vedanta
transforming elements

HZL/SKM/Env/2020 /05/ 27.05.2020

To,
Director (MoEFCC),
Regional Office (Central Region)
5th Floor,Kendriya Bhawan,
Sector-H, Aliganj.
Lucknow (UP).
PIN:226024.

Subject : Half yearly EC compliance report of Sindesar Khurd Mine for the period of October to March 2020.

Reference: J-11015/7/2017-IA.II (M) dated 31.05.2018

Dear Sir,

Please find enclosed herewith half yearly compliance report of conditions given with Environment Clearance granted by Ministry of Environment, Forest & Climate Change to our Sindesar Khurd Mine.

Thanking you,

Yours faithfully,

27/05/2020

Unit – Head
Sindesar Khurd Mine

Copy to :-1.Zonal Officer,
Central Pollution Control Board,
3rd Floor,Sahkar Bhawan,North TT Nagar,
Bhopal-462003.
2.The Member Secretary,
Rajasthan State Pollution Control Board,
4th, Institutional Area, Jhalana Doongari,
Jaipur .PIN - 302004.
3. Regional Officer,
Rajasthan State. Pollution Control Board,
18, Azad Nagar, Pannadhay Circle,Near Telephone Exchange
Bhilwara, PIN – 311001.

Hindustan Zinc Limited
Sindesar Khurd Mine, P.O. Dariba, Teh. Railmagra, Distt. Rajsamand (Rajasthan) - 313 211
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Registered Office : Yashad Bhawan, Udaipur (Rajasthan) - 313 004
CIN : L27204RJ1966PLC001208

Compliance Report of Environment Clearance

Name of the Project: Sindesar Khurd Mine
(Hindustan Zinc Ltd.)
Village :Sindesar Khud ,
PO Dariba ,Tehsil : Railmagra,
Dist : Rajsamand. Rajasthan.

Clearance Letter No.: J-11015/7/2017-IA.II(M) dated 31.05.2018

Period of Compliance: April to September 2019.

Sr. No	Condition	Compliance Status
A.	**Specific Condition**	
1	Environmental clearance is granted subject to final outcome of Hon'ble Supreme Court of India, Hon'ble High Court of Rajasthan and any other Court of Law, if any, as may be applicable to this project.	Noted.
2	This Environmental Clearance is subject to obtaining requisite NBWL Clearance from the Standing Committee of National Board for Wildlife, if any, applicable for this Mining project.	Not Applicable for this Mining Project. Core & Buffer zone area of this project has no National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Tiger/Elephant Reserves. The Letter has been issued by Office of DFO, Rajsamand in this regard.
3	No mining activities will be allowed in forest area, if any, for which the Forest Clearance is not available.	Not Applicable for this project, as all Mining Activities comes under Non Forest Area.
4	The project proponent shall obtain Consent to Operate from the State Pollution Control Board, Rajasthan and effectively implement all the conditions stipulated therein.	Consent to Operate has been obtained from SPCB and compliance of the conditions given in same are being ensured.
5	The Proponent should install online Ambient Air Quality Monitoring System and there should be system for display of digital AAQ data within 03 months at least at three locations as per wind direction. Online provisions of pH and turbidity meters at discharge points of STP and ETP and also at water storage ponds in the mining area may be made. Project Proponent should display the result digitally in front of the main Gate of the mine site.	3 nos. online monitoring stations installed at site results of the same are being displayed at the main gate. Apart from this Monthly AAQ monitoring from 5 locations from core and buffer zone is being done. Provision to measure PH and turbidity at water ponds and display of the same at main gate has been made. Latest AAQ monitoring reports are attached here in **Annexure - I.**
6	The Project Proponent has to take care of gullies formed on slopes. Dump mass should be consolidated with proper filling/levelling with the help of dozer/compactors. The report on slope and stability monitoring should be sent to MoEF&CC and its Regional office every six-months.	Regular monitoring of slope stability of waste dump mass is being done. The waste dump consolidation is being done by compactor and dozer on regular basis. The Survey of waste dump is carried out regularly and records maintained. Report of slope and stability monitoring is being submitted along with half year compliance report. Latest report is attached here in **Annexure-II.**
7	The reclamation at waste dump sites shall be ecologically sustainable. Scientific reclamation has been followed. The local species may be	At present waste dump is in active stage. Inactive waste dump will be reclaimed in

	encouraged and species are so chosen that the slope, bottom of the dumps and top of the dumps are able to sustain these species. The aspect of the dump is also a factor which regulates some climatic parameters and allows only species adopted to that micro climate. This may be recommended to be studied by hiring Expert Ecology Group.	scientific manner. Waste rock generated from mining is being used for filling of mine voids. Waste remained during closure will be filled back in mine voids at the time of mine closure and scientific reclamation by plantation of suitable species will be ensured at waste dump.
8	There is need for regular monitoring of invertebrates and aquatic life of water bodies including the reservoir located close to the mining lease to establish that fish and other animals including the water is not contaminated with heavy metal. There could be a research on "bio accumulation of heavy metals in invertebrates" to completely establish that there is no impact of mining.	Study for assessing impact of heavy metals on crop ,vegetable, surface water , silt aquatic life etc. been conducted and Heavy metals are found within the limit. Regular study is being done.
9	A specialized Institution may be hired to carry out ecological survey on the plant species to evaluate their growth in terms of stunted, deformed and seed viability. The sensitive species and indicator species to heavy metal pollution may be screened out and plantation accordingly designed. Similarly, uptake of Zinc, Cadmium and lead etc. by crops and vegetables grown in the crop lands around the mining lease may be studied. Bottom sediment analysis of ponds, wells and Rivers to ascertain the level of accumulation of heavy metal may be done.	Ecological survey in the surrounding area has been carries out. No impact due to mining operation was observed.
10	The Proponent shall conduct an Occupational health study with respect to the pressure impact on ear drums as person goes underground and implement the recommendations.	Occupational Health Study of employees conducted & no impact has been observed irrespective of depth of working.
11	Project Proponent shall carry out vibration studies well before approaching any such habitats or other buildings to evaluate the zone of influence and impact of blasting on the neighbourhood. Within 500 meters of such sites vulnerable to blasting vibrations, avoidance of use of explosives and adoption of alternative means of mineral extraction. A provision for monitoring of each blast should be made so that the impact of blasting on nearby habitation and dwelling units could be ascertained. The covenant of lease deed under Rule 31 of MCR 1960 provides that no mining operations shall be carried out within 50 meters of public works such as public roads and buildings or inhabited sites except with the prior permission from the Competent Authority.	Blast design is being done as per recommendations of CIMFR keeping public infrastructure in view. Due care is taken in designing the blast, optimizing the explosives, selection of detonators and delay to ensure safe vibration limit on surface. Vibration study for each blast is being carried out regularly and every quarterly by CSIR-CIMFR, Dhanbad.

12	Main haulage road in the mine should be provided with permanent water sprinklers and other roads should be regularly wetted with water tankers fitted with sprinklers. The material transfer points should invariably be provided with Bag filters and or dry fogging system. Belt-conveyors should be fully covered to avoid air borne dust; Use of effective sprinkler system to suppress fugitive dust on haul roads and other transport roads shall be ensured.	Transfer points, loading and unloading points of Ores and roads is being ensured. Dust Extraction systems have been installed in Crushers. All the conveyors are covered to minimise the dust emission. Trial with addition of reagent with water to improve dust suppression has been carried out and sprinkling of the same is being ensured regularly. Heavy duty road sweepers are deployed permanently, and regular road sweeping is being ensured. Avenue plantation along with roads and other areas of mines ensured to mitigate impact of dust. Net work of conveyors established and commissioning shaft, installation of additional crusher in underground is ensured to reduce vehicle movement for Ore movement and dust emission due to vehicle movement.
13	The monitoring of PM 2.5 in the vehicle emission shall be conducted to improve the mine environment and report submitted to the Regional Office of the MoEF & CC.	We are exploring possibility of monitoring the same. we have also submitted request for exemption of this condition to MoEF&CC by our letter (No. SKM/ENV/2020/02/396 dated 19.02.2020 .
14	Project proponent shall compensate all 581 identified families for land and construction cost, i.e. 3 times of DLC rate for land and 3 times of PWD rate for construction will be provided. Rehabilitation site with construction of roads, community centre, school, hospital and other infrastructures will be provided. The PP has confirmed that equal land will be given as a part of displacement.	Details action plan and SOP has been made to relocate the village. Core Team has been formed to ensure progress of shifting. Marking of site and Construction of roads has been completed.Construction of Community centre and temple is under progress. Provision of school, Hospital and other infrastructure is included in plan. Action plan includes more than 3 times DLC rate of land, more that 3 times of PWD rates for construction and land more than existing area for each family of village.

15	Implementation of conservation of all Schedule-I species as per revised plan submitted to DFO-Rajsamand for approval vide letter no. SKM/ENV/DFO/2018/01 dated 09.01.2018 with budgetary provision of Rs. 2 Crore. The Proponent shall implement the Wildlife Conservation Plan along with the funds so allocated with consultation of Chief Wild Life Warden of the State Govt. A copy of action plan shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office, Lucknow and the Chief Wild Life Warden of the State Govt.	Conservation plan of Schedule-1 species has been submitted to DCF, Rajsamand on 09.01.2018. and then after as per on 07.02.2019 to CCF – wildlife office Udaipur and later on CWLWL at Jaipur. The same was submitted to regional office along with 1st EC compliance report in 2018. State forest Department has been made SOP recently. Accordingly, revised conservation plan made and submitted to DCF- Rajsamand on 26th May 2020.
16	Implementation of action plan on remedial and preventive actions for lead contamination on human health for the community in consultation with experts with budgetary provisions of Rs 50 Lakhs for conducting various programs in connection to Lead.	Action plan has been made. Awareness programs conducted. In addition to this, High capacity (1500 Lts/hr) community RO has been installed at Kothdi Village along with 2 ATM s in surrounding village. Also 5 more such type of RO has been planned at Mahenduriya, Kabra,Anjana, Sindesar Kalan, Rajpura along with 15 RO Water ATM's which will meet the safe drinking water requirement of surrounding villages.
17	PP shall run an awareness campaign on sanitation for women and utilization of Sanitary Napkin and also to distribute the Sanitary Napkin/pads to the women and provide the training for proper disposal.	We have collaborated with "Insaniyat Foundation" along with a college committee of Medical professional of Geetanjali Institute, who have conducted awareness camps in 4 surrounding villages covering more than 200 women and school female students. The same is under progress in other villages and sanitary napkins provided.
18	Implementation of Action Plan on the issues raised during the Public Hearing shall be ensured. The Project Proponent shall complete all the tasks as per the Action Plan submitted with budgetary provisions during the Public Hearing.	Actions are being taken as per action plan.
19	Implementation of the outcome of study with regard to "optimization of blast design parameter for the safety and stability of surface structures and subsequent monitoring of vibration on the surface structures for their long term stability" which was carried out by Central Institute of Mining and Fuel Research should be ensured.	Blast design Study by CSIR-CIMFR and implementation of outcomes are being ensured.

20	Continuous monitoring of radioactive elements, if any, shall be undertaken till entire mine is dewatered and report has to be submitted to MoEFCC Regional Office. Periodic monitoring of any adverse impact of Radon and its daughter products on any worker should be included in the Occupational Health Monitoring Programme.	Monitoring if radioactive elements is being ensured and Periodic monitoring of persons is also being done. The report of the same is being submitted along with half yearly compliance report. Copy of latest report is attached here as **Annexure-III.** .
B.	**Standard conditions.**	
1	A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment, Forest and Climate Change 5 years in advance of final mine closure for approval.	Now, Mine is in operation. Shall be ensured before closure.
2	No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment, Forest and Climate Change.	Work is being done as per Mine plan approved by IBM. No change is done
3	No change in the calendar plan including excavation, quantum of mineral and waste should be made.	No change is being done without prior approval.
4	The project proponent shall obtain necessary prior permission of the competent authorities for drawl of requisite quantity of water (surface water and ground water) for the project.	No ground water with drawl is being done. HZL has established STP to treat the sewage of Udaipur City and treated water from the same is main source of water for mining process and Also HZL has agreement with State government for Matrikundia Dam water. However, permission for 121 m3/day of inflow of water due to mining operation has been obtained from CGWB. Additional inflow of 110.5 m3/day is envisaged due to proposed expansion of the mine. Application for renewal of existing NOC of 121 m3 /day and for additional 110.5 m3/day has been submitted to CGWB in advance. CGWB officer visited site on 5th March 2020 for inspection. processing of the same is pending at CGWB. Request for issuing NOC is also submitted to CGWB.
5	Mining shall be carried out as per the provisions outlined in mining plan approved by Indian Bureau of Mines (IBM) as well as by abiding to the guidelines of Directorate General Mines Safety (DGMS).	Mining operations are being ensured as per mine plan approved by IBM and DGMS guidelines.

6	The lands which are not owned by Proponent, mining will be carried out only after obtaining the consents from all the concerned land owners as per the provisions of the Mineral Concession Rules, 1960 and MMDR Act, 1957.	The same will be ensured. At present mining is being ensured within specified and approved area.
7	Digital processing of the entire lease area using remote sensing technique shall be carried out regularly once in three years for monitoring land use pattern and report submitted to Ministry of Environment, Forest and Climate Change its Regional Office.	Digital mapping by remote sensing technique has been conducted. Report attached here as **annexure - IV**
8	The critical parameters as per the Notification 2009 such as PM10, PM2.5, NOx and SOx etc. 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, Forest and Climate Change shall also be referred in this regard for its compliance.	Our Mine is underground mine. However, All said parameters with peak particle velocity are being monitored. Zero discharge is maintained by Recycling in operations. All the Data as per The circular No. J- 20012/1/2006-IA. II (M) dated 27.05.2009 is being displayed on company website and Ambient Air Monitoring data of online monitoring stations is being displayed at main gate.
9	Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution and having high levels of PM1O and PM2.5 such as haul road, loading and unloading point and transfer points. Fugitive dust emissions from all the sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central Pollution Control Board in this regard. Monitoring of Ambient Air Quality to be carried out based on the Notification 2009, as amended from time to time by the Central Pollution Control Board.	3 nos. online monitoring stations installed at site results of the same are being displayed at the main gate. Apart from this Monthly AAQ monitoring from 5 locations from core and buffer zone is being done as per AAQ notification 2009. Water sprinkling on loading and unloading points, transfer points is being done. Permanent water sprinklers are provided at Crushers with venturi spray. Haul roads are being wetted through mobile water sprinkler. Conveyors are covered. Transfer points have dust control system. In addition to above, sprinkling of water though tanker with special reagent to suppress the dust on haul road areas by increasing moisture for settling of dust is being ensured.

10	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease by establishing a network of existing wells and constructing new piezometers during the mining operation. The project proponent shall ensure that no natural water course and/or water resources shall be obstructed due to any mining operations. The monitoring shall be carried out four times in a year pre- monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January) and the data thus collected may be sent regularly to Ministry of Environment, Forest and Climate Change and its Regional Office, Central Ground Water Authority and Regional Director, Central Ground Water Board.	Network has been established to monitor ground water table in and around the mines. monitoring of the same is being done and report is being submitted to CGWB. Reports are attached here **in annexure – V**.
11	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.	monitoring of the flow rate of the springs and perennial nallahs. No natural water bodies or streams flowing in and around village is disturbed. Network has been established to monitor ground water table in and around the mines and regular monitoring is being carried out. Water supply to some villages is being done. The same will be expanded during scarcity.
12	Regular monitoring of water quality upstream and downstream of water bodies shall be carried out and record of monitoring data should be maintained and submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office, Central Ground Water Authority, Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board.	Regular monitoring is carried out & reports are being submitted. **Refer annexure V**
13	Transportation of the minerals by road passing through the village shall not be allowed. A 'bypass' road should be constructed (say, leaving a gap of at least 200 meters) for the purpose of transportation of the minerals so that the Impact of sound, dust and accidents could be mitigated. The project proponent shall bear the cost towards the widening and strengthening of existing public road network in case the same is proposed to be used for the Project. No road movement should be allowed on existing village road network without appropriately increasing the carrying capacity of such roads.	Ore produced from the mines is being treated in Ore beneficiation plant available in the same premises. Necessary precautions are being taken care to minimise impact due to transportation of minerals. Avenue plantation in both sides of roads is developed and PUC certificates for all vehicles are being ensured. All transportation vehicles are covered by tarpaulin. Special safety trainings are being imparted to all drivers with reference to our HZLs internal safety standard “Vehicle and Driving Safety”. Water sprinkling is being done on the haul roads for dust suppression. Noise is being controlled by equipment designing stage. Widening of road outside mine area has been done.

14	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 light/night hours.	Majority of the mining operations are being done in day time. Illumination is being maintained as such way that there will not be any impact on surrounding villages. Mask lights are established accordingly. Monitoring of noise (Day/Night) is being done. Necessary precaution is taken during taken during equipment design stage to minimise the impact of noise. DG sets and other equipment's are ensured with Acoustic enclosure and others are located in closed shed to minimise the impact of noise in surrounding.
15	Main haulage road in the mine should be provided with permanent water sprinklers and other roads should be regularly wetted with water tankers fitted with sprinklers. The material transfer points should invariably be provided with Bag filters and or dry fogging system. In case of Belt- conveyors facilities the system should be fully covered to avoid air borne dust; Use of effective sprinkler system to suppress fugitive dust on haul roads and other transport roads shall be ensured.	Permanent water sprinklers are provided at Crushers and conveyors. Haul roads are being wetted through mobile water sprinkler. Conveyors are covered. Transfer points have dust control system. In addition to above, Also Successful trials have been taken to use *"Dustron"* the reagent suppress the dust on haul road areas by increasing moisture for settling of dust and found effective and started using the same. Plantation is done to minimise the impact of dust.
16	Sufficient number of Gullies to be provided for better management of water. Regular Monitoring of pH shall be included in the monitoring plan and report shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office on six monthly basis.	Our Mine is underground mine. Network of Drains and ponds are provided to collect surface run-off from dump and other areas in mine premises. It also avoids flow of sediments directly natural water bodies. Water is being recycled after necessary precaution of settling of silt material.
17	There shall be planning, developing and implementing facility of rainwater harvesting measures on long term basis and implementation of conservation measures to augment ground water resources in the area in consultation with Central Ground Water Board.	Deepening of village 18 village ponds has been done till date March 2020 in different phases. Which will improve water conservation by by creating additional volume of 3.88 lakh M3.
18	The Project Proponent has to take care of gullies formed on slopes. Dump mass should be consolidated with proper filling/levelling with the help of dozer/compactors.	Regular monitoring of slope stability of waste dump mass is being done. The waste dump consolidation is being done by compactor and dozer on regular basis. The Survey of waste dump is carried out regularly and records maintained. Drain with ponds are provided to collect water
19	The reclamation at waste dump sites shall be ecologically sustainable. Scientific reclamation shall be followed. The local species may be encouraged and species are SO chosen that the slope, bottom of the dumps and top of the dumps are able to sustain these species. The aspect of the dump is also a factor which regulates some climatic	At present waste dump is in active stage. Inactive waste dump will be reclaimed in scientific manner. Waste rock generated from mining is being used for filling of mine voids and also being used in construction

	parameters and allows only species adopted to that micro climate.	work of height raising in tailing dam. Waste remained during closure will be filled back in mine voids at the time of mine closure and scientific reclamation by plantation of suitable species will be ensured at waste dump.
20	The top soil, if any, 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. The over burden (OB) generated during the mining operations shall be stacked at earmarked dump site(s) only and it should not be kept active for a long period of time. The maximum height of the dumps shall not exceed 60m and width 20 m and overall slope of the dumps shall be maintained to 45°. The OB dumps should be scientifically vegetated with suitable native species to prevent erosion and surface run off. In critical areas, use of geo textiles shall be undertaken for stabilization of the dump. The entire excavated area shall be backfilled and afforested. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office on six monthly basis.	Being underground mine and is in operation. No top soil removal is envisaged. However necessary precautions will take care for the same. At present waste dump is in active stage. Prescribed height, width and angle is being maintained. Inactive waste dump will be reclaimed in scientific manner. Waste rock generated from mining is being used for filling of mine voids and. Waste remained during closure will be filled back in mine voids at the time of mine closure voids at the time of mine closure and scientific reclamation by plantation of suitable species will be ensured at waste dump.
21	Catch drains and siltation ponds of appropriate size shall be constructed around the mine working, mineral and OB dumps to prevent run off of water and flow of sediments directly into the river and other water bodies. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly. The drains, settling tanks and check dams of appropriate size, gradient and length shall be constructed both around the mine pit and over burden dumps to prevent run off of water and flow of sediments directly into the river and other water bodies 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 shall be constructed at the corners of the garland drains and desilted at regular intervals.	No natural watercourse is obstructed during mining operations. Catch drains for mine working and mineral dump provided to prevent water run-off and flow of sediments directly natural water bodies. Water is being recycled after necessary precaution of settling of silt material. Zero liquid discharge is being ensured.

