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No. 8-102/2013-FC/ 4230

13th March, 2020

To,

Shri Sandeep Sharma,
Assistant Inspector General of Forests (FC),
Government of India,
Ministry of Environment Forest & Climate Change
(Forest Conservation Division)
Indira Paryavaran Bhawan, Aliganj, Jor Bagh Road,
New Delhi – 110003.

- Sub: (i) Diversion of 4.2 ha of forest land (PH & Barrage Quarry of 0.5 ha and Muck Access Road of 3.7 ha) in respect of Heo Hydro Electric Project (240 MW) being developed by M/s Heo Hydro Power Pvt. Ltd in West Siang District of Arunachal Pradesh.
- (ii) Diversion of 55.70 ha of forest land (Surface forest land = 47.10 ha, River Bed = 5.90 ha, Underground area = 2.70 ha) for construction of (240 MW) Heo Hydro Electric Project being developed by M/s Heo Hydro Power Pvt. Ltd in West Siang District of Arunachal Pradesh.
- (iii) Diversion of 91.70 ha of forest land (Surface forest land = 79.10 ha, River Bed = 9.30 ha, Underground area = 3.30 ha) for construction of Pauk Hydro Electric Project (145 MW) in West Siang District of Arunachal Pradesh by M/s Pauk Hydro Power Private Ltd.
- (iv) Diversion of 52.80 ha of forest land (Surface forest land = 47.10 ha, River Bed = 2.30 ha, Underground area = 2.80 ha) for construction of Pauk Tato-I Hydro Electric Project (186 MW) in West Siang District of Arunachal Pradesh by M/s Siyota Hydro Power Private Ltd.

- Ref: (i) Letter F. No. 8-102/2013-FC dated 19.06.2019 MoEF& CC (FC Division), New Delhi.
(ii) Letter F.No. 8-94/2013-FC(Vol.) dated 19.06.2019 of MoEF&CC, New Delhi.

Sir,

In inviting reference on the subject and letters cited above, I am to enclose herewith the site inspection report carried out by this Regional Office, Shillong on 19th & 20th November, 2019 in respect of the 3 (three) Hydro Electric Projects as desired by Ministry's letter mentioned above for your kind further necessary action please.

Encl.: As stated above.

भवदीय,

(W.I. Yatbon)

वन उप महानिरीक्षक (केंद्रीय)

/Deputy Inspector General of Forests(C)

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**REPORT OF THE SITE VISIT OF TATO-I HEP, HEO HEP AND PAUK HEP CARRIED OUT BY
REGIONAL OFFICE SHILLONG .**

BACKGROUND:

The user agency, Velcan Energy, is developing following three Hydro-Electric projects in cascade on River Yarjep in Shi Yomi District (Previously West Siang District), of Arunachal Pradesh. These projects are:

- Pauk HEP (145 MW), being implemented by Pauk Hydro Power Pvt Ltd
- Heo HEP (240 MW), being implemented by Heo Hydro Power Pvt Ltd
- Tato-I HEP (186 MW), Being implemented by Siyota Hydro Power Pvt Ltd

Area Applied for Forest Clearances for each of the Project is given below:

Table:1: Statement of area Applied for and granted IPA

	Surface Land (Ha)	Riverbed (Ha)	Underground (Ha)	Total (Ha)
Tato-I HEP	47.7	2.3	2.8	52.8
Heo HEP	47.1	5.9	2.7	55.7
Pauk HEP	79.1	9.3	3.3	91.7
Total	173.9	17.5	8.8	200.2

As per the above earlier submission of the User Agency, the In-Principle Approval for the three HEPs were granted by Ministry vide letters mentioned below:-

Sl. No	Name of the proposal	Area (ha)	Letter and date of the In Principle Approval
1	Diversion of 52.80 ha of forest land(Surface forests land =47.1 ha, Riverbed =2.3 ha & Underground area= 2.8 ha) for construction of Tato-I H.E.P. Project (186 MW) in West Siang District of Arunachal Pradesh by M/s Siyota Hydro Power Private Limited.	52.80	Letter F.No. 8-102/2013-FC dated 27.10.2015
2	Diversion of 55.70 ha of forest land(Surface forests land =47.1 ha, Riverbed =5.9 ha & Underground area= 2.7 ha) for construction of Heo H.E.P. Project (240 MW) in West Siang District of Arunachal Pradesh by M/s Heo Hydro Power Private Limited.	55.70	Letter F.No. 8-94/2013-FC dated 27.10.2015
3	Diversion of 91.70 ha of forest land (Surface forests land =79.10 ha, Riverbed =9.30 ha & Underground area= 3.30 ha) for construction of Pauk H.E.P. Project 91.70(145 MW) in West Siang District of Arunachal Pradesh by M/s Pauk Hydro	91.70	Letter F.No. 8-71/2014-FC dated 27.10.2015

Power Private Limited.		
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Now User Agency has sought changes in the area of the three HEPs for which the FAC has examined and the Ministry has sought for a fact check through a Site Visit to ascertain the details of the request made by the User Agency and to make recommendations as per the mandate below:

- i. Regional office Shillong shall inspect the area and submit a detail report related to area required to be deleted or added to the forest land which has already been granted *in-Principle* approval.
- ii. The Status of quarry sites which the user agency had proposed to be abandoned due to geological studies may be ascertained. Regional office may clearly give recommendation if that area can be taken out of the purview of *In-Principle* approval granted earlier to the project and managed under regular management of the forest department or the user agency has to keep the area within the project and maintain as a green belt. The requirement of CA area can be calculated accordingly.
- iii. Regional office may also see the option of approach roads to the newly proposed quarry sites. It may be checked if the area of approach road is also a part of the proposal.
- iv. Regional office may see all three HEPs of the same company. The user agency had proposed re-appropriation of area of these projects. The requirement of CA need to reassessed and reported accordingly.
- v. State Government in consultation with Regional office, Shillong may submit exact requirement of area along with shape files so that the *in principle* approval granted to the project can be modified accordingly.

The site visit has been carried out and 19th & 20th November, 2019 accompanied by the Mr Abhinav Kumar, DFO Aalo, Mr. James T. Singh, Research Officer from Regional Office and accompanied by the representatives from the user agencies. The user agency has provided a detailed and comprehensive presentation on the night of the 18 November, 2019 wherein it has clearly explained the location of the three HEPs, the reason for the change in the area and other details. It may be mentioned that the three HEPs are located in very difficult area and visit to all the possible sites were made but the inaccessible terrain renders visit to all spots very time consuming. After the site visit it was seen that some additional information would be required to prepare a comprehensive report.

The Regional Office, Shillong vide letter No. 8-94/2013-FC/3040-42 dated 27.11.2019 has requested the State Govt to provide the additional information on the 3 HEP's and the reply on the same was furnished by the State Govt vide letter FOR.322/Cons/2010/300-07 dated 31.01.2020.

1. Deletion and Addition of Area:

Area wise break-up as granted under IPA for the 3 projects namely, Tato HEP, Heo HEP and Pauk HEP are given in Table 1 above

The addition and deletion that the User Agency has now desired to make changes within the proposal are as follows:

Table:2: Statement of area of IPA and Changes proposed

		Surface Land (Ha)	Changes In Surface Land (Ha)	Riverbed (Ha)	Underground (Ha)	Total (Ha)
Tato-I HEP	Earlier	47.7		2.3	2.8	52.8
	New	47.7	-0.5+0.5 -0.3+0.3	2.3	2.8	52.8
Heo HEP	Earlier	47.1		5.9	2.7	55.7
	New	51.3	-0.3+0.3 -0.3+0.3 +3.7, +0.5	5.9	2.7	59.9
Pauk HEP	Earlier	79.1		9.3	3.3	91.7
	New	74.9	-3.7 -0.5	9.3	3.3	87.5
Total		173.9		17.5	8.8	200.2

While the overall area is same, that is 200.2 ha, it may be mentioned that there are six area changes that the UA has requested for, of which four sites are changes from old sites (to be abandoned) to new sites and 2 sites are for re-appropriation in Surface Land area from Pauk HEP to be added to the Heo HEP which are discussed below as per the mandate given by the Ministry:

- 1. THE STATUS OF QUARRY SITES PROPOSED TO BE ABANDONED DUE TO GEOLOGICAL STUDIES AND TO RECOMMEND IF THAT AREA CAN BE TAKEN OUT OF THE PURVIEW OF IPA GRANTED EARLIER TO THE PROJECT AND MANAGED UNDER REGULAR MANAGEMENT OF THE FOREST DEPARTMENT OR THE USER AGENCY TO KEEP THE AREA WITHIN THE PROJECT AND MAINTAIN AS A GREEN BELT.**

The User Agency has applied for change of the quarry sites due to unavoidable technical problem, namely, that the rocks from the quarry proposed are not of the required standard. They have substantiated their claim by submitting Petrographic Analysis report of the rock sample from the proposed quarry sites wherein it was found that there is high presence of

Calcite and Biotite (Mica) in the material which is said to be not conducive for construction purposes (Annexure- A). The reason for abandonment of old quarry sites seems justified.

