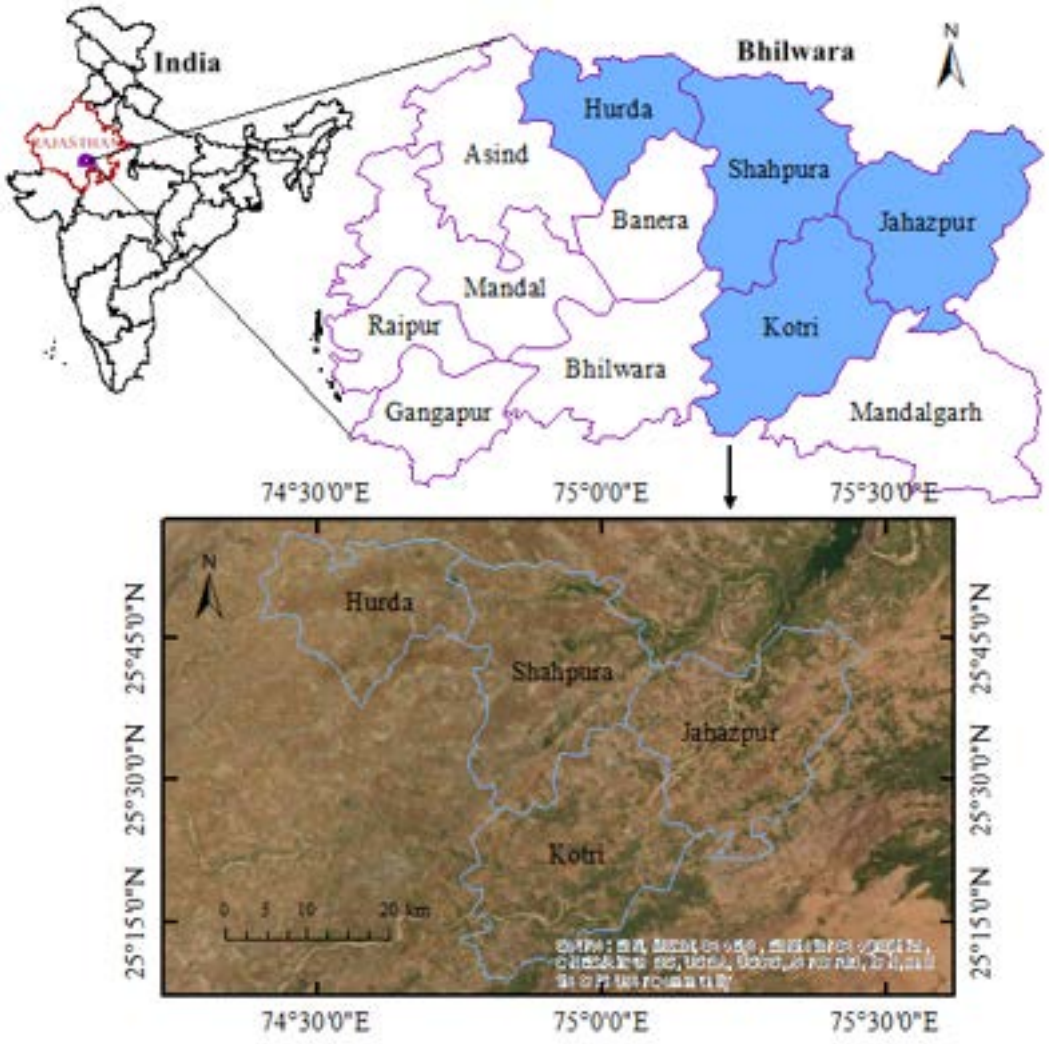

Figure 1: Location map of intervention area in the Hurda, Shahpura, Jahazpur and Kotri blocks of Bhilwara district, Rajasthan.

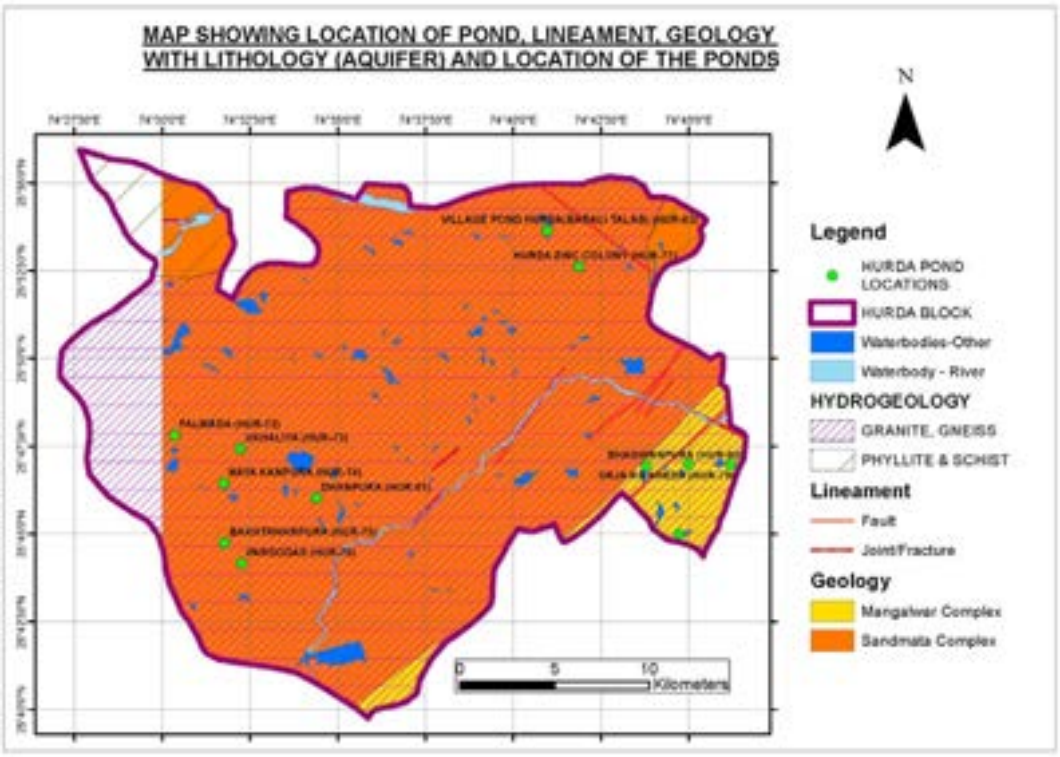

Figure 2: Location of ponds, surface water bodies, hydrogeological features and geological features of Hurda block, Bhilwara district, Rajasthan

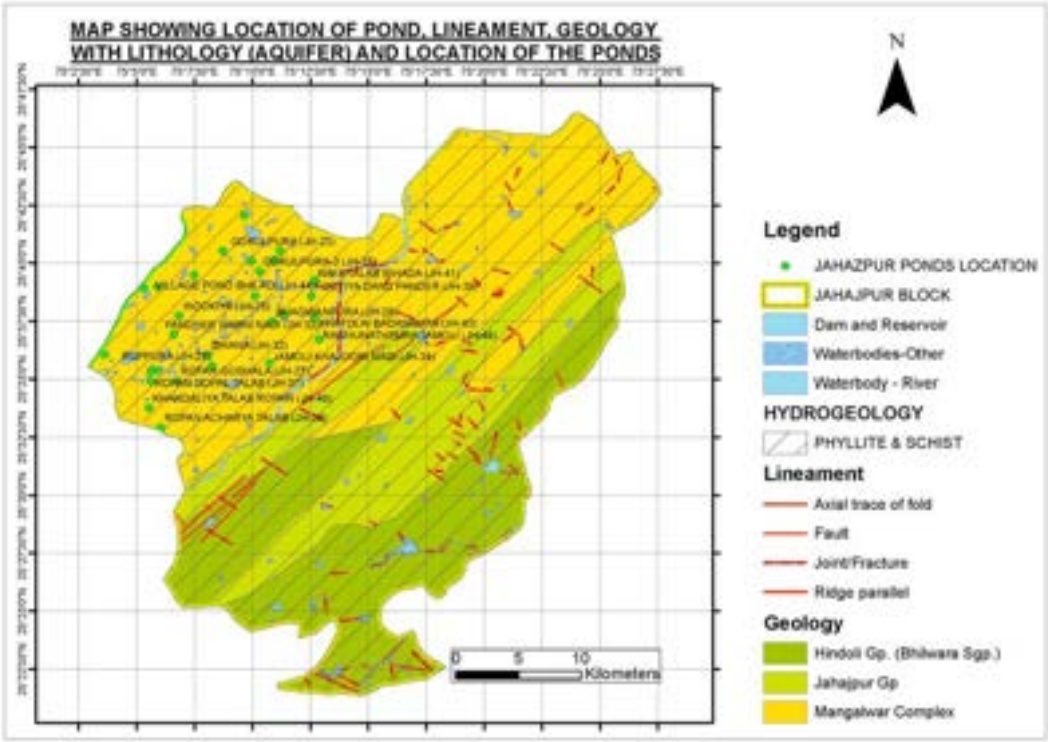

Figure 3: Location of ponds, surface water bodies, hydrogeological features and geological features of Jahazpur block, Bhilwara district, Rajasthan