22	Plantation shall be raised in a 7.5m wide green belt in the safety zone around the mining lease, backfilled and reclaimed area, around water body, along the roads etc. by planting the native species in consultation with the local DFO/Agriculture Department and as per CPCB Guidelines. The density of the trees should be around 2500 plants per ha. Greenbelt shall be developed all along the mine lease area in a phased manner and shall be completed within first five years.	Plantation of species as per guidance from DFO available areas. Considering Green belt in safety zone. Till date 79000 Nos plants have been planted. Further gap filling is being ensured in case of mortality.
23	Project Proponent shall follow the mitigation measures. provided in 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", if any, applicable to the project.	All the requirement of said office memorandum is already covered in various condition of this Environment Clearance letter. Accordingly, compliance status is also given for each condition.
24	The Project Proponent shall make necessary alternative arrangements, where required, in consultation with the State Government to provide alternate areas for livestock grazing, if any. In this context, Project Proponent should implement the directions of the Hon'ble Supreme Court with regard to acquiring grazing land. The sparse trees on such grazing ground, which provide mid-day shelter from the scorching sun, should be scrupulously guarded against felling and plantation of such trees should be promoted.	No livestock grazing or acquisition of grazing land is envisaged. Hence Not Applicable.
25	The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered fauna, if any, spotted in the study area. Action plan for conservation of flora and fauna shall be prepared and implemented in consultation with the State Forest and Wildlife Department. A copy of action plan shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office.	Conservation plan of Schedule-1 species has been submitted to DCF, Rajsamand on 09.01.2018. and then after as per on 07.02.2019 to CCF – wildlife office Udaipur and later on CWLWL at Jaipur. The same was submitted to regional office along with 1st EC compliance report in 2018. State forest Department has been made SOP recently. Accordingly, revised conservation plan has been made and submitted to DCF-Rajsamand on 26th May 2020.
26	As per the Company Act, the CSR cost should be 2 % of average net profit of last three years. Hence CSR expenses should be as per the Company Act/Rule for the Socio Economic Development of the neighbourhood Habitats which could be planned and executed by the Project Proponent more systematically based on the 'Need based door to door survey' by established Social Institutes/Workers. The report shall be submitted to the Ministry of Environment, Forest and Climate Change and Its Regional Office on six monthly basis.	Dedicated team is available at location to implement the CSR projects identified based on survey conducted by reputed organizations. Progress and quality of Implementation of the same is being is being verified in defined frequency by Agency appointed by corporate office.

		As per SOP of base line survey (Need based door to door) needs to be done every 3 years. Last survey was done in 2015. Latest survey was done in June/July 2018. Interim Report has been received. The survey has been done for the entire Group through "TARU" organization. The report will help in fine tuning/intervention covered through Major Projects.
27	The Ministry has issued a circular vide no. 22-65/2017-IA.III, dated 1st May2018 on Corporate Environment Responsibility (CER). Accordingly, PP shall comply the circular w.r.t. details of budget and its activities.	Noted and being complied with.
28	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.	As per our safety policy, we do not provide accommodation for housing at the site. The same is being provided away from the site by our projects contractors with all necessary infra structures. Also infrastructures like Bio-Toilets, safe drinking water and medical health care is being ensured at site.
29	Measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in operations of HEMM, etc. should be provided with ear plugs / muffs.	Necessary measures have been taken to control the noise levels below 85 dBA. All DGs are having acoustic enclosure. Other noise generating equipment's are placed in closed building in isolated. PPEs including ear plugs/muffs are provided to workers engaged in operations of HEMM, etc.
30	Industrial waste water (workshop and waste water from the mine) should be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May, 1993 and 31st December, 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluent.	Mine water is reused in operations. Oil and grease trap systems provided in workshop and water is being reused for further operations. Treatment and Quality of the same is being ensured as per prescribed standard.
31	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.	Job and area specific Training with necessary information to all employees is being imparted in regular intervals al and PPEs are also provided.
32	A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization.	Separate Environmental Management Cell is in place.
33	The funds earmarked for environmental protection measures should be kept in separate account and should not be diverted for other purpose. Year wise expenditure should be reported to the Ministry and its Regional Office.	Sufficient Fund is being allocated for Environment protection for every financial year and not been diverted for other purpose. Environmental Expenditure for year 2019-20 was Rs.1,27,39,126/-

34	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 expansion project, all approvals are in place.
35	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment, Forest and Climate Change, its Regional Office, Central Pollution Control Board and State Pollution Control Board.	Half yearly reports are being submitted regularly within prescribed time.
36	The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information / monitoring reports.	Noted for Compliance.
37	A copy of clearance letter will be marked to concerned Panchayat / local NGO, if any, from whom suggestion / representation has been received while processing the proposal.	Letter has been sent to local panchayat on 04 June 2018.
38	State Pollution Control Board should display a copy of the clearance letter at the Regional office, District Industry Centre and Collector's office/ Tehsildar's Office for 30 days.	Noted.
39	The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of the Ministry of Environment, Forest and Climate Change at www.environmentclearance.nic.inand a copy of the same should be forwarded to the Regional Office.	Published on 06.06.2018 in Rajasthan Patrika & Danik Bhaskar Rajsamand Edition. Copy of the same has been already submitted to MoEF&CC along half yearly EC compliance report.
16	The Ministry or any other competent authority may alter/modify the above conditions or stipulate any further condition in the interest of environment protection.	Noted.
17	Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of the Environment (Protection) Act, 1986.	Noted.

18	The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules made there under and also any other orders passed by the Hon'ble Supreme Court of India/ High Court of Rajasthan and any other Court of Law relating to the subject matter.	Noted.
19	Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Noted.

TEAM TEST HOUSE
(Unit of Team Institute of Science & Technology Pvt. Ltd.)

Approved by Ministry of Environment and Forest, Government of India as Environmental Laboratory

RSPCB **ISO 9001:2015** **OSHAS 18001:2007** **JDA/UDH**

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TEST REPORT

Report No. :	SKM/Mar/01	Date :	07-05-2020
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. - Dariba - 313211, Distt. Rajsamand (Rajasthan),	Type of Unit :	Mines
Type of Sample :	Ambient Air Quality Monitoring	Date of Sample Collection/Monitoring :	18-03-2020
Point of Collection :	Bamania Kalan Village (Residential Area) ($25^0$02.314'N, $074^0$09.309'E)	Date of Receipt :	21-03-2020
Date of Test/Analysis :	21-03-2020	Sampling Plan :	IS 5182:2000(Part 14)RA 2014
Quantity of Sample :	-	Sample Collected By :	Parsa Ram Kudi
Unit's representative :	Digamber Patil	Condition of Sample :	Fit for testing

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	220	IS 5182 (Part 10) : 1999 RA 2019	4000
2	Nitrogen Dioxide as NO2 [microgram/m3]	12.63	IS 5182 (Part 6) : 2006 Reaffirmed 2017	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	247.38	IS 5182 (Part 4) : 1999 RA 2019	-
4	Particulate Matter (PM2.5) [microgram/m3]	28.31	IS 5182 (Part 24)-2019	60.00
5	Sulphur Dioxide [microgram/m3]	5.26	IS 5182 (Part 2) : 2001 RA 2017	80.00
6	Particulate Matter (PM 10) [microgram/m3]	63.75	IS 5182 (Part 23)-2006 RA 2017	100.00

Notes :-

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The samples will be destroyed after 15 days from the date of issue of test report unless otherwise specified.

Puran Mal Yogi
Senior Analyst

Rajesh Maheshwari
Authorized Signatory

(Report No: SKM/Mar/01)

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TEST REPORT

Report No. :	SKM/Mar/02	Date :	07-05-2020
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. - Dariba - 313211, Distt. Rajsamand (Rajasthan),	Type of Unit :	Mines
Type of Sample :	Ambient Air Quality Monitoring	Date of Sample Collection/Monitoring :	18-03-2020
Point of Collection :	Sindesar Khurd Village (Residential Area) ($25^0$00.311'N, $74^0$08.372'E)	Date of Receipt :	21-03-2020
Date of Test/Analysis :	21-03-2020	Sampling Plan :	IS 5182:2000(Part 14)RA 2014
Quantity of Sample :	-	Sample Collected By :	Parsa Ram Kudi
Unit's representative :	Digamber Patil	Condition of Sample :	Fit for testing

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	240	IS 5182 (Part 10) : 1999 RA 2019	4000
2	Nitrogen Dioxide as NO2 [microgram/m3]	13.41	IS 5182 (Part 6) : 2006 Reaffirmed 2017	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	255.27	IS 5182 (Part 4) : 1999 RA 2019	-
4	Particulate Matter (PM2.5) [microgram/m3]	31.46	IS 5182 (Part 24)-2019	60.00
5	Sulphur Dioxide [microgram/m3]	6.37	IS 5182 (Part 2) : 2001 RA 2017	80.00
6	Particulate Matter (PM 10) [microgram/m3]	71.25	IS 5182 (Part 23)-2006 RA 2017	100.00

Notes :-

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TEST REPORT

Report No. :	SKM/Mar/03	Date :	07-05-2020
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. - Dariba - 313211, Distt. Rajsamand (Rajasthan),	Type of Unit :	Mines
Type of Sample :	Ambient Air Quality Monitoring	Date of Sample Collection/Monitoring :	18-03-2020
Point of Collection :	Rajpura Khurd Village (Residential Area) ($24^0$58.331'N, $74^0$07.746'E)	Date of Receipt :	21-03-2020
Date of Test/Analysis :	21-03-2020	Sampling Plan :	IS 5182:2000(Part 14)RA 2014
Quantity of Sample :	-	Sample Collected By :	Parsa Ram Kudi
Unit's representative :	Digamber Patil	Condition of Sample :	Fit for testing

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	250	IS 5182 (Part 10) : 1999 RA 2019	4000
2	Nitrogen Dioxide as NO2 [microgram/m3]	12.63	IS 5182 (Part 6) : 2006 Reaffirmed 2017	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	226.74	IS 5182 (Part 4) : 1999 RA 2019	-
4	Particulate Matter (PM2.5) [microgram/m3]	25.39	IS 5182 (Part 24)-2019	60.00
5	Sulphur Dioxide [microgram/m3]	6.17	IS 5182 (Part 2) : 2001 RA 2017	80.00
6	Particulate Matter (PM 10) [microgram/m3]	67.54	IS 5182 (Part 23)-2006 RA 2017	100.00

Notes :-

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TEST REPORT

Report No. :	SKM/Mar/04	Date :	07-05-2020
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. - Dariba - 313211, Distt. Rajsamand (Rajasthan),	Type of Unit :	Mines
Type of Sample :	Ambient Air Quality Monitoring	Date of Sample Collection/Monitoring :	19-03-2020
Point of Collection	Mine Area Boundary in NE Direction (Industrial Area) ($25^0$00.381'N, $74^0$08.804'E	Date of Receipt :	21-03-2020
Date of Test/Analysis :	21-03-2020	Sampling Plan :	IS 5182:2000(Part 14)RA 2014
Quantity of Sample :	-	Sample Collected By :	Parsa Ram Kudi
Unit's representative :	Digamber Patil	Condition of Sample :	Fit for testing

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	340	IS 5182 (Part 10) : 1999 RA 2019	4000
2	Nitrogen Dioxide as NO2 [microgram/m3]	17.81	IS 5182 (Part 6) : 2006 Reaffirmed 2017	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	314.45	IS 5182 (Part 4) : 1999 RA 2019	-
4	Particulate Matter (PM2.5) [microgram/m3]	38.19	IS 5182 (Part 24)-2019	60.00
5	Sulphur Dioxide [microgram/m3]	7.85	IS 5182 (Part 2) : 2001 RA 2017	80.00
6	Particulate Matter (PM 10) [microgram/m3]	83.42	IS 5182 (Part 23)-2006 RA 2017	100.00

Notes :-

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TEST REPORT

Report No. :	SKM/Mar/05	Date :	07-05-2020
Issued To :	M/S Hindustan Zinc Limited (Sindesar Khurd Mines) P.O. - Dariba - 313211, Distt. Rajsamand (Rajasthan),	Type of Unit :	Mines
Type of Sample :	Ambient Air Quality Monitoring	Date of Sample Collection/Monitoring :	19-03-2020
Point of Collection	Near Encline Area (Industrial Area) (25^{0}00.118'N, 74^{0}08.710'E	Date of Receipt :	21-03-2020
Date of Test/Analysis :	21-03-2020	Sampling Plan :	IS 5182:2000(Part 14)RA 2014
Quantity of Sample :	-	Sample Collected By :	Parsa Ram Kudi
Unit's representative :	Digamber Patil	Condition of Sample :	Fit for testing

RESULTS

S.No	Parameters	Observed Value	Testing Protocol	Limits as per National Ambient Air Quality Standard, 2009
1	Carbon Monoxide [microgram/m3]	370	IS 5182 (Part 10) : 1999 RA 2019	4000
2	Nitrogen Dioxide as NO2 [microgram/m3]	18.52	IS 5182 (Part 6) : 2006 Reaffirmed 2017	80.00
3	Suspended Particulate Matter (SPM) [microgram/m3]	323.61	IS 5182 (Part 4) : 1999 RA 2019	-
4	Particulate Matter (PM2.5) [microgram/m3]	42.36	IS 5182 (Part 24)-2019	60.00
5	Sulphur Dioxide [microgram/m3]	7.91	IS 5182 (Part 2) : 2001 RA 2017	80.00
6	Particulate Matter (PM 10) [microgram/m3]	85.27	IS 5182 (Part 23)-2006 RA 2017	100.00

Notes :-

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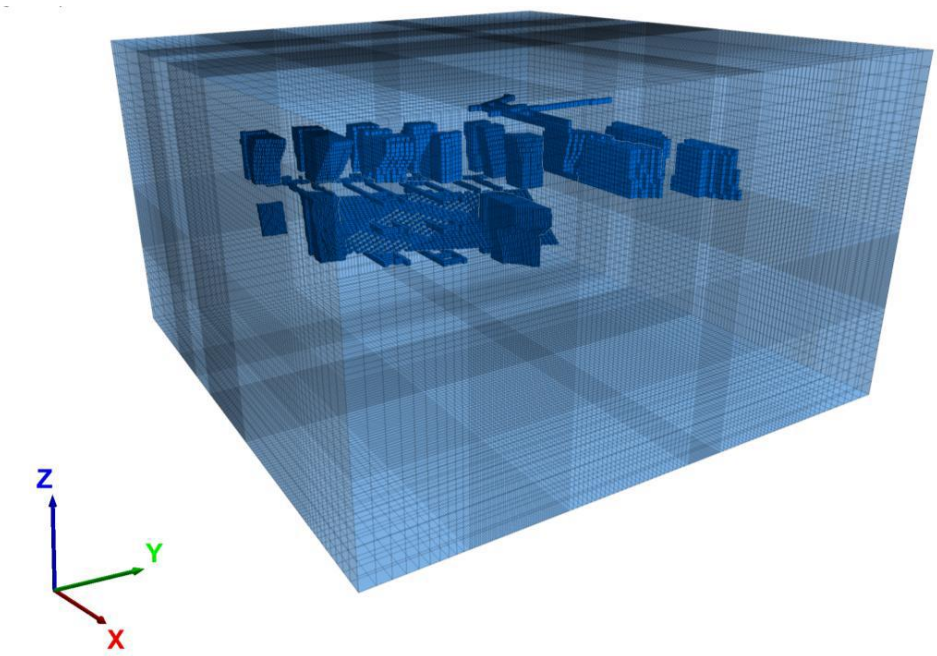
4th Visit Report –18-20 July, 2019, SK Mines, HZL

Part of (PO No.: GNFA/934 / 5100023096 Date:01.06.2018)



July 2019

4th Visit Report –18-20 July, 2019, SK Mines, HZL

Part of (PO No.: GNFA/934 / 5100023096 Date:01.06.2018)

By

Dr. John Loui Porathur	**Sr. Principal Scientist**
Dr. (Mrs.) Chandrani P. Verma	**Principal Scientist**
Dr. J.C. Jhanwar	**Chief Scientist**
Dr. A. K. Soni	**Chief Scientist**
Dr. P. K. Singh	**Director**

(Dr. John Loui Porathur)

July 2019

1.0 FIELD VISIT

A visit was made to SK mines from 18/07/2019 to 20/07/2019. Following areas were visited in underground mines with Mr. S. Dutta, Advisor Rock Mechanics, Mr. Ashok Godugu, Head, Geotech and Mr. Pradeep Kumar, Geotech Dept.

290 mRL

1. Crown mining proposed area
2. P9 and P8

160 mRL

AS-7 AP8 south X cut

100 mRL

1. CS01B stoping
2. Hanging wall portion mined
3. CP01B stoping H/W side completed
4. A large oblique northerly dipping fault plane extending fully in the stope.

2.0 OBSERVATIONS, DISCUSSIONS AND RECOMMENDATIONS

Observations from the field visit and the various issues that were discussed before and after the field visit.

As the fall of ground (FOG) cases increased, the mine management should take atmost care in loose dressing of the old developed areas where persons are working. Such areas should be rehabilitated. Erecting of wire mesh and rebolting in the same area should be done.

The exceptionaly high readings are obtaining from the Earth Pressure Cells fixed to monitor the stress acting on the barricades in some paste filled stopes. The primary conclusion regarding this is that the EPCs are fixed on wooden planks, which causes swelling of the planks as water comes in contact with it. To solve this issue water resistant blocks such as MPVC (Microcellular Polyvinyl Chloride) planks can be used as substitute for wooden planks. Also piezometers for testing the pore pressure may be employed in some barricades for testing the stress due to water.

Care should be taken to reduce the standup time of the stope voids, especially in the C-Block stopes. C-Block secondary stopes are to be extracted part by part by vertically splitting along the strike direction.

3.0 GCMP AUDIT OF SINDESHAR KHURD MINE OF HZL

The observation sheet during the underground visit is as given in Table 1.

Table 1: Observation sheet during GCMP audit of CIMFR in July 2019

Geotechnical Audit Observation Sheet			
Date/ shift: 19 July 2019, general shift			**Observed By: Dr. John Loui Porathur & Mr. Sreenath Sekhar, CSIR-CIMFR**
Location: 290 mRL- P9& S8, 160 mRL- AS7/AP8 South crosscut, 100 mRL- CS01B			
S. No	**To Be Checked In UG**	**Details**	**Remark**
1	The distance of rock bolts from face	rock bolting done after every round of blasting	sequence (3-3.5m) maintained
2	Ground water Condition	mostly dry. Water logging in f/w drives and junctions	ground water management needs improvement
3	Drive axis orientation w.r.t major foliation/ joints sets	As per the designed orientation	In C-Block it was recommended earlier to develop from the western side. Western wall development not yet done.
4	Drive size/section	10% increase generally	At sheared areas the height is more due to the loose formation.
5	Standard bolting Pattern	In general, the primary bolting pattern is good and as per SSR	After further loose dressing, replacement bolting & wire meshing need improvement.
6	Gaps in actual bolting pattern	no gaps found in primary bolting	
7	Rock Bolt Length	as per standards	
8	R.B Grouting	As per standards	
9	Bearing Plate & it's tensioning	As per standards	
10	Scaling quality	Needs improvement	
11	Loose rock found	Occasionally in the roof. More at junction sides & corners	C-Block area has more loose formation. Wire meshing and at places shotcreting required at

			sheared regions
12	Size of loose rock	10cm to 30 cm	
13	Rock bolts drilled as per SSR	As per SSR in primary bolting	
15	Cable bolting	Very good (new mechanization in practice)	C-Block eastern wall require cable bolting to strengthen GMS rock mass
16	Wire mesh	Loose Wire mesh in side and roof. (down to head level)	Wire mesh securing to be done properly & loose ends to be bolted.
17	Wire mesh quality	As per standards (testing of strands done)	An arrangement for wire mesh testing to be developed at site in the future.
18	Socket plug	Not observed	
19	Presence of loose bar	Not observed	
20	Bottom holes	Not observed	
21	Modification in support pattern (R/NR)	wire meshing in roadways / Wire meshing + shotcrete in the weak rock mass, shear plane, fault plane, etc.	
22	Instrumentation and maintaining	BHX, stress cells & EPCs installed and readings taken regularly	Stress cells are to be oriented properly to get across the strike horizontal stress reading. Water accumulation needs to be checked for backfilling over fallen and muck-filled areas. Drain holes to be drilled to reduce water accumulation in the stopes. EPCs require live reading while plug pouring.
23	Detailed remarks (Conclusion)	More elaborate testing of pastefill for post-failure strength is needed to mine below pastefill with greater confidence. Geotechnical mapping is required on a regular basis. UCS testing of rock and re-estimation of RMR for different rock types present is required in C-Block areas. Mass blasting needs to be avoided in C-Block as the ground is weaker. Cable bolting of the eastern side GMS rock mass and the stope back is needed to strengthen the ground. Ground support, especially for secondary supporting (rehabilitation), requires a dedicated crew for loose dressing, additional bolting, fresh wire meshing, removal of loose old wire mesh, shotcreting at places, etc. In the foliated ground, Junction corners are getting loosened, side bolting with wire mesh and shotcrete needed. Wire meshing should be made as a regular practice in all roadways as the roadways are ≥ 5.0 height 2 rows of side bolting to be done, shotcreting in the loose, weak, sheared ground. Surface monitoring to be done over stoped out areas in shallow cover; the water tank to be regularly inspected for cracks; surface dumps to be maintained, safety barriers to be constructed against haulage roads.	

The score sheet of ground control audit done during this visit in July 2019 by CIMFR is as given in Table 2.

