

Geological feasibility Report in Respect of Proposed Dharli to Balag Road (Km 0/0 To 18/900) within the jurisdiction of Suket Forest Division, Sundernagar District Mandi H.P..

INTRODUCTION: -

The Executive Engineer, Sundernagar, Division HPPWD Sundernagar, District Mandi H.P. requested the Department vide office letter no. PW-SNR-WA-Forest Case-2021-22-16581-85 dated 10-03-2022, to submit a Geological report on Dharli to Balag Road (Km 0/0 to 18/900) within the jurisdiction of Suket Forest Division, Sundernagar falling in District Mandi Himachal Pradesh .

In this regard, as per the directions issued by the Geologist, Zone -IV, Himachal Pradesh Shimla-1, vide memo No. Ind- Bhu (Geo-7) Assistant -6/93-Vol-I-4139, dated 26-07-2022, the undersigned visited the site under investigation along with Assistant Engineer, HPPWD Deher Sub Tehsil- Deher, Distt. Mandi H.P which is situated near Dharli, Tehsil- Sundernagar, District Mandi H.P.

GENERAL DESCRIPTIONS ABOUT THE PROJECT: -

Development of roads can be linked closely with development of human civilization. A good communication network is the prerequisite for development of Hilly areas. Special attention should be given to road connectivity to rural and remote areas, which are not yet connected to the main roads. In this context, road is one of the major infrastructure that is required for overall development of a country. In fact, the development of important sectors of economy such as Agriculture, Horticulture, Industry, Mining and Forestry depends upon efficient road network. For a developing country like India, roads play vital roles in lifting up the country's economic conditions.

The said patch of proposed road under investigation located near to the Dharli Village, initial point is from Dharli, which will connect various remote villages of this area reaches to 18 kilometers.

LOCATION:

The area under investigation falls under the survey of India Toposheet no. 53A/15, total length of the road passing through land =17.241km and total forest area required including the existing track/road =10.6019hectare (including dumping), other than forest land

1.659km length is passing through private land having an area 0.9423hect.(source joint inspection report of committee)

