Politecnico di Torino

Dams & Reservoirs DAY 2025

Water and Energy security for Europe

ITCOLD ITYP

OPEN DAY ON DAMS



Dams and environment: engineering solutions for the future

TURIN , May 28, 2025

Dams and climate change: a case study

artaz.lorenzo@cvaspa.it

ITCOLD – II Photo Contest

Index

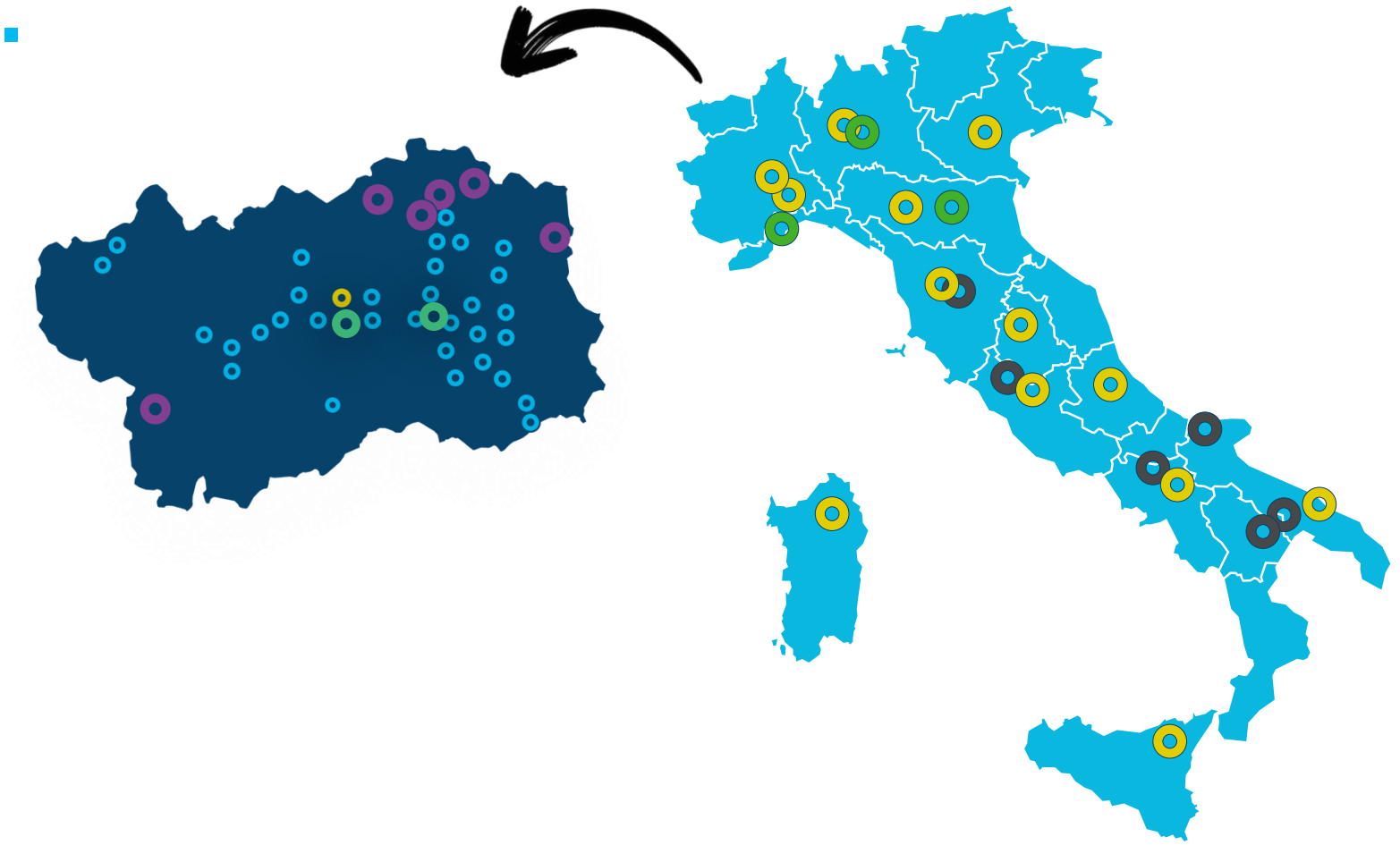
- Presentation of C.V.A. S.p.A. a s.u.
- The “Large Dams"
- Climate change: the effects on the high mountain area of the Aosta Valley and on the glaciers
- Dams are resilient
- Case study - The Place Moulin dam during the flood 29.06.2024
- Post event – Safety and Monitoring - Development and opportunities




CVA
Rinnovabili da sempre

The Company started in Aosta Valley with hydroelectric plants, but now we produce energy all over Italy through wind, solar and hydro plants.