Table 2: Score sheet of Ground control audit July 2019

Ground Control Review by CIMFR- Score Card - July 2019- SK MINE							
Sl No.	**Category**	**Sub-weightage**	**Weightage**	**Non existence (0)**	**Partial compliance (50%)**	**Cent percent compliance (100%)**	**Remarks**
1	**Organisation**		**10%**				
1.1	Appointment of responsible person	2%				2	New HOD is appointed
1.2	Organization chart of geotech person	2%			1.5		Available, but more persons required
1.3	Experience & qualification	6%				6	Specialized training done for young engineers
2	**Systems & implementation**		**50%**				
2.1	Approved GCMP (Geology, Geotech domain, QA/QC of support Standards, SOPs, Roles & responsibilities) & its implementation	10%			5		Proper standoff distance, development through western wall needed, stoping parameters, revision of SSR should be incorporated
2.2	Approved SSR & implementation	5%			3		Needs approval from inspectorate
2.3	Hazard I dentification and Risk Analysis	5%			3		Present, but needs improvement
2.4	Mine Planning, Designing & working as per the design	8%			4		Designing done, but some changes during practice
2.4.1	Geological and Geotechnical Mapping	4%			2		Lag in mapping, major structured to be mapped and shown in plans, etc.
2.4.2	Stoping Parameters depending upon local/global stability aspects	3%		1			The mine should adapt to changing geotech conditions
2.4.3	Numerical Modelling for validation	4%				3	Numerical modelling done; but needs to follow in practice
2.4.4	In-situ stress measurement	4%				3.5	done by Messy, one more measurement needed for D Block bottom areas
2.5	FOG Register- Near Miss Investigation	4%				3.5	FOG register found working
2.6	Inventory of Ground Control Material	3%			2		Maintained
3	**Training & Awareness**		**15%**				
3.1	Ground control training (Basic, advance course, certification, refresher)	5%			3		Ground control personels are trained; Certification course not done
3.2	Workmen / operators	5%				4	Done
3.3	Supervisors & Engineers	5%				5	Done
4	**Resources**		**15%**				
4.1	Manpower	3%			1.5		Departmental manpower available; may require few more trained personel
4.2	Mechanisation/Conventional	3%				3	Mechanisation
4.3	Check sheet/ record books - prestart book, log book	3%			1.5		Checklist is not in practice
4.5	Instrumentation - Stress measurement, MPBs,	3%			1.5		Present; readings of EPCs should be done during pouring; charts to be made handy for critical stoppings, EPC installation needs improvement
4.6	Softwares - 3D modeling/ 2D modeling	3%			1.5		softwares available, Inhouse modelling not in practice
5	**Audit & Peer review**		**10%**				
5.1	Internal	5%				5	Done
5.2	External	5%				5	Done by CIMFR
		100.00%	**100%**			**70.5**	

4.0 INCIDENTS REPORTED IN LAST 4 MONTHS

The incidents related to ground control reported in the last 4 months are briefly described below the table.

Table 3: Ground control record from April 2019 to July 2019

GROUND CONTROL RECORDS OF S.K MINE							
"Fall of Ground" is a failure within the ground control system such that an unplanned or unexpected movement of ground occurs which affects safety, has the potential to affect safety, affects or potentials affects production or has a business impact.'							
DATE	*SECTION*	*LOCATION*	*Location of FOG*	*INCIDENT DESCRIPTION*	*CATEGORY*	*MECHANISM*	*REMEDIAL ACTION*
10-07-2019	Lower	At 130mRL BS03	Back	In 130mRL bs03 while I am going to checking for A shift blast status on extreme hangwall drill drive, piece of rock fallen near me in drill drive area.no injured.	FOG	Scats	60 m Radius to be Scaled after Every production Blast. If Abnormal Sound coming from Strata Sufficent time Should be given For Strata Relaxatition.
09-07-2019	Lower	At 30mRL CP01	Crown	In A shift on 8 July . when VRM crew doing there job for measurement suddenly a one piece of rock fall down from roof . immediately remove the man power from site until the condition was not safe. no any injury was happened .	FOG	Relaxation	60 m Radius to be Scaled after Every production Blast. If Abnormal Sound coming from Strata Sufficent time Should be given For Strata Relaxatition.
09-07-2019	Upper	At Ramp between X -over 3 & 4	Roof	While the mechanic EDWIN come out from the below ground by RBO 14 Through the north ramp between cross over 3 and 4 . one rock fall down from roof but nothing happened any injury or damages.	FOG	Scats	Regular check Scale to be done
08-07-2019	Upper	At Ramp between X -over 2 & 3	Roof	TCL Supervisor was coming to surface in Scissor lift no-02. Near the Bypass No-03 in north ramp a chunk of loose fall in front of the Scissor lift about 5-6 meter ahead. They escaped by fraction of seconds. No injury.	FOG	Scats	Regular check Scale to be done
08-07-2019	Lower	At 130mRL BS04	Roof	In 130 BS04 main cross cut near Footwall Junction Mining Mate was standing and a LPDT passed by tearing the ducting hanging in roof. By the ducting pull some pieces of stone fall on ground and a SANDVIK Mechanic was coming just behind it. The stone fall near the SANDVIK Mechanic. NO injuries.	FOG	Scats	Regular check Scale to be done
09-07-2019	Lower	At 100mRL near loading point	Side wall	LPDT 612, 615 & 608 were waiting for loading. Meanwhile LHD come in front so the LPDT -612 took reverse to give side. There a ducting was loose hanging and duct's one end was laying on floor. The LPDT 612 run over the ducting causing the remaining part of ducting to tear and fall on ground. Due to pull of ducting some loose dislodged from roof and fall on ground. At time of loose fall the TCL Supervisor was standing in man hole near to it. No injury.	FOG	Scats	Regular check Scale to be done
08-07-2019	Lower	At 130mRL BS04	roof	In 130 mRL BS04 in front of the central drive ducting was installed and above it wire mesh was hanged in roof but it was not pinned also loose present in wire mesh. While repositioning the ducting the wire mesh opened up and loose underneath it fall near the supervisor about 5m ahead. No injury.	FOG	Support	Wire mesh Never be installed manually, and it should be Properly Tensioned and overlapped As per SSR.
08-07-2019	Lower	At 130mRL	Side wall	At 130 MRL near solo -5 was running there was too much loose, when sandvik person was going to attend machine a small loose fall just behind him.	FOG	Support	Regular check Scale to be done. No person were allow to go under unscreened Ground.
27-06-2019	Lower	At 160mRL North Ramp	Open Stope	on 23-jun-2019 in B - shift In 160 mRL north ramp entrance right side raise. The worker standing infront of raise for checking of panel lowering work from 190 mRL when people are working at 190 mrl raise suddenly the loose rock falled from raise and gone through besides the worker. when rock sound heard the worker quickly escaped.	FOG	Scats	Regular check Scale to be done
22-06-2019	Lower	At 130 mRL BS03	Crown	In 130 BS03 TCL VRM engineer was checking the blasting cable a small size loose fall down in hang wall side near the engineer. No injury.	FOG	Scats	Areato be Properly Scaled Before Start of Rock bolt Drilling & grouting.
19-06-2019	Lower	At 65mRL BS04 Open Stope	Brow	I was gone to inspect the 65 BS 4 stope when I was standing in the south crosscut then a loose fall took place in the brow and the loose broken in the pieces and one of the small pieces fly towards me and fall around 2m far from me. As I was back side the no go line and was keeping safe distance from the brow so Injuries took place in this near miss.	FOG	Failure in open Stope	no one allow to go beyond the NO go line. There Should be A muck burned before entrance of Man near Brow area.
17-06-2019	Lower	At 190mRL AP15 Brow area	Brow	The water canon was doing water sprinkling in 190 mRL AP15 brow. While doing so the water tanker operator noticed a loose cracked in the roof (left side). so he took reverse, mean while a small chunk of loose dislodged and fall near the operator cabin.no injury.	FOG	Scats	60 m Radius to be Scaled after Every production Blast.
13-06-2019	Lower	At 130mRL Main Drive	Roof	At 130 MRL,North Ramp near the phone area, loose rock fall had occurred on the main ramp where IP was walking on the ramp to phone. Also, a big bolder is hanging on roof. Immediately informed to the mining mate and it is also discussed in Morning War Room Meeting	FOG	Slabbing & Relaxation	60 m Radius to be Scaled after Every production Blast.
04-06-2019	Upper	At 290mRL 6P04 II x cut	Side wall	Observed a small rock fell just near the jumbo hose connector while operator was busy inserting the rock bolt at 290 mrl -6p4-2nd x cut . but no damage or injury was noticed .	FOG	Scats	Areato be Properly Scaled Before Start of Rock bolt Drilling & grouting.
02-05-2019	Lower	At 30mRL Main Drive	Roof	Jumbo operator was retreating Jumbo RDL04 from main drive after scaling, at around 6.40 AM face blast was done in another area due to which small loose fall from the scaled portion was observed.	FOG	Blast induced Fracture	Regular check Scale to be done
13-05-2019	Lower	At 30mRL CP02 N x cut	Roof	Ashoka crew was cutting small pieces of wiremesh for roof drilling in 30/cp2/north xcut suddenly small piece fallen near to one person. no injury took place.	FOG	Scats	Area need to be scaled before Start of Up hole Drilling.
16-04-2019	Lower	At 15mRL BS-04 N X Cut	Roof	At 1:10pm, While drilling for barricade reinforcement in 15mRL BS-04 north X-CUT, small piece of loose fallen down near the working person. No injury occurred.	FOG	Blast induced Fracture	Area to be properly Scaled and Wire meshed.
26-04-2019	Lower	At 30mRL N Raise	Roof	At 30 mRL exhaust raise at north a loose fall was identified from the wedge which got dislodged of size around 1m3 during blasting time. It was blasting time. No people were present in the area soon the area was fenced.	FOG	Wedge in Roof	Area should be Supported with Rock bolt & Cable bolt

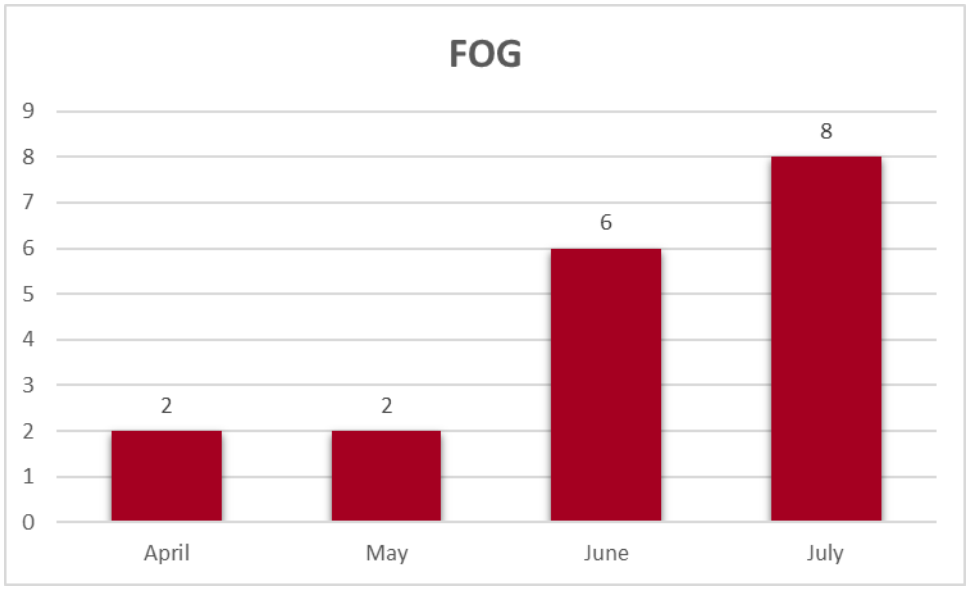


Figure 1: Graph showing the number of FOG incidents per month from April 2019 to July 2019

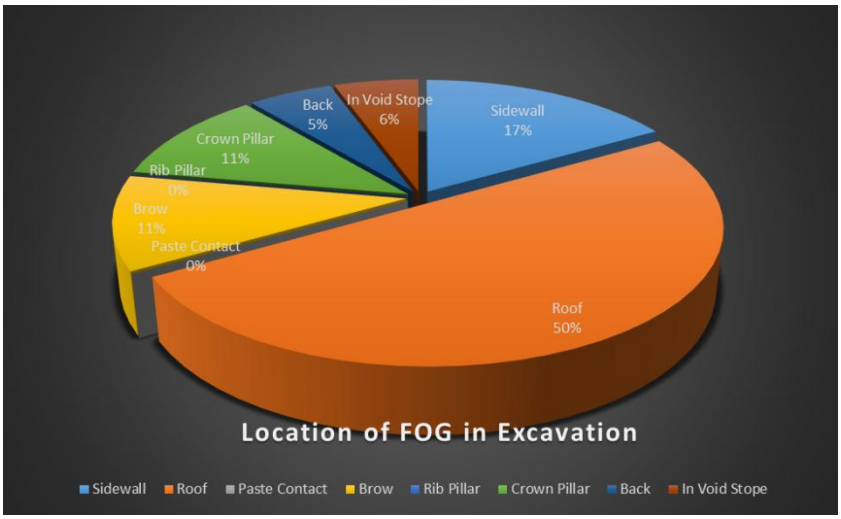


Figure 2: Pie chart showing distribution of FOG incidents in excavation

From the above observations, the FOG incidents has increased in the recent past. Hence the mine management should take adequate precautions to reduce the FOG by improved supporting, especially in older developments. The earlier developed roadways and decline sections are to be rehabilitated to ensure safety of personnel working in such areas.

5.0 INSTRUMENTATION

A part LVS showing the latest instrument location in S K Mine is shown in Figure 1. The instrument readings are analysed for any high stress or movements.

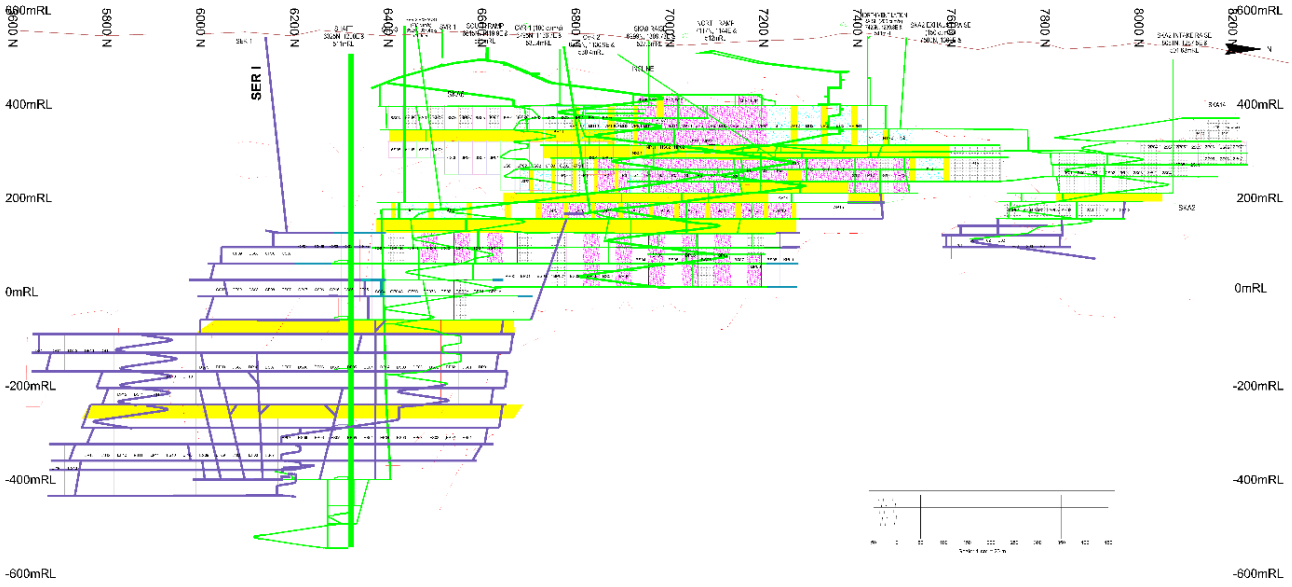


Figure 3: LVS of Sindesar Khurd Mine

5.1 Stress meter readings

The stress meters installed did not show any significant stress build up. Some stress cell readings recorded fall in stress as given in the figures below.

Table 4: Stress meter reading from BS03 PILLAR (130 mRL)

Stress Meter	**BS03 PILLAR (130 Mrl)(no. 18)**		
VWSM No	1639010		
Orientation	UP-DOWN		
Date of installation	19.01.2019		
Hole Length(m)		(BQ=8.50 + Ex=3.80)	
Inclination of Hole (degrees)	0		
Postion of stress Meter(m)			
Load given for wedge setting			
Initial reading, reading before installation	A		microseconds
	F		Hz
Reading after installation	A		microseconds

	F		Hz
Elastic modulus of rock mass (psi)	5000000		
1Psi	0.07030696	Kg/cm2	0.07

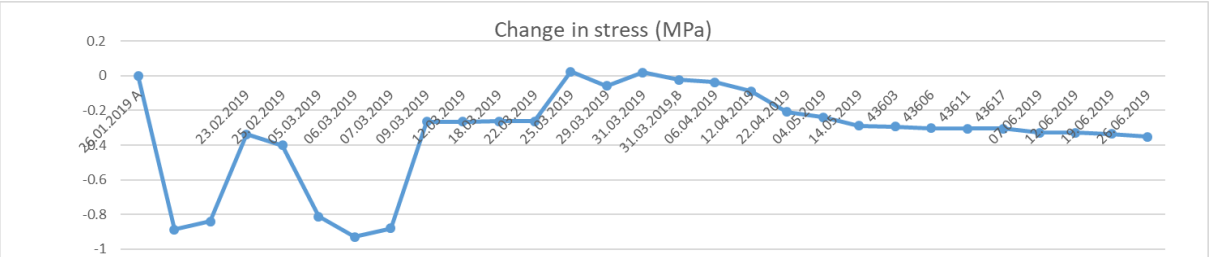


Figure 4: Stress cell readings in BS03 PILLAR (130 mRL)

Table 5: Stress meter reading from CP01A (30 mRL)

Stress Meter	**30 mRL CP01A(no.22)**		
VWSM No	1639003		
Orientation	east-west		
Date of installation	22.03.2019		
Hole Length(m)	7.4	(AW=6.40 + Ex=1.00)	
Inclination of Hole (degrees)	0		
Postion of stress Meter(m)	6.8		
Load given for wedge setting			
Initial reading, reading before installation	A		microseconds
	F		Hz
Reading after installation	A	298.487	microseconds
	F	10787.243	Hz
Elastic modulus of rock mass (psi)	5000000		
1Psi	0.07030696	Kg/cm2	0.07

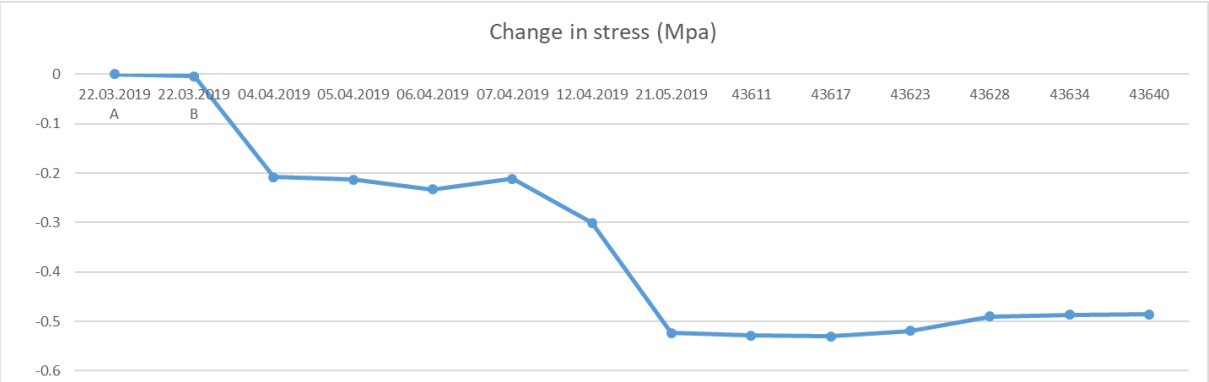


Figure 5: Stress cell readings in CP01A (30 mRL)

Table 6: Stress meter reading from 6P01A Pillar (325 mRL)

Stress Meter	**6P01 PILLAR (325mRL) (no.16)**		
VWSM No			
Orientation	Up-Down		
Date of installation	08.01.2019		
Hole Length(m)	12.3	(BQ =8.50+Ex=3.80)	
Inclination of Hole (degrees)	0		
Postion of stress Meter(m)	11.60 M from collar		
Load given for wedge setting			
Initial reading, reading before installation	A	340.795	microseconds
	F	8601.98	Hz
Reading after installation	A	291.395	microseconds
	F	11788.76	Hz
Elastic modulus of rock mass (psi)	5000000		
1Psi	0.07030696	Kg/cm2	0.07

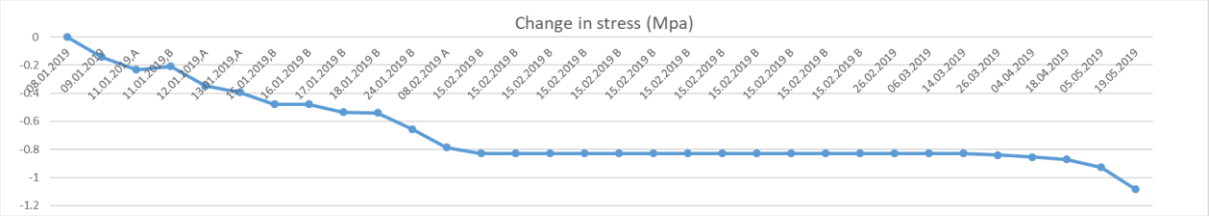


Figure 6**:** Stress cell readings in 6P01A Pillar (325 mRL)

5.2 Multipoint bore hole extensometer

In stopes, the anchors were lost after some movement indicating fall of ground in the footwall side. In other areas, very nominal readings were obtained in the multi-point extensometers with no loss of anchors recorded so far. The ground conditions are found to be good in those regions.