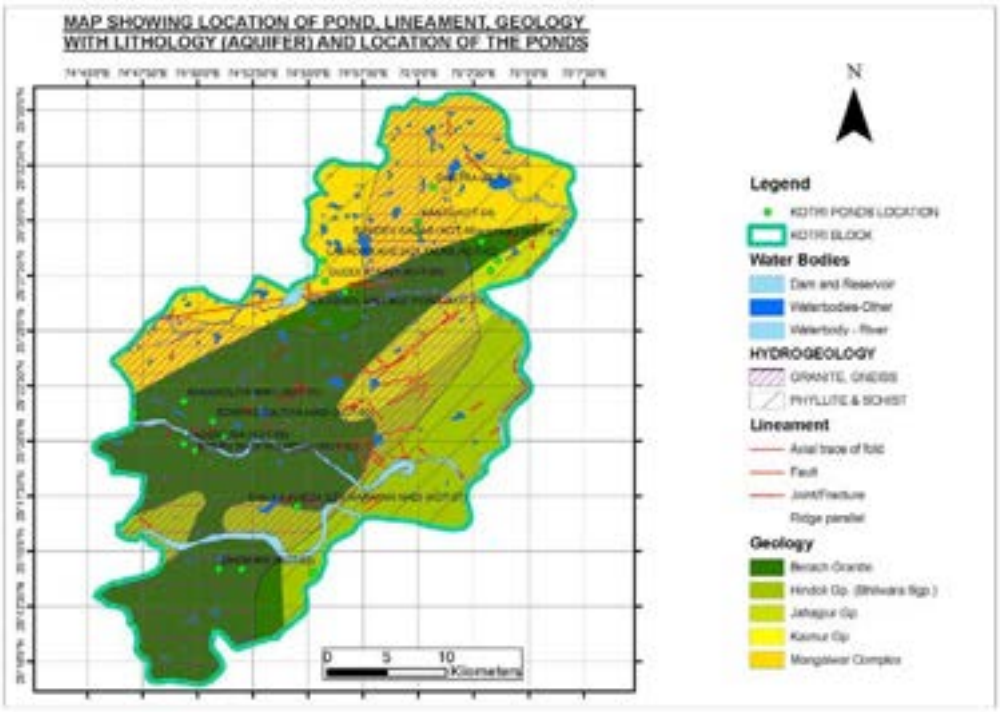

Figure 4: Location of ponds, surface water bodies, hydrogeological features and geological features of Kotri block, Bhilwara district, Rajasthan

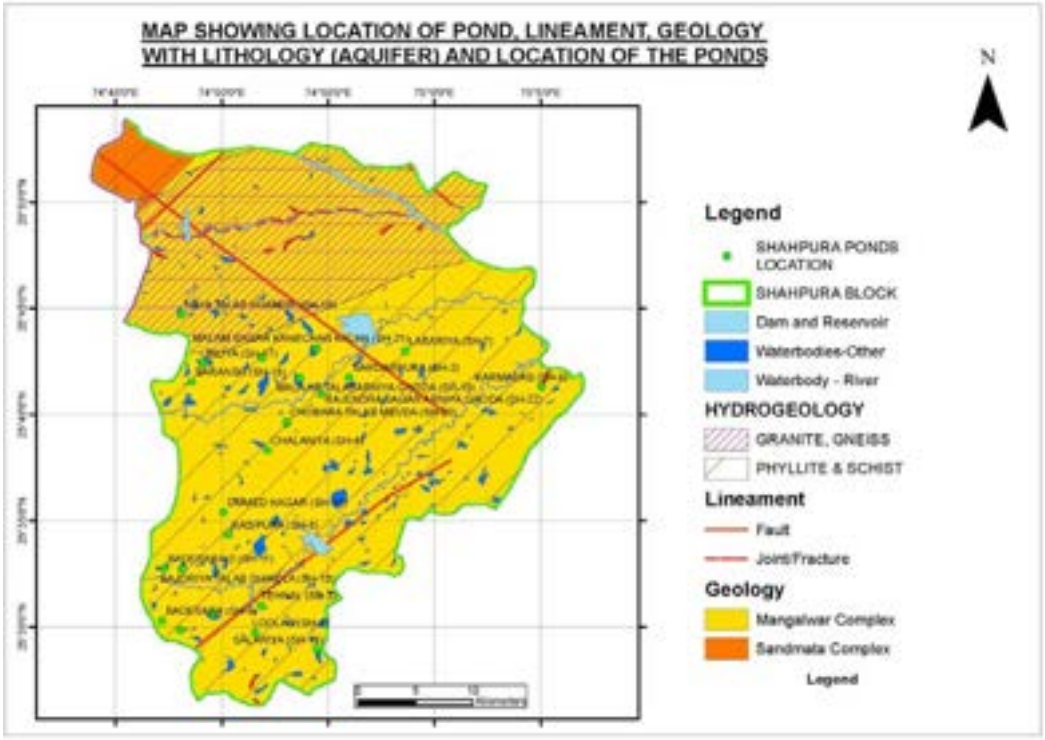

Figure 5: Location of ponds, surface water bodies, hydrogeological features and geological features of Shahpura block, Bhilwara district, Rajasthan

1.5 Site selection criteria and methodology

To ensure the time bound completion of the project to ensure enhancement of pond storage capacity and the installation of recharge shaft for the groundwater recharge intervention to the tune of 8.54 MCM/annum, a scientific approach was adopted by the M/s. HZL (RAM). The major steps taken after scientific evaluation of the approach to ensure the success of set objectives of enhancing ground water recharge primarily included followings:

a. Identification and selection of village ponds which have lost their storage capacity even having good catchment area to accumulate the runoff.
b. Identification and selection of ponds for which there is a need to treat their catchment area.
c. Identification and selection of ponds for the installation of recharge shafts around which continuous decline rate of water table was observed.
d. Evaluation of socio-economic aspects and opinion of local villagers for the selection of appropriate sites of intervention.

The different steps taken while implementing the work plan to meet the objectives of the work are shown in Figure 6.

To accelerate the pace of the project the implementing agency proposed to pre-cast the recharge structure collectively at one site followed by their installation at respective sites as per the plan. This process not only mitigates the wastage of the material but also ensures the utilization of each single working day for the installation of recharge structure just immediately after drilling of recharge shafts.

As per the recommendation of the CGWB vide letter dated 10/08/2020 excavation plan was executed by M/s. HZL (RAM). The CGWB directed to maintain the uniform excavation up to the entire submergence area to increase the storage of water. Thus, the excavation plan for each pond was prepared accordingly and the excavation work was carried out to ensure it meets the recommendation and suggestion of the CGWB.

Site photographs of the field surveys, initial site conditions, treatment interventions and sites after the treatment is shown in Plate 1 to 16 (Annexure - I).

Site selection based on the points described under section 1.5 (a-d) above
↓
Identification of maximum submergence area of ponds through satellite imagery
↓
Well inventory near to ponds
↓
Conducting geophysical survey to assess the potential zone for recharge and to ascertain the depth of recharge shafts
↓
Pre-excavation survey and creation of digital elevation model (DEM)
↓
Preparation of excavation plan with respect to maximum submergence area
↓
Desilting (excavation to remove the silt from the pond) as per excavation plan
↓
Demarcation of suitable location (after evaluating geophysical aspects)
↓
Post excavation survey and creation of digital elevation model (DEM)
↓
Drilling and lowering of slotted UPVC pipes
↓
Conducting rechargetestsfor each recharge shafts
↓
Installation of rechargepit
↓
Pouring of filter media as per the scientifically evaluated plan
↓
Fixing of display board showing the project details

Figure 6: Overall steps undertaken at project sites to achieve the objectives of work

1.6 Recharge potential estimation

Various methods have been developed and proposed by CGWB to assess the recharge potential. The publications and methodologies proposed in (i) report of groundwater estimation committee, (ii) manual on groundwater recharge structures, 2007, and (iii) master plan on artificial recharge, 2013 was referred to estimate the recharge potential.

1.7 Recharge structure

A circular recharge structure of 1.25 m inner dia was casted at one location which were carried later on to each of the selected sites for its installation. The recharge structure is facilitated with filter media. Total height of the structure is 1.95m. The recharge structure is covered with 0.1m thick RCC cover which was constructed in two equal parts. Inlet holes were provided for the water to be enter in the filter pit. A three-layer filter media is provided having a thickness of 0.4m for boulders of 40 mm, 0.3m for 10mm aggregate and 0.5m for coarse sand underlain by Geotextile of 900 GSM. The geotextile is provided so as to prevent the intrusion of sand and aggregate. This also acts as a filter media to prevent the entrance of finer particles of sediments in the recharge shafts. Plan and section of recharge structure is shown in Figure 7 and 8, respectively. Reconnaissance surveys were done by team of experts from M/s HZL (RAM) and GD consultants for the selection of suitable sites for the installation of recharge shaft. The geophysical surveys were also done to ascertain availability of substantial zone of recharge.

Further, to meet out the statutory obligation and to implement the project in accordance with the guidelines of CGWB, well inventory was also prepared to assess the present water level around the pond especially in downstream side.Sites were excluded where the groundwater table is above 6m BGL following the direction of CGWB vide letter dated 10.08.2020.The recharge shaft (s) of 250mm dia with UPVC pipe of 160mm diawere installed that have gravel packing of 20mm. The slotted pipes were provided for efficient recharge.

