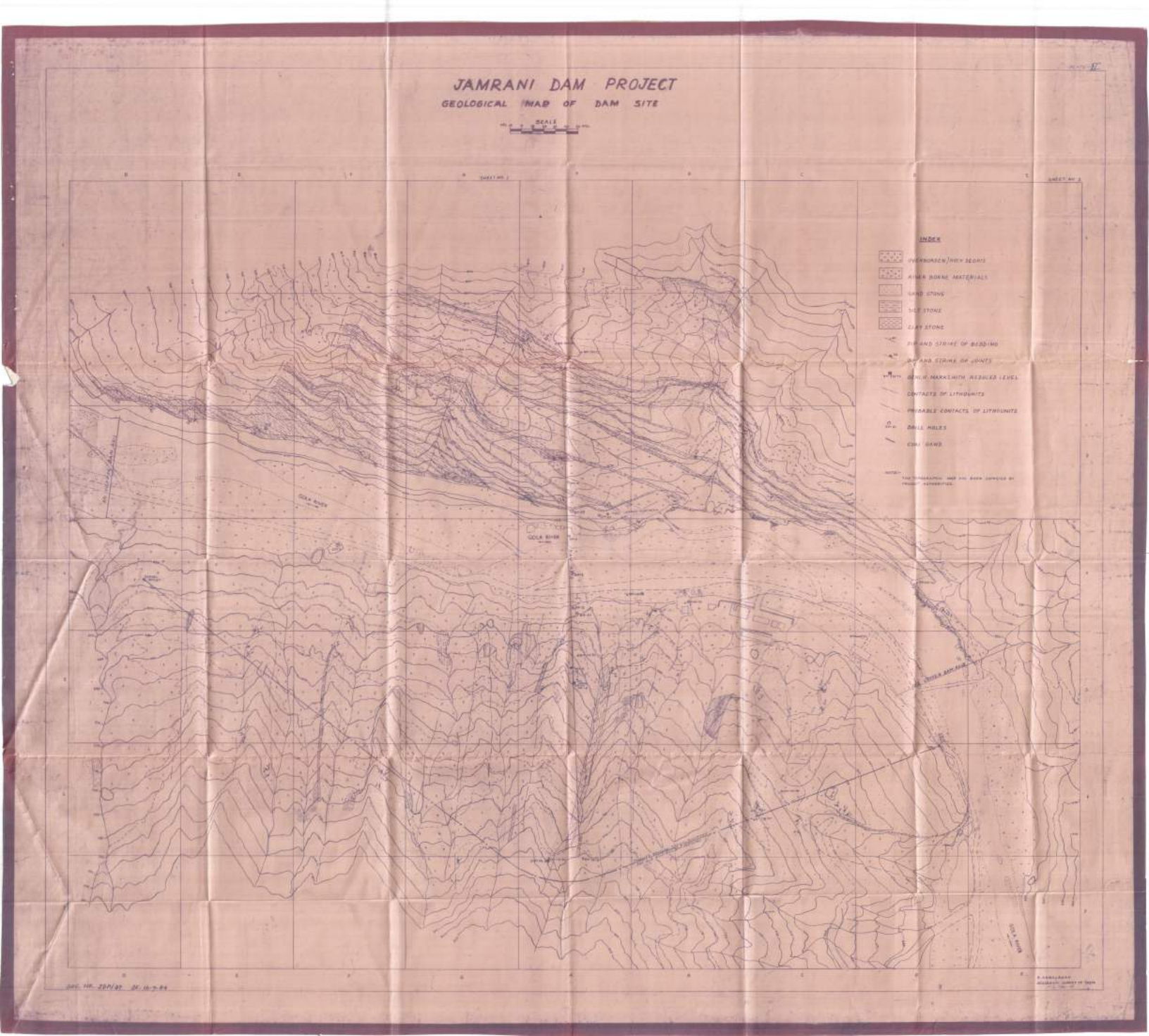
JAMRANI DAM PROJECT

GEOLOGICAL MAP OF DAM SITE

SCALE



(Field Season 1984-85)

A REPORT ON THE GEOLOGICAL STUDIES OF JAMRANI DAM PROJECT, RIVER GOLA, DT. NAINITAL, U.P.