With regards to the status of the quarries proposed to be abandoned, it may be mentioned that the state of Arunachal Pradesh is covered with 79.63 % forest cover. Majority of the land is being held by the community and the area which is being proposed to be diverted is a community land. These lands are given the status of USF (Unidentified State Forests) and are being managed by the Community. It is understood that the whole area involved in the proposal is yet to be acquired and the land acquisition process is yet to start. **Hence as the area is neither being managed by the Forest Department nor does it belong to the User Agency; it would be wise for the land being surrendered by the User Agency to be deleted from the proposal. This area will continue to be with the Community to be managed by them.**

The quarry sites that are proposed to be abandoned by the UA and the status of Green Zone:

Table 3: Sites proposed to be abandoned and status of Green Zone

Project	Quarry status	Name of Village	Area in ha	Justification	Remarks w.r.t. Green Zone
Tato-I HEP	Old(to be abandoned)	Gapo	0.3	Not meeting technical requirement as per petrographic analysis	The old proposed quarry area has not been acquired. The forest is with the Community.
	New	Meying	0.3	Approved Quarry of TEC accorded DPR.	--
	Old(to be abandoned)	Heo	0.5	Not meeting technical requirement as per petrographic analysis	The old proposed quarry area has not been acquired. The forest is with the Community.
	New	Padusa	0.5	Approved Quarry of TEC accorded DPR.	--
Heo HE P	Old(to be abandoned)	Hiri	0.3	Not meeting technical requirement as per petrographic analysis	The old proposed quarry area has not been acquired. The forest is with the Community.
	New	Lipusi	0.3	Approved Quarry of TEC accorded DPR.	
	Old(to be abandoned)	Gapo	0.3	Not meeting technical requirement as per petrographic analysis	The old proposed quarry area has not been acquired. The forest is with the Community.
	New	Meying	0.3	Approved Quarry of TEC accorded DPR.	
Pauk HEP	No site proposed for abandoning/changing. Only re-appropriation of 0.5 ha of quarry area (Chengrong village) and 3.7 ha road (Hiri village) to Heo HEP. (TEC to Pauk DPR not received as Pauk DPR is under preparation stage).				

Apart from the fact that the areas proposed to be abandoned have never been under the Forest Department nor was it acquired by the UA, it is also found that since the location of the proposal itself is in lush green forests and the sites are not surrounded by polluting activities, the idea of green zone does not seem necessary.

Therefore the above sites proposed to be abandoned are recommended to be taken out of the purview of the IPAs and the proposed new sites need to be added to be as part of the IPA issued.

2. STATUS OF APPROACH ROADS TO THE NEWLY PROPOSED QUARRY SITES AND TO CHECKED IF THE AREA OF APPROACH ROAD IS ALSO A PART OF THE PROPOSAL

The matter of access to the new proposed quarry sites have been examined and it is found that the new sites have been proposed along the existing roads or along the proposed roads which are part of the current proposal. User Agency and the DFO Along have given evidence of the same and the proposed sites have been checked as per the KML files submitted and found to be so. A table reiterating what is stated is given below:

Table 4: New Quarry Sites proposed and status of their Access

Project		Name of Village	Area in Ha	Justification	Remarks regarding Access to New Site
Tato-I HEP	Old(to be abandoned)	Gapo	0.3	Not meeting technical requirement	-
	New	Meying	0.3	Approved Quarry of TEC accorded DPR.	Adjoining to Proposed Heo PH road.
	Old(to be abandoned)	Heo	0.5	Not meeting technical requirement	-
	New	Padusa	0.5	Approved Quarry of TEC accorded DPR.	Adjacent to BRO road (Tato-Mechukha)
Heo HEP	Old(to be abandoned)	Hiri	0.3	Not meeting technical requirement	-
	New	Lipusi	0.3	Approved Quarry of TEC accorded DPR.	Adjacent to BRO road (Tato-Mechukha)
	Old(to be abandoned)	Gapo	0.3	Not meeting technical requirement	-
	New	Meying	0.3	Approved Quarry of TEC accorded DPR.	Adjoining to Proposed Heo PH road.
Pauk HEP	New	Chengrong	0.5	Quarry meets technical standards	Situated along BRO main road

The status of connectivity of the roads can also be checked from the maps enclosed as Annexure B, C and E.

3. RE-APPROPRIATION OF AREA OF THE THREE PROJECTS AND ASSESSMENT OF THE REQUIREMENT OF AREA FOR COMPENSATORY AFFORESTATION.

As mentioned earlier, there are six area changes that the UA has requested for, of which four sites are changes from old to new sites and **2 sites are for re-appropriation in Surface Land area from Pauk HEP to be added to the Heo HEP.** The details of the two land re-appropriation are as follows:

- 0.5 ha (out of total quarry area of 1 ha) from Pauk Dam quarry site at Chengrong Village is proposed to be re-appropriated to Heo Barrage/PH to compensate demand of the revised barrage design.
- 3.70 ha of access road (out of 12.6 ha proposed under Pauk HEP) branching off from BRO road which caters accessibility to project components of BOTH Pauk HEP and Heo HEP is proposed to be re-appropriated to Heo HEP (As Pauk DPR has been delayed, this road will provide access to Heo HEP's Barrage Muck Disposal Area).
- Therefore 4.2 ha (0.5 + 3.7 ha) of land re-appropriated (deleted) from Pauk HEP and added to Heo HEP. Hence CA land of 8.4 Ha is indentified at Kasin Puttu VFR, Hapoli Forest Division.

Table showing Re-appropriation of area of the Projects from within the IPA approved area:

Table 5: Statement showing the Re-appropriation of area

Name of HEP	Surface Land (Ha)		Components				Remarks
			Quarry		Access Road		
	Earlier	New	Earlier	New	Earlier	New	
Tato-I HEP	47.7	47.7	No Change				
Heo HEP	47.1	51.3 (4.2 ha added)	0.6	1.1 (0.5 ha added)	3.0	6.7 (3.7 ha added)	An area of 3.7 ha access road from Pauk HEP is added to Heo HEP. Also an area of 0.5 ha from Pauk HEP Quarry is added to Heo HEP Quarry.
Pauk HEP	79.1	74.9 (4.2 ha deleted)	1.0	0.5 (0.5 ha deleted)	12.6	8.9 (3.7 ha deleted)	

The Proposed quarry of 1.0 ha under Pauk HEP of which 0.5 ha is to be re-appropriated to HEO HEP is at location Chengrong Village and the GPS location and reading is verified from the shape file submitted and as per map at Annexure- C and table given at Annexure-D.

The polygon for the change of 3.7 ha from Pauk HEP to Heo HEP being access road to Muck DA has been submitted and the GPS location of the starting and ending point of the road are given as per map at Annexure- E and table given at Annexure-D

REVISED CA AREA REQUIREMENT:

The CA area proposed for the Tato-I and Heo HEPs are given below. However as stated earlier that since the DPR of the Pauk HEP is not completed and that there is likelihood that the area may further change, the CA area of only Tato-I and Heo HEP may be treated as final and the details of Pauk HEP shall be dealt with as and when the DPR is completed.

Table 6: CA Area Requirement for Tato-I and Heo HEPs

Project	Surface Land & River Bed (Ha)	CA as per IPA		Revised CA		Remarks
		Name of Village	Area	Name of Village	Area	
Tato-I HEP	47.7+2.3=50	Chisi VRF	100	Chisi VRF	83	
				Tashi Philly	17	
	Total for Tato		100		100	
Heo HEP	47.1+5.9=53	Chisi VRF	106	Chisi VRF	94	
				Tashi Philly	12	
	4.2			Kasin Puttu (Ago)VFR	8.4	Additional area 4.2 ha from Pauk HEP.
	Total for Heo		106		114.4	

4. STATE GOVERNMENT IN CONSULTATION WITH REGIONAL OFFICE, SHILLONG MAY SUBMIT EXACT REQUIREMENT OF AREA ALONG WITH SHAPE FILES SO THAT THE *IN PRINCIPLE* APPROVAL GRANTED TO THE PROJECT CAN BE MODIFIED ACCORDINGLY.

The exact requirement of the land for the three HEP cannot be ascertained as the Pauk HEP's DPR has not been finalized. The area required may most likely be more than what is currently proposed and given that 4.2 ha (3.7 and 0.5 ha) is being re-appropriated to the

Heo HEP, the status of requirement of land for Pauk HEP cannot be fixed as of now. However for the Tato I HEP and for the Heo HEP the table below shows the exact requirement of forest land.

The State Government has recommended the proposed area and CA area required as per its letter For.322/Cons/2010/300-07 dated 31/01/2020 attached as Annexure-F.