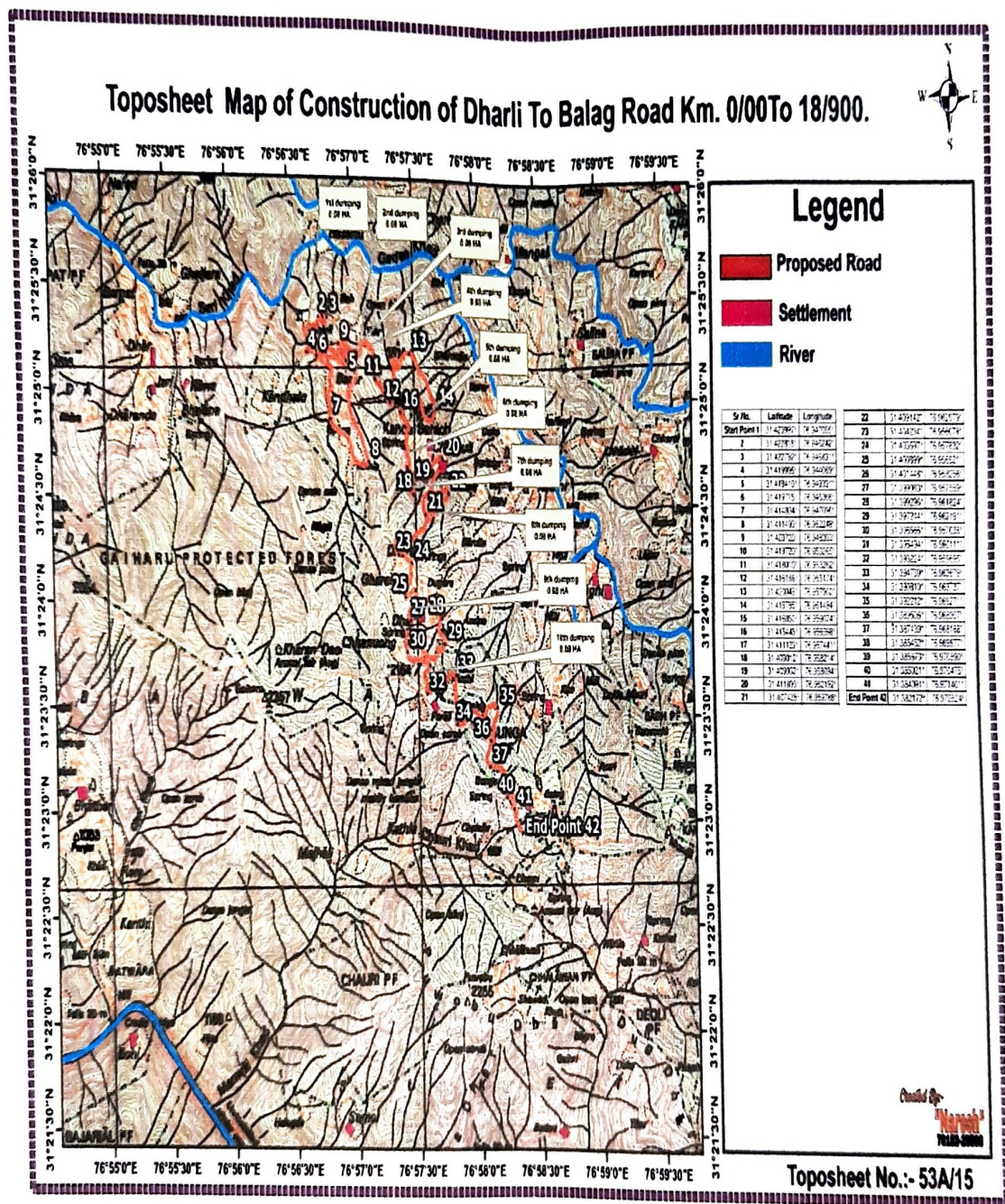


Fig 01: Toposheet no. 53A/15 showing the configuration of the proposed road, Land Surface, Drainage detail of area of the Dharli To Balag Road (Km 0/0 To 18/900) Within The Jurisdiction of Suket Forest Division, Sundernagar District Mandi (H.P).