(With six plates)

By

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Geological Survey of India

(September 1988)

1 ABSTRACT

i)The Jamrani dam envisages the construction of a 130m high dam across river Gola,mainly for irrigation and drinking water in the *bhabar* area of Nainital district.

ii)Lower Siwalik rocks, on which the Jamrani dam is located, are separated towards north from the rocks of Lesser Himalaya by the Main Boundary Fault. The proposed Jamrani reservoir is located partly, on the Lower Siwalik and partly on the Amritpur granite.

iii)The Lower Siwalik rocks exposed at the site comprise thick beds of sandstone interbeded with minor claystone and siltstone layers.

iv)The exploratory drifts, earlier excavated along the dam axis have been re-logged in detail for assessing the limit of stripping on the abutments.

2 INTRODUCTION

The Jamrani dam project envisages the construction of a 130m high dam on river Gola, near Jamrani village (29°16'00"N :79°36'36"E :53 O/11) in Nainital district,UP. The 4.5 sq. km. area of the Jamrani reservoir falls in the Survey of India toposheet 53O/11 and 53O/12 .The catchment of the Gola covers about 450 sq.km.,falling in toposheet 53O/11, 53O/12, 53O/13 and 53O/16, bounded by latitude 29°12'37"-29°27'55"N and longitude 79°32'35"-79°49'20"E. The geological studies of the Jamrani dam were continued during the field season 1984-85,under item no.-EG/530/NR/UP/73/73 of the field season programme of the Geological Survey of India.

During the period from October 1984 to September 1985 the author carried out field investigations and other works of office of Resident Geologist of the project. The following work was attended to:

1) Detailed geological mapping of the area around the dam site — 0.18 sq.km. on 1:1000 scale

2) 3-dimensional geological re-logging of exploratory drifts at the damsite	133 m. on 1:100 scale
3)Detailed geological logging of drill holes	70 m
4)Detailed geological mapping of reservoir areas	4.5 sq.km. on 1:7500 scale.
5) Traverse geological mapping of the catchment area	731 km. on 1:50000 scale
6) No of the field tests	41 nos

The geological investigations of the Jamrani dam project were carried out under the guidance of Sri K.N.Srivastava, Director, Engineering Geology Division-4, Geological Survey of India, Dehradun.

3 GEOLOGY OF THE AREA

The Lower Siwalik rocks on which the Jamrani dam is located are truncated towards north by the Main Boundary Fault (MBF) and are bound by the *bhabar* talus fans towards south. The Lower Siwalik rocks comprise thick sandstone interbedded with claystone and silt stone. The NW-SE trending Lower Siwalik rocks dip consistently at moderate angles (35o-55°) towards NE. The WNW-ESE trending MBF dips at steep angles towards NNE .

The grey, medium to coarse grained Amritpur granite occurs to the north of MBF. The general foliation dip of granite is 30°-40° towards NNE. The rocks are also traversed by closely spaced joints.

The Amritpur granites are separated towards north from the Nagthats by the Salari thrust (Valdiya 1984). The rocks of Nagthat formation (Bhimtal formation of Raina & Dungrakoti 1966) comprise basalts, amphibolites, phyllites, slates, white purple and green quartzites.

The Nagthats are separated towards north by the rocks of Ramgarh Group with Ramgarh thrust marking the contact between the two. Farther towards north the Ramgarh Group, comprising porphyritic granite, augen gneiss and sericite-chlorite schist are thrust over by the Almora Group of rocks with the intervention of South Almora Thrust. The Almora Group, comprising gneiss and schist, intruded by granite-granodiorite suite occur on the northern fringes of the Gola catchment.

The Jamrani reservoir is located partly on the Lower Siwalik and partly on Amritpur granite. The Main Boundary Fault (MBF) marks the contact between them (Plate-1). The Lower Siwalik, exposed in the north-western part of the reservoir, comprise thick sandstone beds interbedded with thin purple, grey to dark grey claystone and siltstone beds. The brownish grey to greenish Lower Siwalik sandstones are fine to coarse grained, micaceous

and moderately hard. The Amritpur granite occupies the north-eastern part of the reservoir. The medium to coarse grained Amritpur granite is generally greyish in colour. In this section, the granite shows typical porphyritic texture (Misra 1980). According to Misra(1980), the crenulations of quartz, kaolinization of feldspars and chloritization of micas indicate that these rocks have been subjected to intense shearing.