Table 7: Final area requirement of Pauk HEP and Heo HEP

	Tato-I HEP		Heo HEP		Remarks
	Earlier	Revised	Earlier	Revised	
Surface Land	47.7	47.7	47.1	51.3	With regards to changes within the HEP and re-appropriation from Pauk to Heo HEP details given in table 2, 3 and 4
Riverbed	2.3	2.3	5.9	5.9	No Change
Underground	2.8	2.8	2.7	2.7	No Change
	52.8	52.8	55.7	59.9	

The area with regards to Pauk HEP as mentioned above is fluid given that the 4.2 ha has been deleted from its present proposal and the DPR is yet to be finalised and the requirement of additional area cannot be ruled out. Ministry may reconsider the IPA granted in respect of Pauk HEP as and when the area is finalized as a fresh proposal or as it deems fit.

Shape file has been submitted and the area with regards to the proposed earlier area components and the 4 new proposed sites of all quarries have been checked at this office and have been found correct.

RECOMMENDATIONS:

- 1. RECOMMENDATION WITH RESPECT TO THE AREA REQUIRED TO BE DELETED OR ADDED TO THE FOREST LAND WHICH HAS ALREADY BEEN GRANTED *IN-PRINCIPLE* APPROVAL.**

The Regional Office having carried out the site visit as directed by the Ministry and having discussed with the local officers and the State Government recommends the following:

Tato HEP: No change in total area involved, i.e. 52.8 ha. Changes with regards to the two new quarries are recommended for approval.

- **Change of site 1:** A new quarry area of 0.5 Ha in Padusa village to be added and 0.5 ha site at Heyo village to be deleted from the IPA
- **Change of site 2:** A new quarry area of 0.3 ha in Meying village to be added and 0.3 ha site in Gapo village to be deleted.

The GPS location details of the polygon of the old (to be abandoned) quarry and the New (to be added) quarry has been given in Annexure D. The new quarries are accessible from existing road and road under proposal.

Heo HEP: Change in total area involved is addition of 4.2 ha by way of re-appropriation, so total area proposed is changed from 57.7 to 61.9 ha and also change of sites for two quarries are recommended.

- **Change of site 1:** A new quarry of 0.3 ha area at Lipusi village to be added and 0.3 ha quarry site in Hiri village to be deleted from the IPA
- **Change of site 2:** A new quarry area of 0.3 ha in Meying village to be added and 0.3 ha site in Gapo village to be deleted from the IPA.
- **Addition of area 1:** A part of 0.5 ha from Pauk HEP Dam quarry site at Chengrong Village to be re-appropriated to Heo HEP.
- **Addition of area 2:** Proposed access road to Muck Dumping Area of an area of 3.70 ha (out of 12.6 ha proposed under roads in Pauk HEP) providing accessibility to both Pauk HEP and Heo HEP proposed under Pauk HEP proposal is to be re-appropriated to Heo HEP (As Pauk DPR has been delayed).

Thus an area of 4.2 ha (0.5 + 3.7 ha) is to be added to the area under IPA.

The GPS location details of the polygon of the old (to be abandoned) quarry and the New (to be added) quarry has been given in Annexure D. The new quarries are accessible from existing road and road under proposal.

Therefore the above changes in respect of Tato-I HEP and Heo HEP as detailed above are recommended for necessary alterations in the IPAs in respect of these HEPs. However, with regards to Pauk HEP, in view of the reasons stated earlier in para 4 which include, possible change in the total area to be required after approval of DPR, it is suggested that the IPA with regards to this HEP may be considered as and when their final requirement as per DPR is submitted by the User Agency.

2. RECOMMENDATION WITH REGARDS TO GREEN ZONE: The sites proposed to be abandoned as detailed in Table 3 are recommended to be taken out of the purview of the IPAs and the abandoned quarries which are currently with the community will continue to be with them and managed by them.

3. RECOMMENDATION WITH REGARDS TO CA AREA:

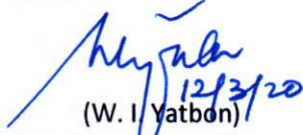
- The CA area with respect to Tato-I remains as given in the IPA, i.e. 100 ha

- With regards to Heo HEP, in view of addition of 4.2 ha, the proposal area has increased from 53 ha to 57.2 ha (surface + riverbed area) and subsequently CA area is to be increased by 8.4 ha from 106 ha to 114.4 ha. The additional area of 8.4 ha being twice the 4.2 ha additional land added to Heo HEP from Pauk HEP has been identified at Kasin Puttu (Ago) VFR has been verified in the DSS by the Sr. T.A. of Regional Office and found to be acceptable.

CA proposed by the State Government with regards to Tato-I and Heo HEP are recommended for acceptance. The area with respect to Pauk HEP can be finalized only after approval of DPR of PAUK HEP.

4. The new proposed CA area of 8.4 ha in respect of Heo HEP has been analysed in the DSS available in this office and the area is found acceptable and report is attached as Annexure-G. The new proposed quarries have also been analysed in DSS as per Annexure-D and the report has been attached as Annexure D-I.

Submitted,


(W. I. Yatbon)
Dy. Inspector General of Forests (C)
Regional Office, Shillong

ANNEXURE-A
(Petrographic Analysis)

INTRODUCTION:

This report incorporates petrographic study of four rock samples from Heo Dam right bank area, Arunachal Pradesh. The rock samples were submitted by M/s Velcan Energy India Pvt. Ltd., New Delhi, at the ATES, New Delhi office dated 26th March-2013.

A total number of 8 thin sections were prepared. Petrography of rock samples has been carried out as per standard IS: 2386 (Pt-8)-1963 (Reaffirmed-1997)-"Petrographic Examination".

Given samples were examined megascopically as well as thin sections under polarizing microscope with an aim to identify different mineral constituents, detrimental minerals, if any and photo-micrographed for documentation. The microscopic examination also includes study of micro-textures and alterations which have been observed between minerals grain boundaries.

The rocks description given hereunder solely pertains to megascopic and microscopic study of two thin sections only of each sample without any feed back of the field description and name, keeping this in view it is suggested that given name of the rock type by laboratory studies should preferably not be matched with text book description of the rock. But it should be viewed in conjunction with alterations identified, if any, of the rock.

PETROGRAPHIC OBSERVATIONS AND INTERPRETATIONS**PETROGRAPHIC STUDY OF SAMPLE NO-1:**

Senders sample ID	:	Sample-1
Field name of sample, if any (assigned by the sender)	:	Not Specified
Nature of the sample	:	Rock Chunk
Location/ Depth of the sample	:	On right side river flank
Sample ID (ATES Lab)	:	Rock Chunk/03-13/182/13/01
Laboratory name of the sample (assigned by the present study)	:	Impure Marble with flakes of biotite

Megascopic Study of the Sample (Study aid –naked eye & hand lens):

It is a greenish to greyish white rock which is medium to coarse grain having low to medium specific gravity. The rock gives profuse effervesces with dilute hydrochloric acid. The chief mineral which is identified in the hand specimen is calcite. The rock is slightly weathered and has thin encrustation of ferruginous material (Fig-1).

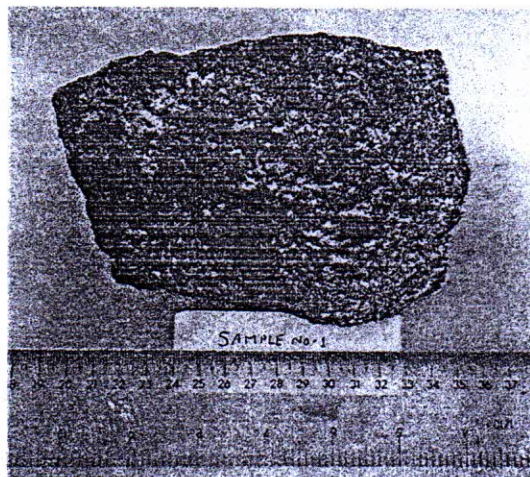


Fig.-1: Rock sample-1



Microscopic study of the sample (Study aids – Computer interfaced high resolution polarizing microscope with photographic attachment)

A. Mineralogical Content (V. E.):

Sl. No.	Mineralogical Content %						Undulose Extinction angle
	Calcite	Quartz	Biotite/ Chlorite	Olivine	Magnetite/ Iron Oxide	Strained quartz of total quartz present	
1	63-65	8-10	12-14	8-10	4-6	Negligible	NA
2	64-66	7-9	14-16	7-9	3-5	Negligible	NA

B. Textures and Microstructures:

It consists of calcite, quartz, biotite/chlorite, olivine and magnetite. It is a coarse grain rock which is characterized by granoblastic texture. Calcite is identifiable due to polysynthetic twinning. Quartz grains are present as scattered grains throughout the rock and they have sharp boundaries with calcite. Biotite grains are profusely altered. Olivine is identifiable due to its high relief. Magnetite is present as irregular grains that occupy the weathered portion in biotite (Fig-2 & 3).

