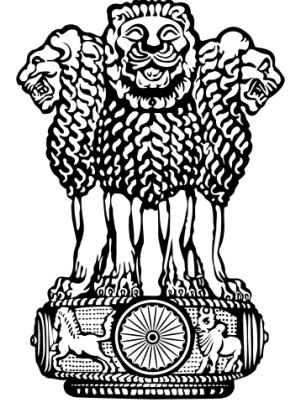




GOVERNMENT OF J&K
I&FC Kashmir



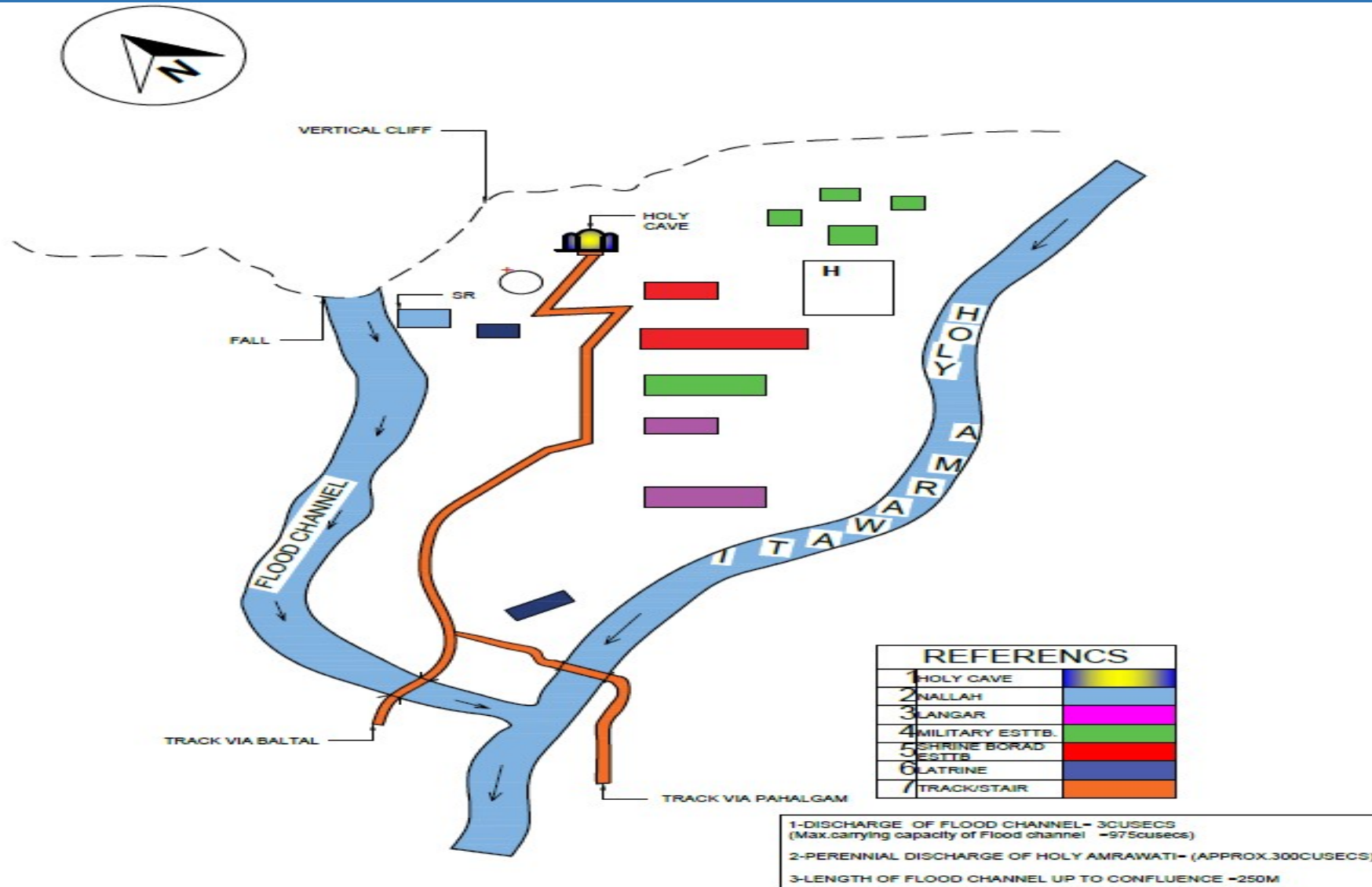
सत्यमेव जयते

Flood Protection Works near Holy Cave
Workshop Series

Presented by: Er. Salim Jhangir Banday, Executive Engineer, FCD Anantnag

30th August 2024

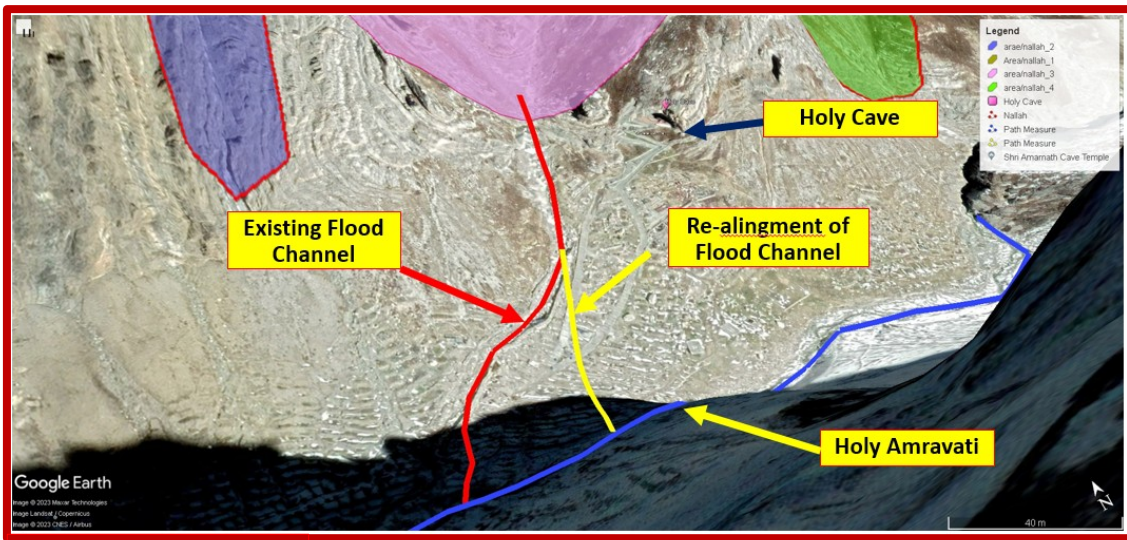
Site Plan of Holy Amarnath cave



SITE PLAN SHOWING THE LOCATION OF FLOOD CHANNEL AT HOLY AMARNATH JI CAVE

Amarnath Holy Cave : Location & Hazard Vulnerability

- ❖ Holy Amarnath cave situated at an altitude of 3,888 m (12,756 ft), around 121 km from [Srinagar](#) City. The place can be reached either through [Sonamarg](#) or [Pahalgam](#) routes.
- ❖ The cave, located in [Sind Valley](#), is surrounded by glaciers snowy mountains and is covered with snow most of the year, except for a short period in the summer, when it is open to pilgrims.
- ❖ Being part of Himalayan region, the area near the Holy cave is prone to multi-hazards such as flash floods, landslides, mudslides, and debris flows. It is believed that disasters exacerbated by climate change.
- ❖ **On 8th of July 2022 at around 5:30 PM flash flood took place near the Holy cave. The unfortunate incident claimed precious lives.**
- ❖ **The IMD claimed that the flash flood was triggered due to localized high intensity rainfall in the upper catchments feeding nallahs.**



Site Plan



**Recapitulating
08th July
2022 Flash
Flood Event
near Holy
Amarnath**

Analysis of Flash Flood

- Preliminary analysis of the flood event to compute flood discharge was afterwards done by the Departmental Engineers and later through Central Power Research Station (CWPRS) Pune which showed that the magnitude of flood triggered on the day was more than **950 Cusecs**.