In the reservoir area, the MBF is generally concealed under debris but passes through south of Sakula and Pastola on the right bank before cutting across the Gola near Panola about 3.5 km. upstream of the dam axis. On the left bank, it passes through south of Hairakhan and enters the Lugar *gad* near Lugar village, close to the maximum level of the reservoir.

4 GEOLOGY OF THE DAM SITE

The Jamrani dam site is located on the Lower Siwalik rocks, which consist of sandstone alternating with siltstone and claystone. The detailed geological mapping of the dam site on 1:1000 scale has been carried out covering an area of 0.18 sq. km. during the current field season. The details have been added to the geological map of the Jamrani Dam Project Site prepared up to F.S.P. 1983-84. (Plate-2).

The more prominent sandstone beds are generally more than 5m. in thickness and the claystone/siltstone beds are generally less then a meter in thickness, though some of the beds range up to 3-5 m.

The sandstone occurring at the dam site is grey and brown coloured micaceous, fine to coarse grained and friable at places due to poor cementation. The micaceous claystone seen at the site is grey, brown and purple coloured and is generally weathered near the surface. The siltstone is generally dark grey coloured micaceous and moderately hard.

The general bedding of Lower Siwalik rocks strikes NW-SE with dips of 30° -50° in northeast direction i.e. upstream. Major structural discontinuities like thrust, fault, etc. are conspicuously absent from the dam base area. However, the rocks are traversed by a few sets of joints.

5 SUB-SURFACE EXPLORATIONS

During the field season under report, the earlier excavated exploratory drifts along the dam axis have been re-logged geologically for obtaining more details. Grouting tests have also been carried out in the dam base area. However, the tests were completed during F.S.P.1985-86, ang therefore, their details have not been covered in this report

Four drifts, two on either abutment have been logged in detail totalling 133m length. The drifts DR-1 and DR-2, on the right abutment are located at El. 692m and 762m respectively and the drifts DL-1 and DL-2, on the left abutment, are located at El. 689m and 771m, respectively.

The drift DR-1 has been excavated just below a NW-SE trending ridge. The rocks encountered in the drift include sandstone, siltstone and claystone. The 1.5 to 5m thick sandstones are grey and brown coloured, micaceous, fine to medium grained and moderately cemented. Some of the bands are calcareous in nature .The purple and grey coloured, micaceous claystone is 0.5 to 4 m in thickness. It shows lateral pinching and swelling and displays minor intercalations of sandstone and siltstone in the form of intra-formational fragments, as seen near RD-20m, on the right wall. The bedding, in general, dips at 40°-55° E. The Northerly dipping joints are very prominent. The effects of weathering in the drift extend up to RD-15m. (Plate-3).

The drift DR-2 is located close to the dam top on the right bank. The rocks encountered in the drift include sandstone, siltstone and claystone. The sandstone and siltstone are almost similar in character to those intersected in DR-1. The bedding planes are well developed with dips varying from 35°-45° towards N30°-55°E direction. The Northerly dipping joints are very prominently exposed. The effects of weathering extend up to 17m. (Plate-4).

The drift DL-1 is located on a N-S trending spur on the left bank. Grey to yellowish grey, medium to coarse grained, micaceous and moderately cemented sandstone is encountered in the drift. Only a 20-40 cm thick bed of claystone has been encountered at RD-16m at crown. The bedding in general dips at 45°-55° in N40°-55°E direction. The north-westerly and westerly dipping joints are well developed. The effects of weathering have been observed up to RD-14m (Plate-5).

The drift DL-2, located on the same spur on which the drift DL-1 is located, is just above the top of the dam. The drift has encountered only sandstone which is similar in lithology as the one exposed in drift DL-1. The effects of weathering extend up to 17.5m. (Plate-6).

6 CONCLUSIONS AND RECOMMENDATIONS

The Jamrani dam project envisages the construction of a 130m high dam across the river Gola in Nainital district, U.P. for an additional irrigation of 64500 hectare of land and drinking water supply in *bhabar* area of the district.

The Lower Siwalik rocks, on which the Jamrani dam site is located, is separated towards north from the rocks of the Lesser Himalaya by the Main Boundary Fault. Several other thrusts occur in the area farther towards north.