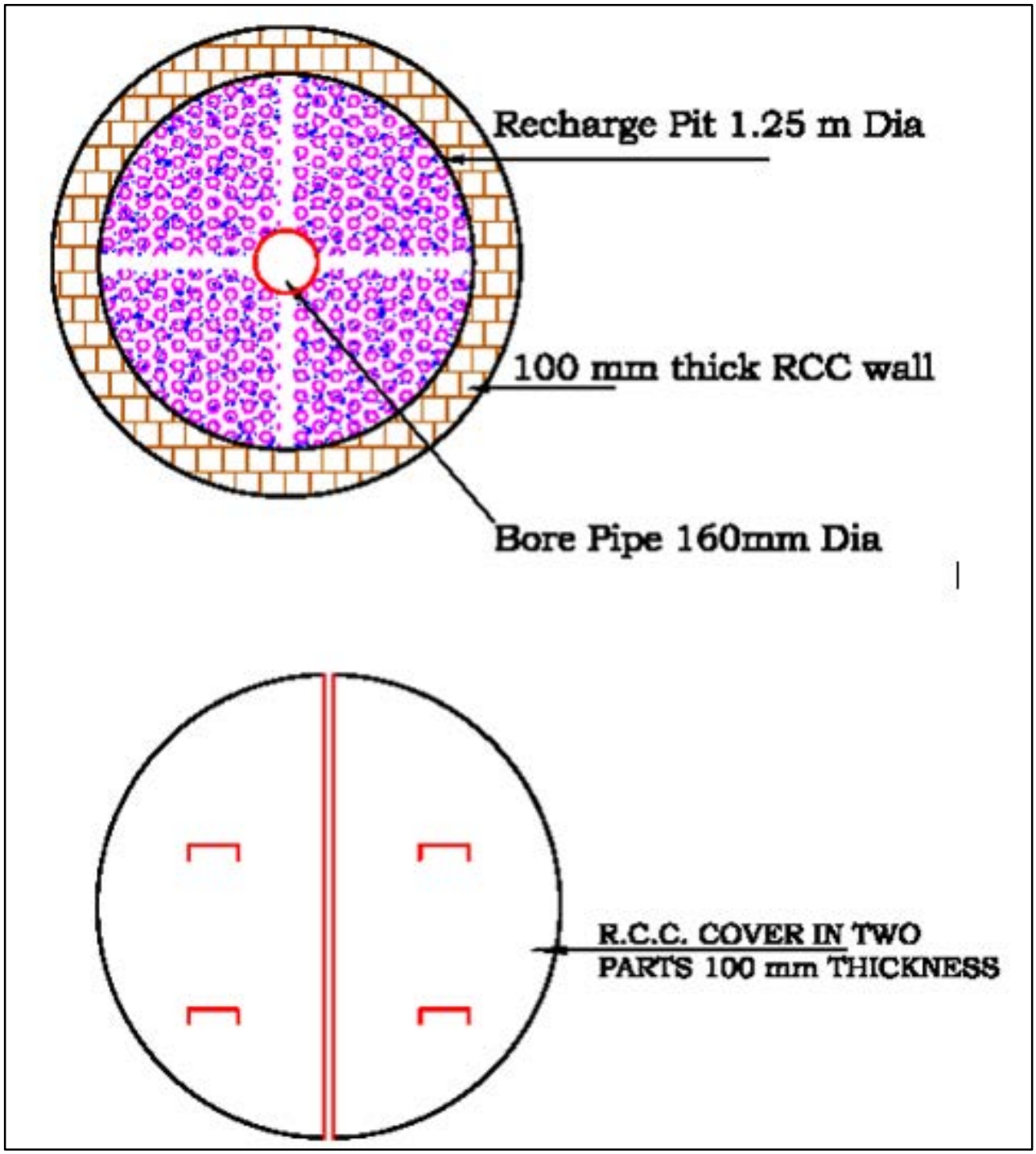

Figure 7: Plan view of recharge shaft

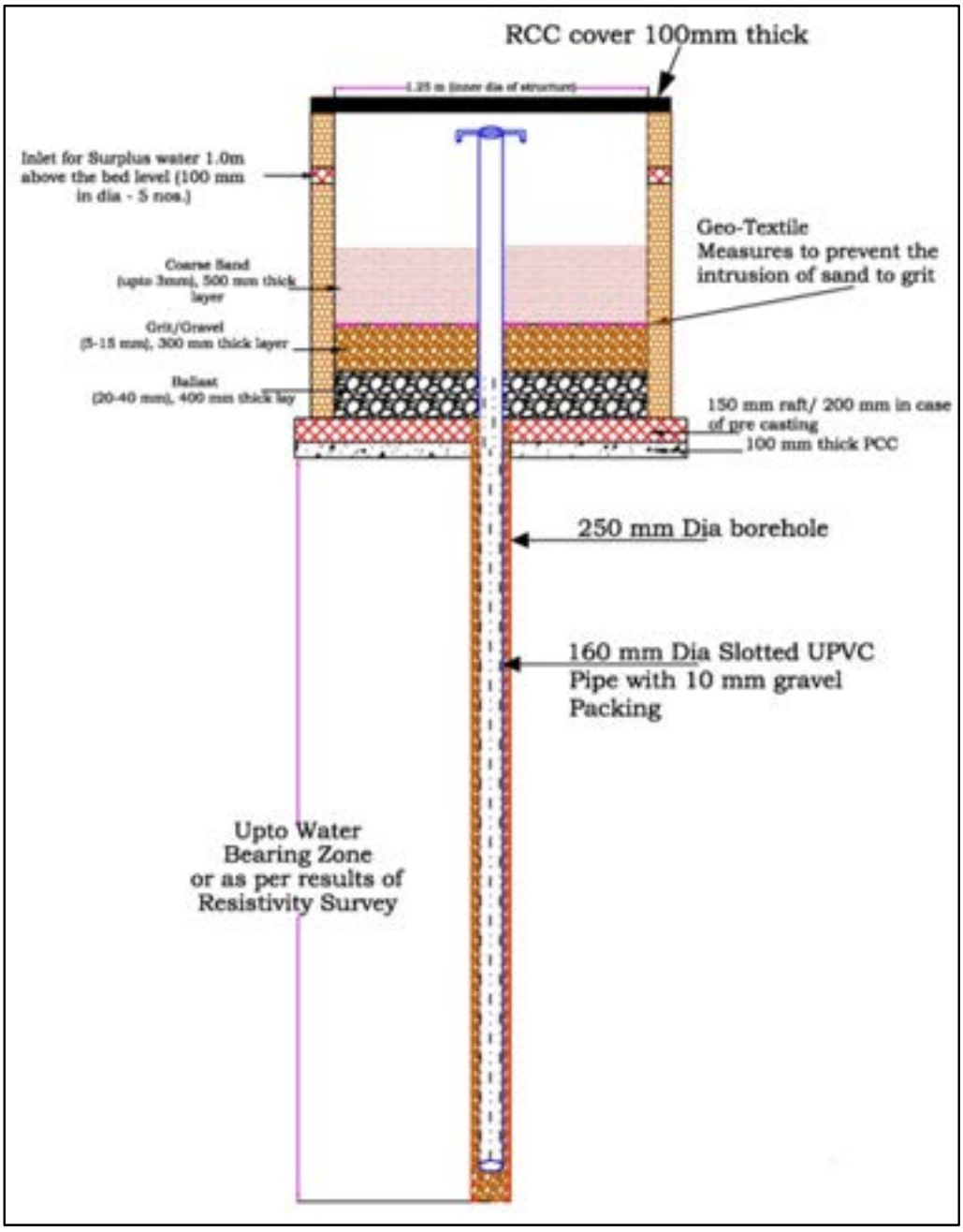

Figure 8: Section view of recharge shaft

1.8 CONSTRUCTION OF WASTE WEIRS AT VILLAGE PONDS

In order to Repair/Construction /Uplifting the existing village waste weirs During the initial survey of the village ponds it was observed that in some village ponds the waste weirs provided earlier for overflow the access water from the pond after full storage of the pond were damaged either fully or partially or some waste weirs were very low elevation .due to this the water passed through the overflows and the ponds were not getting their full storage quantum.

To overcome this situation a proper site elevation survey of pond submergence area and surrounding areas have been done and a suitable overflow elevation have been calculated and fixed for the waste weirs of such ponds.

For the construction of waste weirs the standard waste weir drawings have been followed and the reinforced concrete structure has been constructed for the same from the base elevation up to the top of waste weirs along with the wing walls and apron.

Construction of waste weirs at a proper height on the village ponds were very beneficiary to achieve the full water storage quantum in the pond up to the submergence area and the water which flows as waste was used to the pond.

Through Construction of waste weirs on the village ponds we have saved a plenty of water and it has been used for recharge .in addition to recharge the water spread up to the submergence area because of waste weirs of pond, the ponds water is last for more time and the soil moisture is being there for a long time in the year thus is increasing the crop production in surrounding areas.

