

Field visit Report on Landslide Site
(Village-Jakhan, Panchayat-Madrasoo, Tehsil Vikasnagar)
Dated: 17 August 2023

1. Introduction

Jakhan is one of the villages situated under Gram Panchayat- Madrasoo, Tehsil- Vikasnagar, District- Dehradun; with a total population of 110. Jakhan is approximately 20 KM away from Tehsil headquarters at 30°29'04.9"N, 77°54'41.3"E and situated on Linghaf Road road. The village is surrounded by forest area. In the east hillside & Linghaf Road Road, a rivulet is in north side, West is valley side and river is flowing in south of the Village Jakhan. There is a small habitation comprising 25-30 House-holds. Agriculture and animal husbandry are the main occupation of the dwellers.

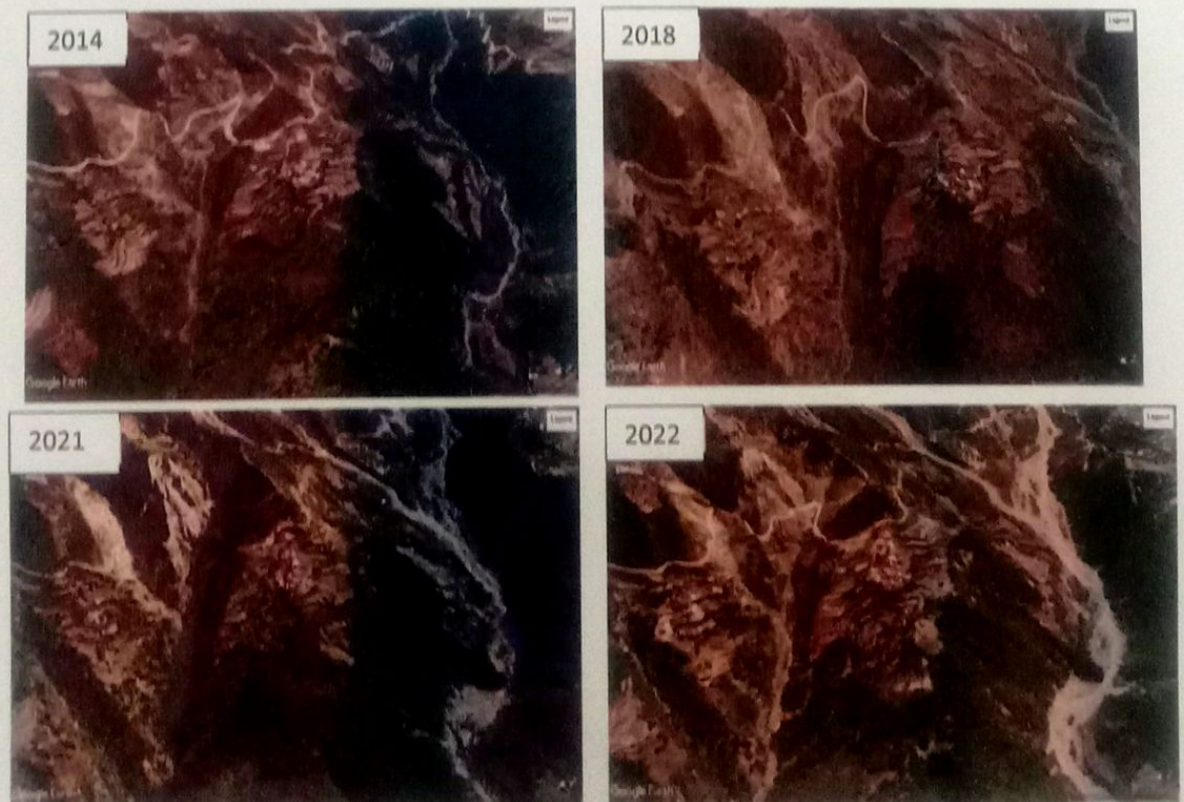
2. Objective/Scope of Visit

To study the possible causes/reasons of the current landslide/slope failure at Linghaf Road which impacted the Village-Jakhan. In compliance of orders received from Director General, ULMCC, a team of following officials visited the site on August 17, 2023 -

- i. Dr Ruchika Tandon, Senior Geologist, ULMCC, Dehradun.
- ii. Shri Vishal Rastogi, Bio-Engineering Specialist, ULMCC, Dehradun.
- iii. Shri Prem Singh Negi, Assistant Engineer, ULMCC, Dehradun.