(II) Adopting Dickens Formula = $CA^{3/4}$

$$Q = CA^{3/4}$$

where

C = Constant value

The constant value (C) is taken as 35 as per S K Garg, Irrigation Engineering and Hydraulics Structures, Figure 7.121 at page no. 448

A = Catchment area in km^2

Sl. No.	Nallah ID	Area (A)		Constant (C)	Discharge	
		(Sqm)	(Sqkm)		(cumecs)	(Cusecs)
1	01	151158	0.151	35	8.48	299.82
2	02	88807	0.089	35	5.69	201.19
3	03	186710	0.187	35	9.94	351.28
4	04	40837	0.041	35	3.18	112.35

Works Executed in Last Three Years

Year 2021		Year 2022		Year 2023	
Works Executed	Cost (in LACS)	Works Executed	Cost (in LACS)	Works Executed	Cost (in LACS)
Nil	Nil	01) Emergency restoration of flood channel by way of laying of flood protection crates at Holy Amarnath Cave (due to flash flood) under SDRF on the instructions of District Administration Anantnag.	41.93 Lacs	1) Removal of snow avalanche with heavy rock boulders by manual means.	62.00
				2) Removal of heavy load deposition including repairs to existing crate work and P/L of cement concrete coping and jacketing.	230.00
				3) Construction of RCC culverts on Holy Amrawati and Flood Channel	25.00
				4) Construction of RCC Ghats on Holy Amrawati	155.00
				5) Construction of RCC Channel near Helipad at Lower Cave	118.00
				6) Construction of Flood Protection Works on Holy Amrawati	250.00
				7) Benching of slopes on R/S of Holy Amrawati and L/S of Flood Channel	87.00
				8) Provision for transportation and accommodation for Engineering and field staff	8.00
				Total	935.00

Work Done Components of FP works executed during 2023-24

S.No.	Name of Work	Qty Executed	Amount involved (in Lacs)	Physical Status
01.	Removal of snow avalanche with heavy rock boulders by manual means (Unforeseen Variation Item)	6300 Cum	62.00	Completed
02.	Removal of heavy load deposition and restoration of damaged crate works (executed last year), laying of cement concrete coping and jacketing of existing crates on both sides of FLOOD CHANNEL.	120 No. Crates	230.00	Completed
03.	Construction of crate works on both sides of HOLY AMRAVATI at various spots in multiple tiers.	850 mts length on either side	250.00	Completed
04.	Construction of RCC and Earthen Channels for catching water on left side of HOLY AMRAVATI and right side of FLOOD CHANNEL.	60 mts (RCC Channel)	118.00	Completed
05.	Benching of slopes and construction of Retaining Walls by way of crate work with cement concrete coping on left side of HOLY AMRAVATI and right side of FLOOD CHANNEL.	421 mts	87.00	Completed
06.	Construction of RCC Culverts	03 No. against 06 No.	25.00	Completed as per SASB instructions & requirements
07.	Construction of Ghats on HOLY AMRAVATI.	04 No. against 10 No.	155.00	Completed as per SASB instructions & requirements
08.	Allied Expenses Contingent to the Execution		8.00	
	Grand Total		935.00	

Challenges in Execution of FP Works

- i) Tough, treacherous and high altitude terrain with limited access
- ii) Harsh working conditions & limited working window (5 hrs during a day on an average only)
- iii) Erratic weather pattern near Cave area.
- iv) Removal of “unforeseen” Snow Avalanches which hit the site in 2023-24.
- v) Arranging of labour gangs for execution of work (no machinery used).
- vi) Logistical arrangements for food and accommodation to support deployed labour gangs.
- vii) Carriage of material like cement/crates using ponies/labours from Baltal side for 14 Kms.

Achievements of 2023-24

- i) First of its kind FP works carried out in the history of the Department .Prior to this FP works have never been executed at such a large scale.
- ii) A success story in terms of mobilisation, coordination, supervision, execution form all the stakeholders.
- iii) Completion of FP works in 2023-24 within record time of two months time period from
- iv) Enhancement in carrying capacity of "Flood Channel" upto **950 Cusec** in order to cater heavy discharge .
- v) Largest investment for disaster Risk reduction near Holy cave in terms of financial value **(plus 9 Crs)**
- vi) Permanent and durable work asset creation to sustain sub-zero temperatures for enhanced longevity.