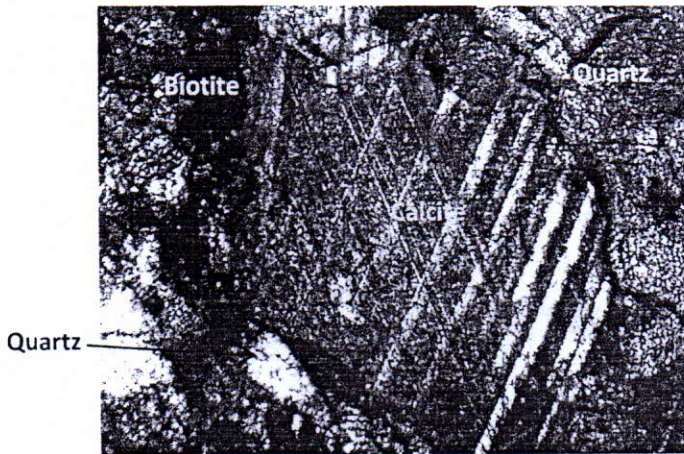


Fig.-2 Mgf: X40

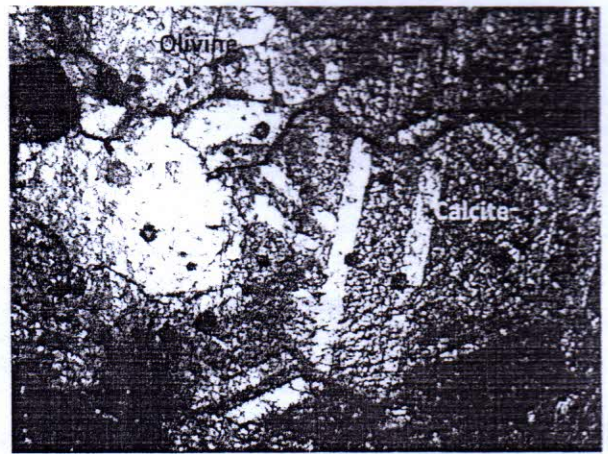


Fig-3 Mgf: X40

PETROGRAPHIC STUDY OF SAMPLE NO-2:

Senders sample ID : Sample-2
 Field name of sample, if any (assigned by the sender) : Not Specified
 Nature of the sample : Rock Chunk
 Location/ Depth of the sample : On right bank upstream of Dam
 Sample ID (ATES Lab) : Rock Chunk/03-13/182/13/02
 Laboratory name of the sample (assigned by the present study) : Impure Marble with flakes of biotite

Megascopic Study of the Sample (Study aid –naked eye & hand lens):

It is a grayish white, medium to coarse grain rock having medium specific gravity. It gives profuse effervesces with dilute hydrochloric acid. Calcite is the main mineral which could be identified in the hand specimen. The rock is slightly weathered in the upper surface and has thin encrustation of ferruginous material (Fig-4).

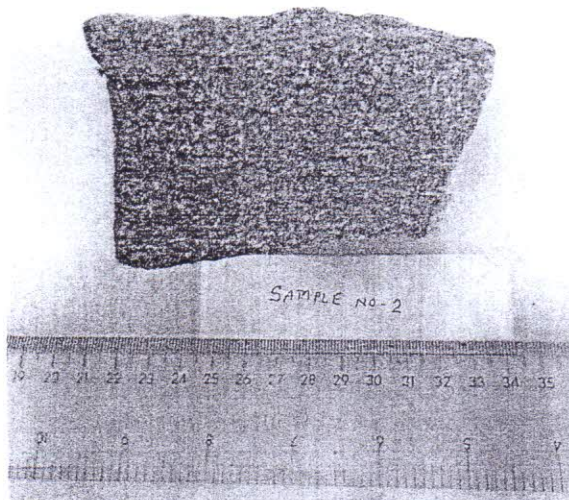


Fig.-4: Rock sample-2

Microscopic study of the sample (Study aids – Computer interfaced high resolution polarizing microscope with photographic attachment)

A. Mineralogical Content (V. E.):

Sl. No.	Mineralogical Content %						
	Calcite	Quartz	Biotite/Muscovite	Olivine	Magnetite/ Iron Oxide	Strained quartz of total quartz present	Undulose Extinction angle
1	63-65	6-8	12-14	8-10	4-6	Negligible	NA
2	64-66	7-9	13-15	8-10	3-5	Negligible	NA

B. Textures and Microstructures:

The given rock consists of calcite, quartz, biotite/muscovite, olivine and magnetite. It is a coarse grain rock and exhibit granoblastic texture. Calcite is the predominant mineral and identifiable due to polysynthetic twinning. Quartz grains are present as scattered grains throughout the rock. Mica (both biotite and muscovite) present in the form of flakes. At places biotite grains are altered to chlorite. Olivine is identifiable due to its high relief. Magnetite present as scattered grains throughout the rock (Fig-5 to 7).

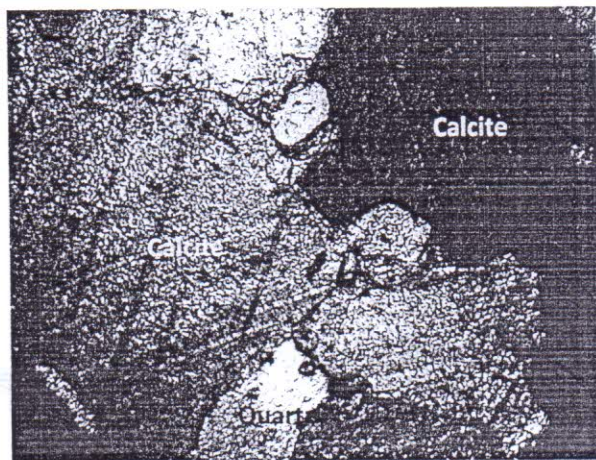


Fig.-5 Mgf: X40

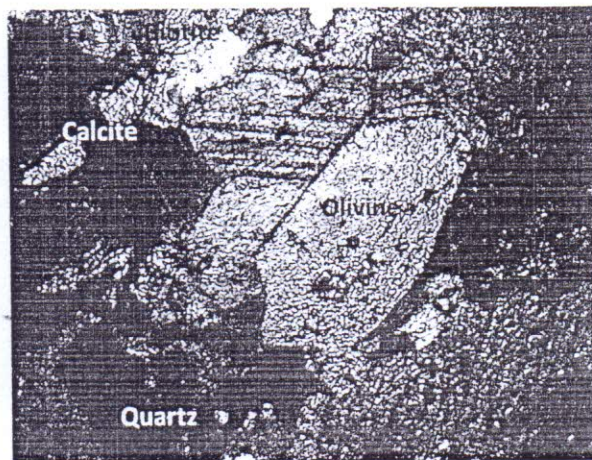


Fig.-6 Mgf: X40

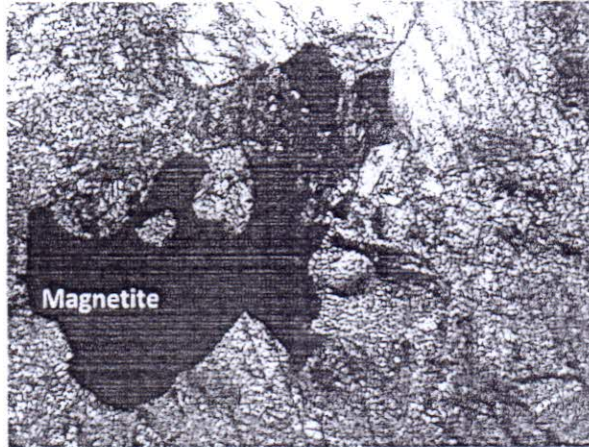


Fig.-7 Mgf: X40

PETROGRAPHIC STUDY OF SAMPLE NO-3:

Senders sample ID	:	Sample-3
Field name of sample, if any (assigned by the sender)	:	Not Specified
Nature of the sample	:	Rock Chunk
Location/ Depth of the sample	:	On right bank upstream side
Sample ID (ATES Lab)	:	Rock Chunk/03-13/182/13/03
Laboratory name of the sample (assigned by the present study)	:	Marble

Megascopic Study of the Sample (Study aid –naked eye & hand lens):

It is a greyish white, medium to coarse grain rock. The rock shows saccaroidal texture. It gives profuse effervesces with dilute hydrochloric acid. Identifiable mineral in the hand specimen is calcite (Fig-8). The rock is slightly weathered in the upper surface. The rock is hard and compact and has medium specific gravity.