The list of the village ponds where the construction of new waste weirs or repairing/uplifting have done is enlisted below-

Table 2: DETAILS OF WASTE WEIRS CONSTRUCTED/ UPLIFTED

S.NO	POND /VILLAGE	G.P	BLOCK	HEIGHT	REMARKS
1	KARAMDAS	IITMARIYA	SHAHPURA	1.000 M.	**NEW**
2	SARDARPURA	ARNIYA GHODA	SHAHPURA	0.600 M	UPLIFTED
3	URJA KA KHEDA	BARATHIYA	HURDA	0.900 M.	**NEW**
4	KALI TALAI	FALAMADA	HURDA	0.300 M.	UPLIFTED

5	PARDODAS	GARHWALON KA KHEDA	HURDA	0.300 M.	REPAIRED
6	BHILDAI	TITHODI	JAHAZPUR	0.300 M.	UPLIFTED
7	BHAGWANPURA	PANDHER	JAHAZPUR	0.300 M.	UPLIFTED
8	RAMDEV SAGAR	CHAPDEL	KOTRI	0.300 M.	UPLIFTED
9	DEVNARAYAN NADI	BAN KA KHEDA	KOTRI	0.500 M.	UPLIFTED & REPAIRED

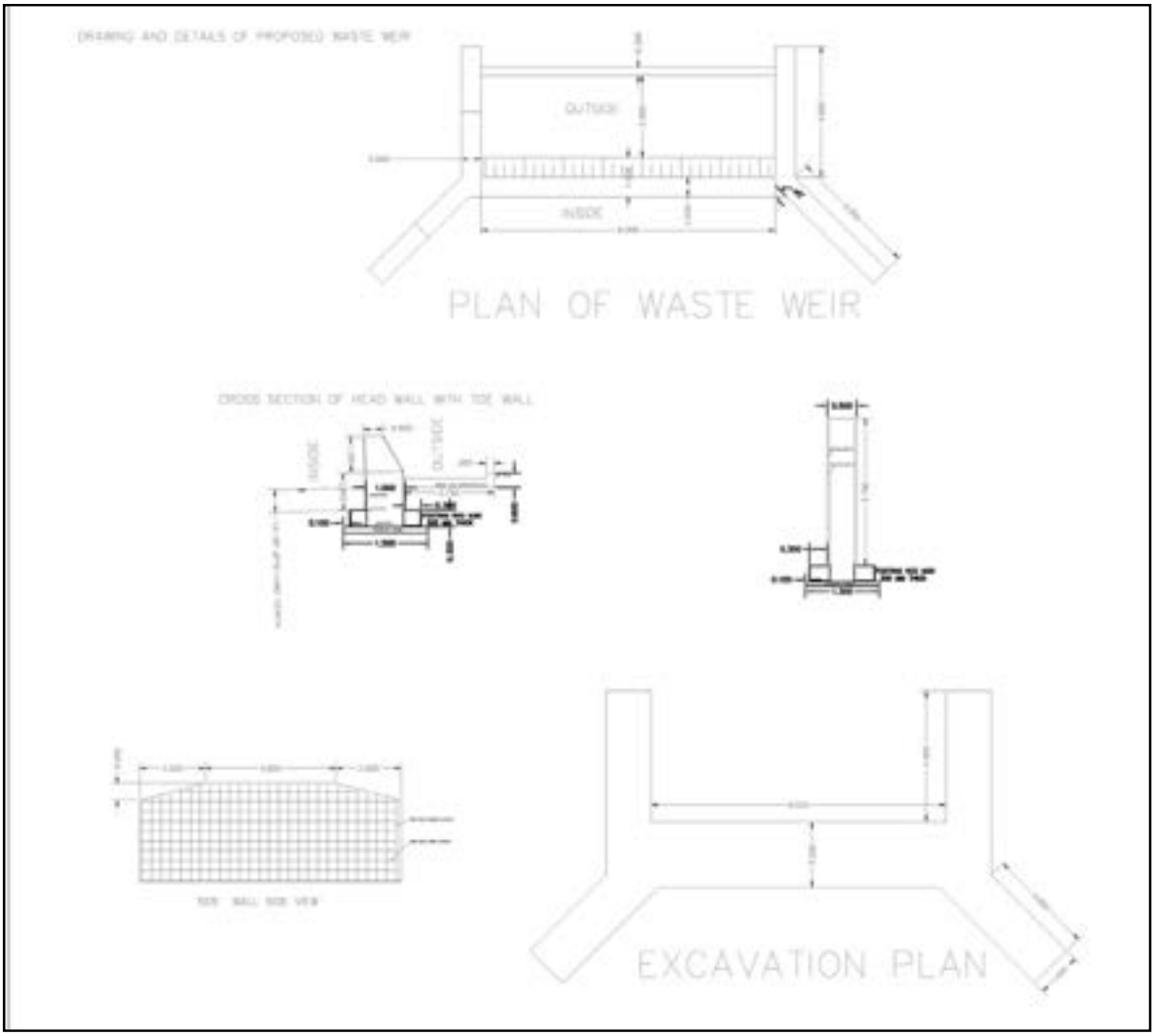

Figure 9: Drawing and Details of Waste Weir

1.9 Block wise distribution of ponds

Block wise location of ponds and their status as on date in Hurda, Jahazpur, Kotri and Shahpura blocks is given in Table 2 -5. Further, as a sum apart from the development of existing village Ponds and extra activities carried out by M/s. HZL (RAM) in order to create additional groundwater recharge potential is also discussed in the further paras.

Table 3: Locations of ponds developed in Hurda block

SN.	Latitude	Longitude	Name of village/site	Status
1.	25.79690300	74.50573800	Falmada	completed
2.	25.79056300	74.53686600	Ukhaliya	completed
3.	25.77413000	74.52908200	NayaKanpura	completed
4.	25.74586300	74.52941400	Bakhtawarpura	completed
5.	25.73597000	74.53758700	Pardodas	completed
6.	25.87694000	74.69766600	Hurdanearzinc colony-1	completed
7.	25.87094000	74.69166600	Hurdanearzinc colony-2	completed
8.	25.74999900	74.74513300	Barathiya	completed
9.	25.78307500	74.74961800	Urjakakheda	completed
10.	25.78233700	74.72946100	Bhagwanpura	completed
11.	25.76712000	74.57290800	Dhanpura	completed
12.	25.78293400	74.76966500	Balaji Talab amratiya	completed
13.	25.89407500	74.68258000	Baralitalab	completed

Table4: Locations of ponds developed in Jahazpurblock

SN.	Latitude	Longitude	Name of village/site	Status
1.	25.67534700	75.18644700	Gokulpura	completed
2.	25.64302700	75.16858300	Pandher near sawar road	completed
3.	25.62868500	75.11375800	Indokiya	completed
4.	25.62456800	75.18066000	Bhagwanpura	completed
5.	25.58178900	75.11212100	Ropan Goshala	completed
6.	25.59264600	75.13723700	Ruppura	completed
7.	25.64883800	75.08819100	Taswariya pond	completed
8.	25.64965500	75.09823200	Taswariya dev chapar	completed
9.	25.58905000	75.09782600	RopanJabarNadi	completed
10.	25.60062100	75.13392400	Sihana	completed
11.	25.62929200	75.18917600	Pandherbamninadi	completed
12.	25.59464000	75.17887300	JamoliKhajoorinadi	completed
13.	25.66072600	75.17155400	Gokulpura-2	completed
14.	25.69010300	75.11652500	Tithodamafi	completed
15.	25.58174400	75.09333000	Ropangopaltalab	completed
16.	25.54869300	75.10052500	Ropan Acharya talab	completed
17.	25.64292000	75.20895000	Footiyadand pander	completed
18.	25.67557300	75.14529900	Aagraiyatalabtithodi	completed
19.	25.65399000	75.21091100	Naya Talab bihada	completed
20.	25.66830800	75.16561500	TumdiyaGokulpura	completed
21.	25.62756700	75.21172400	Khatolaibadanpura	completed
22.	25.65805500	75.12457700	Bhiladi	completed
23.	25.66908400	75.18232700	Pipalitalaigokulpura	completed
24.	25.61191800	75.21425300	Raghunathpurajamoli	completed
25.	25.61563600	75.10993000	GaderiyaIndokia	completed

SN.	Latitude	Longitude	Name of village/site	Status
26.	25.58904400	75.09344600	Kala Talab ropan	completed
27.	25.56279200	75.09189500	Khandaliyaropan	completed
28.	25.70070200	75.16064000	Dhola Talab gandher	completed
29.	25.60087200	75.06000500	Luniya Talab narana	completed

Table 5: Locations of ponds developed in Kotriblock

SN.	Latitude	Longitude	Name of village/site	Status
1.	25.32589700	74.83093000	Bheru nadi holireda	completed
2.	25.23623700	74.86634200	Urdinadi ban kakheda	completed
3.	25.23382400	74.92025000	Badliyas Samiti talab	completed
4.	25.23615200	74.84912900	Dhowani	completed
5.	25.33079000	74.82250300	Aadsipura	completed
6.	25.28370300	74.90810300	Banka Kheda dev Narayan nadi	completed
7.	25.33684700	74.85313500	Holireda doitalab	completed
8.	25.35400800	74.78505200	SalariyaRekhalinadi	completed
9.	25.34762000	74.84482100	Somyasgaltiyanadi	completed
10.	25.36315600	74.82259600	Kankroliyamafi	completed
11.	25.46911500	74.92827500	Lasadiya Khejadi talab	completed
12.	25.46203200	75.05430700	Beerdhol Rukhadi nadi	completed
13.	25.49844300	74.99946100	Kanti	completed
14.	25.46962500	75.05980500	Daharkinadi sarakheda	completed
15.	25.49889300	74.99987700	Ramdev sagar	completed
16.	25.48388200	75.04783200	Kothaj	completed
17.	25.45397500	74.92937900	Guddikinadi	completed
18.	25.52489800	75.01105800	Dantra	completed
19.	25.44586300	74.94454600	Beerdhol village pond	completed
20.	25.49004400	75.00007400	Chawand sagar chapdel	completed

Table6: Locations of ponds developed in Shahpura block

SN.	Latitude	Longitude	Name of village/site	Status
1.	25.495559	74.85921100	Loolas	completed
2.	25.695831	74.93299200	Sardarpura	completed
3.	25.516877	74.86364700	Tehnal	completed
4.	25.638508	74.86913400	Chalaniya	completed
5.	25.497821	74.80065900	Pratappura	completed
6.	25.688526	75.08391100	Karmadas	completed
7.	25.716659	74.97695400	Lasariya	completed
8.	25.572232	74.83810500	Kasipura	completed
9.	25.504950	74.78652400	Badesara	completed
10.	25.590082	74.83438800	Ummednagar	completed
11.	25.545950	74.78806500	Badesara-2	completed
12.	25.711180	74.86453200	Taswariya	completed
13.	25.545806	74.80199600	Bajoriya Talab dhikola	completed
14.	25.510499	74.82628800	Karolai talab nogava	completed
15.	25.482535	74.90744800	Salariya	completed
16.	25.745303	74.80167700	Naya Talab khamor	completed
17.	25.706841	74.81829200	Biliya	completed
18.	25.692438	74.80959000	Saransh	completed
19.	25.695553	74.89445500	Mala ka Talab arniyaghoda	completed

SN.	Latitude	Longitude	Name of village/site	Status
20.	25.660975	74.88390300	Chobara Talab mevda	completed
21.	25.718686	74.90755600	Malam sagarkanechankalan	completed
22.	25.682952	74.91139500	Rajendra sagararniyaghoda	completed

1.10 Total storage capacity of ponds developed after treatment by M/s HZL (RAM)

Total storage capacity of ponds created by site specific interventions and through the treatment of 84 existing village ponds of Shahpur, Jahzpur, Kotri and Hurda blocks is presented in Table 8.