Details of the Flood Protection Works executed near Holy Cave during 2024-25

i) Advertised Cost = 3.35 Crs

ii) Allotted Cost = 2.61 Crs

i) Date of Start = 11.06.2024

ii) Date of Completion = 10.08.2024

S.No.	Name of Work	Estimated Quantity	Achievements till completion	Remarks
01.	Snow Clearance from Flood channel	2000 Sqm	2000 Sqm (100%)	Completed
02.	No. of crates to be laid for construction of Ghats on Holy Amravati	143 No's	143 No's (100%)	Completed
03.	Jacketing and Coping on crates	105 Cum	105 Cum (100%)	Completed
04.	Construction of RCC channel	270 Cum	270 Cum (100%)	Completed
05.	Construction of Prefabricated Hut	01 No's	Platform constructed including Soak Pit. The rest of the work will be taken up next year.	

Future Studies near Holy Cave for Risk Reduction

National Institute of Hydrology (NIH) has been roped in to undertake studies on with following identified broad objectives :

1. Identifying flash flood-prone areas
2. Modelling potential inundation extents
3. Simulating flash flood scenarios
4. Identifying mass movements (debris flows) and avalanches zones
5. Assessing impacts on population and infrastructure
6. Developing risk maps and proposing mitigation measures

Removal of snow Avalanche in 2023-24

AVALANCHE BEFORE REMOVAL



AVALANCHE DURING REMOVAL



AVALANCHE AFTER REMOVAL



Labour Gangs at Work for Clearing Avalanche



Construction of RCC Channel

BEFORE



Latitude: 34.211518
Longitude: 75.493458
Elevation: 3755.56±249 m
Accuracy: 15.8 m
Time: 01-08-2023 10:38
Note: proposed RCC channel at lower cave

Powered by NoteCam

DURING



Latitude: 34.210828
Longitude: 75.491937
Elevation: 3761.76±21 m
Accuracy: 105.8 m
Time: 10-08-2023 08:29
Note: RCC channel at lower cave

Powered by NoteCam

AFTER EXECUTION



Latitude: 34.211473
Longitude: 75.493551
Elevation: 3764.89±44 m
Accuracy: 20.3 m
Time: 08-09-2023 15:11
Note: CULVERT ON RCC CHANNEL AT LOWER CAVE

Powered by NoteCam

Construction of RCC Culvert

DURING



Latitude: 34°12'49"N
Longitude: 75°30'8"E
Elevation: 3777.5±26 m
Accuracy: 3.3 m
Azimuth: 181° (S)
Pitch: -6.8° (1.4°)
Time: 06/09/23 09:17

Powered by AngleCam

AFTER



Latitude: 34°12'51"N
Longitude: 75°30'7"E
Elevation: 3774.3±26 m
Accuracy: 9.1 m
Azimuth: 179° (S)
Pitch: -14.2° (8.6°)
Time: 06/09/23 09:08
Note: measurements of culvert no 2 at flood channel

Powered by AngleCam

Construction of Ghats

DURING



Latitude: 34.210695
Longitude: 75.492065
Elevation: 3761.8±5 m
Accuracy: 7.0 m
Time: 10-08-2023 16:41
Note:

ghat at lower cave near RCC BRIDGE

Powered by NoteCam

AFTER



Latitude: 34°12'39"N
Longitude: 75°29'32"E
Elevation: 3697.1±28 m
Accuracy: 5.5 m
Azimuth: 182° (S)
Pitch: -12.3°
Time: 05/09/23 18:47
Note: Ghat no 04 after completion

Powered by AngleCam

Snow Clearance from Flood Channel 2024-25

Before Execution



During Execution



After Execution



Repair/Renovation of Existing Drain near Holy Cave

Before Execution



During Execution



After Execution



Construction of RCC Channels for intercepting Ravine discharge

Before Execution

During Execution

After Execution



Construction of Ghat No.5 at Holy Cave

Before Execution



During Execution



After Execution



Construction of Platform for Prefab. Hut for Engineering & Supervisory Staff

Before Execution



GPS Map Camera

Forest Block, null, null
Chandanbadi Amarnath Trek, Forest Block, 192230
Lat 34.211586°
Long 75.493272°
08/08/24 10:45 AM GMT +05:30

During Execution



GPS Map Camera

Forest Block, null, null
Chandanbadi Amarnath Trek, Forest Block, 192230
Lat 34.210581°
Long 75.491743°
09/08/24 02:07 PM GMT +05:30