The Jamrani reservoir is located partly on the Lower Siwalik rocks and partly on the Amritpur granite. The Main Boundary Fault(MBF) marks the contact between them. While the Lower Siwalik rocks are exposed on the north-western part, the Amritpur granites are exposed on the south-eastern part of the reservoir. The NW-SW trending Lower Siwalik rocks dip consistently at moderate angles towards NE, i.e., upstream in general . The general foliation in Amritpur granite is 30°-40° towards NNE to NE. The WNW-ESE trending MBF dips at steep angles towards NNE and is mostly concealed under debris cover. Though it is believed that

the thrust plane may not lead to any excessive leakage of reservoir water under impoundment, it has to be proved experimentally, by intercepting the thrust plane at depth by an inclined drill hole and carrying out water pressure tests in the thrust zone.

The Jamrani dam site is located on the Lower Siwalik rocks which consist of sandstone alternating with siltstone and claystone. The bedding in the rocks generally strike NW-SE and dip 30°-50° in NE. direction i.e. upstream, which is a favourable disposition. The major geological discontinuities like thrusts faults etc. are absent in the dam base area.

The exploratory drifts along the dam axis have been re-logged for assessing the limit of stripping. While the drifts on the right bank have intersected sandstone claystone and siltstone beds, the drifts on the left bank progressed through sandstone only. The limit of stripping is assessed on the basis of weathering as inferred by the presence of plant roots inside the drifts. The lateral extent of weathering indicated by drifts range from 15m at El 692m to 17m at El 762m on the right bank and 14m at El 689m to 17.5m at El 771 m on the left bank. It is recommended that two more exploratory drifts on each abutment may be excavated for defining of stripping on the abutments.

Sd/-

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Dated 6th April 1989.

LIST OF UNPUBLISHED REPORTS OF G.S.I ON JAMRANI DAM PROJECT

1. Dayal,H.M. (1973): A geotechnical note on the Ranibag and Jamrani dam sites on Gola river, Nainital District, U.P. (with five plates). Field season 1972-73.

2. Arora,C.L., Das,L.K. and Prakash,D. (1973): An interim note on the geophysical investigations conducted at the proposed dam sites at Amritpur (Ranibagh) and Jamrani, District Nainital, U.P. Field season 1972-73.

3.Dayal,H.M. (1973): Second geotechnical note on the interpretations of drilling data, Jamrani dam site, Gola river, Nainital District, U.P. (with three plates) Field season 1972-73.

4. Dayal,H.M(1974): Third Geotectnical note on the proposed dam and the appurtenant structure sites and interpretation of drilling data, Jamrani dam site, Gola project, Nainital district,U.P. (with three plates) Field season 1973-74.

5. Dayal,H.M. (1975): Fourth geotechnical note on the Jamrani Dam Project, Gola river, Nainital district, U.P. (with seven plates) Field season 1973-74.

6. Jain,M.S. (1975): A geotechnical review of the salient features of the Jamrani dam site, Gola river, Nainital district. Field season 1974-75.

7. Dayal, H.M (1978): Fifth geotechnical report on the Jamrani dam project,Gola river,Nainital district,U.P. (with six plates) Field season 1974-75.

8. Dayal,H.M. (1978): Sixth geotechnical note on the Jamrani dam project, Gola river Nainital district, U.P. (with fourteen plates) Field season 1976-77.