3. Background of the site

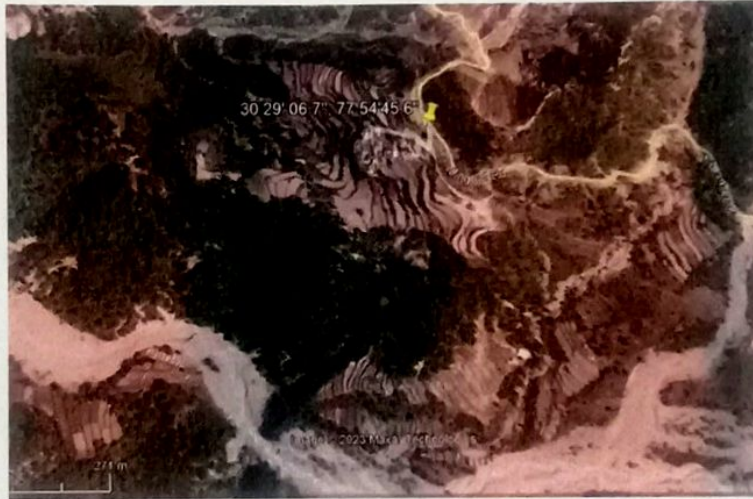
As per the following chronology of the spot a gradual widening of the rivulet can be clearly located. In the year 2011, there was a minor landslide event occurred along the rivulet.



Chronology of the spot deformation

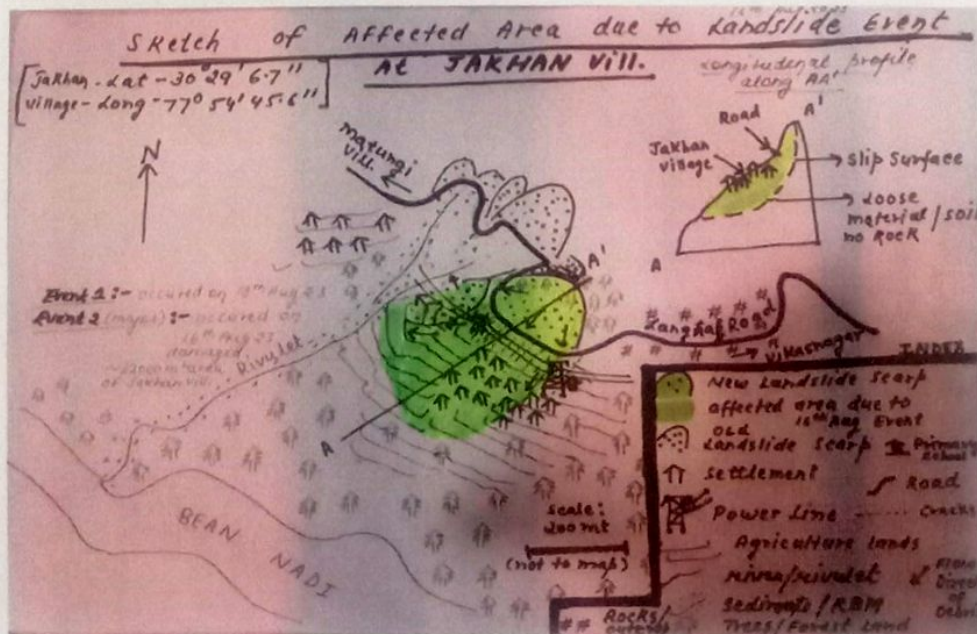
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A transmission line (Vyasi Hydro Power) is also passing through the vicinity. There is no new road cutting or road, no deforestation, no industrial establishment and no perineal waterbody but a seasonal waterway crossing the farms of the village & flowing towards valley side. Further, entire arable land within the vicinity is rainfed and even there is no source of micro irrigation. Following satellite image of the vicinity may depict the pre-devastation state of landscape-