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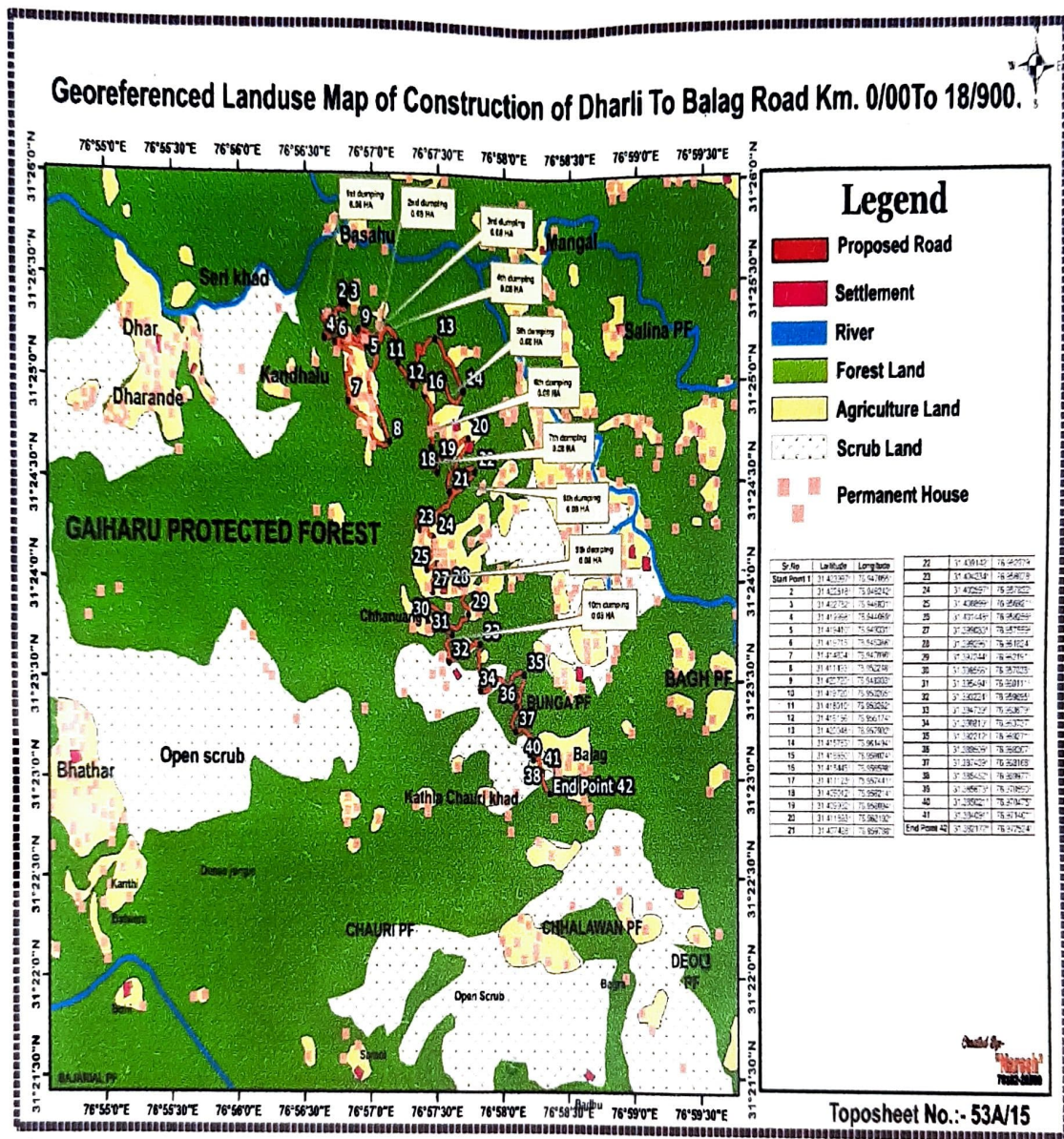


Fig 02: Georeferenced Landuse Map Toposheet no. 53A/15 showing the configuration of the forest land, Agriculture land, scrub land, permanent houses of the proposed Dharli To Balag Road (Km 0/0 To 18/900) Within The Jurisdiction of Suket Forest Division, Sundernagar District Mandi (H.P)

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REGIONAL GEOLOGY OF MANDI DISTRICT : -

Mandi District lies between latitude $31^{\circ}13'30''$: $32^{\circ}04'22''$ N and longitude $76^{\circ}36'08''$: $70^{\circ}23'26''$ E. The District has a total area of 3950 Sq Km and covers 7.10 percent of the state. The area consists of Lesser Himalaya characterized by rugged topography.

The district Mandi District lies within lesser and other Himalaya. Jutog, Chail, Shah & Tertiary group of rocks are found to occur in the district. The oldest rocks belong to Jutog groups whereas the youngest valley fills are of recent age comprising of clay, sand and gravel beds. The Jutog formation comprises of slates, Schists and Quartzite with Hematite and magnetite bands are included in chail formation. The Granitic rocks found to occur around Karsog area are known as Karsog Granite. Mandi —Darla Volcanics are also known to occur which represents lava flows in the past. The Shah formation is represented by Salt grit, Dolomite, Limestone, Quartzite and red Shales. Thin bands of Slates are also found to occur. Salt grit locally known as lokhan is overlain by Mandi Darla volcanics. The Tertiary rocks mostly consist of Sandstone, Shale and Clay. Green Shales and Limestone of Dharamsala formation are found to occur in the area which is followed by Siwahik formation. The lower part of Siwahik formation is composed of Sandstone interbedded with purple and red Shales are found to occur in the middle part.

The oldest rock exposed in the district belongs to the Sundru Formation of Vaikrata Group consisting of Biotite schist with Kyanite gneiss and migmatites. Karsog, Mandi and Chichot-Sundru granites of Paleozoic age intruded in it.