Table 7: Details of MPBEx at 65 CP02

Nomenclature	65 CP02
Hole length (mtr)	29
Hole plug at (mtr)	-
Dip	
Installation date	24.03.2019
Section	

Anchor number	Length of Anchor
1	25
2	22
3	20
4	15
5	10
6	2

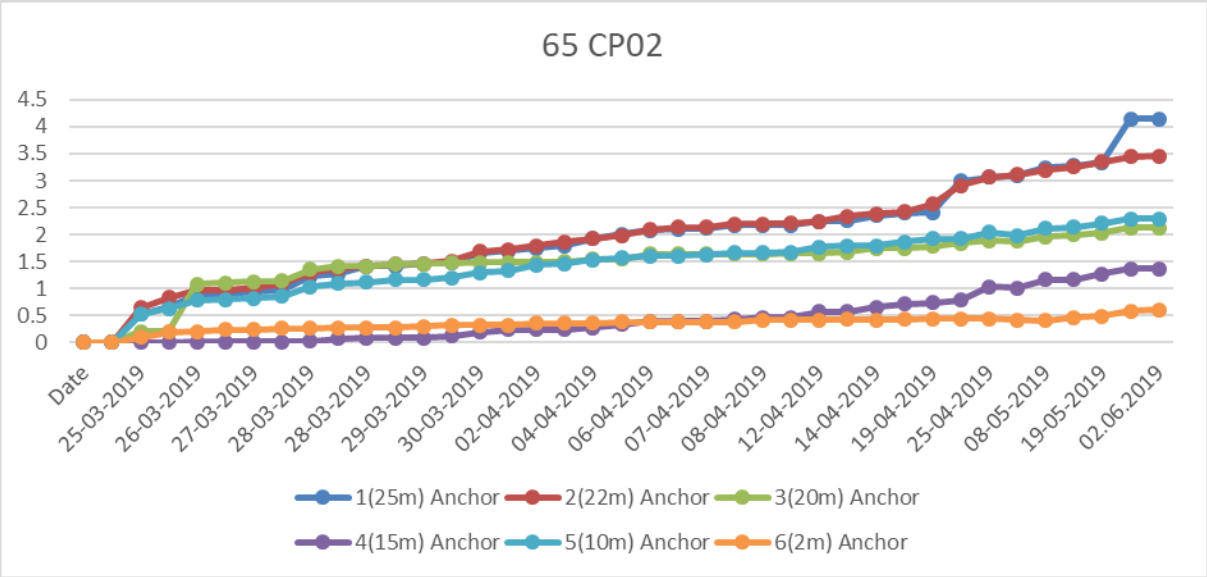


Figure 7: MPEx readings at 65 CP02

Table 8: Details of MPBEx at 160 AS07 CENTER

Nomenclature	160 AS07 CENTER
Hole length (mtr)	
Hole plug at (mtr)	-
Dip	90°
Installation date	20-04-2019
Section	
Anchor number	Length of Anchor
1	20
2	18
3	15
4	14
5	10
6	2

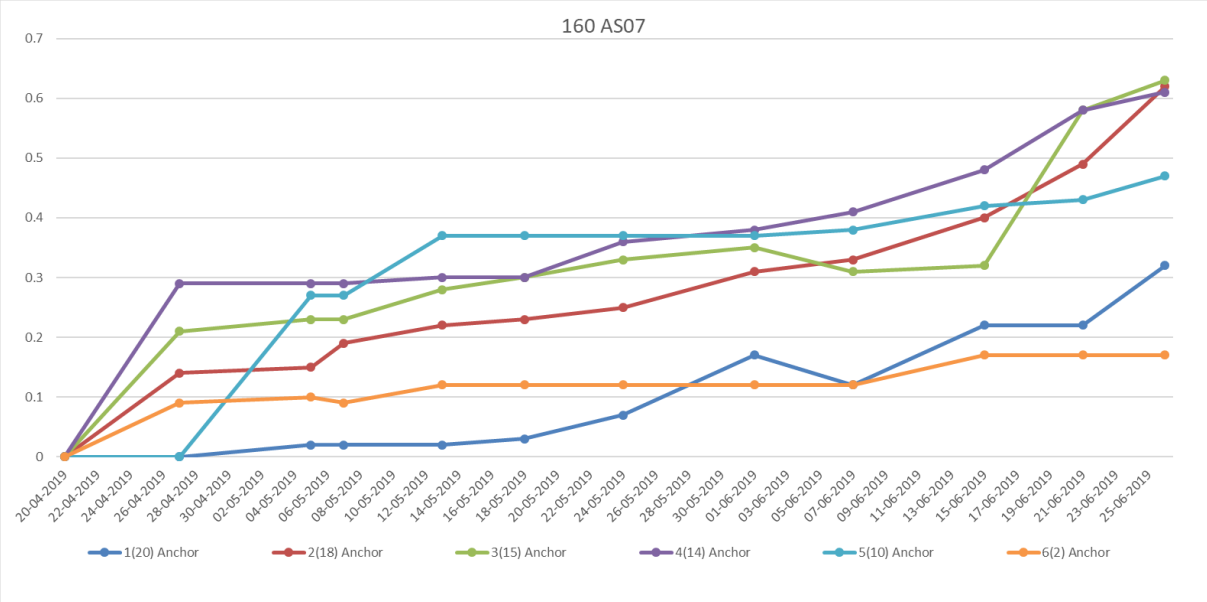


Figure 8: MPEx readings at 160 AS07 CENTER

Table 9: Details of MPBEx at 30 CP01A FW

Nomenclature	30 CP01A FW
Hole length (mtr)	21m
Hole plug at (mtr)	21m
Dip	
Installation date	27.05.2019
Section	
Anchor number	Length of Anchor
1	20
2	18
3	15
4	12
5	10
6	2

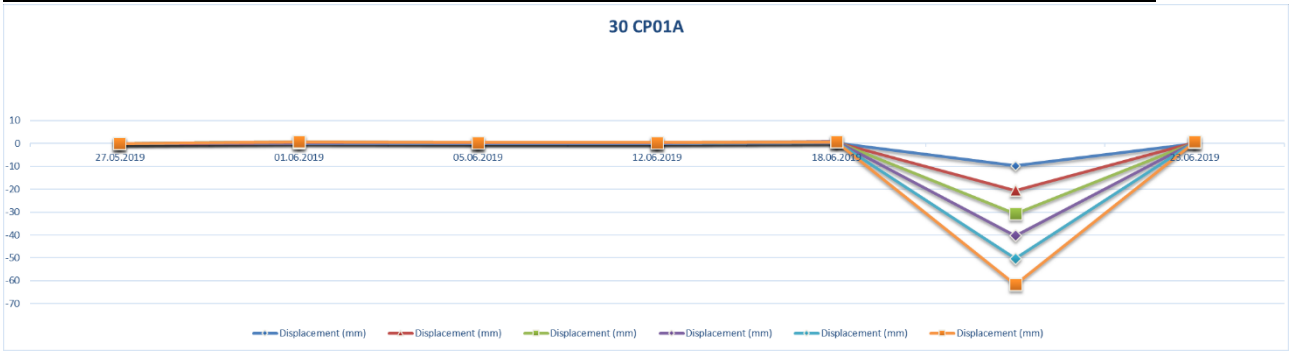


Figure 9: MPEx readings at 30 CP01A FW

6.0 NUMERICAL MODELLING & DESIGN DONE AFTER 3rd VISIT

The numerical modelling studies undertaken in the previous quarter at CIMFR are as listed below.

6.1 Stability of lower level stopes 6P02L, 6P07L and 6P08L at 250-325 mRL in SK-A6 lens of Sindeshar Khurd Mine, HZL

The auxiliary lens SK-A6 is being extracted below 400 mRL. The top-level primary stopes are almost completely extracted between 350 mRL and 400 mRL, with the secondary stopes standing as support pillars. The mine management is currently planning to extract below 325 mRL after leaving a crown pillar between 325 mRL and 350 mRL. Three primary stopes have been identified currently, viz 6P02L, 6P07L, and 6P08L. Three-dimensional numerical modelling has been conducted to study the feasibility of extracting these stopes below worked out upper level stopes and to asses the adequacy of the crown pillar between 325 and 350 mRL.

From the numerical modelling studies crown pillar between 325 mRL and 350 mRL shows good stability and is adequate for separating the top stopes from the lower level stopes. Rock mass yielding is anticipated to take place in the horizontal parting, the waste patch within the stopes, especially in 6P02L and 6P07L. Hence it will be prudent to extract these stopes in sequence, after back filling the hanging wall potion prior to extracting the footwall side. The fault plane may have only localized effect on the stability of the stopes. However, care should be taken while blasting the rings to ensure no premature collapse would take place. The modeling has been done based on the rock mass properties and the stope geometry supplied by the mine management. If any significant changes in the site conditions are encountered during development and stoping, adequate arrangements/precautions needs to

be done by the mine management. The 6P02L stope has a larger width with a waste patch separating the hanging wall side from the foot wall portion. If any major shear/fault plane is found passing through the stope, the stope may be extracted in 2 or 3 sequences by back filling each sequence. This is to avoid shear/fault planes getting exposed fully. The stope back should be cable bolted from the top-level ore drives and cross cuts. The sheared portions may also require cable bolting as practically as possible. The development roadways at the shear/weakness planes require wire meshing and shotcreting. The blast vibrations should be monitored on the surface especially near the water tank and the other surface installations. Ground subsidence should also be monitored over the proposed stopes.

6.2 Extraction starategy for C-block, sindeshar Khurd mine, hzl part 2: secondary stopes

The rock mass in the C block are weaker as compared to the B block and other upper level blocks. There is presence of sheared zones and graphite mica schist (GMS) in the footfall contact portion. Further the orebody (Dolomite) also has more frequent joints, which tend to separate during stoping. The ore body also has taken a reverse turn, making the footwall its geological hanging wall. These above adverse geological conditions led to the collapse of a primary stope at the footwall side (eastern side), viz CP03A. There are a few other primary stopes yet to be extracted in C-Block. The study is an addendum to the part 1 for C-Block stoping, in which a method for extracting the secondary stopes in C block (Part 2) is suggested using 3D numerical modelling. Based on the study following conclusions and recommendations were made.

1. The stability of the secondary stopes indicates that the secondary stopes are in partially yielded state prior to its extraction. Extractions can be done in yielded rock conditions, but the size of the excavation and the stand up time need to be reduced as much as practically possible. Hence it will be better to split the secondary stopes in 2 or 3 parts while extracting.

2. Due to the reverse gradient, it will also be prudent to make the access from the western side (geological footwall) for secondary stoping. However this may not be compulsory, if the stoping geometry towards the eastern wall can be modified to make it vertical so as to neutralise the reverse dip effect.

3. Each secondary stope may have to be extracted in parts by backfilling, as its size is quite large to be extracted at a time for the weaker rock mass and high induced stresses acting in the area.

4. During the extraction cycles it is good if the stopes has support from the bottom and it remain attached to the footwall. It is better to avoid under-cutting, instead side slashing of rings will be preferable.

5. If the orebody/stoping width is greater than 30 m (in any of the levels), the stope may be extracted in 3 parts with backfilling after each stage, as given in Fig. 9. The hanging wall side (eastern wall side, with weaker rock mass GMS) shall be extracted in two sub parts by restricting the strike length to not more than 20m. The footwall side (western side) may be extracted in one go. Two sub-levels may be extracted simultaneously with a lag of not more than 2 rings to avoid undercutting.

6. The pastefill wall between the eastern side blocks (stage 1 and 2) and western side block (stage 3) may be kept vertical to avoid dilution from pastefill.

7. If the orebody width is not more than 30m, it may be extracted in 2 stages, by splitting in the strike length to a 20m:15m split or in equal parts. The second split in both these cases may be extracted in a transverse manner through a single cross-cut.

8. In some secondary stopes, due to overbreak during primary stoping, the remaining portion may be reduced to 20~25 m. In this case the remaining portion may be extracted in transverse manner with one cross cut covering a width of about 20 m. Here also if the orebody width is greater than 30 m, the stope shall be extracted in two stages with backfilling from eastern side to western side.

9. It is preferred to leave a skin of about 3.0 m against the weak GMS rock mass at the eastern wall during Stage 1 and 2.

10. It is further recommended to cable bolt the wall rocks, especially in GMS rock type to further strength the footwall/hanging wall.

11. The footwall needs to be monitored using MPBX installed from the footwall drive or X-cuts.

12. The mine management should also take precautions during blasting to restrict blast vibrations and rock mass deterioration.

13. All the cross cuts and drives should be adequately supported to enable safe multiple-time entry of persons during charging.

14. From the current experience from C block and B block it is clear that the stresses in the mine are higher and/or rock mass is weaker at places. Hence for deeper blocks the current extraction sequence of primary and secondary mining may have to be relooked.

7.0 NUMERICAL MODELLING TO BE UNDERTAKEN IN THE FOLLOWING QUARTER

1. Feasibility study of crown pillar mining between 290-315 mRL
2. Stability analysis of the AP series hanging wall lens
3. SK-A6 Primary /secondary stope design between 255 and 325 mRL and crown pillar stability between 325 and 350 mRL

8.0 STABILITY OF SURFACE WASTE DUMP

Waste dump on the surface has been analysed for its stability. The plan and section of the dump profile is as shown in figure 10. A photograph of the dump is shown in Fig. 11. The maximum height of the dump from the surface floor is only about 25m. Currently the bench configuration is quite stable. However, if the height of the dump from the original surface profile is increased more than 30m, a bench of minimum 30m width needs to be left prior to starting a second bench. Wherever the dump boundary comes closer to a haulage road, a protective wall needs to be constructed against the same to avoid roll down of any waste rock into the haulage road. The dump profile movements are continued to be monitored using Total Station survey on a regular basis.

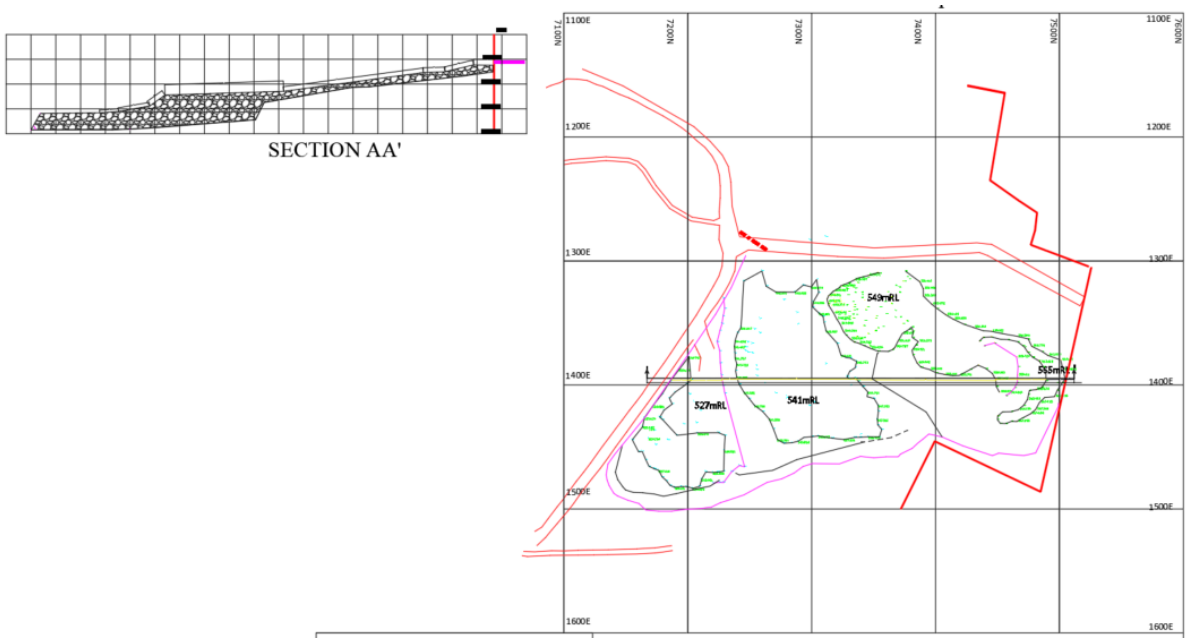


Fig. 10: Plan and section of the surface waste dump

Fig. 11: A photograph of the dump

Waste Dump stability Report : November 2019 .

Guideline on Surface waste Dump Stability by CIMFR-

Waste dump on the surface has been analysed for its stability. The plan and section of the dump profile is as shown in figure 1. A photograph of the dump is shown in Fig. 2.

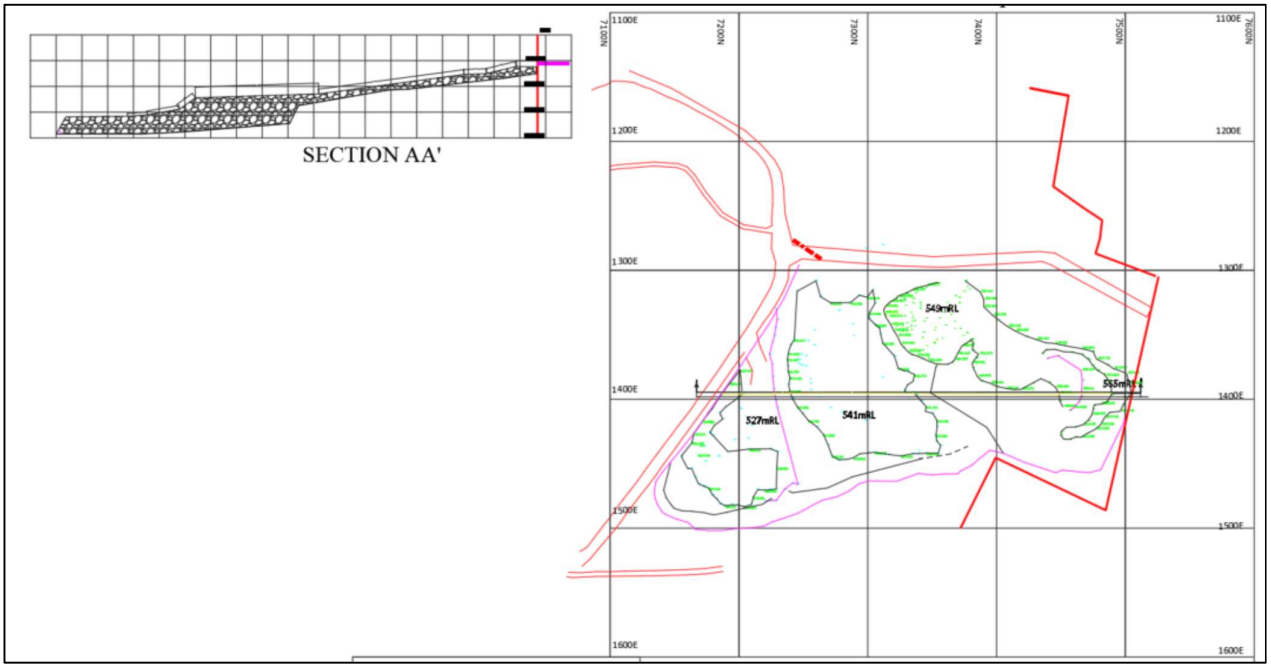


Figure 1. - Plan and section of the surface waste dump

Figure 2. - A photograph of the dump

- The maximum height of the waste dump should not exceed 30m from the ground profile, with its natural angle of repose. If it exceeds, then multiple benching is to be done with the the overall slope angle not exceeding 33o at any side of the dump.
- The maximum height of the dump from the surface floor is only about 25m. Currently the bench configuration is quite stable. However, if the height of the dump from the original surface profile is increased more than 30m, a bench of minimum 30m width needs to be left prior to starting a second bench.
- Wherever the dump boundary comes closer to a haulage road, a protective wall needs to be constructed against the same to avoid roll down of any waste rock into the haulage road.
- The dump profile movements are continued to be monitored using Total Station survey on a regular basis.

Internal Audit observation and recommendation –

Date – 22.11.2019
Auditees – Ashok Kumar Godugu (Head Geotech)

- Digamber patil (Environment head)
- Pradeep kumar (geotechnical Engineer)
- Suraj Sethy (AM - Mining)

- Gradient of waste dump surface was not properly maintained, chances of water accumulation. Immediately sloping of the Area required.
- Bench was properly maintained.
- Turning width was not sufficient, turning width need to be widened.
- Haul road width sufficient for hauling.
- Loading & dumping was going on at Same place, if loading was going on then Dumping should be done at another place.

Waste Dump Stability Report – Feb 2020.

Guideline on Surface waste Dump Stability by CIMFR-

Waste dump on the surface has been analysed for its stability. The plan and section of the dump profile is as shown in figure 1. A photograph of the dump is shown in Fig. 2.