4. Geology & Geomorphology

Geologically, it falls under Lesser Himalayan sequence comprises of meta sedimentary rocks mainly shale and slate exposed near to affected area whereas at the affected site, there is no outcrop observed. However, the slope forming material having chunks of shale and slate embedded in silty sandy matrix suggested its weak nature/ presence of fault. Towards the left side of the affected area along Linghaf road, well bedded shale is exposed which is of grey in colour and thinly bedded. Geomorphologically, the area has average moderate slope. Above the linghaf road, the slope is steep and has gradient of 65° whereas below the road it is 40° . The slope is cut into gentle steeped like terraces for agricultural practices. The sketch of the affected area (marked as green in colour) as under-



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5. Current scenario

- i. As first event of landslide, a heavy rainfall occurred on August 13, 2023 (as informed by the dwellers) which slightly impacted the edge of rivulet, approx. 100 m. away (up-hill). No other impact or signs observed in the area.



Post Devastation landscape

- ii. The second event of devastation occurred on August 16, 2023 in the post meridian. There were no rain showers observed on 14th to 16th August 2023.



Landslide scarp after first & second event

- iii. A landslide scar is 200 m wide and 70 m high (approximately) along the road side (towards up-hill) while towards valley side it is around 300 m. deep as slide/failure. A 200 m stretch of road washed out completely.
- iv. Foundation of one transmission line tower (Vyasi Hydro Power) is also damaged and due to traction one carrier of transmission line also found broken.
- v. Geologically, the soil forming slope is weak in nature and have least cohesion (binding parameter in soil). After observing the slope material in the vertical wide cracks, it is

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observed that the area is located on the palaeo landslide material as the slope forming material have chunks of rock particles distributed in the entire slope.

- vi. Fortunately, at the time of devastation all the dwellers were out of their houses and no life loss occurred. As per information received, out of 19 Households, 10 are considered totally damaged while 02 are partially damaged. Further, approx. 2 ha of arable land also covered by slide material.



Damaged House-holds

- vii. All 19 houses and cowsheds are evaluated and relief & rescue operation was conducted by Administration and SDRF.
- viii. All the natives were shifted to a temporary shelter at Village Pashta and given assistance in shape of basic immediate aids, ration an interim monetary relief also.
- ix. Following image of the vicinity may depict the post-devastation state of landscape-



Longitudinal View of Landslide



Longitudinal cracks on Ground

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6. Observations

- i. Approximate dimension of the scar is 200 m along the road side and 70 m high while towards valley side it may be approximately 300 m. The failure of surface has circular slip surface with average vertical depth lies about 40 m.
- ii. Slide material (scrap) consist of the soil, trees, other vegetations and road with breast wall which rest on the base as it is (with trees etc). The road & breast wall also slide and rested accordingly with major cracks on ground/slide surface. In the slide material, the cracks are found as significantly deep ranging from 40-120 cm (approx.) with varied width & length.



Crack on Ground of Government School



Ground Settlement along the longitudinal cracks

- iii. The slide material consists of variety of soil type, some of the material is found like wet clay with high organic carbon content. On other hand some material found as brittle and has no cohesion. Some angular chunks (less than 20 cm) of rock shale and slate imbedded in fine gain matrix is visible in the scar area.