Kullu Group is exposed in Beas Valley has been divided into three Formations as given below:

Lithostratigraphy of the Kullu Group	
Formation	Lithology
Kharmada	Carbonaceous slate, phyllite, quartzite and limestone
Garh	Streaky and banded gneiss
Khokhan	Schist and Quartzite

The rocks of Proterozoic –III resting over the Vaikrita Group, occupying a major syncline comprising Chamba, Manjir and Katarigali Formation. The Lithostratigraphy of these Formations is given below:

Formation	Lithostratigraphy
Katarigali	Dark grey slate, micaceous sandstone, quartzite and calcareous siltstone
Manjir Formation	Diamicite, shale, slate, sandstone and limestone

Chamba	Carbonaceous slate, phyllite & quartzite
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The lithostratigraphy of the Sundernagar Group is given below

Lithostratigraphy of the Sundernagar Group	
Formation	Lithology
C	Green slate and phyllites with purple interbands, local limestone
B	White and purple quartzite with red shale partings
A	Grey slates and phyllites

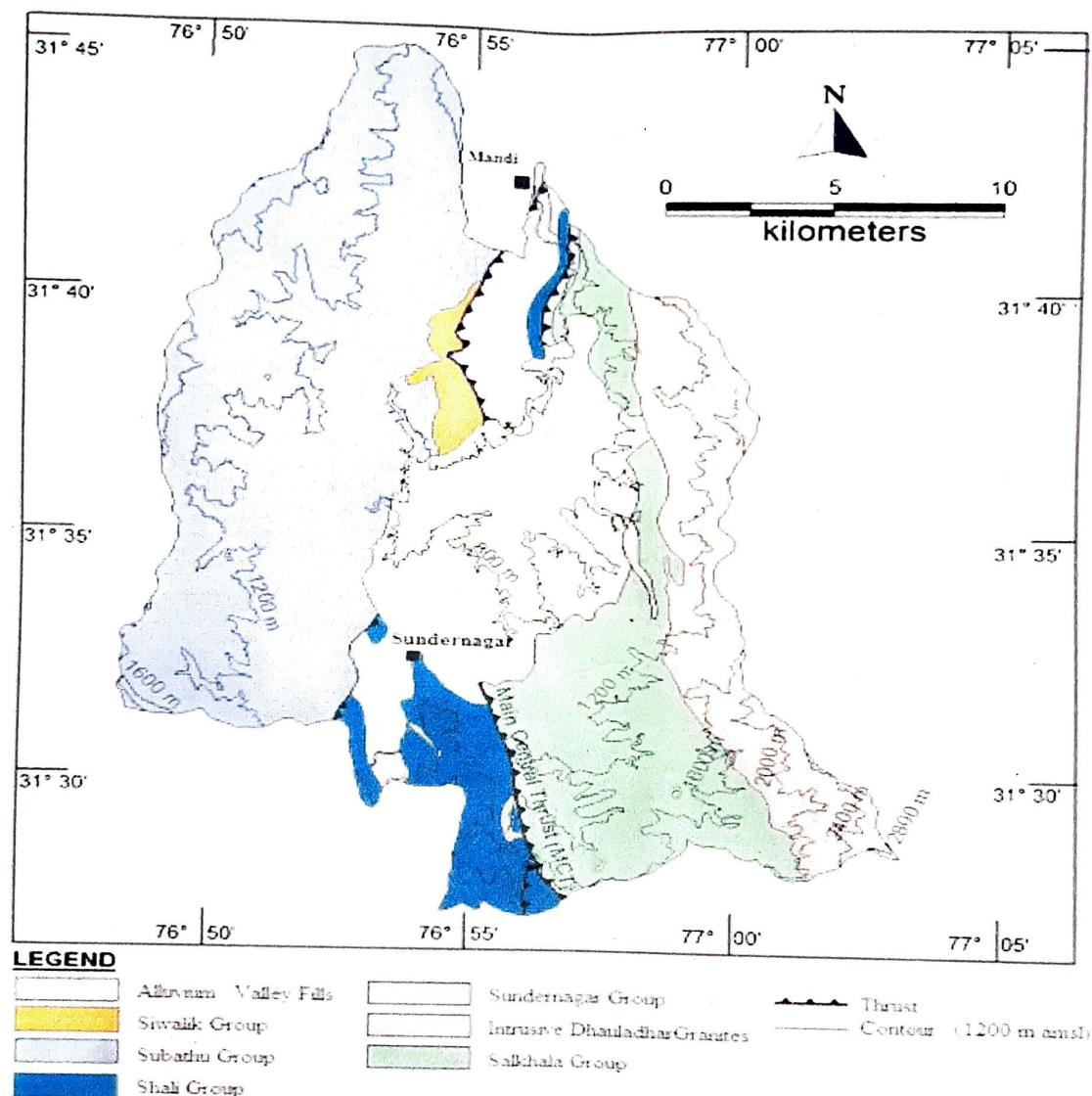


Fig 03 : Geological map of Mandi District.

The Shali Group of rocks overlying the Sundernagar Formation is divisible into seven Formations the detail of Shali group is given below

Shali Group			
Group	Formation	Lithology	Thickness (m)
Shali	Bandla	Green and purple coloured shale, slate, siltstone, sporadic earthy limestone, thin bedded orthoquartzite and a fairly persistent band of white quartzarenite at the base.	250
	Parnali	Cherty dolomite, grey limestone and white quartzarenite.	700
	Makri	Grey, green, black and purple shales and slates, thin bedded limestone, thin bedded quartzarenite with or without dolomite.	180
	Tattapani	Cherty dolomite, grey and pink in colour with grey phyllited shales.	610
	Sorgharwari	Pink and grey cream textured limestone with shale partings.	460
	Khatpul	Massive dolomite with sporadic quartzarenite, and a thin red shale band at the base.	300
	Khaira	Mainly pink and purple, also white quartzarenite.	380
	Ropri	Brick red shale and siltstone with grey dolomite in the lower horizon; local development of salt, salt grit and the marly lithocomplex "Lokhan"	400

In Lari area the Lari Group of Rocks is divided into three Formations as given below

Lari Group		
Formation	Member	Lithology
Aut	F	Earthy calcareous conglomerate, gritty dolomite with bands of pink and green limestone