2.0 Estimated recharge potential created

Various methods to assess the recharge potential provided by CGWB's publications such as Report of Groundwater Estimation Committee, Manual on Groundwater Recharge Structures, 2007, Master Plan on Artificial Recharge, 2013 were used to estimate the recharge potential. Table 6 represents explanation, sources and formula used for the calculation of various components in assessing the recharge potential.Demonstration of actual estimate as an example is presented in Table 7.

Table 7: Components and formula used for the estimation of recharge potential

Sr. No.	Components and explanation (sources)	Formula used
1.	Block name	--
2.	Latitude (n)	--
3.	Longitude (e)	--
4.	Name of village	--
5.	Panchyat name	--
6.	Area of pond in sq.m. (source: actual field survey)	--
7.	Catchment area (ha) of ponds (source: derived from the drainage density map of the study)	--
8.	Average rainfall (source: IMD)	--
9.	Runoff coefficient (source: strange's table)	--
10.	Water available from the catchment	K= (H*10000)*I*J
11.	Depth of the pond after development (source: actual survey at field)	--
12.	Storage capacity of the pond in cu.m	M=G*L
13.	Water required for dead storage in	N=(G*80%)*1

	cu.m. for 1 mtr of water column	
14.	Water available after deduction of dead storage	O=M-N
15.	Water available for recharge in cu.m. 70% of available other 30% cosidered as natural infiltration and evaporation losses	P=O*70%
16.	Number of rechargeshaftsconstructed	Q=Total Recharge Shafts installed in Pond
17.	Recharge due to tanks and ponds, according to point no. 5.6.1.2.4 at page no. 52 of GEC, 2015. Recharge factor considered as 0.0014 mtraccording to point no. 3.3.5 at page no. 33 of GEC, 2015.	R= RTP=AWSA*G *RF
18.	Recharge through recharge shafts installed cum./annum	S= Q*Recharge Rate m^3/annum by Each Shaft
19.	Total recharge (through recharge shafts + desilting)	T=R+S

Table 8: Explanation of calculation for each component shown as an example for the estimation of the recharge potential.

Sr. No.	Components	Formula used	Values
1.	Area of pond in sq.m.	--	63560.20
2.	Catchment area of the pond in ha.	--	160.59
3.	Average rainfall mm	--	0.676
4.	Runoff coefficient	--	0.18
5.	Water available from the catchment	K=(H*10000)*I*J	195402.26
6.	Depth of the pond after development	--	2.85
7.	Storage capacity of the pond in cu.m.	M=G*L	181146.57
8.	Water required for dead storage in cu.m. for 1 mtr of water column	N=(G*80%)*1	50848.16
9.	Water available after deduction of dead storage	O=M-N	130298.41
10.	Water available for recharge in cu.m. 70% of available other 30% considered as natural infiltration and evaporation losses	P=O*70%	91208.89
11.	Number of recharge shafts	Q=Total recharge shafts installed in pond	4.00
12.	Recharge due to tanks and ponds	R=RTP=AWSA*G *RF	5606.01
13.	Recharge through recharge shafts installed cum./annum	S= Q*Recharge Rate m^3/annum by Each Shaft	89746
14.	Total recharge (through recharge shafts + desilting)	T=R+S	95352

Total recharge potential created in Shahupra, Jahazpur, Kotri and Hurda block by M/s HZL (RAM) is presented in Table 9 – 12.

Table 9: Runoff availability and enhanced storage capacity of ponds after intervention by M/s HZL (RAM)

SN.	Block	Name of village/site	Area of pond in sq.m (G)	Catchment area of the pond in ha. (H)	Average rainfall (I)	Runoff coefficient (J)	Water available from the catchment K=(H*10000)*I*J	Depth of the pond (L)	Storage capacity of the pond in cu.m. M=G*L
1	Shahpura	loolas	63560.20	160.59	0.676	0.18	195402.26	2.85	181146.57
2	Shahpura	sardarpura	139214.00	344.81	0.676	0.18	419564.20	2.56	356387.84
3	Shahpura	tehnal	66350.64	147.00	0.676	0.18	178869.60	2.80	185781.79
4	Shahpura	chalaniya	79242.00	217.10	0.676	0.18	264167.90	2.53	200482.26
5	Shahpura	pratappura	81572.50	183.61	0.676	0.18	223412.94	2.90	236560.25
6	Shahpura	karmadas	85704.46	218.72	0.676	0.18	266138.50	2.95	197120.26
7	Shahpura	lasariya	108761.25	256.20	0.676	0.18	311744.16	2.56	278428.80
8	Shahpura	kasipura	54290.15	138.82	0.676	0.18	168916.18	2.94	146583.41
9	Shahpura	badesara	98413.00	196.33	0.676	0.18	238893.13	2.43	239143.59
10	Shahpura	ummednagar	87620.00	194.23	0.676	0.18	236339.06	2.56	205907.00
11	Shahpura	badesara-2	97216.00	271.10	0.676	0.18	329875.79	2.67	259566.72
12	Shahpura	taswariya	95685.79	250.78	0.676	0.18	305154.08	2.37	226775.32
13	Shahpura	Bajoriyatalabdhikola	191774.20	481.74	0.676	0.18	586181.23	1.95	373959.69
14	Shahpura	Karolai Talab nogava	117570.90	494.74	0.676	0.18	601999.63	2.60	305684.34
15	Shahpura	Salariya	124094.70	285.95	0.676	0.18	347943.96	2.50	310236.75
16	Shahpura	Nayatalabkhamor	84117.30	261.39	0.676	0.18	318059.35	2.40	201881.52
17	Shahpura	Biliya	84558.81	176.00	0.676	0.18	214156.80	2.35	198713.20
18	Shahpura	Saransh	76923.00	1565.32	0.676	0.18	1904681.38	2.45	188461.35
19	Shahpura	mala ka Talab arniyaghoda	120000.00	480.00	0.676	0.18	584064.00	2.45	294000.00
20	Shahpura	Chobara Talab mevda	74347.00	325.00	0.676	0.18	395460.00	2.85	211888.95
21	Shahpura	Malamsagarkanechan kalan	114583.21	383.53	0.676	0.18	466679.30	2.65	303645.51
22	Shahpura	Rajendra sagararniyaghoda	77800.00	170.57	0.676	0.18	207549.58	2.70	210060.00
23	Jahazpur	Gokulpura	57240.00	119.56	0.791	0.18	170230.76	2.99	171147.60
24	Jahazpur	pandher near sawar road	74085.00	138.97	0.791	0.18	170230.76	2.54	188175.90
25	Jahazpur	Indokiya	66114.00	161.30	0.791	0.18	197865.27	2.94	152062.20