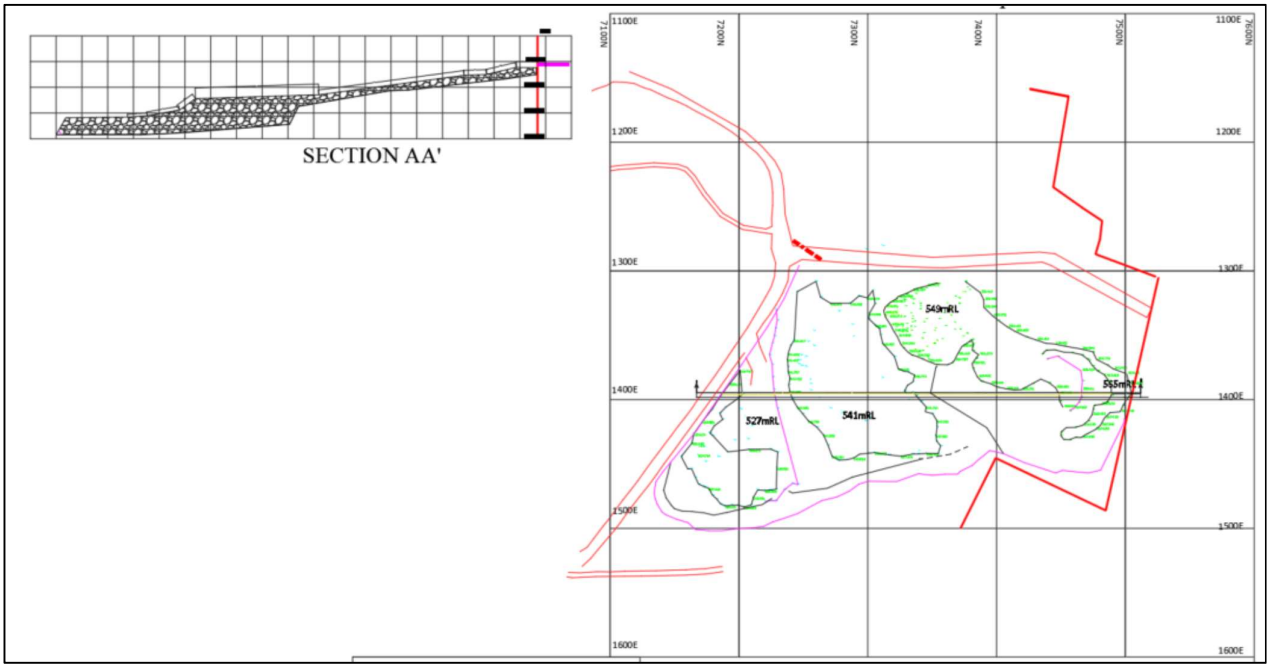


Figure 1. - Plan and section of the surface waste dump

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- The maximum height of the waste dump should not exceed 30m from the ground profile, with its natural angle of repose. If it exceeds, then multiple benching is to be done with the the overall slope angle not exceeding 33o at any side of the dump.
- The maximum height of the dump from the surface floor is only about 25m. Currently the bench configuration is quite stable. However, if the height of the dump from the original surface profile is increased more than 30m, a bench of minimum 30m width needs to be left prior to starting a second bench.
- Wherever the dump boundary comes closer to a haulage road, a protective wall needs to be constructed against the same to avoid roll down of any waste rock into the haulage road.
- The dump profile movements are continued to be monitored using Total Station survey on a regular basis.

Internal Audit observation and recommendation –

Date – 08.02.2020
Auditees – Ashok Kumar Godugu (Head Geotech)

- Digamber patil (Environment head)
- Suraj Sethy (AM - Mining)

- Drains at toe point of the Dump was not maintained, As water accumulation may lead to Decrease the Cohesion and internal Friction angle of Dump, So immediately Drain to be maintained.
- Hight of the safety berm was inadequate, need to increase the required Berm height.
- No visual cracks and opening found on floor.
- Angle of slope was maintained.

Safety Status Report (SSR)

(Nucleonic Gauge Facility)

This status report should be submitted by the authorized user of the nucleonic devices through eLORA system in the **first week of January & July** every year, as per the terms and conditions of the authorization issued under the Atomic Energy (Radiation Protection) Rules, 2004.

Name of Institution:	**Sindesar khurd Mines**
e-LORA Institution Number	**RJ-35620**
SSR Reporting period	**Jan'20**

	Inventory of the Nucleonic Gauges/Sources	
1.	Total number of Nucleonic Gauge (NG) devices/sources in possession of your institution:	**32**
2.	Total number of NG devices/sources not in use:	0
3.	Total number of NG devices/sources which are disused and to be disposed off :	0
4.	Steps being taken to dispose of disused sources, if any:	**NA**
	Radiation protection, surveillance and physical security (tick the appropriate)	
5.	Whether periodic radiation protection survey performed for all NG devices/sources and records are maintained?	Yes / No
6.	Whether Personal monitoring services availed for radiation workers (as applicable)	Yes / No / NA
7.	Whether adequate physical security measures provided for NG devices/ sources?	Yes / No
8.	Whether Radiation symbol and warning, in English, Hindi and regional language displayed on source housing and at the fencing/at the access point of NG Devices?	Yes / No
9.	Emergency procedures with contact details of responsible person displayed at appropriate location in the institution?	Yes / No
10.	Whether the representatives of AERB inspected the Nucleonic Device installations?	Yes / No
11.	If yes, dates of inspection	
12.	Any other information:	

13. DETAILS OF NUCLEONIC GAUGES

S.No	Make & Model of nucleonic devices	Number of nucleonic devices	Sr. number of nucleonic device	Source & Activity	* Stray Radiation Level from External housing of device (µSv/hr)		Location/ Plant name	Reference No. of NOC issued by AERB/BARC	Present status of the device (In use)
					5 cm	100cm			
1	Berthold LB491	1	463-02-10	Cs137 & 15 mCi	2.19	.29	U/F HYDROFILL	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2010	In Use
2	Berthold LB491	1	464-02-10	Cs137 & 15 mCi	2.40	.25	U/F HYDROFILL	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2011	In Use
3	Berthold LB491	1	465-02-10	Cs137 & 15 mCi	3.07	.40	REGRIND CYCLONE	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2012	In Use
4	Berthold LB491	1	466-02-10	Cs137 & 10 mCi	2.45	.80	PR-SEC CYCLONE STR-1	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2013	In Use
5	Berthold LB491	1	467-02-10	Cs137 & 10 mCi	3.9	.75	PR-SEC CYCLONE STR-2	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2014	In Use
6	Berthold LB491	1	468-02-10	Cs137 & 10 mCi	1.30	.40	TDPH	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2015	In Use
7	Berthold LB491	1	469-02-10	Cs137 & 10 mCi	1.50	.80	TDPH	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2016	In Use
8	Berthold LB491	1	470-02-10	Cs137 & 10 mCi	2.05	.69	TDPH	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2017	In Use
9	Berthold LB491	1	471-02-10	Cs137 & 10 mCi	1.6	.30	TAILING THICKENER	AERB/RSD/NG /NR435/2010/ 2641 Dt.22/03/2018	In Use

10	Berthold LB491	1	472-02-10	Cs137 & 6mCi	2.97	.30	ZN THICKENER	AERB/RSD/NG/NR435/2010/2641 Dt.22/03/2019	In Use
11	Berthold LB491	1	473-02-10	Cs137 & 20mCi	2.95	.26	Pb THICKENER	AERB/RSD/NG/NR435/2010/2641 Dt.22/03/2020	In Use
12	Berthold LB491	1	1017-06-10	Cs137 & 10mCi	2.25	..12	TAILING THICKENER	AERB/RSD/NG/NR435/2011/2067 Dt.15/02/2011	In Use
13	E&H FQG31	1	TB616	Cs137 & 200mCi	26.01	2.38	LOW	AERB/RSD/NG/NR435/2010/9983 Dt.14/10/2010	In Use
14	E&H FQG31	1	TB617	Cs137 & 200mCi	27.09	2.10	HIGH	AERB/RSD/NG/NR435/2010/9983 Dt.14/10/2011	In Use
15	Berthold LB491	1	1372-08-12	Cs137 & 20mCi	3.20	.40	CYCLONE FEED HYDROFILL	AERB/RSD/NG/NR435/2012/10504 Dt.23/08/2012	In Use
16	Berthold LB491	1	1373-08-12	Cs137 & 20mCi	4.21	.12	CYCLONE FEED HYDROFILL	AERB/RSD/NG/NR435/2012/10504 Dt.23/08/2013	In Use
17	Berthold LB491	1	1374-08-12	Cs137 & 10mCi	3.43	.21	HYDROFILL	AERB/RSD/NG/NR435/2012/10504 Dt.23/08/2014	In Use
18	Berthold LB491	1	1375-08-12	Cs137 & 10mCi	2.96	.3	HYDROFILL	AERB/RSD/NG/NR435/2012/10504 Dt.23/08/2015	In Use
19	Berthold LB491	1	1514-08-13	Cs137 & 50mCi	7.15	.80	PASTE FILL-TAILING THICKNER	AERB/RSD/NG/NR435/2013/11772 Dt.02/09/2013	In Use
20	Berthold LB491	1	1515-08-13	Cs137 & 50mCi	4.02	.69	PASTE FILL-TAILING THICKNER	AERB/RSD/NG/NR435/2013/11772 Dt.02/09/2014	In Use

21	Berthold LB491	1	1516-08-13	Cs137 & 20mCi	3.35	..03	PASTE FILL	AERB/RSD/NG /NR435/2013/ 11772 Dt.02/09/2015	In Use
22	Berthold LB491	1	1599-09-13	Cs137 & 20mCi	4.02	.07	PASTE FILL	AERB/RSD/NG /NR435/2013/ 12841 Dt.24/09/2013	In Use
23	FQG60	1	LB000D01145	Cs137 & 5mCi	20	1.17	LEAD Thickener Stream2	16-NGPROC-128695	In Use
24	FQG60	1	LB000C01145	Cs137 & 1mCi	2.40	.31	Tailing Thickener Stream2	16-NGPROC-128694	In Use
25	FQG60	1	LB000901145	Cs137 & 3mCi	14	1.04	Zinc Thickener Stream2	16-NGPROC-128693	In Use
26	FQG61	1	LB004B0113F	Cs137 &30mCi	7.33	.32	Cyclone Feed Pump Stream2	16-NGPROC-128687	In Use
27	FQG61	1	LB004A0113F	Cs137 &10mCi	.92	.11	Regrind Cyclone Feed Pump	16-NGPROC-128693	In Use
28	FQG60	1	LB000601145	Cs137 &2mCi	9.20	.38	Combined Tailing Disposal Pump	16-NGPROC-128692	In Use
29	FQG60	1	LB000701145	Cs137 &2mCi	1.15	0.09	Combined Tailing Disposal Pump	16-NGPROC-128691	In Use
30	FQG60	1	LB000801145	Cs137 &2mCi	10.2	.56	Combined Tailing Disposal Pump	16-NGPROC-128690	In Use
31	FQG60	1	LB000A01145	Cs137 &3mCi	21	1.06	At Paste fill pump discharge line	16-NGPROC-128688	In Use
32	FQG60	1	LB000B01145	Cs137 &3mCi	11.5	.82	At Paste fill pump discharge line	16-NGPROC-128689	In Use

I hereby certify that the above particulars are true to the best of my knowledge and belief and are in complete conformity with the applicable terms and conditions of authorization and that the sources in our possession have been physically verified by me and found satisfactory from radiation safety point of view.

Head - E & I

Signature:
Name: JITENDRA MINARE
Date: 30-05-20

Employer/Licensee

Signature: 30/05/2020
Name: SANJAY KUMAR SHARMA
Date:

(Seal of the Institution)

Unit Head
Sindesar Khurd Mine
Hindustan Zinc Limited
P.O. Dariba-313211
Dist. Rajsamand (Raj.)

1.0 INTRODUCTION

Hindustan Zinc Ltd., Udaipur (HZL) is carrying out underground mining for lead-zinc ore near village Sindesar Khurd, (SK), tehsil Relmagra, district Rajsamand since 1999. HZL has obtained mining lease (ML-7/95) covering an area of 199.84 hectares with present annual production is 6.00 MTPA. It lies between Latitudes 24° 59' 27.35" N – 25 °00' 58.55" N and Longitudes 74° 08' 23.22" E - 74° 09' 0.77" E on Survey of India topo sheet No. 45/L1 and 45K/4.

Now, it has been asked by the MoEFCC in its EC that HZL may take up monitoring of land use pattern once in three years by digital processing of the lease area. HZL, for meeting this requirement, decided to get the land use maps prepared for operating of SK mining lease. Hydro-Geosurvey Consultants Pvt. Ltd., Jodhpur (HCPL) were retained by HZL to prepare the land use maps and reports of mines by digital processing using remote sensing techniques. The land use maps and report for SK mine is being prepared for the first time for the year 2018 for onward submission to MoEF. Now, HZL is again required to submit the land use report of the lease area after three years when the changes in land use pattern during last 3 years will be indicated.

The present report contains the integrated land use/land cover map of lease area along with other thematic layers for the year 2018.

2.0 HYDROLOGY

2.1 Physiography of Banas river basin

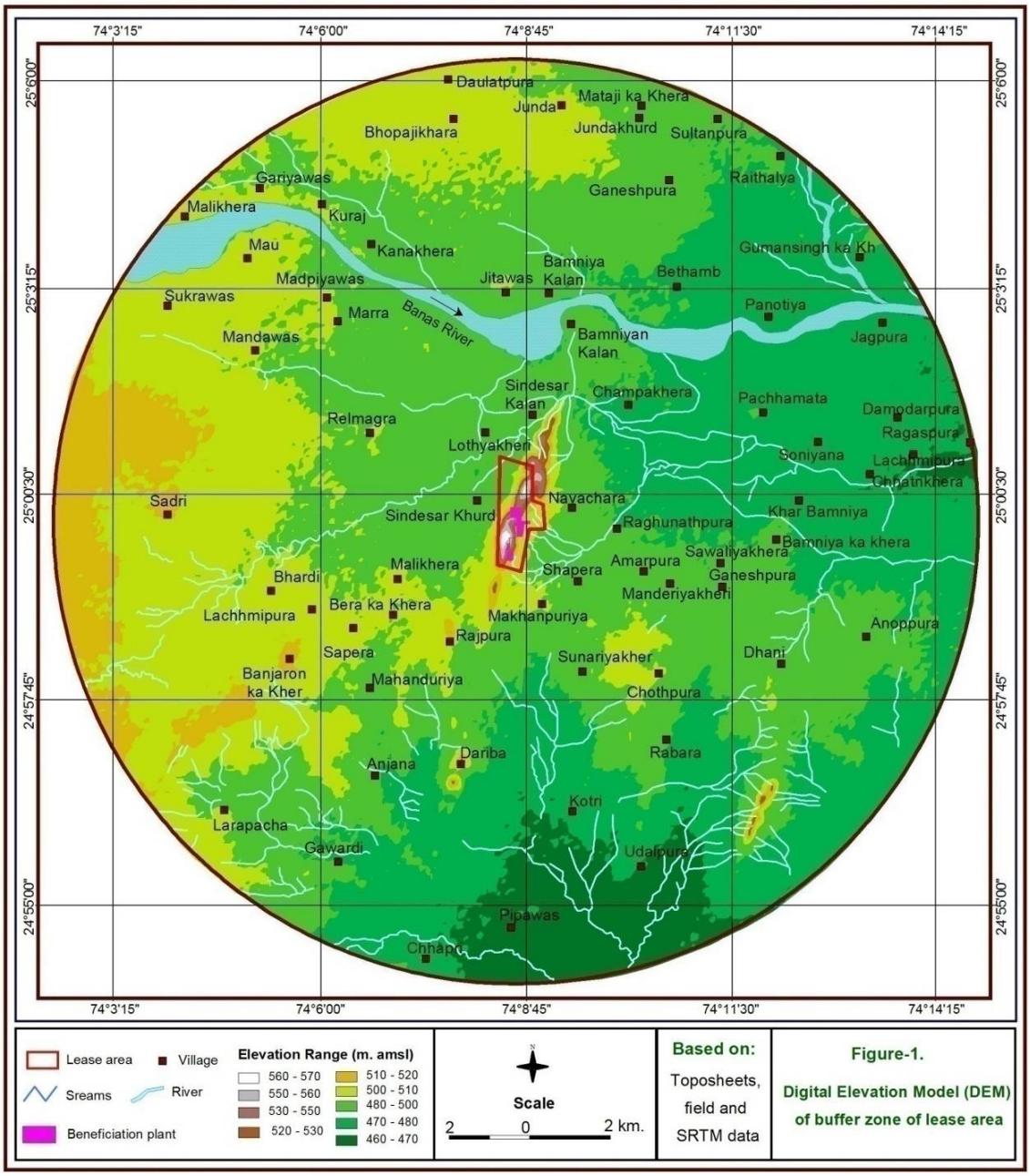
The buffer zone of Sindersar Khurd mine falls in the catchment area of Banas river, which flows through the northern boundary of the lease area. Banas river originates in the eastern slopes of the Aravali ranges near Kumbhalgarh and after flowing eastwards for about 512 km through districts of Rajsamand, Chittorgarh, Bhilwara, Tonk, and Sawai Madhopur meets Chambal river near Rameshar village in Sawai Madhopur district. The Banas river basin covers an area of 47,052 sq.km .The Banas river after originating in the eastern slopes of

Aravali ranges, and traveling through Rajsamand district enters Chittorgarh district near Rashmi. Banas river, within Rajsamand district is joined from left by Chandrabhaga river near village Gangas.

Banas river is an ephemeral river and flows in direct response to rainfall and goes dry during summer months. It is an influent river, recharging ground water all along its course before it meets Chambal river. Banas river has limited flow till mid - December and afterwards dry till monsoon.

Physiography of the lease area is characterized by almost flat country with isolated few low ridges. The NNE-SSW quartzitic ridge, south of Sindesar Kalan is a prominent feature of the area achieving the elevation of 579 metres above msl. There are few tanks near Chokri, Mandara, Relmagara, Jitwas and Armi which get filled up during rainy season and dry up by the summer. There is big size tank near mine known as Mataji Ka Khera and another near village Pipawas.

Figure-1. Digital Elevation Model (DEM) of buffer zone



2.2 Major surface water reservoirs of Banas river upstream of Railmagra

The surface water resources of Banas river and its tributaries have been harnessed at many locations by constructing major and medium irrigation projects. The major irrigation projects

(having CCA more than 10,000 ha.) and medium irrigation projects (having CCA from 2,000 to 10,000 ha) upstream of Railmagra are shown as under.

Table-1. Major surface water reservoirs of Banas river upstream of Railmagra

S. No.	Project Name	River	Catchment Area (km^2)			Live Storage Mm^3	CCA Ha.
			Total	Intercepted	Free		
1.	Rajsamand	Banas	523	93	432	98.7	10441
2.	Matrikundia	Banas	3415	2472	943	50	9500
3.	Badgaon	Banas	1699	1300	398.9	30.2	9400
4.	Bhopalsagar	Banas	215	38.6	176.4.	18.4	3870
5.	NandSamand	Banas	839.2	217	622	19.5	7881

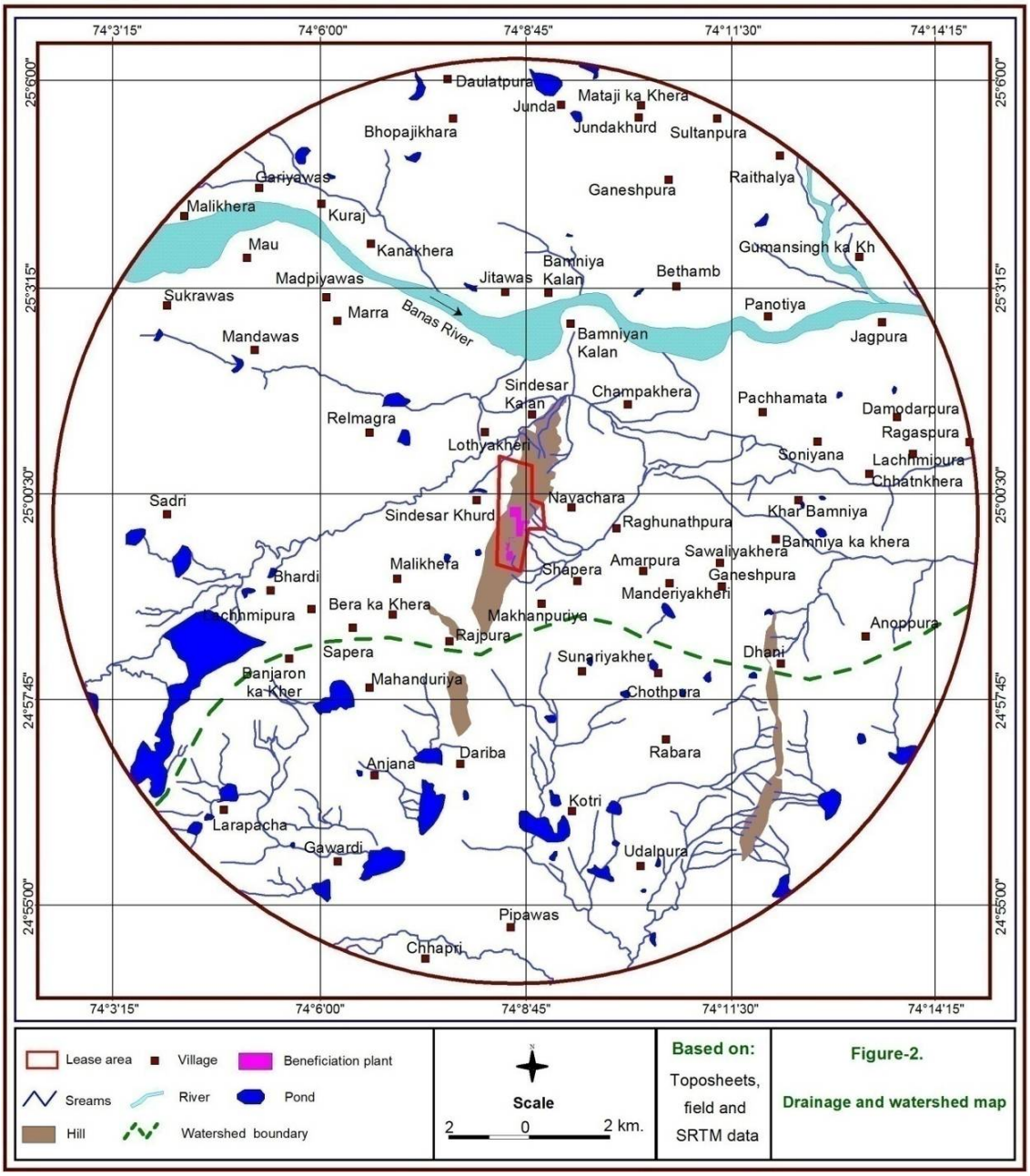
CCA- Culturable Command Area
Source – Irrigation department, 1996

There are few minor irrigation tanks constructed on tributaries of Banas river basin. These tanks when completely filled provide irrigation to command area developed in nearby villages. However, this year due to exceptionally high rainfall, the tanks were full providing irrigation to the area of buffer zone.