	E	Grey dolomite with Stromatolites
	D	Cream and purple limestone
	C	Grey dolomite
	B	Cream, grey and purple limestone
	A	Grey dolomite with stromatolites

Shah

Hurla		Grey, white, pink and purple quartarenite with shale partings
Naraul	C	Calcareenite, shale and slate
	B	White quartzarenite and conglomerate with slate and phyllite
	A	Quartarenite, grey phyllite and diamictite

The rocks of the Rampur Group is divisible into three formations as given below:

Formation	Lithology
Manikaran Formation	Grey and white massive quartzarenite, locally bands of metabasalt
Banjar Formation	Mainly metabasalt as dark green phyllite. Interbeds of white massive quartzite and grey phyllite
Bhallan Formation	Slates, greenish phyllite schists with interbeds of white flaggy quartzarenite

In the Sarakagahat area the rocks of Sirmur Group and Siwalik Group is also exposed the lithostratigraphy of the formations is given below :

Group	Formation	Member	Lithology
Siwalik	Upper Siwalik	B	Predominantly massive conglomerate with red and orange clay as matrix and minor sandstone and earthy buff and brown clay stone
		A	Sandstone, clay and conglomerate alternation
	Middle Siwalik	B	Massive sandstone with minor conglomerate and local variegated Claystone
		A	Predominantly medium to coarse – grained sandstone and red clay alternation, soft pebble with subordinate claystone, locally thick prism of conglomerate
	Lower Siwalik	B	Alternation of fine to medium – grained sporadically pebble sandstone, calcareous cement and predominant chocolate and maroon claystone in the middle part
		A	Red and mauve calystone with thin intercalations of medium to fine-grained sandstone
Sirmur	Kasauli/ Dharamshala		Massive sandstone, subordinate shale
	Dagsai	Pabo	Alternation of sandstone and clay
		Chimnun	Red and purple claystone with subordinate siltstone



	Subathu	B	Red, green and indigo blue colored mudston, shale, quartzarenite
		A	Green shale, foraminiferal limestone and oyster marls, quartzarenite, local carbonaceous shale, calcareous sandstone

A small patch of Quarternary sediments is developed along Beas river and its tributaries

The rocks have undergone several phase of deformation. The General trend of the rock is northwest-southeast. The main fold axis trending roughly northwest-southeast are clearly exhibited by Largi antiform, Shali antiform and Pandoh Synform.