SN.	Block	Name of village/site	Area of pond in sq.m (G)	Catchment area of the pond in ha. (H)	Average rainfall (I)	Runoff coefficient (J)	Water available from the catchment K=(H*10000)*I*J	Depth of the pond (L)	Storage capacity of the pond in cu.m. M=G*L
26	Jahazpur	bhagwanpura	46378.00	116.35	0.791	0.18	229654.93	2.94	136351.32
27	Jahazpur	ropan goshala	53123.00	98.23	0.791	0.18	165665.43	2.24	118995.52
28	Jahazpur	Ruppura	58591.96	134.13	0.791	0.18	139859.87	2.90	169916.68
29	Jahazpur	taswariya village pond	99074.20	206.48	0.791	0.18	293980.56	2.51	248676.24
30	Jahazpur	taswariya dev chapar	59206.00	311.38	0.791	0.18	443341.67	2.94	174065.64
31	Jahazpur	Ropan jabarnadi	55632.12	116.21	0.791	0.18	165453.72	2.80	155769.93
32	Jahazpur	Sihana	56115.39	124.94	0.791	0.18	177889.57	2.95	165540.40
33	Jahazpur	Pandher Bamninadi	49502.85	116.10	0.791	0.18	165298.98	2.90	143558.25
34	Jahazpur	jamol I Khajoorinadi	58686.91	149.04	0.791	0.18	212206.75	2.85	167257.69
35	Jahazpur	gokulpura-2	49784.32	115.23	0.791	0.18	164060.60	2.96	147361.59
36	Jahazpur	tithodamafi	115620.00	202.72	0.791	0.18	288632.37	2.51	290206.20
37	Jahazpur	Ropan gopal talab	50550.08	104.79	0.791	0.18	149197.93	2.73	138001.72
38	Jahazpur	Ropan Acharya talab	69849.52	504.92	0.791	0.18	718899.91	2.85	199071.12
39	Jahazpur	footiyadand pander	57563.56	126.18	0.791	0.18	179655.08	2.90	166934.32
40	Jahazpur	Aagraiya Talab tithodi	80541.52	238.99	0.791	0.18	340273.96	2.85	229543.33
41	Jahazpur	Naya Talab bihada	92329.39	185.90	0.791	0.18	264684.42	2.65	244672.88
42	Jahazpur	Tumdiya Talab gokulpura	63789.51	157.04	0.791	0.18	223593.55	2.80	178610.63
43	Jahazpur	Khatolaibadanpura	58863.36	305.75	0.791	0.18	435326.85	2.85	167760.58
44	Jahazpur	village pond bhiladi	56248.50	201.24	0.791	0.18	286525.51	2.75	154683.38
45	Jahazpur	Pipalitalaigokulpura	68167.33	144.78	0.791	0.18	206137.76	2.65	180643.42
46	Jahazpur	Raghunathpura jamoli	59857.57	335.51	0.791	0.18	477699.14	2.85	170594.07
47	Jahazpur	Gaderiya Talab indokia	58916.47	121.49	0.791	0.18	172977.46	2.85	167911.94
48	Jahazpur	kala Talab ropan	57872.00	127.09	0.791	0.18	180950.74	2.80	162041.60
49	Jahazpur	Khandaliya Talab ropan	86229.00	299.23	0.791	0.18	426043.67	2.40	206949.60
50	Jahazpur	Dhola Talab gandher	98500.22	163.24	0.791	0.18	232421.11	2.35	231475.52
51	Jahazpur	Luniya Talab narana	59418.25	194.60	0.791	0.18	277071.48	2.75	145574.71
52	Kotri	Bherunadi holireda	310515.51	365.61	0.803	0.18	528458.85	1.39	431616.56

SN.	Block	Name of village/site	Area of pond in sq.m (G)	Catchment area of the pond in ha. (H)	Average rainfall (I)	Runoff coefficient (J)	Water available from the catchment K=(H*10000)*I*J	Depth of the pond (L)	Storage capacity of the pond in cu.m. M=G*L
53	Kotri	Urdinadi ban kakheda	76555.12	173.17	0.803	0.18	250296.42	2.51	192153.35
54	Kotri	Badliyas Samiti talab	147774.52	255.11	0.803	0.18	368729.71	2.37	350225.61
55	Kotri	dhowani	76149.00	183.61	0.803	0.18	265396.07	2.51	191133.99
56	Kotri	aadsipura	44965.64	114.48	0.803	0.18	165476.12	2.95	132648.64
57	Kotri	ban kakheda dev Narayan nadi	62786.24	127.05	0.803	0.18	183638.62	2.85	178940.77
58	Kotri	Holiredadoitalab	59738.79	132.75	0.803	0.18	191876.85	2.95	176229.43
59	Kotri	Salariya Rekhalinadi	59718.85	148.78	0.803	0.18	215046.51	2.95	176170.61
60	Kotri	Somyas Galtiyanadi	60961.57	127.98	0.803	0.18	184982.29	2.90	176788.55
61	Kotri	Kankroliya mafi	90033.29	207.11	0.803	0.18	299351.71	2.94	264697.87
62	Kotri	Lasadiya Khejadi talab	73817.77	175.95	0.803	0.18	254322.52	2.80	191926.20
63	Kotri	Beerdhol Rukhadi nadi	60985.25	139.75	0.803	0.18	201994.65	2.90	176857.23
64	Kotri	Kanti	45050.26	98.35	0.803	0.18	142155.09	2.95	132898.27
65	Kotri	Daharki nadi sarakheda	31614.05	71.21	0.803	0.18	102926.93	2.85	90100.04
66	Kotri	Ramdev sagar	59817.31	153.22	0.803	0.18	221464.19	2.95	176461.06
67	Kotri	Kothaj	63250.00	126.76	0.803	0.18	183218.90	2.95	117012.50
68	Kotri	Guddikinadi	60985.50	120.30	0.803	0.18	173881.62	2.90	176857.95
69	Kotri	Dantra	46990.19	566.52	0.803	0.18	818848.01	2.90	136271.55
70	Kotri	Beerdhol village pond	61217.25	280.00	0.803	0.18	404712.00	2.90	177530.03
71	Kotri	Chawand sagar chapdel	115409.65	1400.00	0.803	0.18	2023560.00	2.85	328917.50
72	Hurda	falmada	97750.00	256.76	0.698	0.18	322588.87	2.67	260992.50
73	Hurda	ukhaliya	56600.15	116.01	0.698	0.18	145760.11	2.94	166404.44
74	Hurda	nayakanpura	61851.00	143.94	0.698	0.18	180843.18	2.90	179367.90
75	Hurda	bakhtawarpura	78900.00	195.03	0.698	0.18	245031.92	2.85	224865.00
76	Hurda	pardodas	59645.00	157.37	0.698	0.18	197724.69	2.94	175356.30
77	Hurda	hurda zinc colony-1	107679.52	239.45	0.698	0.18	300839.33	2.79	300425.85

SN.	Block	Name of village/site	Area of pond in sq.m (G)	Catchment area of the pond in ha. (H)	Average rainfall (I)	Runoff coefficient (J)	Water available from the catchment K=(H*10000)*I*J	Depth of the pond (L)	Storage capacity of the pond in cu.m. M=G*L
78	Hurda	hurda zinc colony-2	61521.48	136.80	0.698	0.18	171881.17	2.78	171029.72
79	Hurda	barathiya	70624.00	215.84	0.698	0.18	271180.45	2.53	178678.72
80	Hurda	Urjakakheda	56342.00	124.85	0.698	0.18	156861.54	2.60	146489.20
81	Hurda	bhagwanpura	95222.46	378.64	0.698	0.18	475723.30	2.51	239008.37
82	Hurda	dhanpura	54242.91	143.93	0.698	0.18	180833.65	2.70	146455.86
83	Hurda	Balajitalabamratiya	70789.63	151.26	0.689	0.18	187592.65	2.55	180513.56
84	Hurda	village pond hurda(Baralitalab)	136436	715.25	0.698	0.18	898640.10	2.40	327446.40

Table 10: Total recharge potential created in Shahupra block by M/s HZL (RAM)

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)* I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA* G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
1	Loolas	50848.16	130298.41	91208.89	4.00	5606.01	89746	95351.52
2	Sardarpura	111371.20	245016.64	171511.65	8.00	12278.67	170953	183231.18
3	Tehnal	53080.51	132701.28	92890.90	4.00	5852.13	91091	96943.24
4	Chalaniya	63393.60	137088.66	95962.06	4.00	6989.14	95359	102347.70
5	Pratappura	65258.00	171302.25	119911.58	5.00	7194.69	118407	125601.61
6	Karmadas	68563.57	128556.69	89989.68	4.00	7559.13	89380	96939.05
7	Lasariya	87009.00	191419.80	133993.86	6.00	9592.74	133178	142771.02
8	Kasipura	43432.12	103151.29	72205.90	3.00	4788.39	70349	75136.91
9	Badesara	78730.40	160413.19	112289.23	4.00	8680.03	110869	119549.40
10	Ummednagar	70096.00	135811.00	95067.70	4.00	7728.08	94509	102237.00
11	Badesara-2	77772.80	181793.92	127255.74	6.00	8574.45	126972	135546.65
12	Taswariya	76548.63	150226.69	105158.68	5.00	8439.49	105100	113539.43
13	Bajoriya Talab dhikola	153419.36	220540.33	154378.23	7.00	16914.48	153622	170535.99

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)* I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA* G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
14	Karolai Talab nogava	94056.72	211627.62	148139.33	7.00	10369.75	147874	158243.42
15	Salariya	99275.76	210960.99	147672.69	7.00	10945.15	147500	158445.51
16	Naya Talab khamor	67293.84	134587.68	94211.38	4.00	7419.15	93179	100598.58
17	Biliya	67647.05	131066.16	91746.31	4.00	7458.09	90961	98418.97
18	Saransh	61538.40	126922.95	88846.07	4.00	6784.61	88351	95135.27
19	Mala ka Talab arniyaghoda	96000.00	198000.00	138600.00	6.00	10584.00	137962	148545.90
20	Chobara Talab mevda	59477.60	152411.35	106687.95	5.00	6557.41	106323	112880.76
21	Malamsagarkanechankalan	91666.57	211978.94	148385.26	7.00	10106.24	148070	158176.64
22	Rajendrasagararniyaghoda	62240.00	147820.00	103474.00	4.00	6861.96	100537	107398.66
Total					**112.00**	**187283.80**	**2510291**	**2697574.41**

Table 11: Total recharge potential created in Jahazpur block by M/s HZL (RAM)