2.3 Drainage pattern

Although there is a well defined drainage system having dendritic drainage pattern in the buffer zone, a major part of drainage has been harnessed by constructing minor irrigation projects and tanks **(Figure-2)**. Whatever runoff is produced by the average annual rainfall of 571 mm in the buffer zone, major part goes as surface runoff after meeting the evapo-transpiration losses and a part percolates to the zone of saturation.

Figure-2. Drainage map of buffer zone



2.4 Run -off

Average annual rainfall in the buffer zone of SK Mine is 637 (636.66) mm out of which 90 % happens to be during monsoon period from June to October. Winter monsoon is low, hardly contributing any surface runoff.

The rainfall during the year 2016 was recorded as 1180 mm at the mine which is much more than the average annual rainfall of 637 mm. The surface run-off in Banas river basin has been computed as 15 to 18% based on the storage of minor irrigation dams.

2.5 Climate

The nearest IMD meteorological station in Banas river basin is at Udaipur which is hardly 50 km in south west. The climatic conditions as recorded at Udaipur therefore can be considered applicable for the buffer zone of Sindesar Khurd mine.

The Indian Meteorological Department (IMD) has divided Rajasthan in two meteorological sub-divisions, i.e. west Rajasthan and east Rajasthan and the sub-basin falls in east Rajasthan sub-division.

Based on Koppen classification of climatic pattern, the sub-basin may be classified as tropical steppe, semi-arid and hot. The year is divided in to four seasons. The winter season is from mid- December to February and is followed by the hot summer season from March to mid-July, including the pre-monsoon season from April to June. The period from July to mid-September constitutes the south west monsoon season and the period from the later half of September to mid- December as post monsoon season.

2.5.1 Temperature

Temperature records from Udaipur observatory are available for 60 years. The period from April to June is marked by continuous increase in the temperatures May is the hottest months of the year with a mean daily maximum and minimum temperature (in May) of 39.5°C and

27.3°C respectively. Night temperatures in June are relatively higher than the May. With the onset of southwest monsoon by about mid-June, the temperatures go down considerably. From November onwards, both the day and night temperatures decrease and January, the coldest month, with daily maximum and minimum temperatures of 22.2°C and 7.3°C.

2.5.2 Rainfall

Average annual rainfall based on rainfall data recorded at Rajpura-Dariba mine for last 25 years has been observed as 637 mm. Of the annual rainfall, about 90 % fall during four monsoon months (June to September) with July and August getting the maximum rains. The following table gives the annual rainfall recorded at Rajpura-Dariba, since 1994.

Table-2. Rainfall recoded at Rajpura-Dariba mines

Year	Rain fall (mm)	Year	Rain fall (mm)
1994	710.50	2007	586.75
1995	479.75	2008	619.50
1996	690.00	2009	562.50
1997	609.50	2010	858.00
1998	590.50	2011	632.00
1999	440.50	2012	723.00
2000	324.00	2013	861.00
2001	593.00	2014	635.00
2002	254.00	2015	585.00
2003	450.00	2016	1180.00
2004	624.00	2017	640.00
2005	780.00	2018	463.00
2006	1025.00	**Average**	**636.66**

2.5.3 Humidity

Relative humidity during the southwest monsoon is generally over 60 %. During the rest of the year, air is normally dry. Relative humidity during summer afternoon is as low as 20 % while during monsoon, it does not go more than 80 %. The mean annual humidity values in the morning are 65.4 % and 37.6 % in the evening.

2.5.4 Winds

Winds are generally light to moderate, except during the south west monsoon season, when these are moderate to strong. From May to September, winds blow mostly from direction from northwest to southwest. In the post monsoon and winter months, winds are mostly from direction lying between northeast and northwest. Mean wind speed is highest in June (7.4 km / hour) and lowest in November & December (1.5 km / hour).

2.5.5 Cloudiness

Skies are generally moderately to heavily clouded during southwest monsoon season, being overcast on some days. During the rest of the year, the skies are normally clear to lightly clouded. During the months of July- August, the mean cloudiness (in Oktas) is usually more than 4, being generally higher in the evenings than the mornings.

Table- 3. Meteorological data as recorded at Udaipur

Month	Temperature		Relative Humidity		Mean Wind Speed	Mean Cloudiness	
	Mean Daily Max. °C	Mean Daily Min. °C	08:30 %	17:30 %	Km/hr	08:30 Oktas	17:30 Oktas
Jan.	24.2	7.8	66	40	2.2	1.0	1.0
Feb.	27.6	9.7	55	29	2.6	0.9	0.9
Mar.	32.3	15.1	43	24	3.6	0.8	0.9
Apr.	36.0	20.2	34	25	4.6	0.7	0.9
May	38.6	24.9	38	25	6.3	0.8	0.6
Jun.	35.9	25.3	63	48	7.4	3.1	2.6
Jul.	30.7	23.9	78	70	6.3	4.0	3.9
Aug.	29.3	22.9	81	75	4.7	5.5	4.9
Sep.	30.9	22.1	76	65	3.7	3.2	3.4
Oct.	32.0	18.9	62	42	2.3	1.4	1.2
Nov.	29.1	11.0	57	39	1.5	1.1	1.2
Dec.	26.3	8.3	63	40	1.5	1.1	1.1
Annual mean	**31.1**	**17.5**	**60**	**43**	**3.9**	**2.0**	**1.8**

2.6 Quality of surface water

The quality of surface water is good as the rocks are mostly crystalline metamorphics having thin alluvial cover. The rainfall being moderate and having adequate drainage, the surface

water remains free from salinity. Water sample collected from Banas river and village tanks during rainy season has indicated low salts content, less than 250 mg/l and all constituents within permissible limits of drinking, industrial and irrigation purposes.

3.0 HYDROGEOLOGY

3.1 Regional geology

The geology of the area is mainly composed of thin alluvial cover, belonging to Sub-Recent to Recent period of Cenozoic Era followed by Rajpura-Dariba group of Bhilwara Super Group of Archaeans. The geological succession can be summarized as under:

Era	Period	Super Group	Group /Formations	Rock Types
Cenozoic	Sub-Recent to Recent	Fluvial & Colluvium	Alluvium	Sand, silt, clays gravel etc.
----------	----------	----------Unconformity----------	----------	----------
		Intrusives		Pegmatite, quartz Veins
Archaeans		Bhilwara Super Group	Rajpura-Dariba Group	Dolomitic marble, Graphitic kyanite schist, quartzite,
			Mangalwar Complex	Migmatite, gneiss, mica schist, quartzites
			Banded gneissic complex	Gneisses, schist, etc.

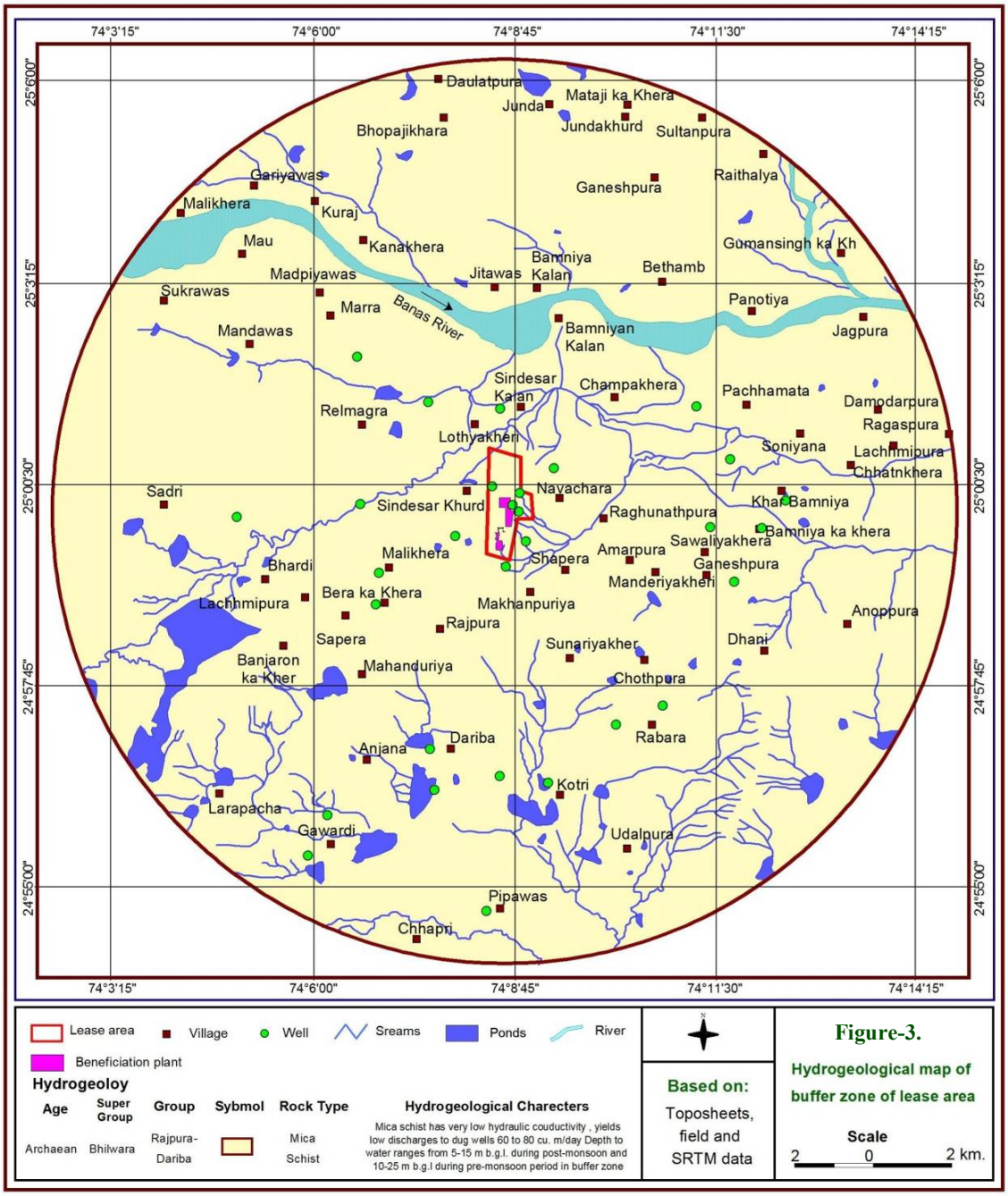
Lead –zinc mineralization is hosted mainly by dolomites and quartz mica schist. Other rocks which also carry mineralization are carbonaceous and calc-silicates.

Of all the rocks exposed in the area, only mica schist forms the poor aquifer while alluvium generally thin, remains above water table.

3.2 Hydrogeology of 10-km area (Buffer zone)

Mica schist is the main rock exposed in the buffer zone. Mica schist is intruded by pegmatite

and quartz veins. The general strike of the rocks is NNE-SSW to NE-SW with steep dips towards east. The hydrogeological map of the buffer zone has been prepared **(Figure-3)** which shows that mica schist is the principal aquifer in the entire buffer zone.



3.2.1 Nature of occurrence of ground water

Ground water occurs under water table conditions and is transmitted through fractures, joints and foliations. Mica schist is impervious in nature and have developed secondary porosity only due to joints and fractures. There is very limited thickness of weathered zone and generally lies above the zone of saturation.

The depth to water in crystalline metamorphics in the lease area (core zone) during post monsoon period ranges from 8 metres to 21 metres below the land surface while it ranges from 10 to 23 metres below the land surface during pre-monsoon period. The depth to water in buffer zone ranges from 1 metres to 21 metres during post monsoon period and 4 metres to 23 metres during pre-monsoon period. It is shallow near the river courses, surface water reservoirs and ponds while it is deeper in the area away from these sources. The fluctuations due to rainfall and ground water withdrawal are significant as the rocks have very low fracture porosity and hydraulic conductivity

3.2.2 Movement of ground water

Ground water movement is controlled mainly by the hydraulic conductivity of the crystalline metamorphics and hydraulic gradient. The ground water movement mainly takes place through the fractures and foliations of the crystallines.

The ground water movement is controlled mainly by the hydraulic conductivity of aquifer. A review of the topography and drainage pattern reveals that the general slope of the area is towards south east, and ranges from 6 m/km to about 7 m/km. The ground water flow also follows the topography and surface water flow direction and moves in south east direction. However, the hydraulic gradient is moderate and has been observed as 5.75 m/km as calculated from the monitoring of wells of the area **(Figure-4).**

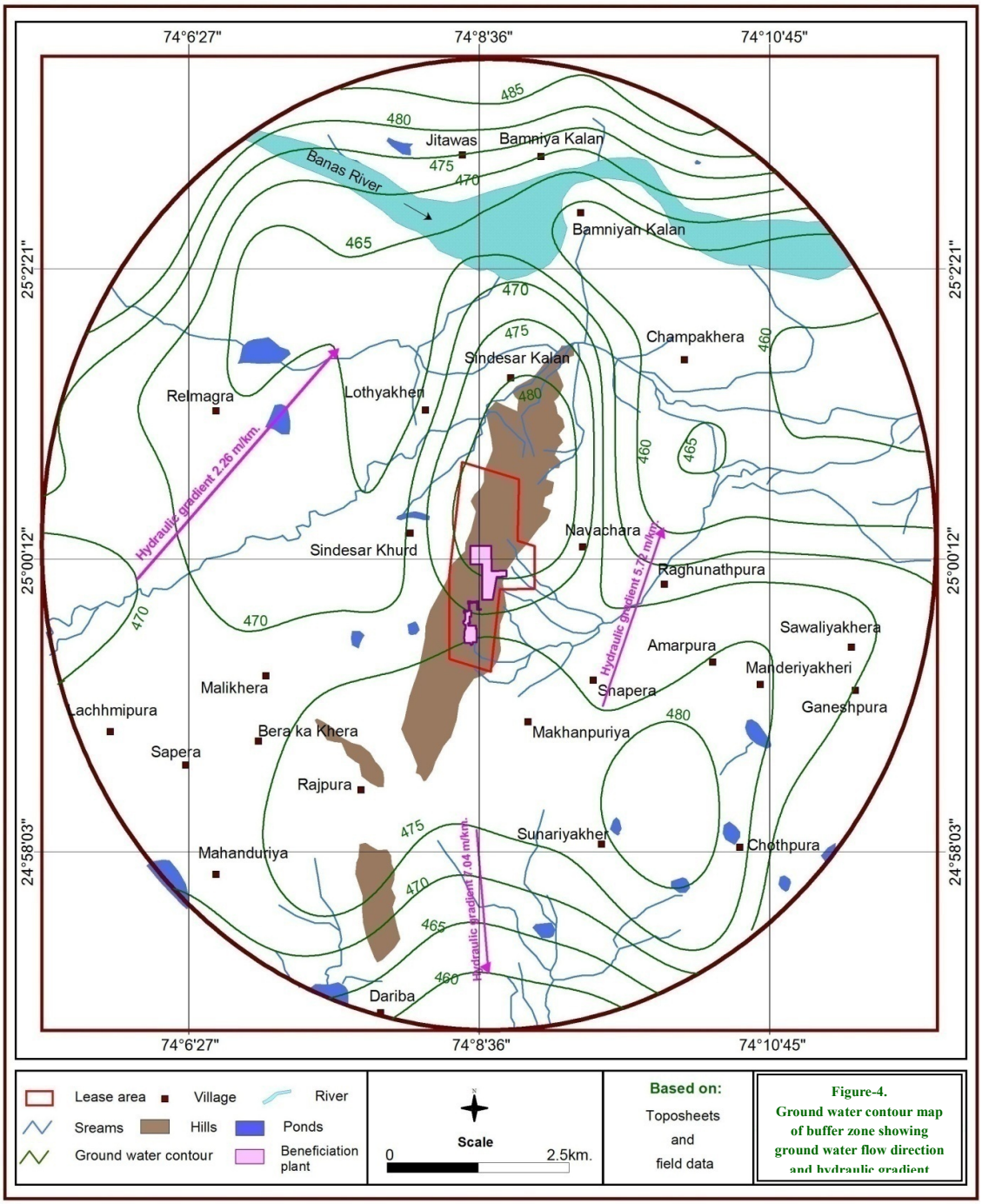


Figure-4.
Ground water contour map of buffer zone showing ground water flow direction and hydraulic gradient

4.0 REMOTE SENSING STUDIES FOR MINING LEASE AREA

4.1 Data source

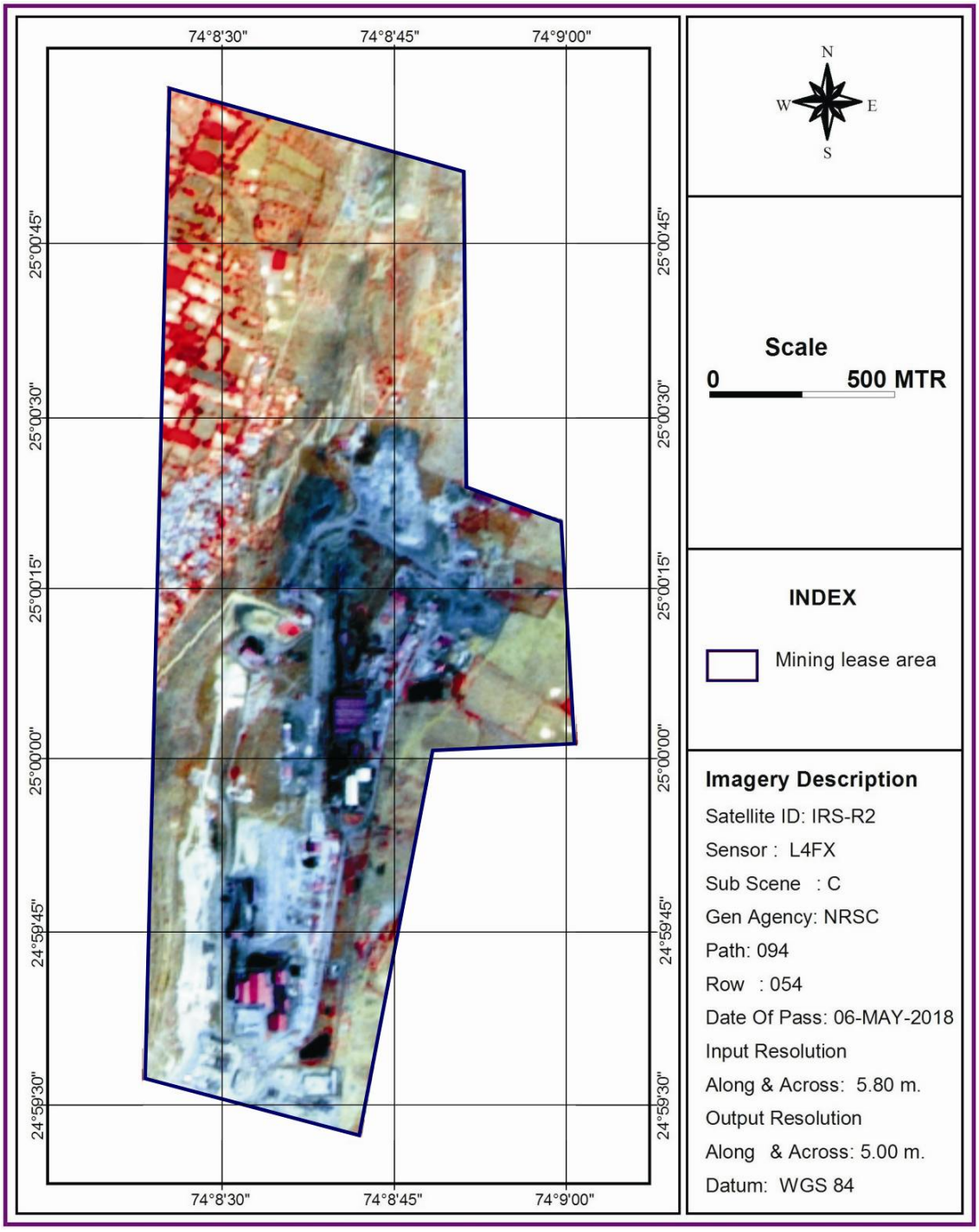
Systematic mapping and periodic monitoring of land use and land cover in any developmental activity is one of the most important components necessary for environmental impact assessment. The remote sensing satellite plays a major role in these studies by virtue of their repetitive and synoptic coverage. In order to strengthen the baseline information on existing land use pattern, the following data for the given study area was used:

Table-4. Imagery specification

S. No.	Specification:	
1.	Satellite ID	IRS-R2
2.	Sensor	L4FX
3.	Sub Scene	C
4.	Gen Agency	NRSC
5.	Path	094
6.	Row	054
7.	Date Of Pass	06-MAY-2018
8.	No Of Bands	3
9.	Band Numbers	234
10.	Pass Type	PLD
11.	Date Of Dump	06-MAY-2018
12.	Dumping Orbit No	036559
13.	Imaging Orbit No	036559
16.	Bytes Per Pixel	2
17.	Bits Per Pixel	10
18.	Generation Date Time	06-MAY-2018 14:02:12
19.	Prod Code	STUC00GTV
20.	Prod Type	GEOREF
21.	Input Resolution Along	5.80
22.	Input Resolution Across	5.80
23.	Output Resolution Along	5.00
24.	Output Resolution Across	5.00
25.	Season	MAY
26.	Image Format	GEOTIFF
27.	Map Projection	UTM
28.	Ellipsoid	WGS 84
29.	Datum	WGS 84

This digitized data has been used for delineating the different land units by Land cover mapping of the area. Satellite imagery of the area is shown as **Figure-5.**

Figure-5. Satellite imagery of buffer zone of lease area (LISS-4)



4.2 Approach for land use mapping

The spatial resolution and the spectral bands in which the sensors collect the remotely sensed data are two important parameters for any land use survey. Appropriate remote sensing data were processed to investigate land use pattern through digital image processing techniques. SOI toposheets were geo-referenced to superimpose on orthorectified satellite image. Mosaicing was performed for the geo-referenced toposheets to form a continuous frame.