Landslide scarp



Damaged Transmission line Tower

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- iv. The team visited at the top of the scar to the bottom of the slide including settlement area. During the visit the team has made observations and collected information about the village & current devastation. Some netizen and Tehsil Officials were contacted for the same.
- v. In the settlement area, no cracks were found in metalled surfaces (other than damaged houses).
- vi. There may be possibility that some tensional cracks were already developed in the upper reach of ridge above Jakhan village. Due to inaccessibility of the ridge, such cracks may not be noticed or reported by anyone. Otherwise, it may be considered as one of the indicators of devastation.
- vii. Considering, all above observations, it seems during the heavy rain occurred a significant quantum of rainwater may flow into the cracks (at ridge) which may result into slope failure.
- viii. Considering all above observations, a site-specific landslide primary mechanism can be understand as- the above mentioned first event of landslide triggered the second event by unstable the hill slope just below spots of second event. The topography of the site landscape does not allow to flow the scarp towards rivulet and rest just adjoining to the Government school. Subsequently, the slope gradually failed and impacted the Linghaf Road followed by destructing settlements & arable land.

7. Conclusion

Considering the above observations, we concluded that landslide event occurred in two phases. In the first phase, a landslide occurred after the heavy rainfall of 13 August, 2023 in which part along the rivulet and just below the road washed away along with cracks visible of Linghaf road. In the second major event on 16 August 2023 above the Linghaf road there may be possibility of cracks occurred which may not notice or reported by anyone as due to inaccessibility or it is present near to ridge. due to the action of rainwater these tensional cracks widen and activated and finally the landslide took place. Further,

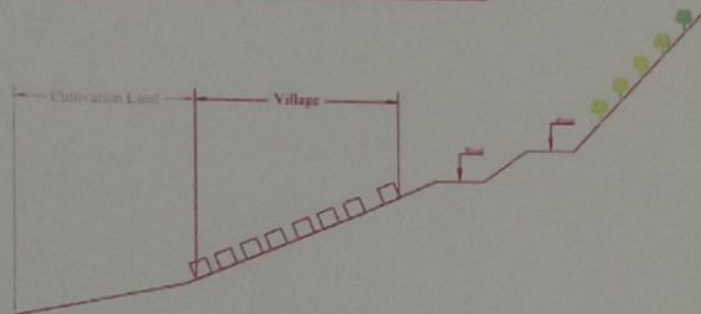
- In near future, the possibility of slide/ failure of adjoining area of the scar cannot be ruled out, as the area seems to be unstable.
- The slide material is loose and susceptible to flow/sink further. As a precautionary measure, all the settlements must be remained evacuated till further orders.
- The land use of the concern land which is bearing slide material may be converted to other suitable purposes, eg- forest, and propose eco-restoration.
- Road construction to be done with geo-technical study and must be equipped with breast wall and retention wall or any other suitable work.
- The rivulet must be cure with suitable revetment works to check soil erosion/ widening.
- The electric supply must be repaired/ reconnect (including transmission line). Before repair/ reconnect the transmission line the foundation of tower(s) may be examined.

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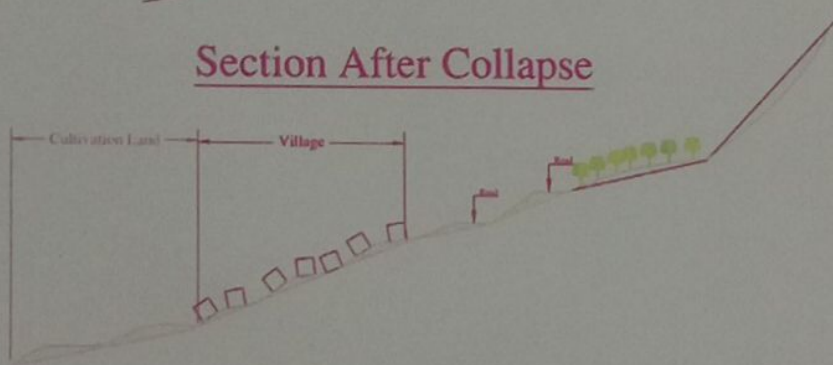
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8. Section of Site

Section Before Collapse



Section After Collapse



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