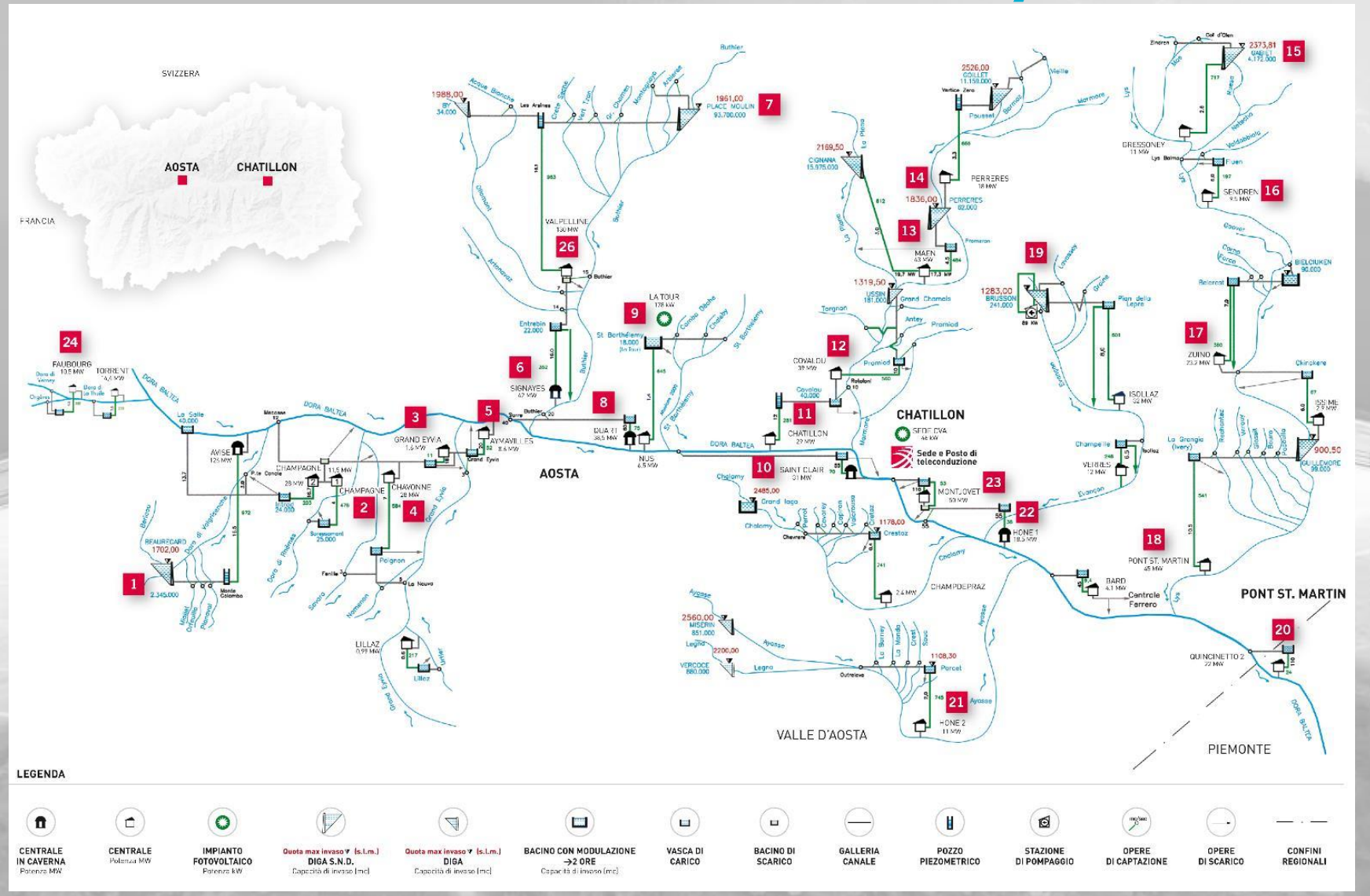
- **8** Large Dams
- **32** Hydroelectric power plants
- **9** Wind farms
- **60** Photovoltaic
- **5** Operational headquarters