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80 %)*I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA* G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
1.	Gokulpura	45792	125356	87749	4.00	5048.57	87013	92061.30
2.	Pandher near sawar road	59268	128908	90236	4.00	6534.30	89927	96461.45
3.	Indokiya	52891	99171	69420	3.00	5831.25	68783	74614.08
4.	Bhagwanpura	37102	99249	69474	3.00	4090.54	68190	72280.13
5.	Ropan goshala	42498	76497	53548	2.00	4685.45	52397	57082.03
6.	Ruppura	46874	123043	86130	4.00	5167.81	85718	90885.56
7.	Taswariya village pond	79259	169417	118592	3.00	8738.34	76500	85238.34
8.	Taswariya dev chapar	47365	126701	88691	3.00	5221.97	83563	88784.64
9.	Ropanjabarnadi	44506	111264	77885	3.00	4906.75	76500	81406.75
10.	Sihana	44892	120648	84454	4.00	4949.38	84377	89325.91
11.	Pandherbamninadi	39602	103956	72769	3.00	4366.15	72283	76649.42
12.	JamoliKhajoorinadi	46950	120308	84216	4.00	5176.19	84186	89362.36
13.	Gokulpura-2	39827	107534	75274	3.00	4390.98	75000	79390.98

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)*I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA*G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
14.	Tithodamafi	92496	197710	138397	3.00	10197.68	77400	87597.68
15.	Ropangopaltalab	40440	97562	68293	3.00	4458.52	67664	72122.62
16.	Ropan Acharya talab	55880	143192	100234	4.00	6160.73	99600	105760.73
17.	Footiyadand pander	46051	120883	84618	4.00	5077.11	84508	89585.45
18.	Aagraiyatalabtithodi	64433	165110	115577	5.00	7103.76	114948	122051.32
19.	Naya Talab bihada	73864	170809	119567	5.00	8143.45	118842	126985.93
20.	Tumdiya Talab gokulpura	51032	127579	89305	4.00	5626.23	88782	94407.82
21.	Khatolaibadanpura	47091	120670	84469	4.00	5191.75	84389	89580.49
22.	Village pond bhiladi	44999	109685	76779	3.00	4961.12	74034	78994.68
23.	Pipalitalaigokulpura	54534	126110	88277	4.00	6012.36	87435	93447.31
24.	Raghunathpurajamoli	47886	122708	85896	4.00	5279.44	85530	90809.53
25.	Gaderiyatalabindokia	47133	120779	84545	4.00	5196.43	84450	89646.14
26.	Kala talabropan	46298	115744	81021	3.00	5104.31	78325	83429.64
27.	Khandaliya Talab ropan	68983	137966	96576	4.00	7605.40	94700	102305.61

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)*I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA*G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
28.	Dhola Talab gandher	78800	152675	106873	5.00	8687.72	106515	115202.91
29.	Luniya Talab narana	47535	98040	68628	3.00	5240.69	67513	72753.35
Total					**105.00**	**169154.37**	**2419070**	**2588224.17**

Table 12: Total recharge potential created in Kotri block by M/s HZL (RAM)

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)*I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA*G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
1.	Bherunadiholireda	248412	183204	128243	5.00	27387.47	127000	154387.47
2.	Urdinadi ban kakheda	61244	130909	91636	4.00	6752.16	91221	97973.34
3.	Badliyas Samiti talab	118220	232006	162404	7.00	13033.71	161269	174303.07
4.	Dhowani	60919	130215	91150	4.00	6716.34	90832	97548.62
5.	Aadsipura	35973	96676	67673	3.00	3965.97	67573	71538.60

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)*I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWS A*G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
6.	Ban kakheda dev Narayan nadi	50229	128712	90098	4.00	5537.75	89991	95528.34
7.	Holiredadoitalab	47791	128438	89907	4.00	5268.96	89838	95106.46
8.	SalariyaRekhalinadi	47775	128396	89877	4.00	5267.20	89813	95080.70
9.	SomyasGaltiyanadi	48769	128019	89614	4.00	5376.81	89603	94979.62
10.	Kankroliyamafi	72027	192671	134870	4.00	7940.94	103200	111140.94
11.	LasadiyaKhejaditalab	59054	132872	93010	4.00	6510.73	92320	98831.04
12.	BeerdholRukhadinadi	48788	128069	89648	4.00	5378.90	89631	95009.55
13.	Kanti	36040	96858	67801	3.00	3973.43	67675	71647.95
14.	Daharkinadisarakheda	25291	64809	45366	2.00	2788.36	45249	48037.29
15.	Ramdevsagar	47854	128607	90025	4.00	5275.89	89932	95207.93
16.	Kothaj	50600	66413	46489	2.00	5578.65	46147	51725.65
17.	Guddikinadi	48788	128070	89649	4.00	5378.92	89631	95009.87
18.	Dantra	37592	98679	69076	3.00	4144.53	68694	72839.00
19.	Beerdholvillage pond	48974	128556	89989	4.00	5399.36	89903	95302.85
20.	Chawandsagarchapdel	92328	236590	165613	7.00	10179.13	165200	175379.13

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)*I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% considered as natural infiltration and evaporation losses(P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA*G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
Total					**80.00**	**141855.21**	**1844722**	**1986577.42**

Table 13: Total recharge potential created in Hurda block by M/s HZL (RAM)

SN.	Name of village	Water required for dead storage in cu.m for 1 mtr of water column (N) N=(G*80%)*I	Water available after deduction of dead storage (O) O=M-N	Water available for recharge in cu.m 70% of available other 30% cosidered as natural infiltration and evouparation losses (P) P=O*70%	Number of recharge shafts (Q) Q=Total Recharge Shafts Installed in Pond	Recharge due to Water conservation structure (R) R=RTP=AWSA*G*RF	Recharge through recharge shafts cu.m./annum (S) S=Q*Recharge Rate m3/annum by each shaft	Total recharge from pond and through recharge shafts in cu.m./annum (T) T=R+S
1.	Falmada	78200.00	182792.50	127954.75	6.00	8621.55	127942	136563.35
2.	Ukhaliya	45280.12	121124.32	84787.02	3.00	4992.13	80619	85610.75
3.	Nayakanpura	49480.80	129887.10	90920.97	4.00	5455.26	90072	95527.08
4.	Bakhtawarpura	63120.00	161745.00	113221.50	5.00	6958.98	112225	119183.51
5.	Pardodas	47716.00	127640.30	89348.21	4.00	5260.69	88531	93791.26
6.	Zinc colony-1	86143.61	214282.24	149997.57	7.00	9497.33	149839	159336.39

7.	Zinc colony-2	49217.19	121812.54	85268.78	4.00	5426.19	85267	90693.22
8.	Barathiya	56499.20	122179.52	85525.66	4.00	6229.04	85473	91701.57
9.	Urjakakheda	45073.60	101415.60	70990.92	3.00	4969.36	69934	74903.40
10.	Bhagwanpura	76177.97	162830.41	113981.28	5.00	8398.62	113685	122083.65
11.	Dhanpura	43394.33	103061.53	72143.07	3.00	4784.22	71077	75861.55
12.	Balaji Talab amratiya	56631.70	123881.85	86717.30	4.00	6243.65	86426	92669.48
13.	Village pond hurda (Barali talab)	109148.80	218297.60	152808.32	7.00	12033.66	152088	164121.31
Total					**59.00**	**88870.69**	**1313176**	**1402046.51**

2.1 Total recharge potential in four blocks

As already discussed in above paras that the entire interventions were carried out in four blocks of the Bhilwara district. Total recharge potential through development of village ponds and installation of recharge shafts is 8.67 MCM/Annum. Block wise distribution of recharge potential created is given in Table 13.

Table 14: Total recharge potential created through intervention by M/s HZL (RAM)

Name of block	Number of ponds developed	Total number of recharge shafts	Total recharge potential created in m^3
Shahpura	22	112.00	2697574.41
Jahazpur	29	105.00	2588224.17
Kotri	20	80.00	1986577.42
Hurda	13	59.00	1402046.51
Total	**84**	**356**	**8674422.51**

Total recharge potential created in mcm 8.67

2.2 Additional recharge through existing mini percolation tanks

M/s. HZL (RAM) has constructed four number of rainwater harvesting/groundwater recharge structures by participating in various Govt. initiatives taken for groundwater augmentation. Details of the structures implemented, and recharge potential created through is as given below.

Recharge due to Water Conservation Structures estimated based on the following formula: $\mathbf{R_{WCS} = GS*RF}$

where, R_{WCS} = recharge due to water conservation structures, GS= gross storage (i.e. storage capacity multiplied by number of fillings), RF= recharge factor.

The estimate of recharge potential created through rainwater harvesting and ground water recharge structures with its location in villages where intervention was done is shown in Table 14.

Table 15: Details of additional recharge through existing mini percolation tanks constructed under Mukhyamantri Jal Swavlamban Abhiyan (MJSA) implemented by M/s HZL (RAM)

Type of Structure	Village/ Block	Location Details	Name of Campaign	Storage capacity in Cu.m	Recharge Factor 50% of storage as per GEC, 2015	Total recharge potential Cu.m/Annum
		Latitude/ Longitude				
Mini Percolation Tank	Lasadiya/ Shahpura	25.69666 / 75.08868	MJSA	1350	675	2025
	Lasadiya/ Shahpura	25.69927 / 75.10446	MJSA	1350	675	2025
	Devpuri/ Shahpura	25.69533 / 75.08859	MJSA	2000	1000	3000
	Jodhras/ Asind	25.64546 / 74.58328	MJSA	2000	1000	3000
Total				**6700**	**3350**	**10050**

2.3 Totalrecharge potential created in the study area

Total recharge potential from various sources (existing + proposed) is summarized in Table 15.