A base map was generated from the mosaic of SOI toposheet comprising features such as administrative boundaries major roads, railways and river drainage. IRS-R2, L4FX data offers spatial resolution of 5m x 5m. The shapes, sizes and colours of several geomorphic features are visible in the IRS data. Three spectral bands provide high degree of measurability through band combinations including False Colour Composites (FCC) generation, bands ratioing, classification etc. These features of the IRS data are particularly important for better comprehension and delineation of the land use classes. Hence IRS-R2, L4FX data has been used for land use mapping. The standard FCC is generated by assigning blue, green and red colours to visible green, visible red and near Infrared bands respectively.

Image processing and Ortho rectifications was done in ERDAS IMAGINE (V.8.5) software and spatial data was created in Arc view GIS (Ver.3.2a) software. Area of interest comprising the study area was then selected and extracted from the satellite image. Suitable image enhancements were the applied on the extracted area on interest. A visual interpretation followed by supervised classification (digital image processing approach) was adopted to classify areas land use-cover features. Several training sets/signatures for classification were collected prior to applying supervised classification.

After evaluating the statistical parameters of trainings sets, the training areas were rectified by deleting non-congruous training sets and creating new ones. Mask of mine area was superimposed on the final output to generated area statistics for different land use categories. Classification accuracy estimation was done on the supervised classified image for further rectification. Based on this, final identification of grazing land, plantation and fodder plots

was done. Area, which was earlier a part of grazing land but later acquired by HZL for its Zinc smelter is also shown and its replacement, another private land was procured by HZL and transferred as grazing land to the village.

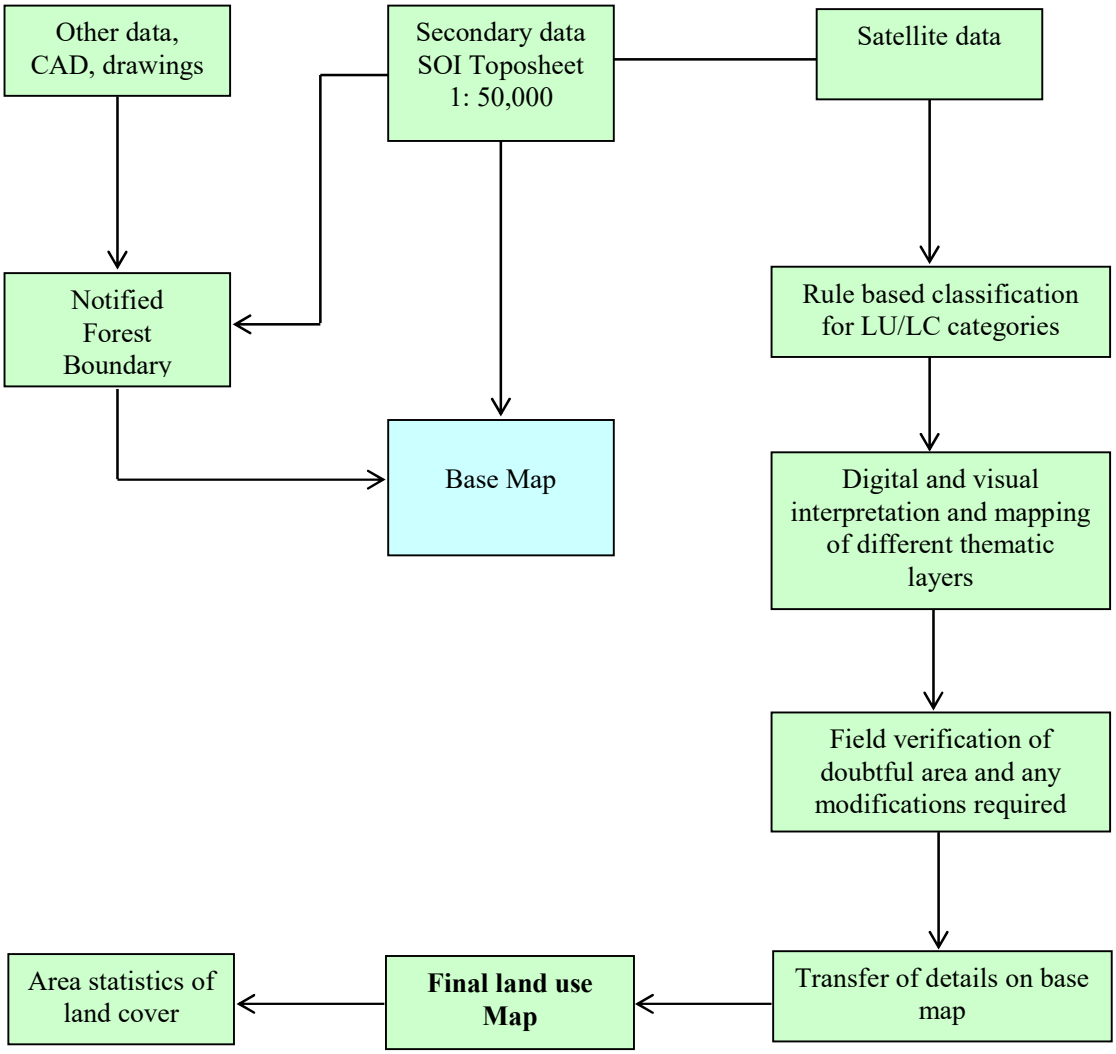
After integrating the geological thematic layer of land use units and drainage, an integrated map has been prepared showing the grazing land in the lease area which is shown as **Figure-9**.

The base map of the area was prepared, which included all the important features like lease area, villages, main roads collected from the toposheet of the area keeping common marks for each theme. This base map was used for mapping different themes by digital and visual interpretation of satellite data which was procured from NRSA. These maps were converted to digital mode in GIS form and then checked in field for respective details and finalized.

4.3 Procedure followed

For preparing land use/ land cover map of study area and its respective thematic layers, the procedure as shown in the following Flow diagram was adopted. The procedure adopted for preparing each thematic layer is discussed as under.

Flow diagram showing the methodology adopted for land use mapping



4.4 Land use / Land cover map

After proper registration of satellite data, the satellite data was digitally interpreted and different categories of land use units were marked using standard digital techniques.

4.5 Thematic mapping

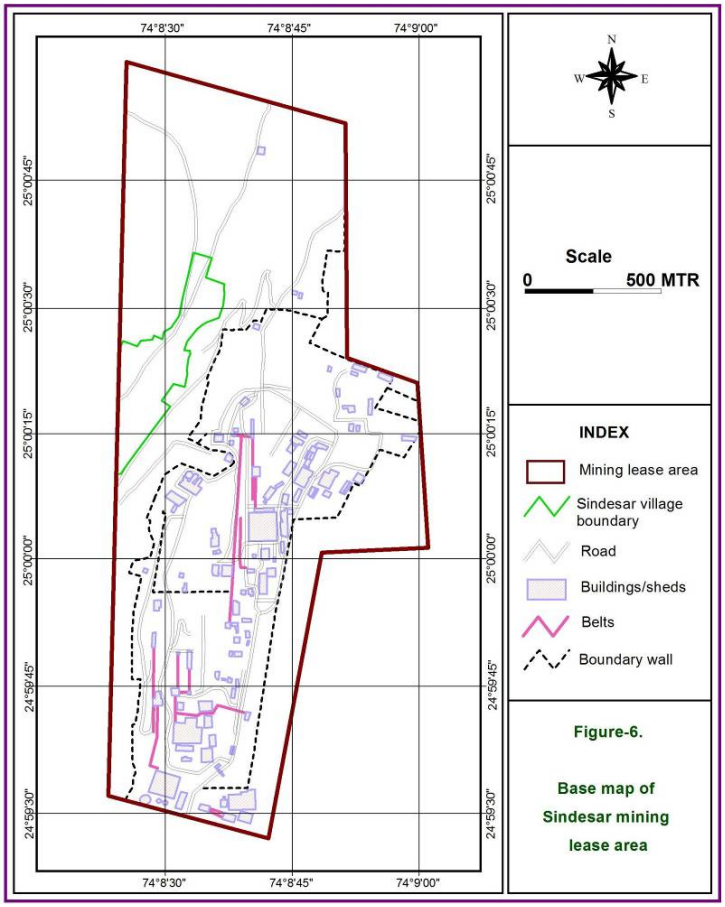
By adopting the methodology as mentioned above, thematic layer on base line, drainage, plantation in the lease area, within the acquired area, and agricultural land have been

prepared. The area of each unit and its percentage in the lease area has been prepared. Each thematic layer is discussed as under. Each thematic layer is discussed as under.

4.5.1 Baseline Information

The roads, village (Sindesar Khurd) and constructed area (Plants buildings) of the lease were marked using toposheet and satellite data and was updated by field check. The **figure-6** shows the baseline layer of the lease.

The base map indicating main village, roads and lease area has been prepared and is shown as **Figure-6.** Only some part of the village Sindesar Khurd lies in west boundary of the lease area. The base map also shows different buildings and sheds of the plant, sheds, road and houses/huts etc. The network of roads shows that plant is well connected.



4.5.2 Drainage

The drainage map of the lease area has been prepared **(Figure-7)** based on the satellite imagery and shows that there are two water reservoir constructed in the plant area. Few first order streams originating the lease area and flowing surface runoff outside the lease.

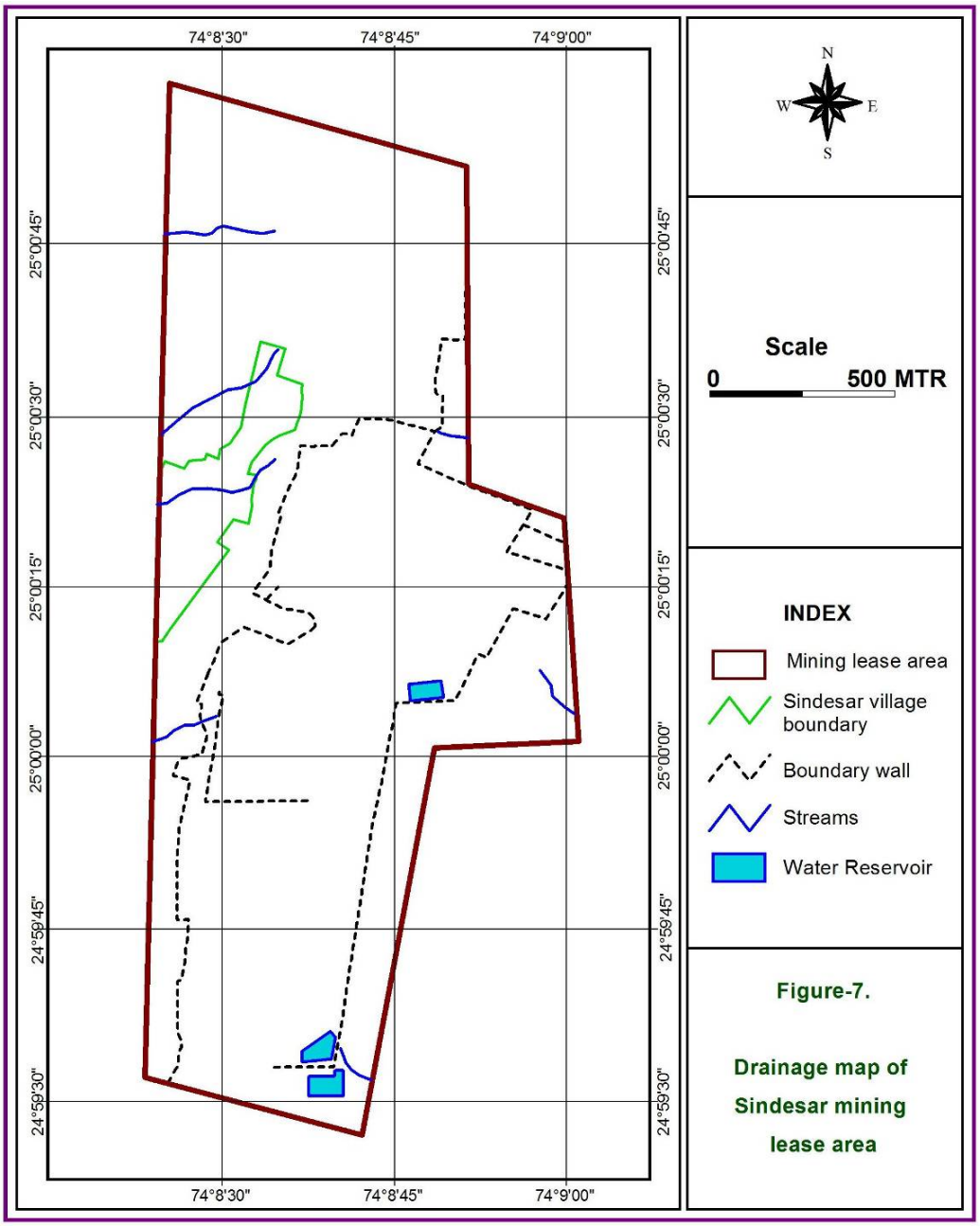


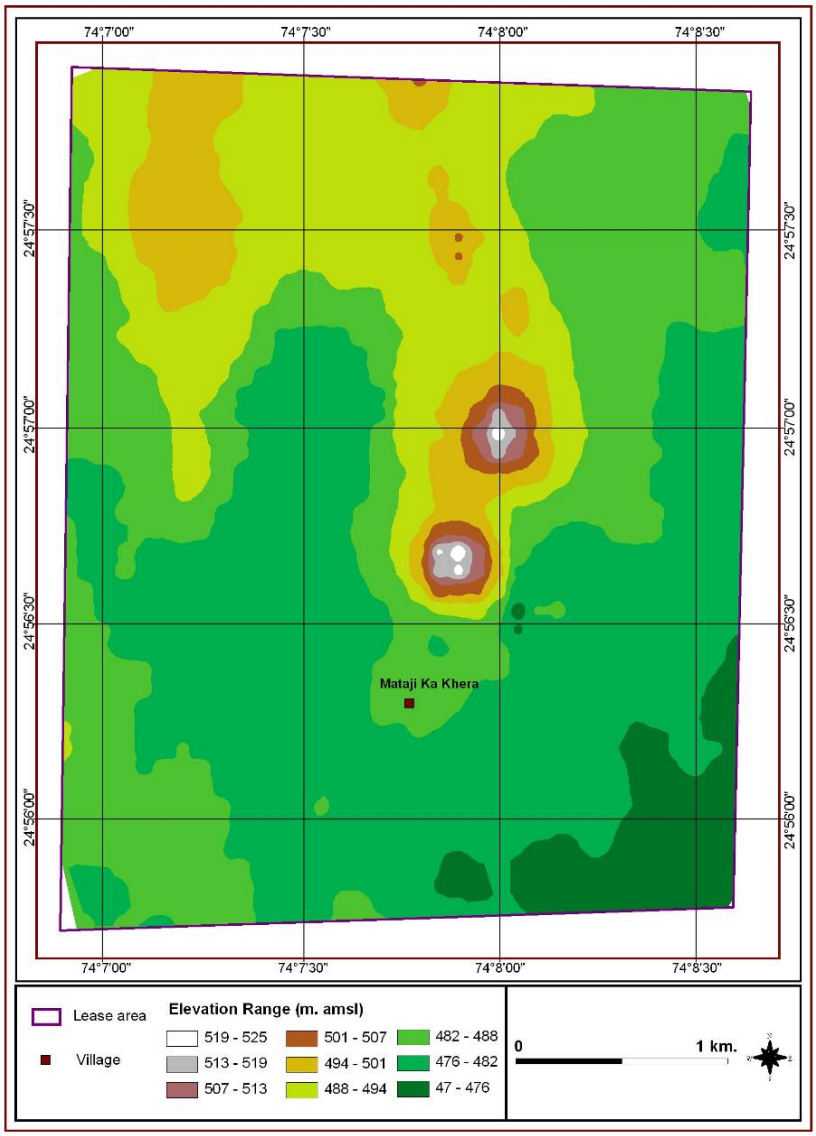
Figure-7.

Drainage map of Sindesar mining lease area

4.5.3 Digital Elevation Model

The digital elevation model shows **(Figure-8)** three small hillocks with elevation ranging from 559 meters to 470 meters in the central portion of the area. Thus following the topography, drainage is mostly from center towards east and west and drainage density is very poor. There is a canal entering the lease area from west then moving to the central portion and then finally going out from the southern boundary.

Figure-8. Digital Elevation Model of the lease area



4.5.4 Agriculture land

The thematic layer prepared using satellite imagery shows that total agriculture land within the lease area during Rabi period covers 11.40 ha which forms 5.703 % of the lease area **(Photoplate-2).** The agriculture land covers Kharif (Fallow land) period is covers 22.32 ha. which forms 11.17% of the lease. The major crops grown in this area during Khariff are Maize and Pulses and during Rabi are cotton seed, wheat and mustard.

4.5.5 Built Up Land

There is only some part of the Sindesar Khurd village, located western boundary of the lease boundary falls within the lease. The roads (Gravel & cemented) in the plant are well developed. Besides this, there are many buildings, like beneficiation plant, chemical Lab., administrative building, newly constructed plant and labour huts. The other small structures include Temple and Tower near the hill. The total built up area covers 42.04 ha **(Photoplate-1).**

4.5.6 Waste Dump

Sindesar Khurd mine is underground mine and having there dumps having covers 7.06 hectares which form 3.53 % of the lease area.

4.5.7 Ore Dump

There is a small ore dump in the eastern-central part of the Sindesar Khurd mines that covers 1.27 hectares which form 0.64 % of the total lease area.

4.5.8 Waste land

Waste land is mostly uncultivable land and is mainly classified as degraded land, land with scrubs and without scrubs, stony land, hill slopes and barren land **(Photplate-3).** It has been found that out of 41.14 hectares of the lease area which forms 20.59 % of the total lease area.

4.5.9 Land with shrubs

The overall light red tone in the entire lease area (**Figure-1**) represents the undulating stony waste land with small shrubs in the lease **(Photoplate-4)**. This area has thin vegetation, mostly shrubs and small trees. This waste land covers 32.75 ha and forms 16.39 % of the lease area.

4.5.10 Water bodies

There are two prominent water reservoir in the plant in the eastern and south-eastern boundary of the lease area. The satellite picture clearly shows that the reservoir. The other major water body is few small first order streams. The water bodies are 2.06 ha which forms 1.03 % of the lease area. HZL has carried out plantation around these reservoirs.

4.5.11 Dense Natural vegetation

There is natural vegetation (Babul, etc.) near hill slopes and roads. The area of this in the lease area occupy 11.51 hectares which forms 5.76 % of the total lease area **(Photoplate-6).**

4.5.10 Plantation done by HZL

Immediately, after the commencing of underground mining by HZL, regular plantation was carried out, saplings were planted and trees were grown. The important locations of plantation covered the area, behind the Administrative building, along the main road, within round chemical laboratory, around beneficiation plant and in the open area in front of beneficiation plant and workshop **(Photoplate-7).** This plantation covers an area of 28.29 ha and forms 14.16 % of the lease area.

4.6 Integrated land use map of the lease area

After integrating the different thematic layers of land use units of drainage and settlements etc., an integrated map has been prepared which is shown as **Figure-9.** The different land units falling under classes are shown in **Table-5** along with its % in the total mining lease area of 199.84 hectares.