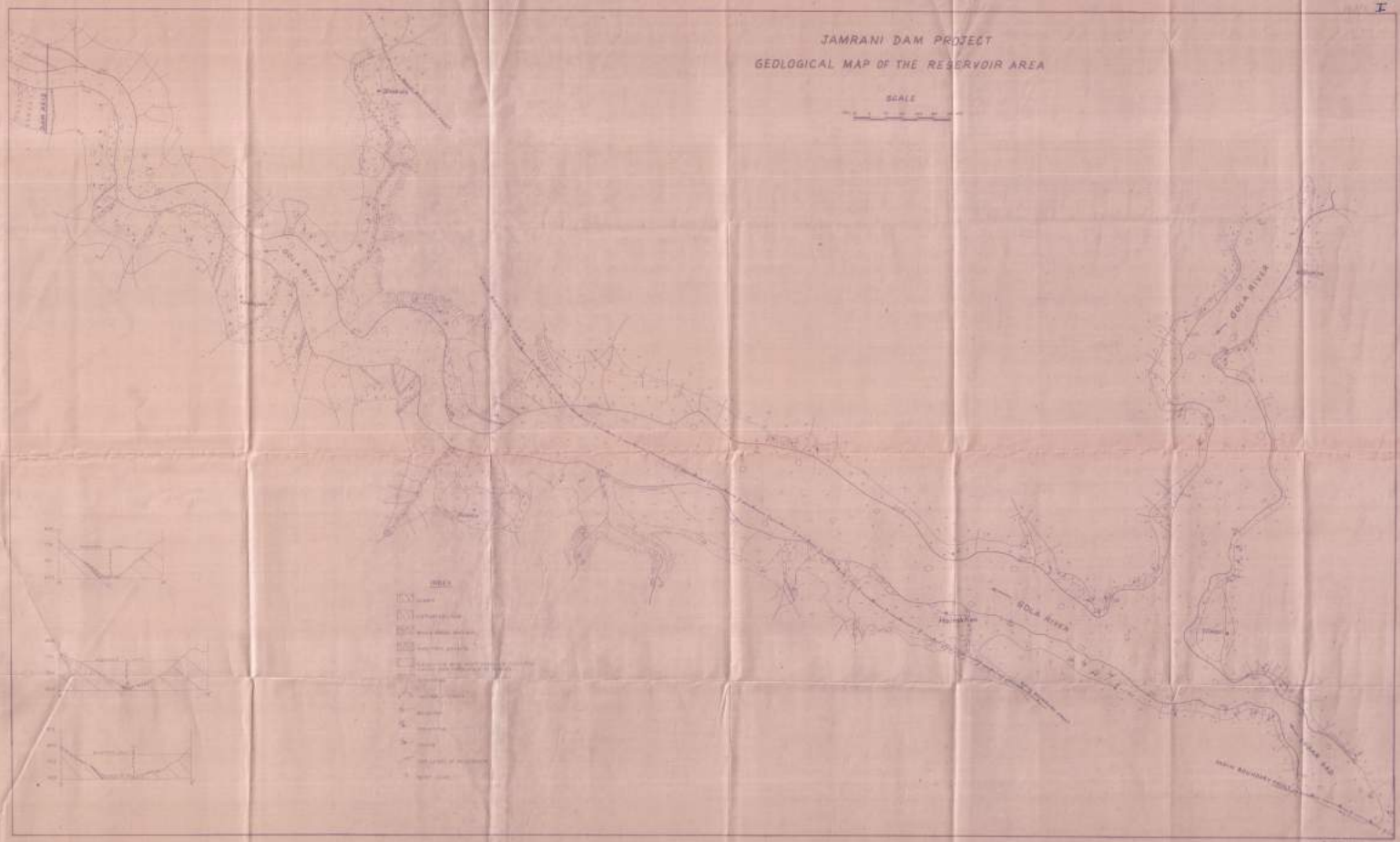
9. Jaitle,G.N.: Geotechnical report on the Jamrani dam project on river Gola, district Nainital, U.P. (with two plates) Field season 1979-80.

10. Iyer,R.V., Anbalagan,R. and Sanwal,R.K : Geotechnical report on the Jamrani dam project, Gola river, Nainital District, U.P. (with eight plates) Field season 1980-81 to 1983-84.

