Government of India

Ministry of Mines

Geological Survey of India

A note on preliminary assessment of landslides in Gudalur Taluk Nilgiri District, Tamil Nadu

1. Introduction:

The Nilgiri district of Tamil Nadu receives rainfall both in southwest and northeast monsoons. The southwest monsoon is more active contributing nearly 50 percent in the west and 40 percent in the east. The northeast monsoon is moderate, contributing nearly 40 percent. The precipitation of rainfall gradually decreases from west to east of the District. The main triggering factor for landslides in Nilgiri is heavy rainfall.

During 18th August 2022, subsidence has taken place near Nadu Gudalur, Gudalur Taluk after a spell of heavy rainfall for past few hours. Around 15 houses were damaged as a result of the subsidence and creep, NH-181 road near Gudalur has partially damaged and subsided. In response to this, a team of geologists from GSI, SU: TNP has visited the site along with the expert team of State Disaster Management Authority (SDMA), Nilgiri District and a preliminary assessment of the landslides was carried out to suggest immediate remedial measures for the said landslide incidence.

2. Location:

The study area falls in Survey of India Toposheet Nos. 58A/07, Gudalur Taluk, Nilgiri District, Tamil Nadu.

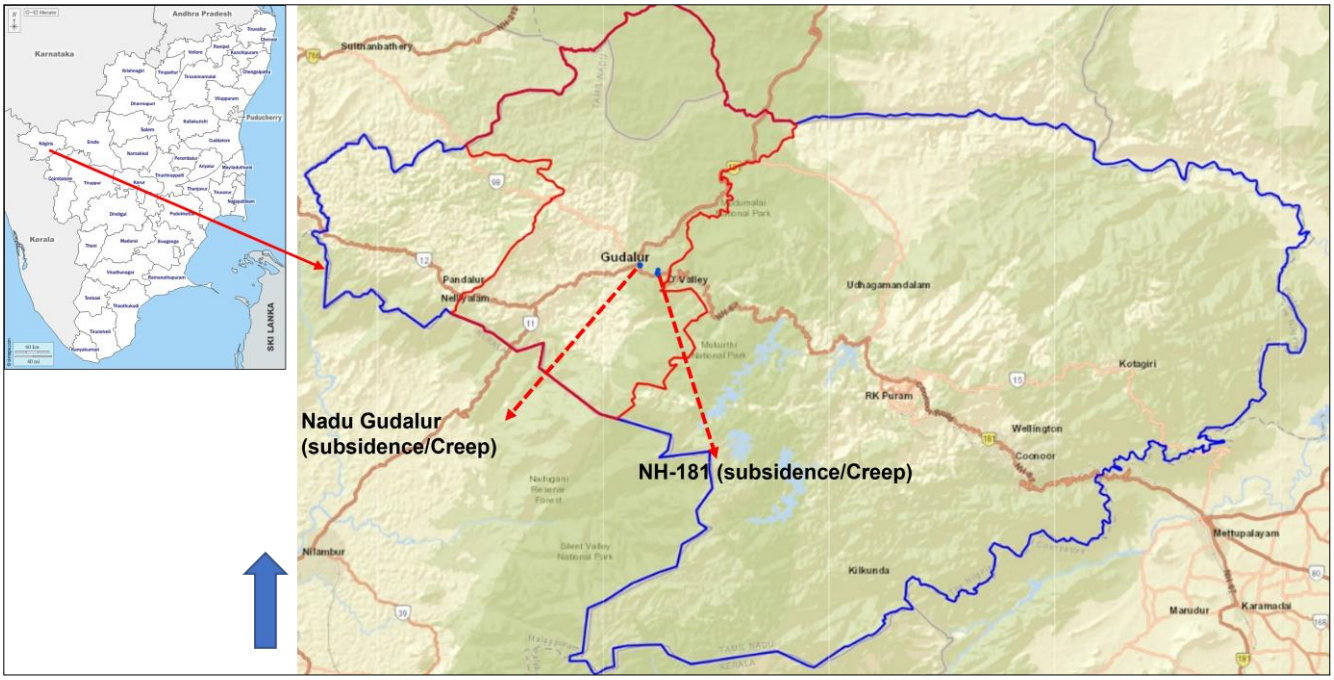

Fig: 1. location map of study area

3. Geology of the area:

The Nilgiri massif is occupied by high grade metamorphic rocks of Archaean age. Garnetiferous and non-garnetiferous charnockites and banded garnetiferous biotite gneiss are the predominant rock types exposed in the area, overlain by thick overburden of lateritic soil. Minor concordant enclaves of metabasites and quartz magnetite schists occur within these rocks, which are considered to be equivalents of Sargur Group of rocks of Karnataka. The regional foliation trends in ENE-WSW direction with steep dips on either side. The joints trends are generally N40° to 60° E - S 40° to 60°W with dip 80° towards S30° to 50° E.

4. History of events