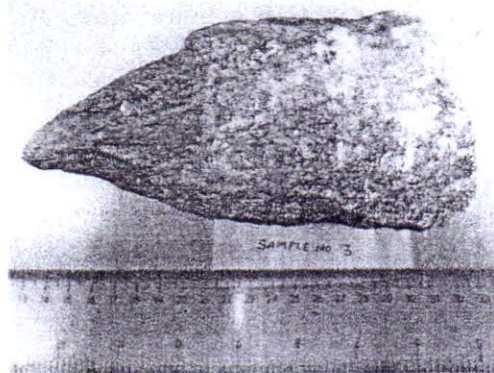


Fig.-8: Rock sample-3

[Handwritten signature]

Microscopic study of the sample (Study aids – Computer interfaced high resolution polarizing microscope with photographic attachment)

A. Mineralogical Content (V. E.):

Sl. No.	Mineralogical Content %					
	Calcite	Quartz	Biotite/ Muscovite	Magnetite/ Iron Oxide	Strained quartz of total quartz present	Undulose Extinction angle
1	81-83	4-6	8-10	3-5	Negligible	NA
2	79-81	5-7	9-11	3-5	Negligible	NA

B. Textures and Microstructures:

It mainly consists of calcite with minor amounts of quartz, biotite/muscovite and magnetite/iron oxide. It is a coarse grain rock which is characterized by granoblastic texture. Calcite is identifiable due to polysynthetic twinning. Quartz grains are present as scattered grains. Biotite and muscovite present as flakes throughout the rock. At places biotite is altered to chlorite. Magnetite present as irregular grains throughout the rock (Fig-9 to 11).

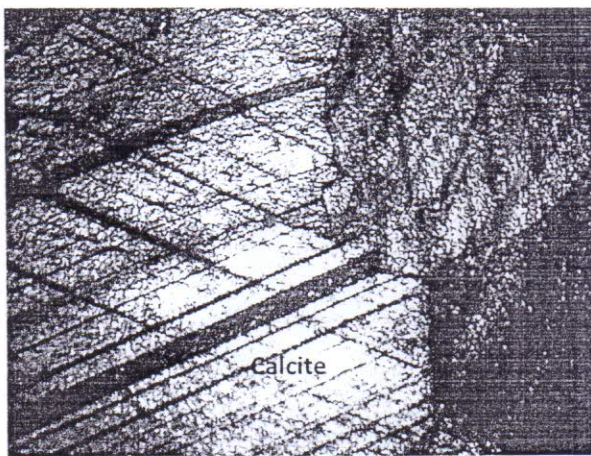


Fig.-9 Mgf: X40

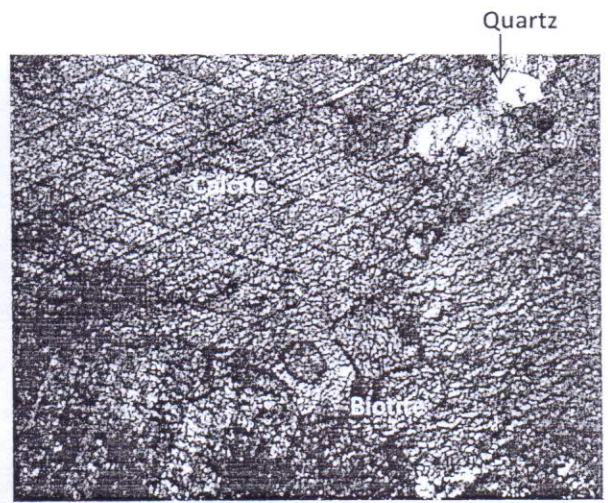


Fig.-10 Mgf: X40



Fig.-11 Mgf: X40



PETROGRAPHIC STUDY OF SAMPLE NO-4:

Senders sample ID	:	Sample-4
Field name of sample, if any (assigned by the sender)	:	Not Specified
Nature of the sample	:	Rock Chunk
Location/ Depth of the sample	:	Right bank Tato-Mechuka road
Sample ID (ATES Lab)	:	Rock Chunk/03-13/182/13/04
Laboratory name of the sample (assigned by the present study)	:	Highly altered calcareous quartzite

Megascopic Study of the Sample (Study aid –naked eye & hand lens):

It is a yellowish white, medium to coarse grain, iron stained rock. It gives effervesces with dilute hydrochloric acid. The rock shows saccharoidal texture (Fig-12). The chief mineral which is identified in the hand specimen is calcite. The rock also have subordinate amount of ferruginous minerals. It is hard and compact and has medium specific gravity.

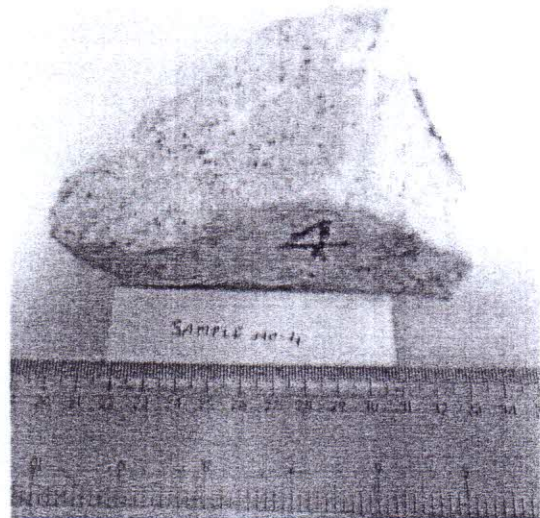


Fig.-: 12 Rock sample-4

Microscopic study of the sample (Study aids – Computer interfaced high resolution polarizing microscope with photographic attachment)

A. Mineralogical Content (V. E.):

Sl. No.	Mineralogical Content %							Undulose Extinction angle
	Calcite	Quartz	Biotite/ Muscovite	Feldspar	Chlorite	Magnetite/ Iron Oxide	Strained quartz of total quartz present	
1	20-22	40-42	16-18	10-12	6-8	2-4		NA
2	22-24	40-42	14-16	10-12	5-7	3-5	Individual grains too fine in size to observe strain effect.	NA

B. Textures and Microstructures:

It consists of calcite, quartz, muscovite/biotite, feldspar, chlorite and magnetite/iron oxide. It is fine to medium grained rock where individual grains are identifiable. Most of the quartz grains are present as replacing partially or completely calcite grains. The rock is weathered and flakes of muscovite occupy as clusters at different places of thin section. Some of the grains of calcite are pseudomorph which have retained the structure of calcite but have been replaced volume by volume by quartz/ feldspar (Fig-13 & 14).



Fig.-13 Mgf: X40

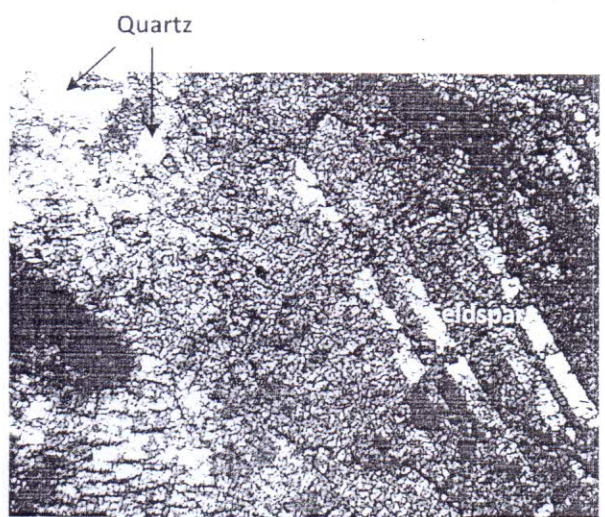


Fig.-14 Mgf: X40

Magnetite

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Corporate Office : Naimex House, A-8, Mohan Co-operative Industrial Estate, Mathura Road, New Delhi-110044, INDIA
 Phone : 91-11-30810277/259 Fax: 91-11-26956911 Email: testinglab@aimil.com atesdel@aimil.com Website: www.aimil.com

Report No.: Rock Chunk-113
 Date: 09.04.13


TEST REPORT

- | | | | |
|----|-----------------------|---|--|
| 1. | Material Tested | : | Said to be Rock Chunk (Lab Code: Rock Chunk/03-13/182/13/01 to 04) |
| 2. | Name of Client | : | Velcan Energy India Pvt. Ltd.
G-77, Sujan Singh Park, New Delhi-110003, India |
| 3. | Date of Receipt | : | 26/03/13 |
| 4. | Condition of Sample | : | ok |
| 5. | Date of Testing | : | 30/03/13 |
| 6. | Environment Condition | : | Temp. 27 ± 2° C, RH 60 ± 10% |
| 7. | Tested as per | : | IS: 2720-Part-13-1976 |
| 8. | Results | : | |

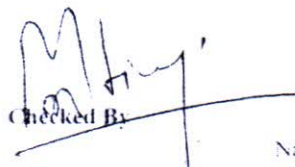
A. Calcium Carbonate

Sl. No.	Sample ID	% of CaCO ₃
1	Sample - 1	33.70
2	Sample - 2	26.70
3	Sample - 3	98.80
4	Sample - 4	93.40

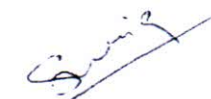
B. For petrographic analysis report please see annexure A.