JAMRANI DAM PROJECT

GEOLOGICAL MAP OF THE RESERVOIR AREA

SCALE



JAMRANI DAM PROJECT

GEOLOGICAL MAP OF DAM SITE

SCALE

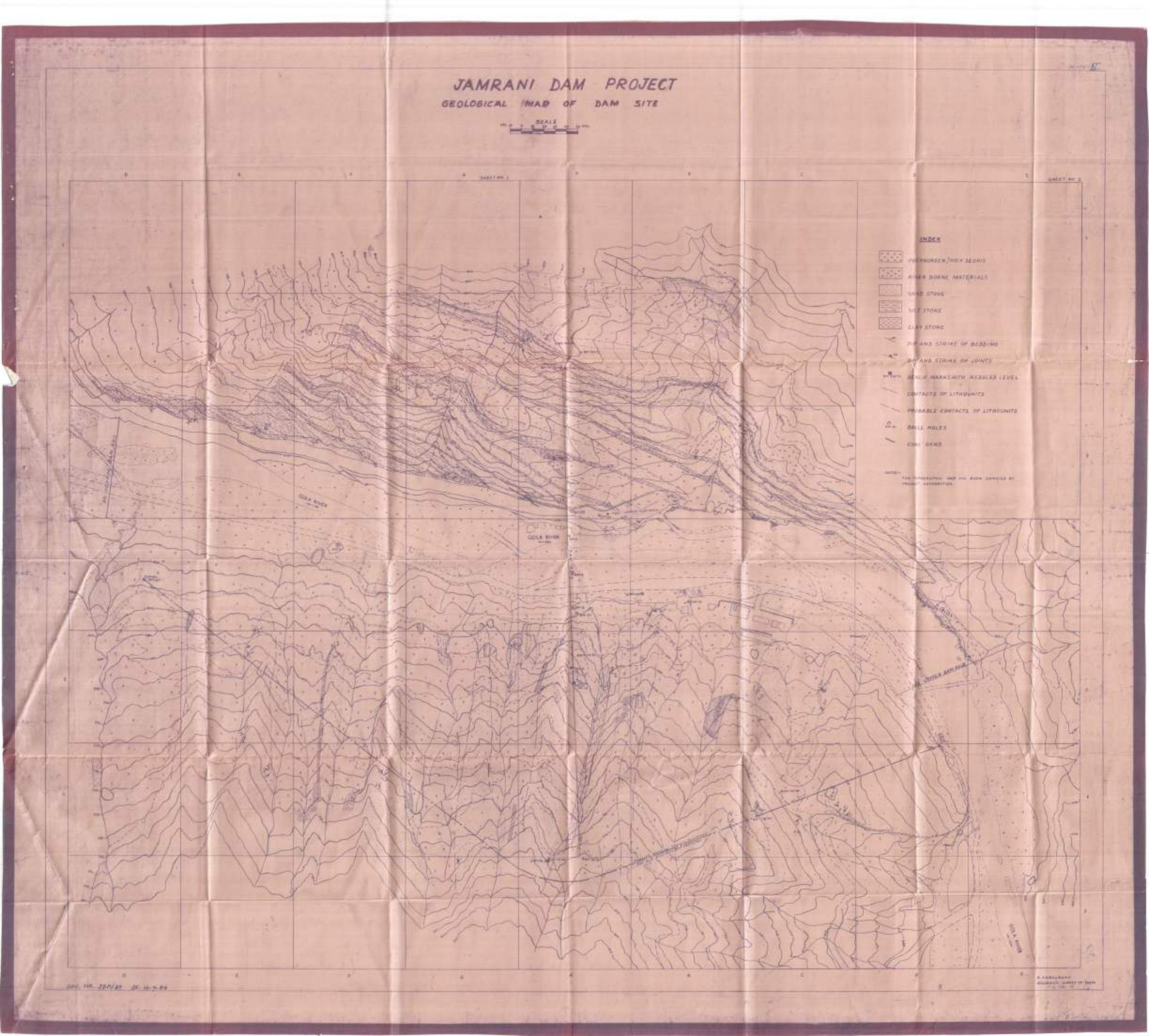
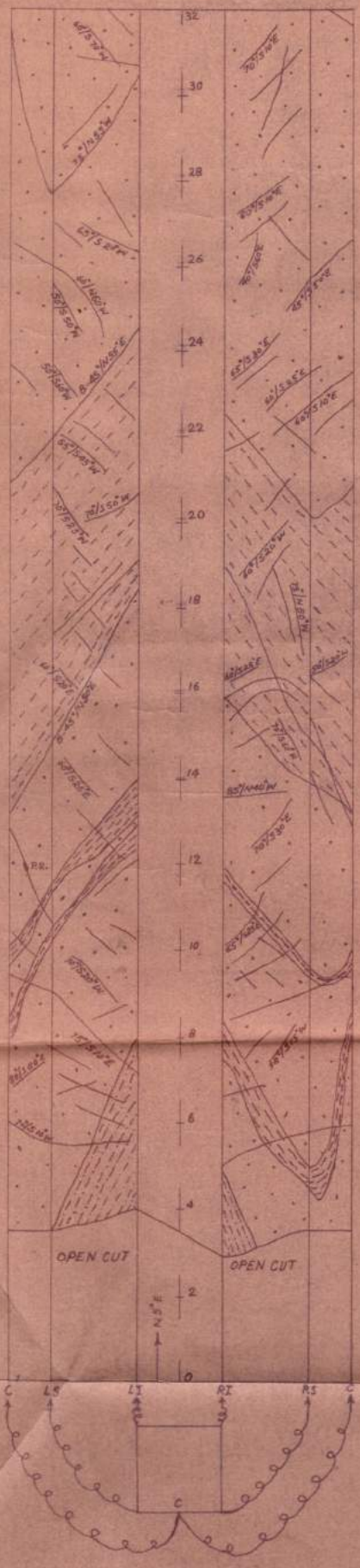