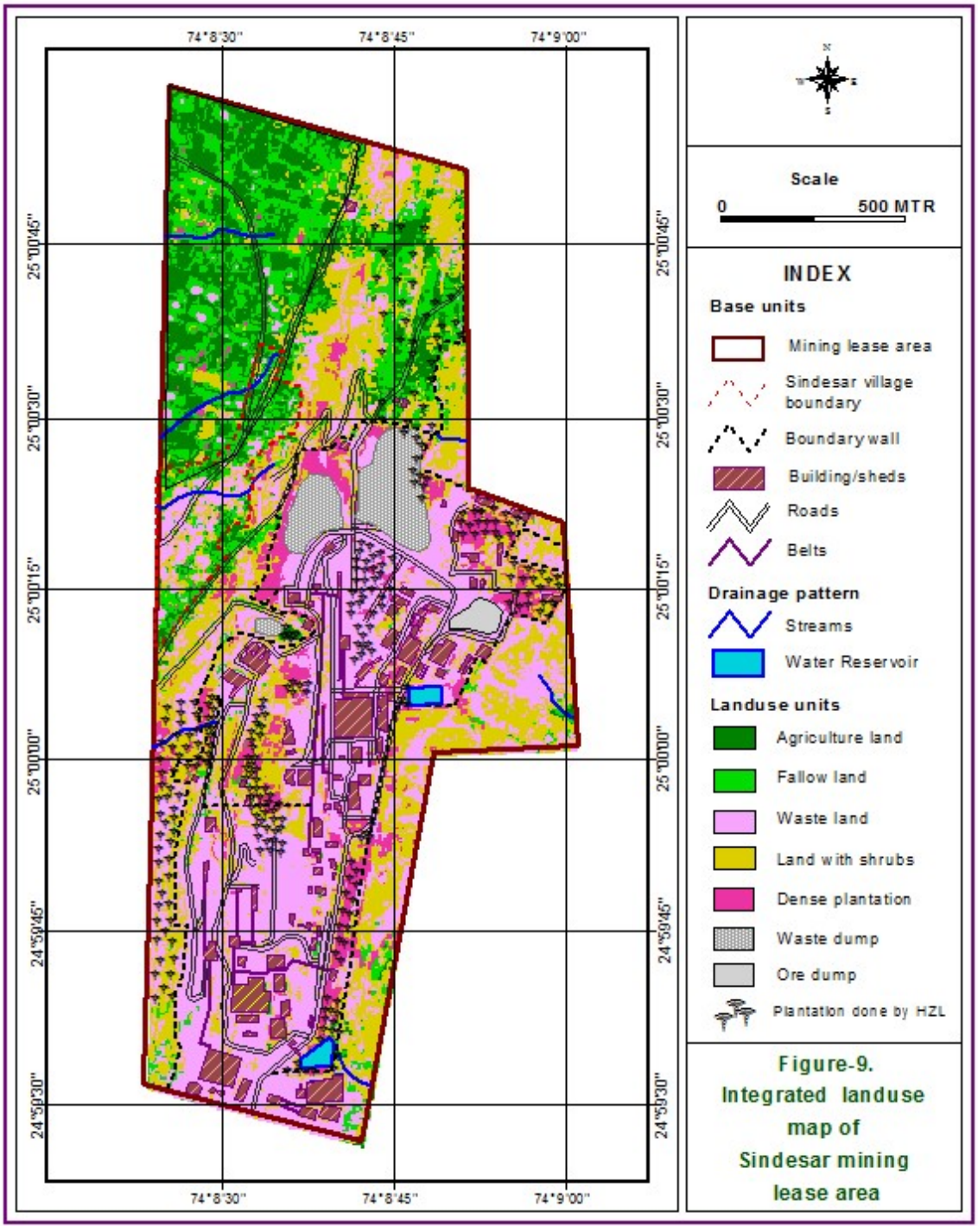
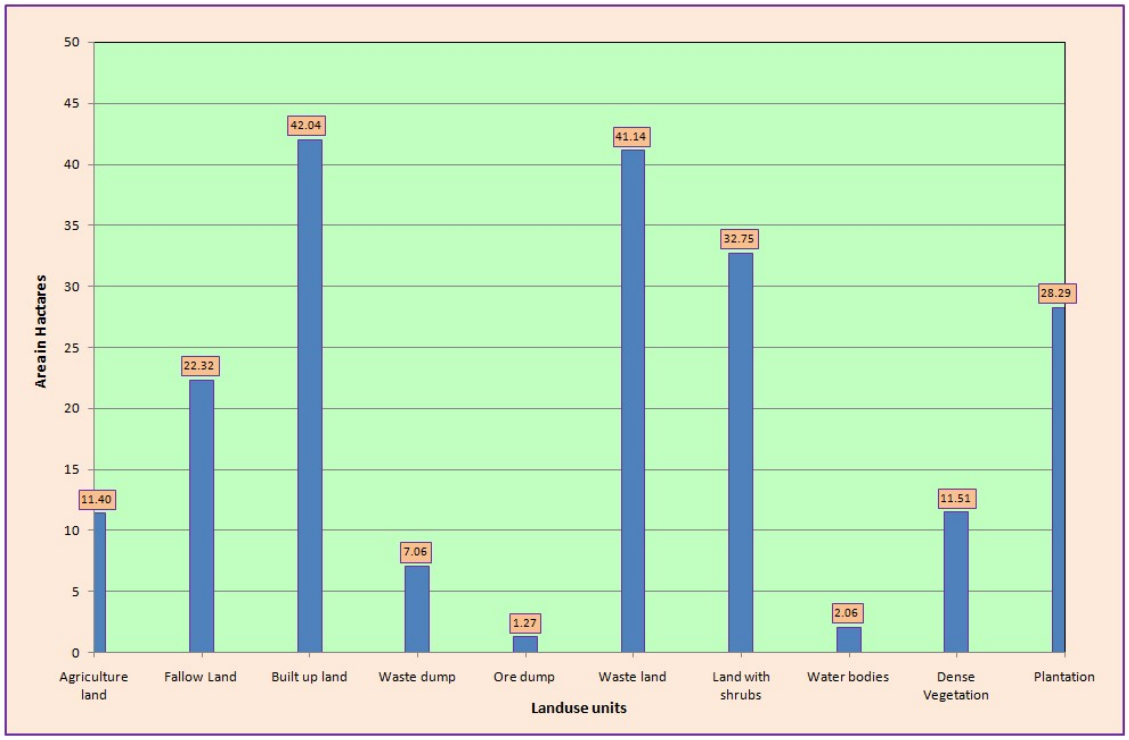


Figure-9. Integrated landuse map of Sindesar mining lease area

Table-5. Area under different land use classes in Sindesar mining lease area for integrated land use map

S. No.	Category Level I	Level II	Area in ha.	% of the total area
1.	Agriculture land	Rabi	11.40	5.70
2.	Fallow Land	Kharif	22.32	11.17
3.	Built up land	Plant buildings/sheds, road, belts/houses	42.04	21.04
4.	Waste dump	Dumps	7.06	3.53
5.	Dump	Ore dump	1.27	0.64
6.	Waste land	Barren land	41.14	20.59
7.	Land with shrubs& Plantation	Barren low lying stony waste with plantation	32.75	16.39
8.	Water bodies	Streams, water reservoir	2.06	1.03
9.	Dense Vegetation+ Plantation	Vegetation + Plantation	11.51	5.76
10.	Separate Plantation	Plantation done by HZL	28.29	14.16
			199.84 ha.	**100 %**

Figure-10. Hydrograph showing different land use units



For Hydro-Geosurvey Consultants Pvt. Ltd.,

(Dr. V.B. Khilnani)
Managing Director

Photoplate-1. Plant (Built-up land)

Photoplate-2. Agriculture land

Photoplate-3. Waste land (Barren land)

Photoplate-4. Land with shrubs

Photoplate-5. Natural vegetation (Babul)

Photoplate-6. Plantation-1

Plantation done by HZL in SK mining lease area

Plantation Photo: 1

Latitude: 25°00' 07.77"N , Longitude:74°08' 50.32"E

Plantation Photo: 2

Latitude: 25°00' 10.36"N , Longitude:74°08' 42.29"E

Plantation Photo: 3

Latitude: 25°00' 19.39"N , Longitude:74°08' 51.84"E

Plantation Photo: 4

Latitude: 25°00' 16.17"N , Longitude:74°08' 56.42"E

Plantation Photo: 5

Latitude: 24°59' 50.07"N , Longitude:74°08' 27.86"E

Plantation Photo: 6

Latitude: 25°00' 16.61"N , Longitude:74°08' 35.31"E

Plantation Photo: 7

Latitude: 25°00' 39.39"N , Longitude:74°08' 47.28"E

Plantation Photo: 8

Latitude: 25°00' 35.54"N , Longitude:74°08' 42.00"E

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JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.:U74140RJ2013PTC042216

MoEF&CC RECOGNIZED LABORATORY
NABLCERTIFICATE NO. : TC-6960
ISO 9001:2015 CERTIFIED LABORATORY
ISO 14001:2015 CERTIFIED LABORATORY
OHSAS 18001:2007 CERTIFIED LABORATORY

Sample ID No: SCS /GW/20190603/06-09	**Date of Registration: 03.06.2019**
Report No. SCS/HGCPL/GW/20190603/06-09	**Date of Report: 10.06.2019**

TEST REPORT

Name of Client : **M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client : C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt : 03.06.2019
Date of start of testing : 04.06.2019
Date of end of testing : 10.06.2019
Details of Sample : SK Mine samples marked as SK-1, SK-2, SK-3 & SK-4
Sample submitted by : M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location				IS-10500:2012		Protocol
		SK-1	SK-2	SK-3	SK-4	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	7.16	8.20	7.62	7.37	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	2160	1,596	1,280	1,272	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	3.84	1.04	0.58	0.35	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	1410	1,069	860	844	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	200	540	480	392	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	596	176	252	368	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	201.2	38.8	50.0	68.8	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	22.60	19.20	30.86	47.63	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	191.20	95.97	101.97	181.94	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	413.80	193.78	125.90	103.81	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	33.98	2.02	9.86	8.59	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.35	1.25	1.32	1.23	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	0.08	0.05	0.21	< 0.01	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	0.37	< 0.01	0.01	< 0.01	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	< 0.01	< 0.01	0.01	< 0.01	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	4.7	4.9	4.5	5.2	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

Dr. L K Agarwal 10/06
(Quality Manager)
Authorized Signatory

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RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.:U74140RJ2013PTC042216

MoEF&CC RECOGNIZED LABORATORY
NABLCERTIFICATE NO. : TC-6960
ISO 9001:2015 CERTIFIED LABORATORY
ISO 14001:2015 CERTIFIED LABORATORY
OHSAS 18001:2007 CERTIFIED LABORATORY

Sample ID No: SCS /GW/20190603/10-12	**Date of Registration: 03.06.2019**
Report No. SCS/HGCPL/GW/20190603/10-12	**Date of Report: 10.06.2019**

TEST REPORT

Name of Client : **M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client : C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt : 03.06.2019
Date of start of testing : 04.06.2019
Date of end of testing : 10.06.2019
Details of Sample : SK Mine samples marked as SK-5, SK-6 & SK-7
Sample submitted by : M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location			IS-10500:2012		Protocol
		SK-5	SK-6	SK-7	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	7.39	7.33	7.83	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	1570	1940	1,720	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	0.24	0.45	2.80	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	1025	1298	1,151	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	440	548	380	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	384	336	304	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	69.8	69.2	59.6	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	50.91	39.61	37.67	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	124.98	139.96	147.94	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	147.99	191.52	292.74	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	5.50	11.98	18.10	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.44	1.46	1.33	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	< 0.01	< 0.01	< 0.01	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	0.03	0.06	0.54	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	<0.01	<0.01	<0.01	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	4.8	4.6	5.2	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

Dr. L K Agarwal
(Quality Manager)
Authorized Signatory

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RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.:U74140RJ2013PTC042216

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NABLCERTIFICATE NO. : TC-6960
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ISO 14001:2015 CERTIFIED LABORATORY
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Sample ID No: SCS /GW/20190603/13-15	**Date of Registration: 03.06.2019**
Report No. SCS/HGCPL/GW/20190603/13-15	**Date of Report: 10.06.2019**

TEST REPORT

Name of Client : **M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client : C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt : 03.06.2019
Date of start of testing : 04.06.2019
Date of end of testing : 10.06.2019
Details of Sample : SK Mine samples marked as SK-8, SK-9 & SK-10
Sample submitted by : M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location			IS-10500:2012		Protocol
		SK-8	SK-9	SK-10	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	7.20	7.35	7.69	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	2745	2520	2910	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	0.83	0.25	0.72	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	1790	1596	1875	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	540	556	584	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	620	484	632	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	132.40	129.6	150.4	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	70.23	38.88	62.21	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	448.9	387.98	469.98	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	256.81	186.46	160.20	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	38.20	42.5	38.13	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.44	1.10	1.23	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	< 0.01	< 0.01	0.03	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	0.06	0.15	0.01	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	<0.01	<0.01	<0.01	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	5.3	4.8	5.4	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

10/06

Dr. L K Agarwal
(Quality Manager)
Authorized Signatory

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JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.:U74140RJ2013PTC042216

MoEF&CC RECOGNIZED LABORATORY
NABLCERTIFICATE NO. : TC-6960
ISO 9001:2015 CERTIFIED LABORATORY
ISO 14001:2015 CERTIFIED LABORATORY
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Sample ID No: SCS /GW/20190603/16-18	Date of Registration: 03.06.2019
Report No. SCS/HGCPL/GW/20190603/16-18	Date of Report: 10.06.2019

TEST REPORT

Name of Client : **M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client : C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt : 03.06.2019
Date of start of testing : 04.06.2019
Date of end of testing : 10.06.2019
Details of Sample : SK Mine samples marked as SK-11, SK-12 & SK-13
Sample submitted by : M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location			IS-10500:2012		Protocol
		SK-11	SK-12	SK-13	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	7.14	7.36	7.51	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	2510	1925	2,210	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	0.76	0.92	2.84	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	1620	1240	1478	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	458	561	544	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	596	468	488	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	173.10	94.2	80.0	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	39.67	56.50	69.98	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	253.95	61.95	375.85	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	191.48	175.10	91.20	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	17.20	39.13	4.50	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.32	1.32	1.41	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	< 0.01	0.02	0.01	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	0.01	0.01	0.01	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	<0.01	<0.01	<0.01	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	4.9	4.3	4.7	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

Dr. L K Agarwal
(Quality Manager)
Authorized Signatory

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RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.:U74140RJ2013PTC042216

MoEF&CC RECOGNIZED LABORATORY
NABLCERTIFICATE NO. : TC-6960
ISO- 9001:2015 CERTIFIED LABORATORY
ISO- 14001:2015 CERTIFIED LABORATORY
ISO-18001:2007 CERTIFIED LABORATORY

Sample ID No: SCS /GW/20191105/19-22	Date of Registration: 05.11.2019
Report No. SCS/HGCPL/GW/20191105/19-22	Date of Report: 09.11.2019

TEST REPORT

Name of Client	:	**M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client	:	C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt	:	05.11.2019
Date of start of testing	:	05.11.2019
Date of end of testing	:	09.11.2019
Details of Sample	:	SK Mine samples marked as SK-1, SK-2, SK-3 & SK-4
Sample submitted by	:	M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location				IS-10500:2012		Protocol
		SK-1	SK-2	SK-3	SK-4	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	6.58	7.42	7.84	6.91	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	2,290	860	1,683	1,920	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	2.37	8.84	< 0.10	< 0.10	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	1,486	568	1,001	1,279	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	336	140	520	416	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	584	324	160	544	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	198.4	78.4	27.2	132.8	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	21.38	31.1	22.36	51.52	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	305.91	97.96	63.98	211.93	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	392.58	6.9	253.19	375.45	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	32.94	61.48	0.91	37.12	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.19	1.07	1.81	1.07	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	0.05	1.15	<0.01	< 0.01	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	0.74	0.05	0.01	<0.01	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	0.05	0.03	<0.01	<0.01	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	5.1	5.1	5.6	4.6	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

Dr. L K Agarwal
(Quality Manager)
Authorized Signatory

SCS ENVIRO SERVICES PVT. LTD. JAIPUR

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SCS **SCS ENVIRO SERVICES PRIVATE LIMITED**

7, KESAR VIHAR, OPPOSITE KHATU SHYAMJI TEMPLE,
RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.:U74140RJ2013PTC042216

MoEF&CC RECOGNIZED LABORATORY
NABLCERTIFICATE NO. : TC-6960
ISO- 9001:2015 CERTIFIED LABORATORY
ISO- 14001:2015 CERTIFIED LABORATORY
ISO-18001:2007 CERTIFIED LABORATORY

Sample ID No: SCS /GW/20191105/23-25	Date of Registration: 05.11.2019
Report No. SCS/HGCPL/GW/20191105/23-25	Date of Report: 09.11.2019

TEST REPORT

Name of Client : **M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client : C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt : 05.11.2019
Date of start of testing : 05.11.2019
Date of end of testing : 09.11.2019
Details of Sample : SK Mine samples marked as SK-5, SK-6 & SK-7
Sample submitted by : M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location			IS-10500:2012		Protocol
		SK-5	SK-6	SK-7	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	7.22	7.02	7.07	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	1,842	1,790	1,522	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	<0.10	<0.10	<0.10	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	1,078	966	858	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	372	540	464	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	268	308	344	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	57.6	65.6	70.4	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	30.13	34.99	40.82	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	179.94	133.96	103.97	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	301.26	158.26	146.94	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	0.31	18.93	19.18	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.7	1.7	1.81	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	0.2	< 0.01	< 0.01	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	0.36	0.11	0.05	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	<0.01	<0.01	<0.01	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	5	5.1	5	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

Dr. L K Agarwal
(Quality Manager)
Authorized Signatory

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RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.:U74140RJ2013PTC042216

MoEF&CC RECOGNIZED LABORATORY
NABLCERTIFICATE NO. : TC-6960
ISO- 9001:2015 CERTIFIED LABORATORY
ISO- 14001:2015 CERTIFIED LABORATORY
ISO-18001:2007 CERTIFIED LABORATORY

Sample ID No: SCS /GW/20191105/26-28	**Date of Registration: 05.11.2019**
Report No. SCS/HGCPL/GW/20191105/26-28	**Date of Report: 09.11.2019**

TEST REPORT

Name of Client : **M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client : C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt : 05.11.2019
Date of start of testing : 05.11.2019
Date of end of testing : 09.11.2019
Details of Sample : SK Mine samples marked as SK-8, SK-9 & SK-10
Sample submitted by : M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location			IS-10500:2012		Protocol
		SK-8	SK-9	SK-10	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	7.04	6.71	6.75	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	2,590	1,188	2,530	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	0.65	0.4	1.25	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	1,453	794	1,543	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	452	384	488	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	464	548	584	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	112	166.4	126.4	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	44.71	32.08	65.12	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	389.9	89.97	389.8	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	171.97	59.45	141	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	24.97	30.85	1.29	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.36	1.01	1.18	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	< 0.01	< 0.01	0.05	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	0.06	0.13	2.11	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	<0.01	<0.01	0.05	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	5	5.1	4.7	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

Dr. L K Agarwal
(Quality Manager)
Authorized Signatory

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ISO- 14001:2015 CERTIFIED LABORATORY
ISO-18001:2007 CERTIFIED LABORATORY

Sample ID No: SCS /GW/20191105/29-31	Date of Registration: 05.11.2019
Report No. SCS/HGCPL/GW/20191105/29-31	Date of Report: 09.11.2019

TEST REPORT

Name of Client : **M/s Hydro-Geosurvey Consultants Pvt. Ltd.,**
Address of Client : C-103, Shastri Nagar, Jodhpur-342003
Date of Sample Receipt : 05.11.2019
Date of start of testing : 05.11.2019
Date of end of testing : 09.11.2019
Details of Sample : SK Mine samples marked as SK-11, SK-12 & SK-13
Sample submitted by : M/s Hydro-Geosurvey Consultants Pvt. Ltd., Representative

Parameters	Units	Location			IS-10500:2012		Protocol
		SK-11	SK-12	SK-13	Requirement (Acceptable Limit)	Permissible Limit	
pH	---	6.92	7.42	7.13	6.5 to 8.5	No relaxation	APHA (22nd Edition) 4500- H^+
Electrical Conductivity	µS/cm	1,142	2,130	3,530	-	-	APHA(22nd Edition) 2510-B
Colour	Hazen	<1	<1	<1	5	15	APHA(22nd Edition) 2120
Turbidity	NTU	0.61	1.22	1.75	1	5	APHA(22nd Edition) 2130
Dissolved solid	mg/l	643	1,409	2,089	500	2000	APHA (22nd Edition) 2540 C
Total alkalinity as $CaCO_3$	mg/l	388	436	532	200	600	APHA (22nd Edition) 2320 B
Total Hardness as $CaCO_3$	mg/l	216	796	720	200	600	APHA (22nd Edition) 2340 C
Calcium as Ca	mg/l	44.8	128	145.6	75	200	APHA (22nd Edition) 3500 Ca B
Magnesium as Mg	mg/l	25.27	115.67	86.51	30	100	APHA (22nd Edition) 3500 Mg B
Chlorides as Cl	mg/l	101.97	147.95	633.8	250	1000	APHA (22nd Edition) 4500 Cl B
Sulphate as SO_4	mg/l	30.77	387.42	265.14	200	400	APHA (22nd Edition) 4500 E
Nitrate as NO_3	mg/l	0.86	23.78	29.13	45	No relaxation	APHA (22nd Edition) 4500 B
Fluoride as F	mg/l	1.43	0.93	1.29	1	1.5	APHA (22nd Edition) 4500 F D
Iron as Fe	mg/l	0.04	< 0.01	< 0.01	0.3	No relaxation	APHA (22nd Edition) 3500- B
Lead as Pb	mg/l	<0.01	<0.01	<0.01	0.01	No relaxation	APHA (22nd Edition) 3111- B
Zinc as Zn	mg/l	1.1	< 0.01	< 0.01	5	15	APHA (22nd Edition) 3111- B
Cadmium as Cd	mg/l	<0.003	<0.003	<0.003	0.003	No relaxation	APHA (22nd Edition) 3111- B
Copper as Cu	mg/l	<0.01	<0.01	<0.01	0.05	1.5	APHA (22nd Edition) 3111- B
Nickel as Ni	mg/l	<0.01	<0.01	<0.01	0.02	No relaxation	APHA (22nd Edition) 3111- B
Total Chromium as Cr	mg/l	<0.01	<0.01	<0.01	0.05	No relaxation	APHA (22nd Edition) 3111- B
Manganese as Mn	mg/l	0.06	<0.01	<0.01	0.1	0.3	APHA (22nd Edition) 3111- B
Dissolved Oxygen	mg/l	4.7	4.6	5.3	-	-	APHA (22nd Edition) 4500 DO C

Per pro SCS Enviro Services Pvt. Ltd;

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