Table 16: Total recharge potential created by M/s HZL (RAM)

Block	Recharge Through Recharge Shafts in Village Ponds in MCM/Annum	Recharge Through Mini Percolation Tanks under MJSA	Recharge Through Artificial Pond at Zinc Colony, Hurda	Total Recharge Potential in MCM/Annum
		MCM/Annum	MCM/Annum	
Hurda	1.40	--	0.044	1.44
Shahpura	2.69	0.01005	--	2.70
Kotri	1.98	--	--	1.98
Jahazpur	2.58	--	--	2.58
Total	**8.67**	**0.01**	**0.04**	**8.72**

Recharge potential created by M/s. HZL is:

- **0.01 MCM/Annum** through Mini Percolation Tanks (MPTs) in Shahpura block constructed under Mukhyamantri Jal Swavlamban Abhiyan (MJSA).The company has created an artificial pond to store the runoff generated from the colony and has installed 2 nos. of recharge shafts to facilitate the groundwater recharge through the rainwater collected in the pond.
- **0.042 MCM/Annum** through one Artificial Pond in Zinc Colony with Installation of two recharge shafts.

Recharge through development of existing village ponds and through installation of recharge shafts as on 01.09.2021 is 8.67 MCM. However, total recharge potential includingdevelopment of village ponds, installation of recharge shafts (2 Nos.), construction of mini percolation tanks and artificial pond under Mukhya Mantri JalSwavlamban Abhiyan (MJSA)is 8.72 MCM/Annum.

3.0 Maintenance and monitoring

For efficient functioning of the recharge structures and to maintain the substantial storage capacity of the developed pond, the company intended to maintain the ponds in terms of removal of top layer of earth material (sediments) gathered in the ponds due to runoff, cleaning of recharge shafts and replacement of filter media wherever required on yearly basis. Further, to assess the impact of the project on the surrounding area as per the criteria provided in guidelines for impact assessment of artificial recharge structures/schemes, February 2021 by CGWB.A status report of the same will be submitted to Regional Office of CGWB, time to time.


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Plate 1: *Field visit to assess site suitability and selection of ponds*

Plate 2: *View of submergence area of the Pond through Satellite Imagery*

Plate 3*: Visit for making well inventory around the ponds*

Plate 4: *Glimpse of Geophysical survey done to assess the potential zones of recharge and to ascertain the depth of recharge shafts*

Plate 5:*Showing Pre-Excavation Survey and creation of Digital Elevation Model*

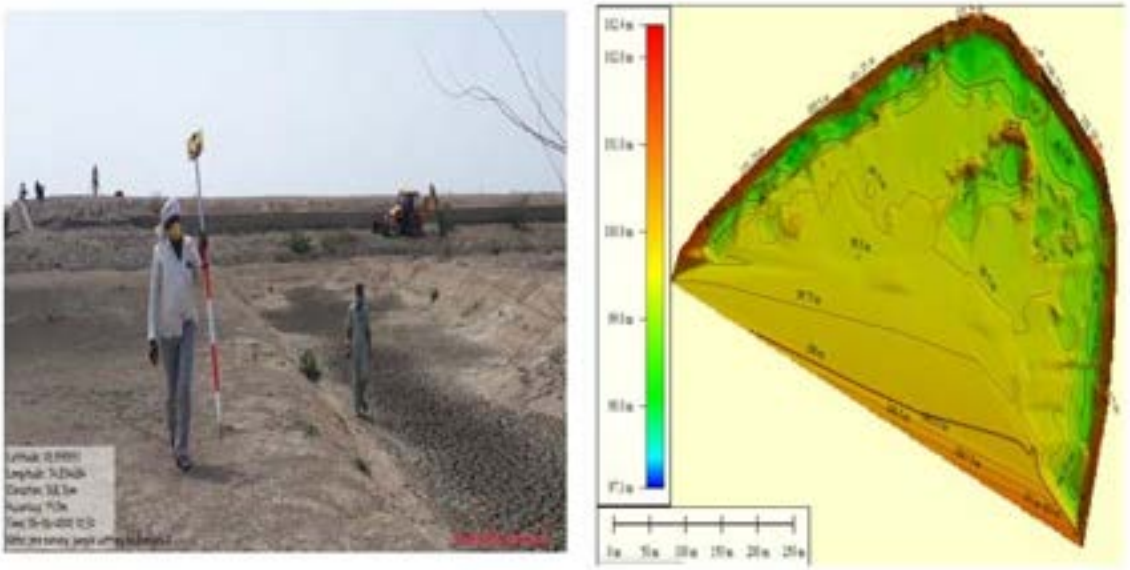

Plate 6:*Desilting work (Excavation to remove the silt from the pond) as per excavation plan*

Plate 7: *Desilting work (Excavation to remove the silt from the pond) as per excavation plan*

Plate 8: *Demarcation of suitable location (following Geophysical results)*

Plate 9:*Post Excavation Survey and Creation of Digital Elevation Model (DEM)*

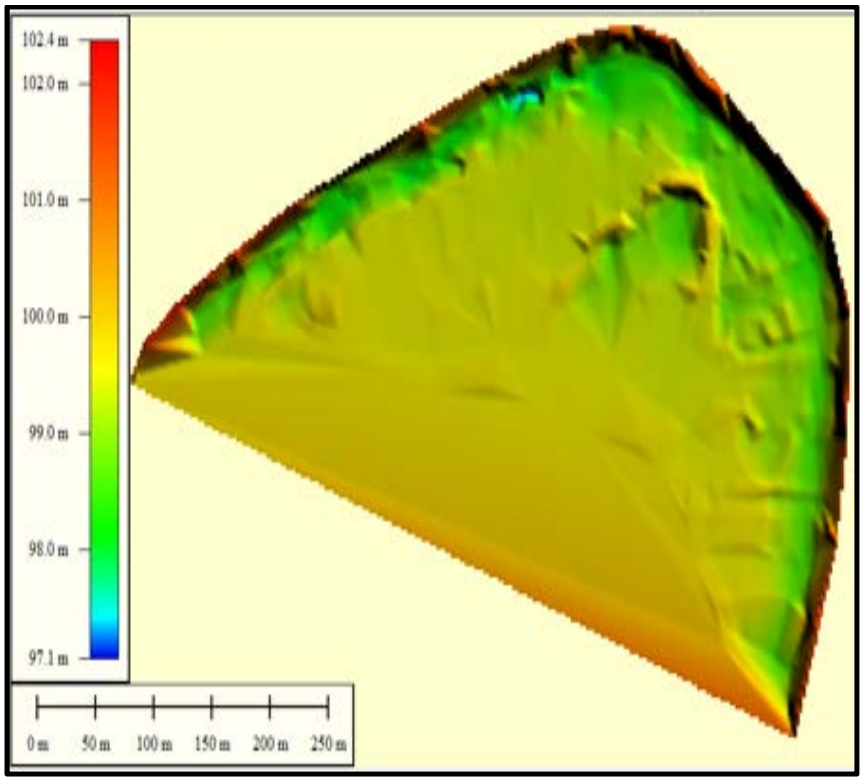

Plate 10: *Drilling and Lowering of Slotted UPVC Pipes*

Plate 11: *Drilling and Lowering of Slotted UPVC Pipes*

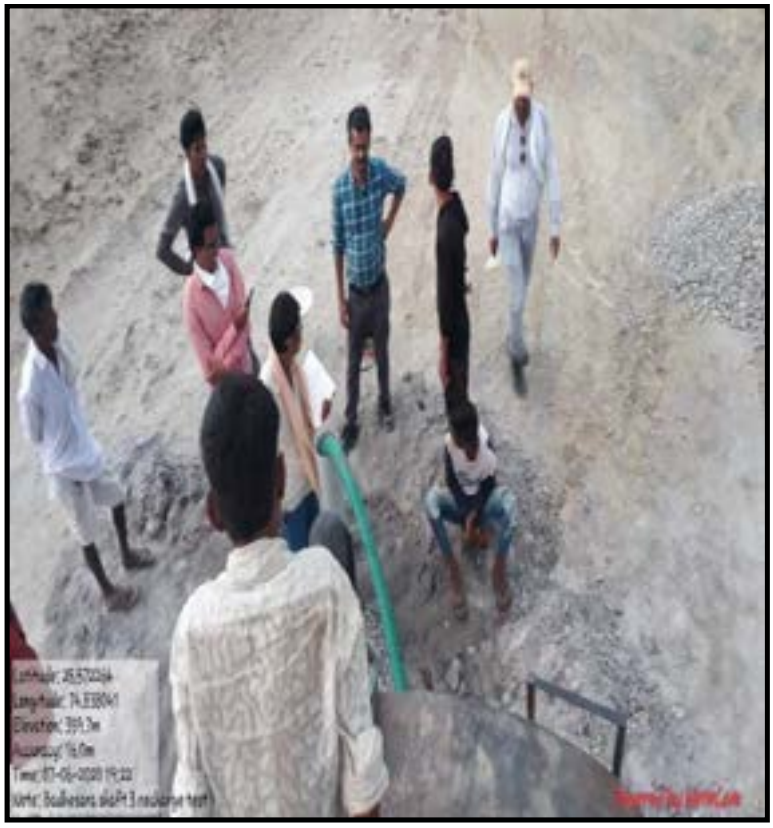

Plate 12: *Installation of Recharge Pit*


Latitude: 25,592562
Longitude: 75,136012
Elevation: 362,03 m
Accuracy: 3,2 m
Time: 22-11-2020 12:07
Note: Rappura shaft 1 Structure installation

Plate 13: *Preparation of filter media as per the approved drawing*

Plate 14: *Pre-casting yard*

Plate 15: *Repairing of vest weir*

Plate 16: *Repairing of vest weir*

Plate 17: *Rejuvenated and waterfilled ponds after treatment by M/s HZL (RAM)*