Landslides are frequently occuring incidence in the Nilgiri District, which occur during both north east and south west monsoon, after spells of heavy rainfall. In November 2009, the district received a rainfall of 547 mm, which is the highest rainfall recorded in a period of thirty years, during this month which induced 163 slides. During August 2019 total 77 numbers of landslides were recorded, in and around Nilgiri District. The most affected taluks are Kundha, Gudalur and Pandalur most of the landslides affecting the

road have originated from steep cut slopes, which are left unsupported after removal of lateral support and thus become prone to failure during heavy rains. In August 2022 the the Nadu Gudalur and NH 181 near Gudalur areas witnessed debris flow & subsidence of road, which were the outcome of heavy rainfall during south west monsoon.

5. Landslide incidents

Totally two landslide incidents have been inventoried during the period between 23rd and 24th August 2022. One slide inventoried in Nadu Gudalur which is subsidence and creep and the other one is road subsidence in NH 181 near Gudalur taluk.

A. Nadu Gudalur

During 18th August 2022, a debris flow has taken place near Nadu Gudalur, Gudalur Taluk, after a spell of heavy rainfall for past few hours. Around 15 houses were damaged as a result of the subsidence and creep, area is occurring on a moderately steep covered slope with thick vegetation which bounded by latitude- 11.497633 & longitude- 76.497433.

Length: 300 m, ***width:*** 80 m, ***height:*** 25m, ***depth:*** 1.5-2 m***, Type of material:*** Debris,

Type of movement: Creeping

B. Observations and causative factors:

The slide is a complex type of slide, which initiated as cut slope failure, slope modification and anthropogenic activities which is subsequently leading to the subsidence and creep. Ground cracks ranging from 5-15 cm were observed in the close vicinity of the slide, which are indications of chances of future reactivation, if untreated. Ground subsidence of about 1 m was observed in the slide zone. The slope forming material is mainly soil/ dump debris materials having a thickness of about 2-3 m in (Fig.2). Deep gully erosion along the streamlet due to heavy rainfall. Presence of dumped debris materials along the slope, which is very prone to cause landslides. Steep cutting of slope for building constructions also supplement to the cause of the slide.