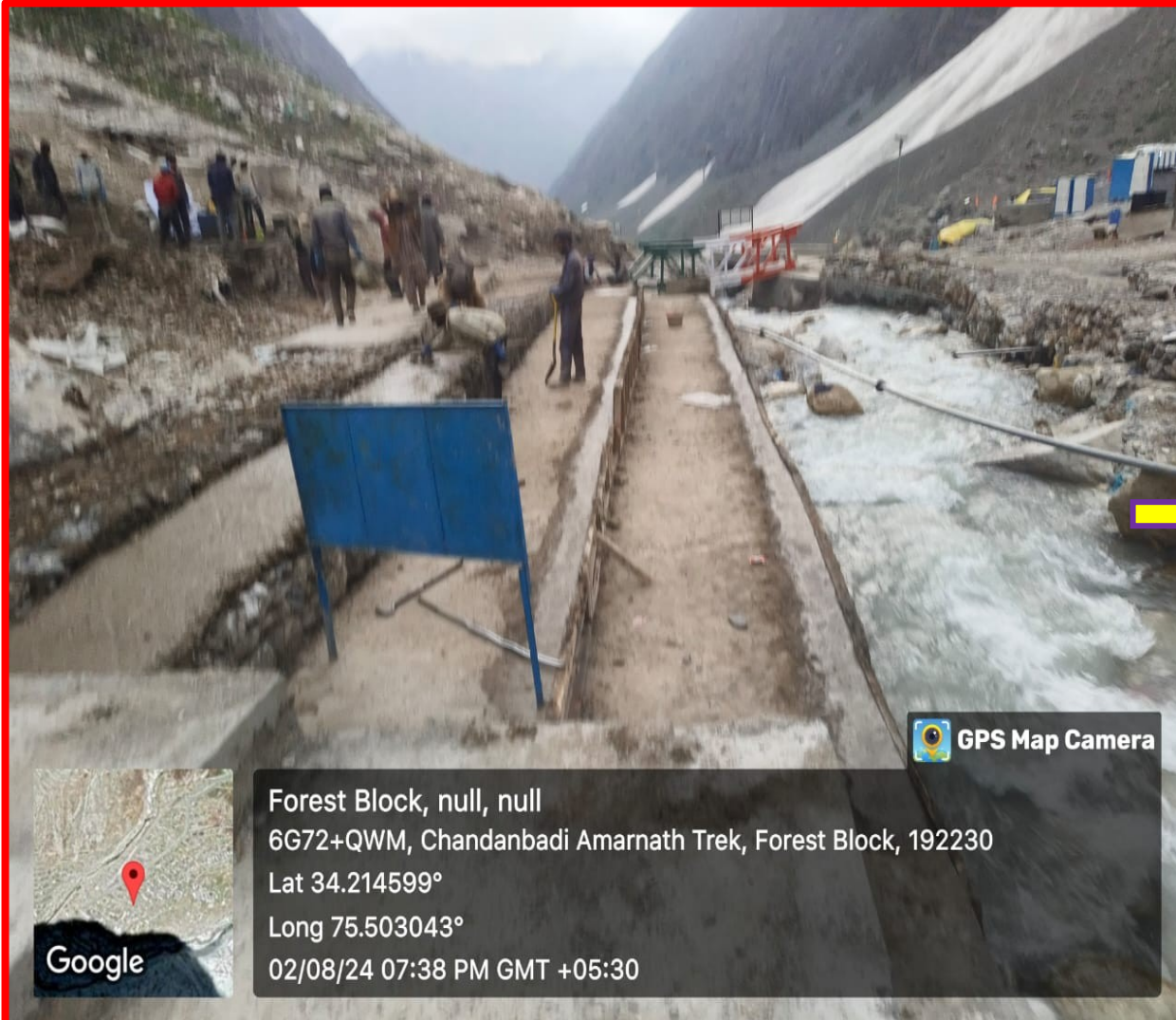
After Execution



Forest Block, null, null
Chandanbadi Amarnath Trek, Forest Block, 192230
Lat 34.210692°
Long 75.492022°
10/08/24 09:37 AM GMT +05:30

Extension of Ghat No.1 at Holy Cave

During Execution



After Execution



Protection Work Around Toilet Block near Holy Cave

During Execution



After Execution



Thanks.....