 Tested By
 (ANAND KUMAR)

P.T.O.: Terms & Conditions


 Checked By

Name:
 Designation:


 Approved By





Corporate Office: Naimex House, A-8, Mohan Co-operative Industrial Estate, Mathura Road, New Delhi-110044, INDIA
 Phone: 91-11-30810277, 259 Fax: 91-11-26950011 Email: testinglab@aimil.com, atesdel@aimil.com Website: www.aimil.com

Report No: CA-107
 Date: 25/11/2016

TEST REPORT

1. Material Tested : Said to be Coarse Aggregate (Lab Code: CA/11-16/66/07/01-01)
2. Name of Client : Velcan Energy India Pvt. Ltd.
3. Date of Receipt : 15/11/2016
4. Condition of Sample : ok
5. Date of Testing : 17/11/2016 to 25/11/16
6. Environment Condition : Temp. $27 \pm 2^\circ \text{C}$; RH $60 \pm 10\%$
 IS:2386 Part-3-1963 (Reaffirmed1997). IS:2386 Part-1-1963 (Reaffirmed1997). IS:2386 Part-5-1963 (Reaffirmed1997). IS:2386 Part-7-1963 (Reaffirmed2007). IS:2386 Part-4-1963 (Reaffirmed2007)
7. Tested as per :
8. Results :

A. Specific Gravity & Water Absorption

Sl. No.	Identification	Specific Gravity	Average Specific Gravity	Water Absorption (%)	Average Water Absorption (%)
1	Gapo Village Area in West Siang Distt., Arunachal Pradesh	2.712	2.727	0.13	0.15
2		2.741		0.17	

B. Flakiness Index, Elongation Index

Sl. No.	Identification	Flakiness Index (%)	Elongation Index (%)
1	Gapo Village Area in West Siang Distt., Arunachal Pradesh	21	33

C. Los Angeles Abrasion Value

Sl No	Identification	Size of the sample	Trial No.-1 (%)	Trial No.-2 (%)	Average (%)
1	Gapo Village Area in West Siang Distt., Arunachal Pradesh	Grading-A	28	27	28

D. Aggregate Crushing Value

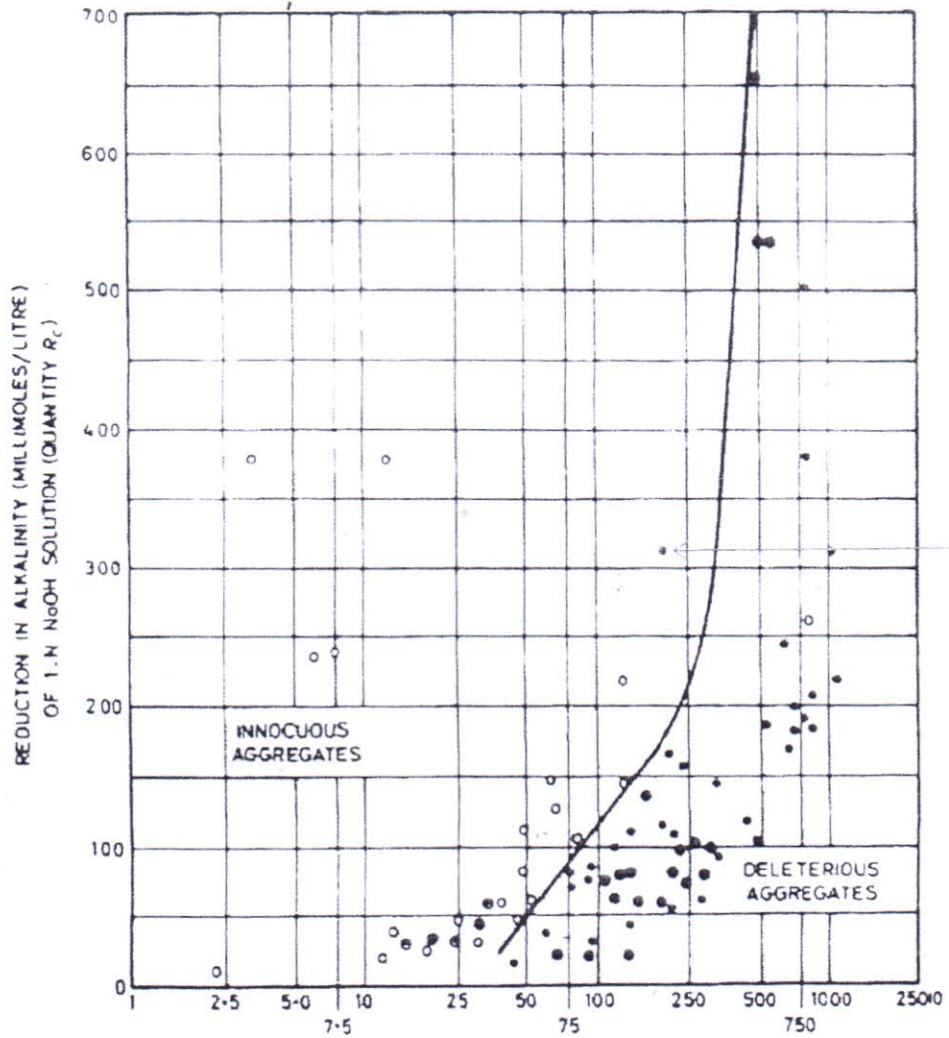
Sl No	Identification	Size of the sample	Trial No.-1 (%)	Trial No.-2 (%)	Average (%)
1	Gapo Village Area in West Siang Distt., Arunachal Pradesh	Passing 12.5 mm and retained on 10 mm IS Sieve	21	20	21

E. Aggregate Impact Value

Sl No	Identification	Size of the sample	Trial No.-1 (%)	Trial No.-2 (%)	Average (%)
1	Gapo Village Area in West Siang Distt., Arunachal Pradesh	Passing 12.5 mm and retained on 10 mm IS Sieve	20	20	20

ANNEXURE-A
 POTENTIAL AGGREGATE REACTIVITY BY CHEMICAL METHOD
 (COARSE AGGREGATE)

IS : 2386 (Part VII) - 1963



Gapo Village
 Area in West
 Siang Distt.

SILICA DISSOLVED FROM 300 TO 150 MICRONS SIZE AGGREGATE
 MATERIAL (MILLIMOLES/LITRE) BY 1.1N NaOH SOLUTION (QUANTITY S₂)

- Aggregates causing mortar expansion more than 0.1 percent in a year when used with a cement containing 1.38 percent alkalis.
- Aggregates causing mortar expansion less than 0.1 percent in a year under same conditions.
- ⊗ Aggregates for which mortar expansions data are not available but which are indicated to be deleterious by petrographic examination.
- ⊙ Aggregates for which mortar expansion data are not available but which are indicated to be innocuous by petrographic examination.
- Boundary line between innocuous and deleterious aggregates.

FIG. 6 ILLUSTRATION OF DIVISION BETWEEN INNOCUOUS AND DELETERIOUS AGGREGATES
 ON BASIS OF REDUCTION IN ALKALINITY TEST

ANNEXURE-B

INTRODUCTION:

This report incorporates petrographic study of one rock sample from Gapo Village Area in West Siang Distt., Arunachal Pradesh. The rock sample was submitted by M/s Velcan Energy India Pvt. Ltd. on 15th November, 2016 at the ATES, New Delhi office.

Petrography of rock samples has been carried out as per standard IS: 2386 (Pt-8)-1963 (Reaffirmed-1997)-"Petrographic Examination".

Thin sections of the given sample were examined megascopically as well as under polarizing microscope with an aim to identify different mineral constituents, detrimental minerals, if any and photo-micrographed for documentation. The microscopic examination also includes study of micro-textures and alterations which have been observed between minerals grain boundaries.

The rock description given hereunder solely pertains to megascopic and microscopic study of two thin sections of each sample without any feedback of the field description and name from the sender. Keeping this in view, it is suggested that given name of the rock type by laboratory studies should preferably not be matched with text book description of the rocks. But it should be viewed in conjunction with alterations identified, if any, of the rock.

It is pertinent to mention here that veracity of representativeness of the sample of the field area rests with sender and petrographic study undertaken and given hereunder includes characters recorded on the samples supplied.

PETROGRAPHIC OBSERVATIONS AND INTERPRETATIONS

PETROGRAPHIC STUDY OF SAMPLE NO: 1

- | | |
|---|--|
| 1. Sender's sample no. | : Not specified |
| 2. Field name of sample, if any
(assigned by the sender) | : Not Specified by the sender |
| 3. Nature of the sample | : Rock Chunk |
| 4. Location/ Depth of the sample | : Gapo Village Area in West Siang Distt.,
Arunachal Pradesh |
| 5. Sample no (ATES Lab) | : CA/11-16/66/07/01 |
| 6. Laboratory name of the sample
(assigned by the present study) | : Micaceous-quartzite |

Megascopic Study of the Sample (Study aid –naked eye & hand lens)

The given rock sample is light grey in colour with shining specks. It is a fine grained foliated rock and has medium specific gravity. Identifiable minerals include quartz and mica (Fig-13).