PLATE III

JAMRANI DAM PROJECT

3-D GEOLOGICAL LOG OF DRIFT DR-1 ON RIGHT ABUTMENT



NOTE

1. THE ELEVATION OF THE DRIFT IS 692·20m.
2. THE WEATHRING EFFECTS ARE OBSERVED UPTO RD – 15·0m.

INDEX

SANDSTONE

CLAYSTONE

SILTSTONE

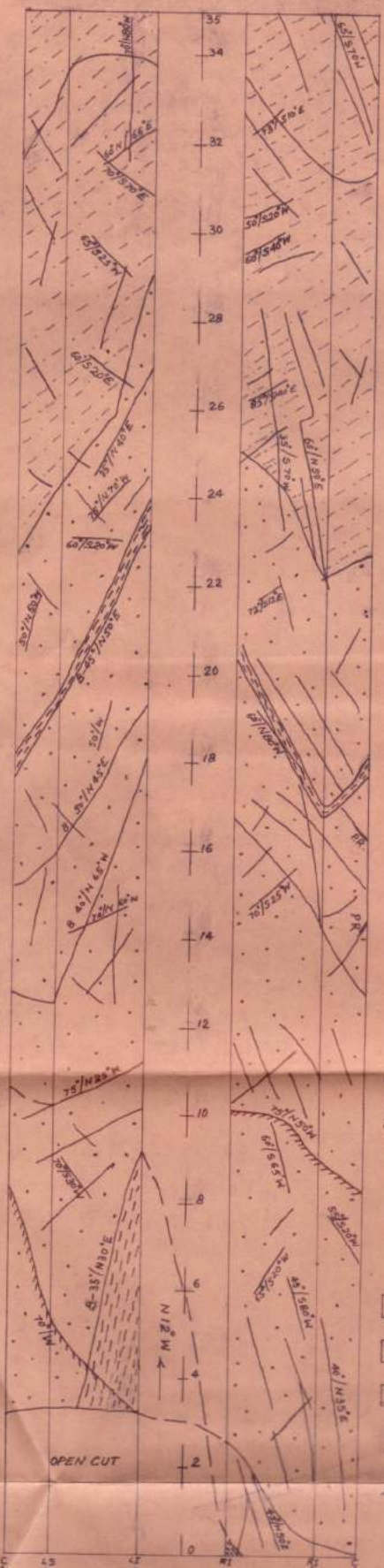
PR – PLANT ROOT

R. ANBALAGAN
GEOLOGICAL SURVEY OF INDIA

PLATE-IV

JAMRANI DAM PROJECT

3-D GEOLOGICAL LOG OF DRIFT DR-2 ON RIGHT ABUTMENT



NOTE

1. THE ELEVATION OF THE DRIFT IS 761.57m.
2. THE WEATHERING EFFECTS ARE OBSERVED UPTO RD-17.0m.

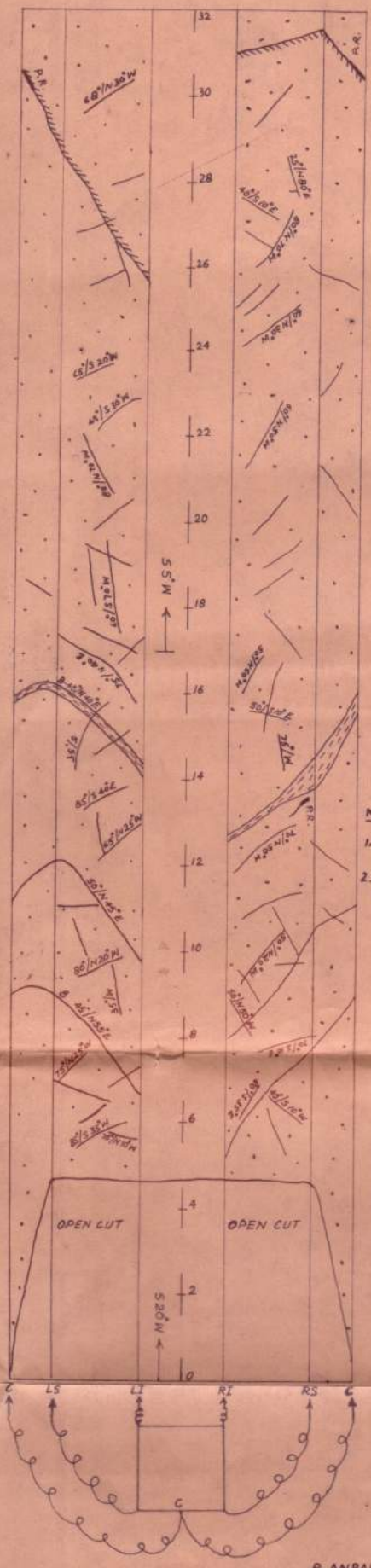
INDEX

- SANDSTONE
- CLAYSTONE
- SILTSTONE
- PR- PLANT ROOT
- SHEAR JOINT