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Gruppo CVA

Hydroelectric Plants in the Aosta Valley



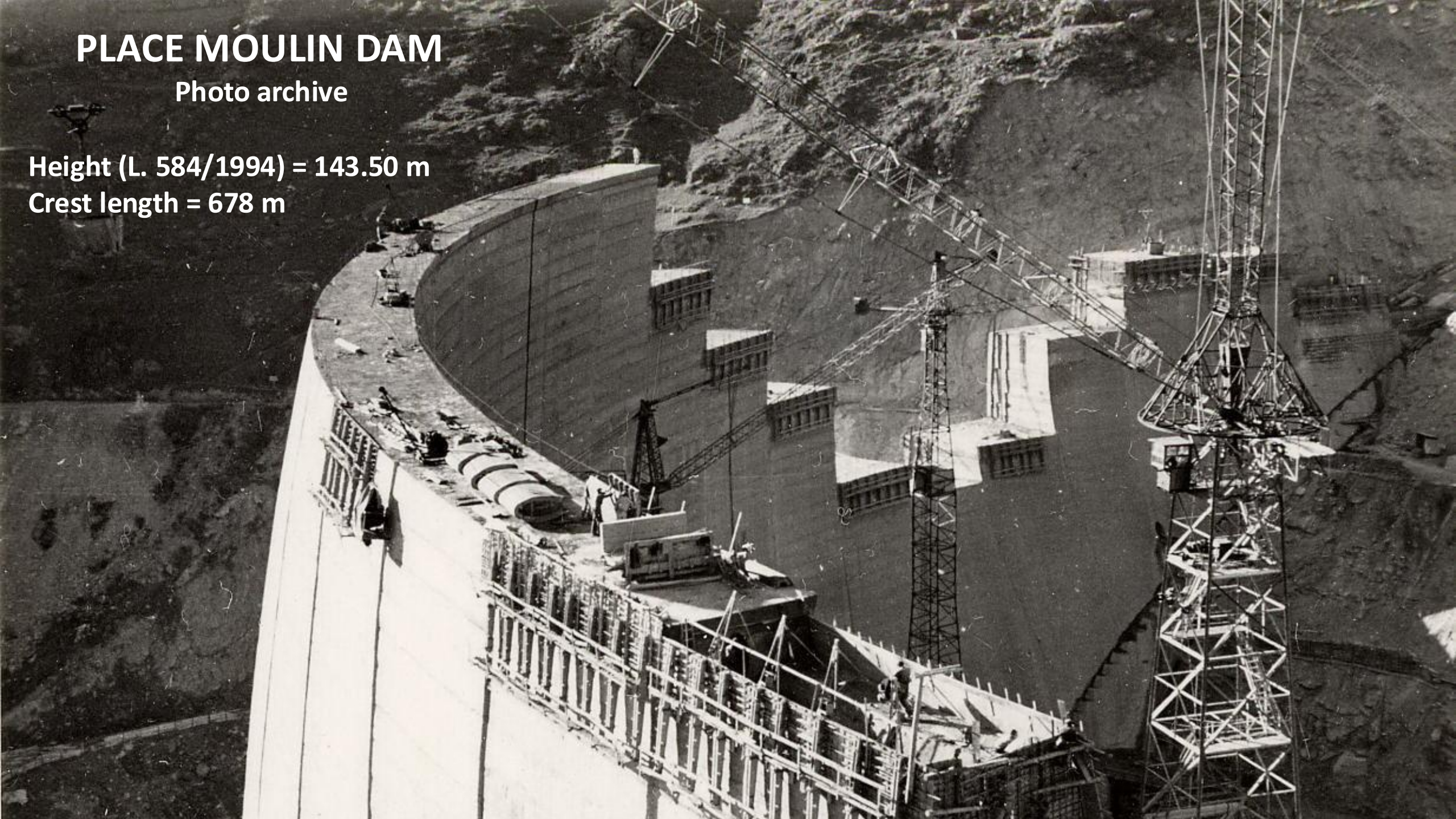

CVA GROUP:
8 large dams
Place Moulin
V=93 Mm³
Beauregard
V=6,75 Mm³
Main and secondary
Cignana
V=16,16 Mm³
Goillet
V=11,16 Mm³
Perrères
V=0,073 Mm³
Gabiet
North and South
V=4,02 Mm³


Place Moulin Dam
SEASONAL RESERVOIR
ARCH-GRAVITY DAM
FILLING OF THE REVERVOIR- The final test certificate 1969
CVA