Fig.-1 Rock Core Sample

Microscopic Study of the Sample (Study aids – Computer interfaced high resolution polarizing microscope with photographic attachment)

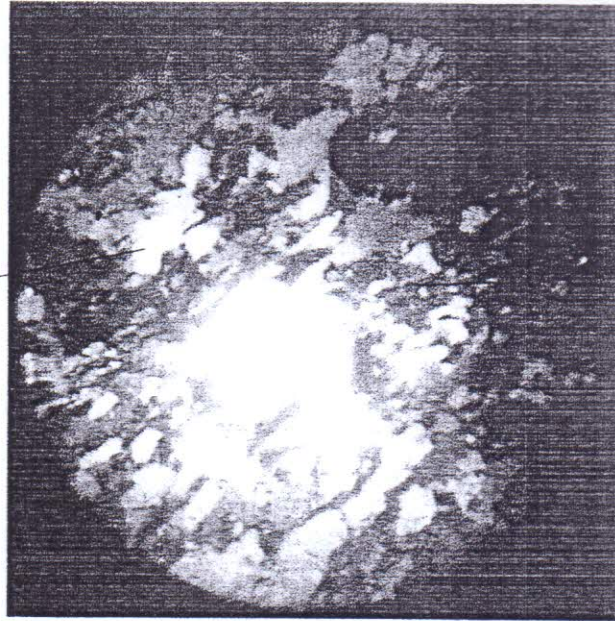
A. Mineralogical content (V.E.)

Sl. No.	Mineralogical Content %					
	Quartz	Feldspar	Biotite	Magnetite	Strained quartz of total quartz present	Undulose Extinction angle
1	76-78	6-8	10-12	2-4	18-20	16-18°
2	77-79	5-7	10-12	2-4	18-20	16-18°

B. Textures and microstructures

It consists of quartz grains which range in size from medium to coarse, flakes of biotite. Most of the grains of quartz are sutured. Feldspar grains are identifiable due to their cleavage and twinning. At places flakes of biotite are in preferred orientation which defines the foliation of the rock. The rock is deformed and at places strained lamellae in quartz have been observed. At places there are minute grains of quartz around coarse grains of quartz. At places flakes of biotite are present around the boundary of the quartz grain.

Quartz ←



→ Biotite

Fig.-2 Mgf: X40

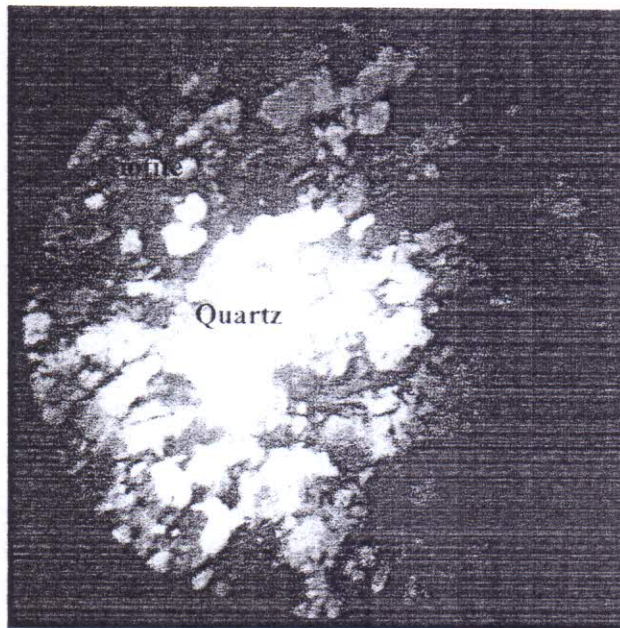


Fig.-3 Mgf: X40

DA

ANNEXURE- D

Table: The Recommended addition and deletion of area for TATO-I HEP with GPS details

S1. No	Component	Old(to be abandoned/deleted)			New (to be added)		
		Name of Village	Northing	Easting	Name of Village	Northing	Easting
1	Tato-I PH Quarry	Heyo (0.5 ha)	28.535472	94.347653	Padusa (0.5 ha)	28.532829	94.291015
			28.535086	94.347398		28.53298	94.290835
			28.535016	94.347596		28.533243	94.290719
			28.534922	94.348004		28.532706	94.290126
			28.534692	94.348497		28.532268	94.290588
			28.534672	94.348564		28.5328	94.291174
			28.534932	94.348807		28.532829	94.291015
			28.534934	94.348801		28.532829	94.291015
			28.535472	94.347653			
2	Tato-I Intake Quarry	Gapo (0.3 ha)	28.539586	94.320174	Meying (0.3 ha)	28.545352	94.315948
			28.539868	94.319645		28.545066	94.316166
			28.539505	94.319386		28.545547	94.316874
			28.539197	94.319889		28.545781	94.316681
			28.539586	94.320174		28.545352	94.315948

Table: Recommended addition and deletion of area of HEO HEP with GPS details

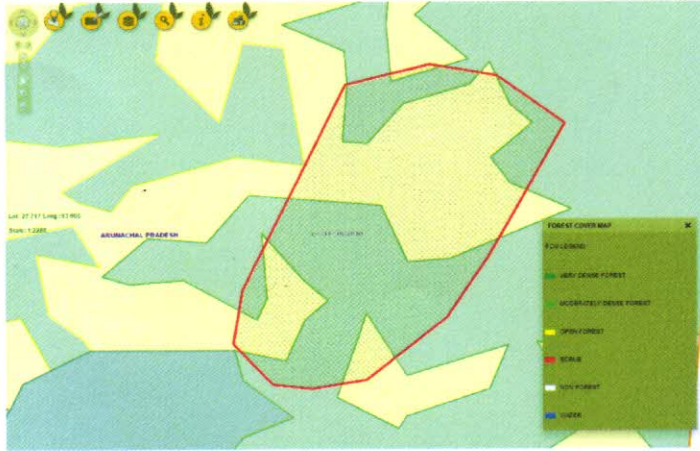
S1. No	Component	Old (to be abandoned/ Deleted)			New (to be added)		
		Name of Village	Northing	Easting	Name of Village	Northing	Easting
1	Heo PH Quarry	Hiri (0.3 ha)	28.537858	94.273293	Lipusi (0.3 ha)	28.535424	94.285821
			28.538389	94.273082		28.535007	94.285282
			28.538263	94.27262		28.534674	94.28552
			28.537709	94.27284		28.535154	94.286078
			28.537858	94.273293		28.535424	94.285821
2	Heo Barrage Quarry	Gapo (0.3 ha)	28.539586	94.320174	Meying	28.546038	94.316475
			28.539197	94.319889		28.545635	94.31577
			28.539054	94.320112		28.545352	94.315951
			28.538925	94.320388		28.545781	94.316684
			28.539275	94.320675		28.546038	94.316475
			28.539586	94.320174		28.546038	94.316475
			28.539586	94.320174			

Re-appropriation of Area from Pauk HEP to Heo HEP

3	Heo Barrage Quarry from Pauk HEP	Chengrong	28.547678 28.547958 28.548083 28.548192 28.547933 28.547481 28.547561 28.547678 28.547678	94.229549 94.229617 94.229558 94.229519 94.228619 94.228686 94.229107 94.229549 94.229549	Chengrong	28.547678 28.547958 28.548083 28.548192 28.547933 28.547481 28.547561 28.547678 28.547678	94.229549 94.229617 94.229558 94.229519 94.228619 94.228686 94.229107 94.229549 94.229549
4	Heo Barrage access road from Pauk HEP	--	Starting Point 28.53862 Ending Point 28.539703	Starting Point 94.274004 Ending Point 94.262975		Starting Point 28.53862 Ending Point 28.539703	Starting Point 94.274004 Ending Point 94.262975

The proposed CA site of 8.40 ha

As per the observation of DSS, the proposed CA site includes 4.16 ha of Moderately Dense Forest and the remaining part is under Open Forest. However, the CA site proposed on the top of hill may be considered as degraded land as seen on Google earth satellite imagery dated 06.12.2017.



(MRITYUNJAY KAR)
Senior Technical Associate
MoEF&CC, R.O- Shillong

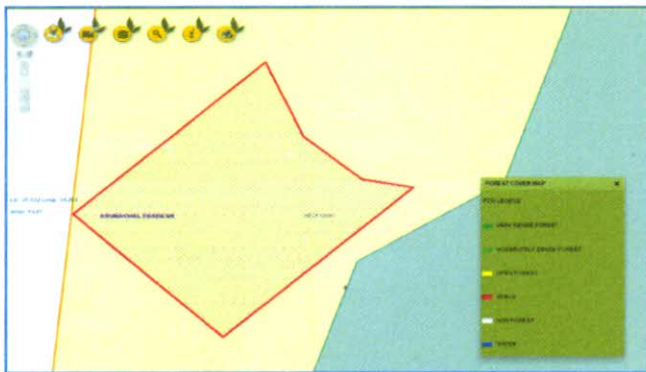
Tato-I PH Quarry (0.5 ha)

The proposed quarry site has been examined through DSS and the following information has been observed below.