R. ANBALAGAN

PLATE V

JAMRANI DAM PROJECT
3-D GEOLOGICAL LOG OF DRIFT DL-1 ON LEFT ABUTMENT



NOTE

1. THE ELEVATION OF THE DRIFT IS 689·12 m.
2. THE WEATHRING EFFECTS ARE OBSERVED UPTO RD-14 m.

INDEX

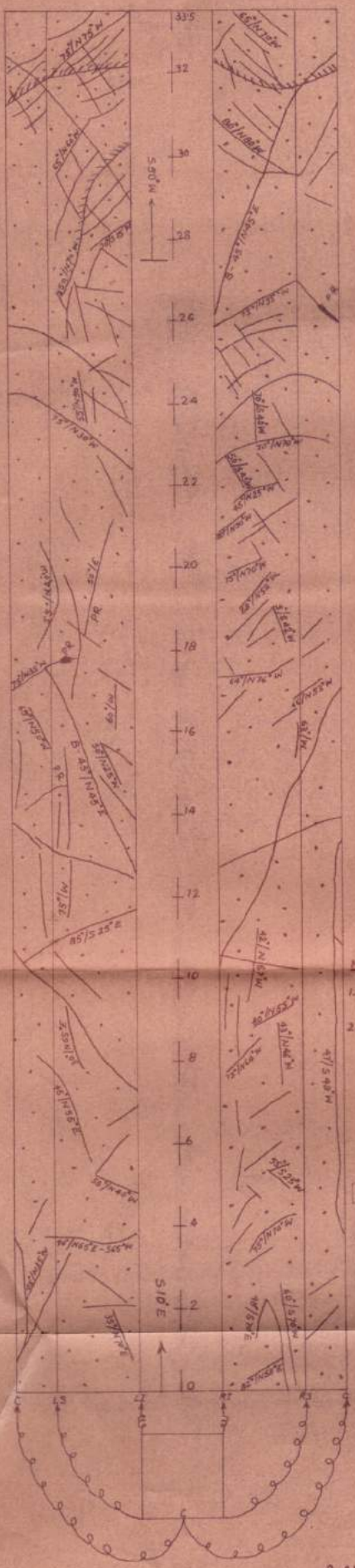
- SANDSTONE
- CLAYSTONE
- SHEAR JOINT
- PR – PLANT ROOT

R. ANBALAGAN
GEOLOGICAL SURVEY OF INDIA

PLATE VI

JAMRANI DAM PROJECT

3-D GEOLOGICAL LOG OF DRIFT DL-2 ON LEFT ABUTMENT



NOTE

1. THE ELEVATION OF THE DRIFT IS 771·39 m.
2. THE WEATHERING EFFECTS ARE OBSERVED UPTO RD-17·5m.

INDEX

SANDSTONE

SHEAR JOINT

PR – PLANT ROOT

R. ANBALAGAN
GEOLOGICAL SURVEY OF INDIA