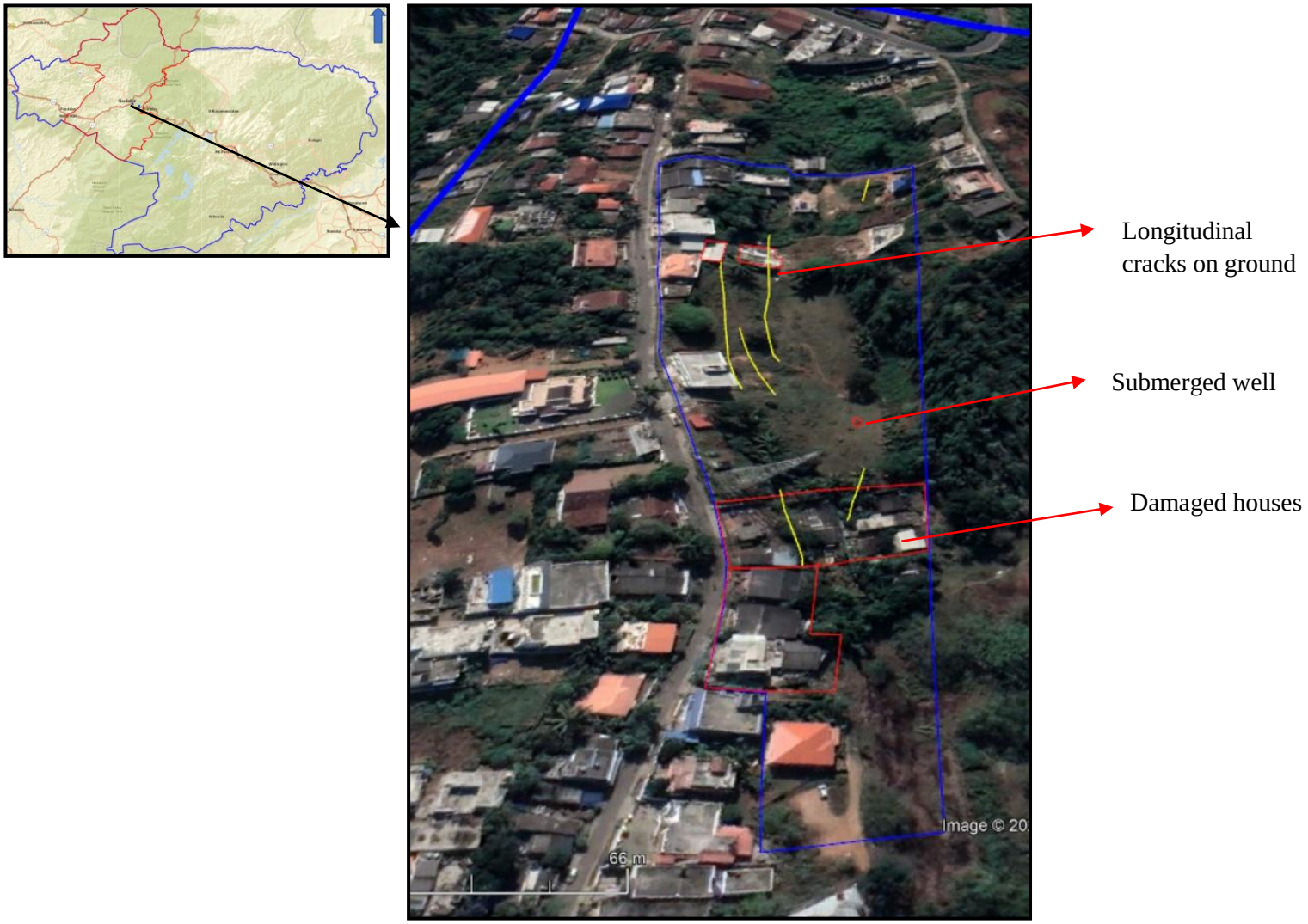

Fig: 2. Plain view of study area showing landslide location area showing cracks

C. Recommendations:

To assess and quatify the damge and aslo to sugegst appropriate remidial measures based on scientific studies, a detailed geological mapping on 1:1000 scale with the help of DGPS & Total Station will have to carried out, along with geological section studies, sub-surface exploration by geophysical method comprising of Shallow seismic refraction survey, site response survey and Electrical Resistivity survey has to be carried out to ascertain the depth to bed rock and physical characterization of different soil layers. Soil samples (undisturbed) would have to collect at various location during detailed geological mapping, for testing its geotechnical properties (such as Moisture content, Density (Relative, Bulk & Dry), Specific Gravity, void Ratio, Porosity, Grain size analysis, Cohesion, Angle of internal friction, Permeability, Natural water content &

Atterberg limit (Liquid Limit, Plastic Limit, Shrinkage Limit & Plastic Index) to carryout slope stability analysis and arrive at the Factor of Safety.

However temporary supportive measures should be implemented at the earliest as given below

i) Proper channelizing of the streamlet and diverting it to the stable area.

ii) People living in the damaged houses, in the unstable slopes/ subsided area may be relocated in safe places at their convinience.