GRID ID	SCORE FCM	SCORE FTM	SCORE BR	SCORE LANDSCAPE	AGGREGATE SCORE
488471	66.32	68.86	79.91	98.17	78.32

The aggregate score of the grid is found to be above 70. Therefore, per DSS rule No.-2, the proposed area has been labelled as Inviolable.

The Forest Cover Map in DSS shows that the entire proposed quarry site falls under Open Forest. Based on visual interpretation of Google Earth satellite imagery dated 23.11.2018, the area proposed on the extreme slope surface (30 degree gradient) is covered with tall trees.



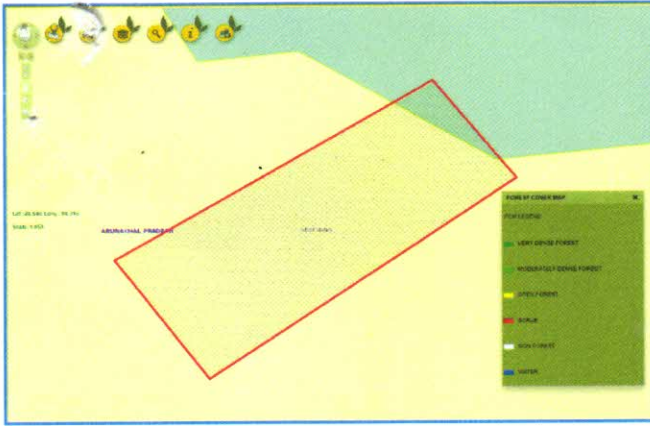
Tato-I Intake Quarry (0.3 ha)

The proposed quarry site has been examined through DSS and the following information has been observed below.

GRID ID	SCORE FCM	SCORE FTM	SCORE BR	SCORE LANDSCAPE	AGGREGATE SCORE
487323	64.41	68.66	82.88	98.44	78.6

In view of the above mentioned table, the aggregate score of grid is found to be above 70. Therefore, the proposed quarry site has been considered as Inviolable in accordance with DSS rule No.-2.

As per the Forest Cover Map, the proposed quarry site comprises 0.29 ha of Open Forest and 0.01 ha of Moderately Dense Forest. On the other side, the Google Earth satellite imagery dated 19.11.2012 shows that the quarry site proposed on steep slope (more than 40 degree gradient) has been covered with vegetation.

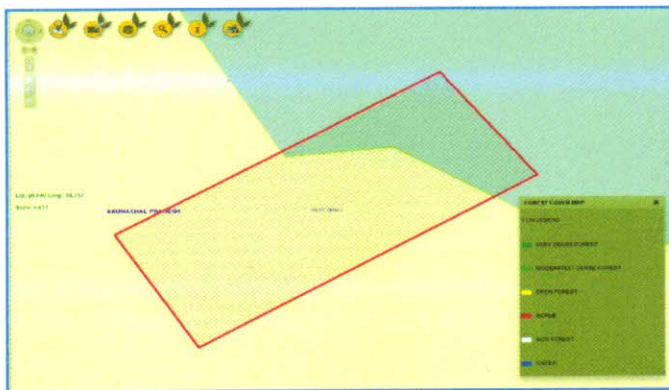


Heo PH Quarry (0.3 ha)

Based on four parameters (FCM, FTM, BR, LI) of DSS rule No.-2, the proposed quarry site has been considered as Inviolate. The score value of each layer is mentioned below.

GRID ID	SCORE FCM	SCORE FTM	SCORE BR	SCORE LANDSCAPE	AGGREGATE SCORE
487323	64.41	68.66	82.88	98.44	78.6

As per the observation of Forest Cover Map, the proposed quarry site includes 0.23 ha of Open Forest and 0.07 ha of Moderately Dense Forest. The Google Earth satellite imagery dated 19.11.2012 shows that the quarry site proposed on steep slope (more than 40 degree gradient) has been covered with vegetation.



Heo Barrage Quarry (0.3 ha)

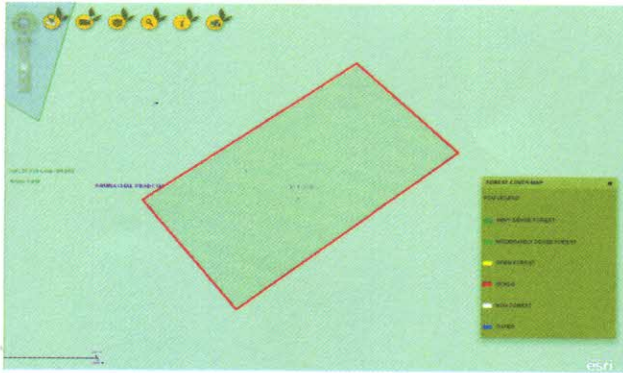
The proposed quarry site has been examined through DSS and the following information has been observed below.

GRIDID	SCORE FCM	SCORE FTM	SCORE BR	SCORE LANDSCAPE	AGGREGATE SCORE
488470	68.63	58.78	79.4	98.31	76.28

The aggregate score of four parameters of a grid is found to be above 70. Therefore, this proposed quarry site has been considered as Inviolable in accordance with DSS rule No.-2.

As per Forest Cover Map , the entire quarry site falls under Moderately Dense Forest.

Based on visual interpretation of Google Earth satellite imagery dated 23.11.2018, the quarry site proposed on the extreme slope surface (30 degree gradient) is covered with vegetation.

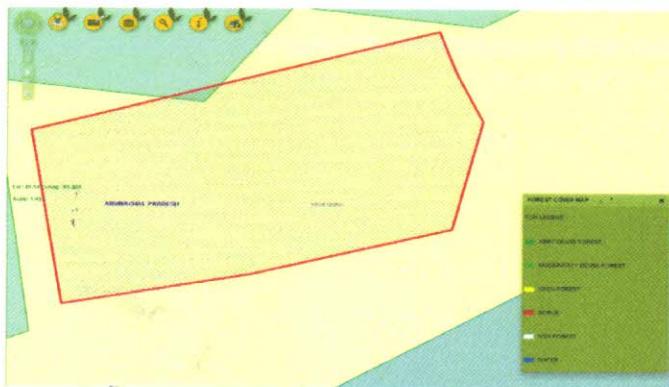


Heo Barrage Quarry from Pauk HEP (0.5 ha)

Based on four parameters (FCM, FTM, BR, LI) of DSS rule No.-2, the proposed quarry site has been considered as Inviolable. The score values are mentioned below.

GRIDID	SCORE FCM	SCORE FTM	SCORE BR	SCORE LANDSCAPE	AGGREGATE SCORE
487314	63.04	56.28	91.06	94.39	76.19

The Forest Cover Map of DSS shows that the entire quarry site falls under Open Forest. However, as per the observation of Google Earth satellite imagery dated 23.11.2018, the quarry site is proposed on the forested slope.

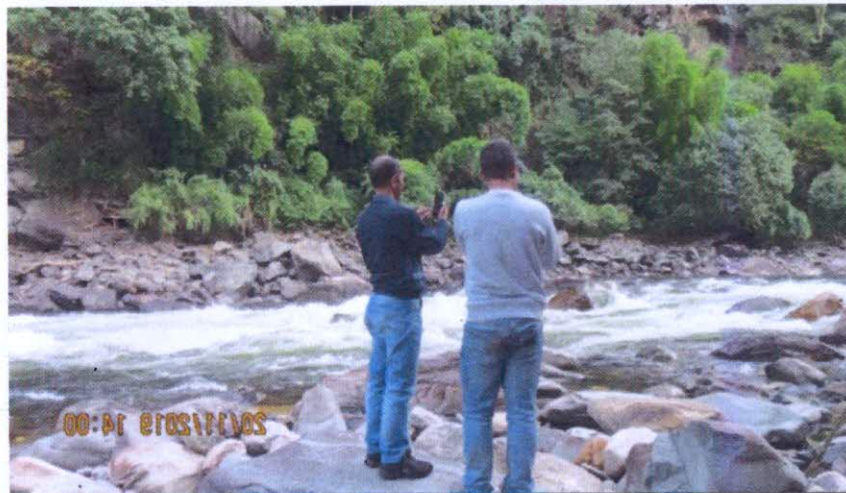




Photographs showing the muck Dumping site (2.0ha) proposed for Heo HEP in Hiri Village.



Photographs showing the muck access road (3.7 ha) in Hiri Village for the proposed HeoHEP shifted/deleted from Pauk Hydro Power Project.



Photographs of river Yargap ("Shi"-local name) below the Muck Dumping site 2.0ha) and Muck Access road (3.7 ha) in Hiri Village for the proposed Heo HEP.



View of Tato village where old quarry proposed to be abandoned (could not be visited)



Location of earlier proposed quarry site in Heyo village for Tato-I HEP.



Location of Quarry site(0.5ha) in Padusa village for Tato-I HEP shifted from earlier proposed quarry site in Heyo village.



Proposed location of quarry site(0.5ha) near to Saechu Nahla shifted from Pauk HEP and added to Heo HEP.