Two main tectonic planes in the form of thrust sheet are Kullu, and Vaikrita. Beside these a few small klippe are also present within various groups of rocks. Cross fault trending generally N-S to NE-SW and E-S are also present.

LOCAL GEOLOGY: -

The local geology of the area occupies the Shalli and Sunderngar Group. The Sunderngar Group presents an association of sedimentary rocks with intrusion of acidic volcanic rocks. It tectonically transgresses over the younger Shali Group of platform type carbonate rocks along a major thrust. The dolomite of the Shalli and Sunderngar Group mainly lies in the area and composed of CaMg carbonates (Dolomites). Rock type along road is Pink and grey cream textured limestone with shale partings.



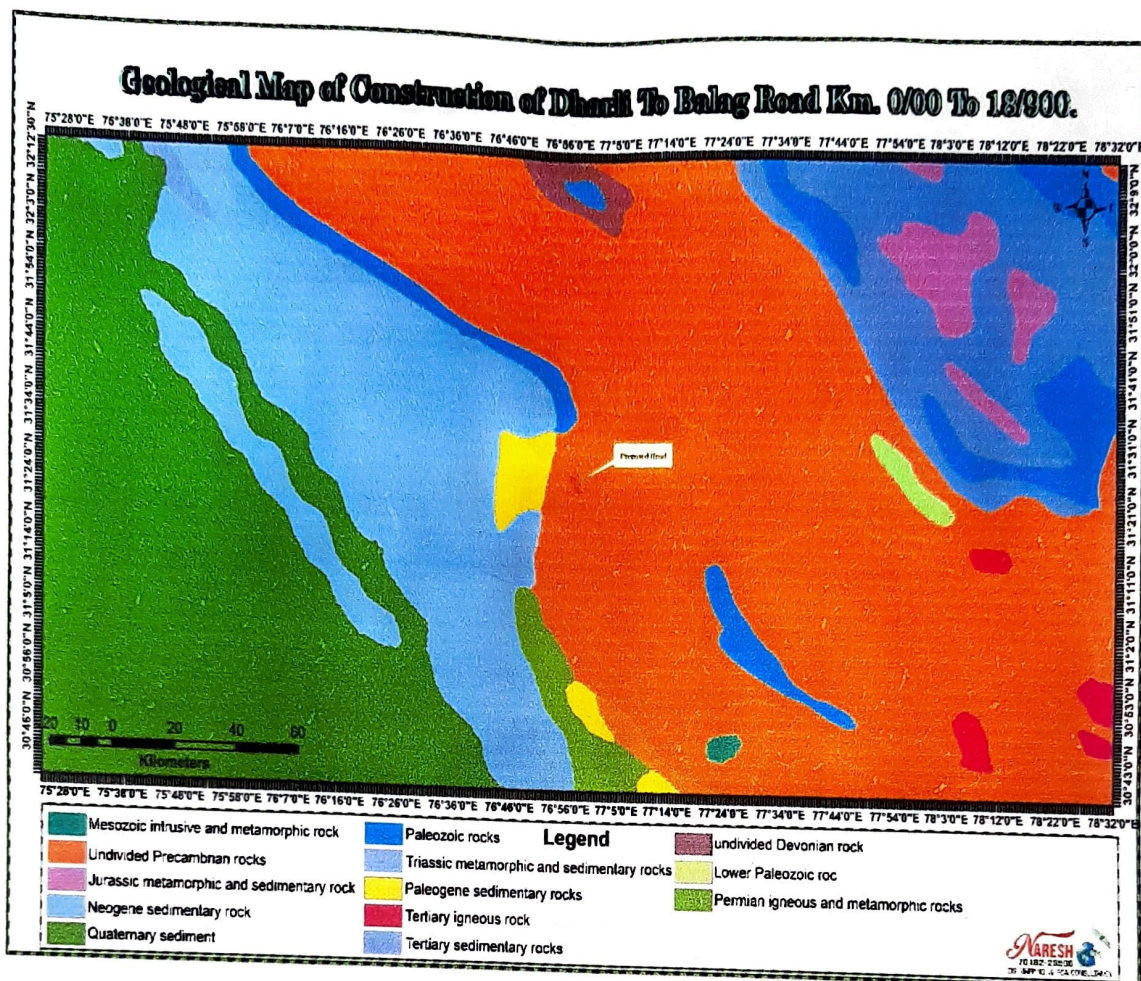


Fig no. 04: : Geological map of surrounding areas of proposed road .

OBSERVATION:-

During the course inspection, the proposed alignment for the construction of said road is well distinguished from the adjoining lands. The existing path, which is wide enough and currently used as footpath shall be used for the construction of proposed road. After inspection of proposed patch of road site, following observations has been taken in to consideration:-

1. The proposed road follows almost existing footpath and lies near to the ridge of the hills. The slopes along the proposed road area quite gentle.
2. The exposed bedrocks in the section along the proposed route comprised mainly of Pink and grey cream textured limestone with shale partings.
3. No major river falls in between the proposed road only few local nallas of 1st or 2nd order stream exists .

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4. The proposed road will connect Dharli ,Ropa,bandla ,Bunga ,Balag ,Shalag of subdivision Sundernagar District Mandi.

Mitigation methods which are commonly used for prevention of landslides are as follows.

1. Slides in the pervious material are prevented by reducing slopes. Efforts should also be made not to allow the additional water to enter into the material.
2. In order to check the surface water to enter into the unstable ground, it is diverted and made to run off as rapidly as possible away from that area.
3. In pervious materials, the landslides may be prevented by increasing the internal friction of the mass by lowering the water content.
4. Their water may be removed by drain pipes, by drainage through tunnels or by pumping from wells.
5. In situations where slides may cause loss of life and property, the loose rock material is prevented from sliding by constructing retaining walls, concrete piers or by use of piling.