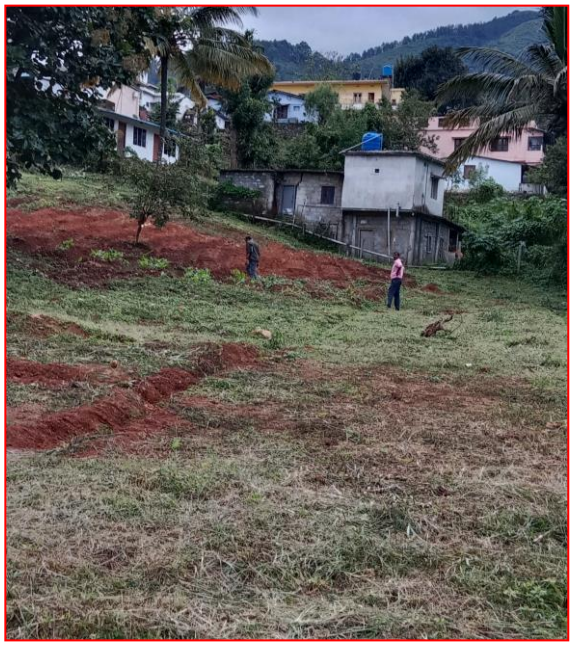

Fig: 3. Land has been affected by long longitudinal cracks and gully erosion

Fig.4: Well got submerged due to subsidence and creep

Fig.5: Crack in Wall and floor

Fig.6: House got completely damaged due to subsidence and creeping

D. NH 181 near Gudalur:

During 18th August 2022, a spell of heavy rainfall for past few hours, due to which NH-181 road (Nagapattinam - Gudalore - Mysore) near Gudalur taluk, has partially damaged and subsided, which is bounded by latitude- 11.496999 & longitude-76.514739.

Length**:** 300 m, ***width*****:** 55 m, ***height*****:** 25m, ***depth:*** 1.5m**, *Type of material:*** Debris, ***Type of movement:*** **-**Subsidence**.**

E. Observations and causative factors of NH 181:

Landslide subsidence and the road got partially damaged in NH 181 near Gudalur taluk. Rainwater ingress over a prolonged period and blockage of drainage channel were caused road crack and subsidence. No proper management of efficient drainage outlet system designed and storm water drainages system needed at road side of NH-181 near Gudalur. During high intensity of rainfall in prolonged duration which leads to oversaturation in turn pore pressure development over the crown surface.

Fig.8: Subsidence of NH 181 road near Nadu Gudalur

Fig 9: Subsidence with curvilinear cracks of NH181 road near Nadu Gudalur

F. Recommendations:

1. As a temporary measure regularization of traffic along the damaged road and no heavy trucks should be allowed to pass through.
2. To prevent water percolating along the current fractures, remove the slush materials from each side of the road and fill it with rich concrete.
3. To prevent erosion and water stagnation, toe drains along the road become necessary for draining seepage water.

4. In case of heavy rains during the monsoon, proper care should be given to the existing culverts and drains to prevent choking and maintain free flow.

5. Avoid blocking, chocking, or diversion of the existing drainage system

6. Permanent remedial measures will be suggested once after compilation of detail geological site specific studies that would be carried out by GSI after necessary approval.

References:

1. "*A preliminary note on Post Disaster Landslide Studies occurred during august 2019 in Nilgiri District, Tamil Nadu", 2019-20, Rajkumar M, Jeevarathinam K, Asrar Ahmed A, Senior Geologist's & Souvik Acharya, Geologist*

2. "*A report on Macro scale (1:50,000) landslide susceptibility mapping in parts of toposheets no. 58A/7, 11, 12 & 15, Coimbatore and Nilgiri Districts, Tamil Nadu", FS:2015-16, Rajkumar M., & Souvik Acharya, Geologists.*

3. A Report on Macro scale (1; 50,000) landslide susceptibility mapping in parts of Toposheet nos. 58G/4,7,8,9,10,13,14, 58H/1,5 & 58A/02, 06, 08 & 10 parts of Tirunelveli, Theni, Madurai , Virudunagar & Nilgiri Districts of Tamil Nadu". 2019-20, Asrar Ahmed A, Senior Geologist's & Souvik Acharya, Geologist.