6. At some places the unstable unconsolidated material may be consolidated by cement grouting, chemical means, and artificial freezing.

CONCLUSIONS AND SUGGESTIONS: -

Although the road construction in hilly areas causes damages to both flora and fauna and have adverse effects on local environment but it gives the proper communication facility, which provides opportunities to explore the valuable wealth of such areas. Certain scientific construction measures must be taken into account while building the roads in hilly regions.


Following suggestive measures must be taken care during the constriction of road.

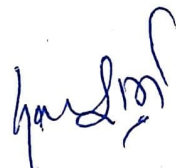
I. **Drainage** – Road side drains are essentially required on Hill roads. Proper dewatering drains along the entire run of road must be designed in such a way so as to keep the rain water or spring water, if any, away from the ingression in the host rock or joints, with carefully designed peep holes to drain the percolating water to stabilize the road base. Surface runoff of water from Apple orchards can be avoided by construction of proper drainage channels and by diverting the water to the nearest channels. Suitable drainage structures in sufficient numbers should be provided to prevent accumulation of excessive water, which causes erosion of the road surface.

II Protection Works- Most of the road were formed by cutting the hill in overburden and Rock mass, thereby disturbing natural equilibrium of slopes. Cut and fill method must be used wherever necessary especially at hairpin curves with proper dewatering schemes. Suitable protection work like side walls and Gabion Structures should be erected where ever necessary. If possible the retaining walls should be constructed on firm rock base otherwise sufficient depth should be provided to the retaining wall in order to stabilize the hill slope.

III. Post construction maintenance - The hill roads are very prone to landslides, heavy rain fall, snowfalls etc. The aim is to keep road surface in good order and prevention of further damages, erosions etc. Not only regular maintenance and repair but also cleaning of drains and ditches should be taken periodically to prevent any damages etc.

IV. Afforestation - Afforestation involves the planting of low height deep rooted plantation along the slope, which reduce surface run off. It also prevents mass wasting or surface soil erosion.


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