PLACE MOULIN DAM

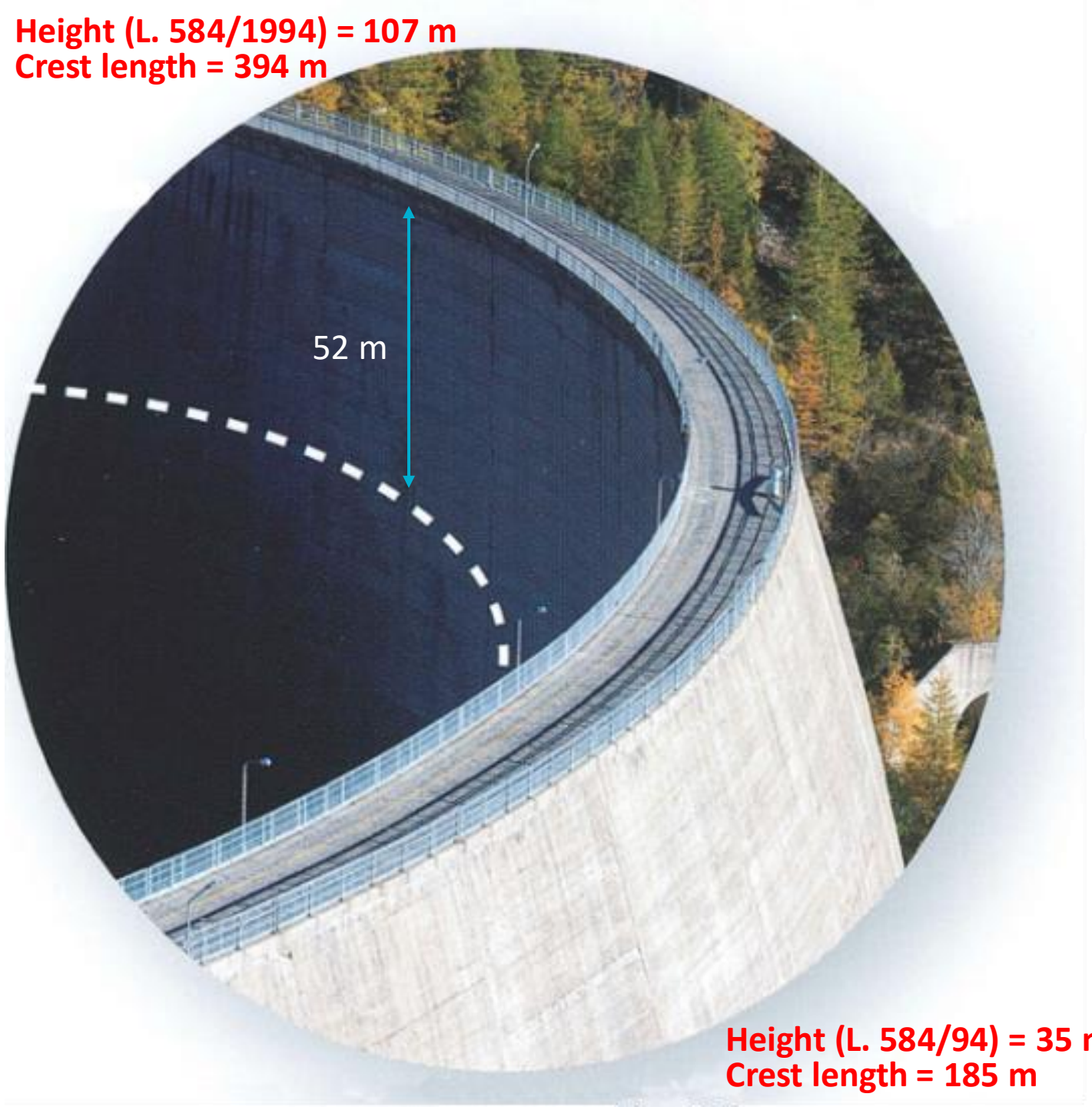
Photo archive

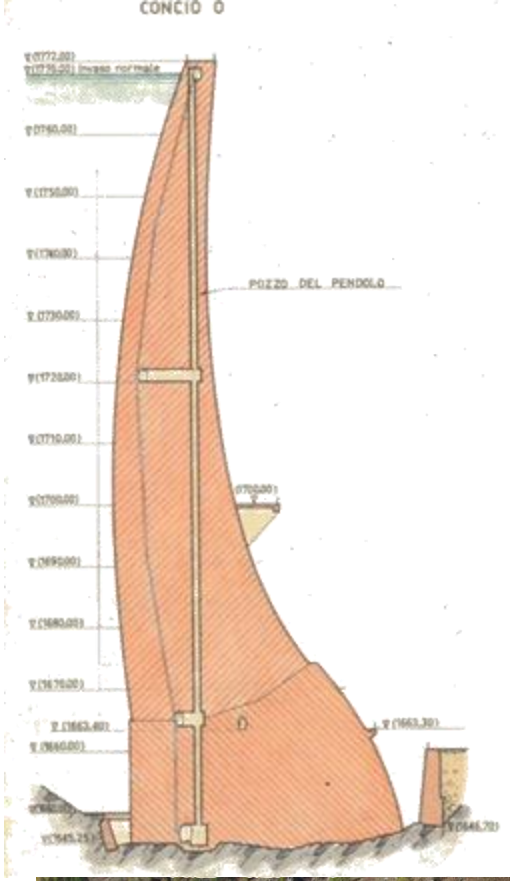
Height (L. 584/1994) = 143.50 m
Crest length = 678 m

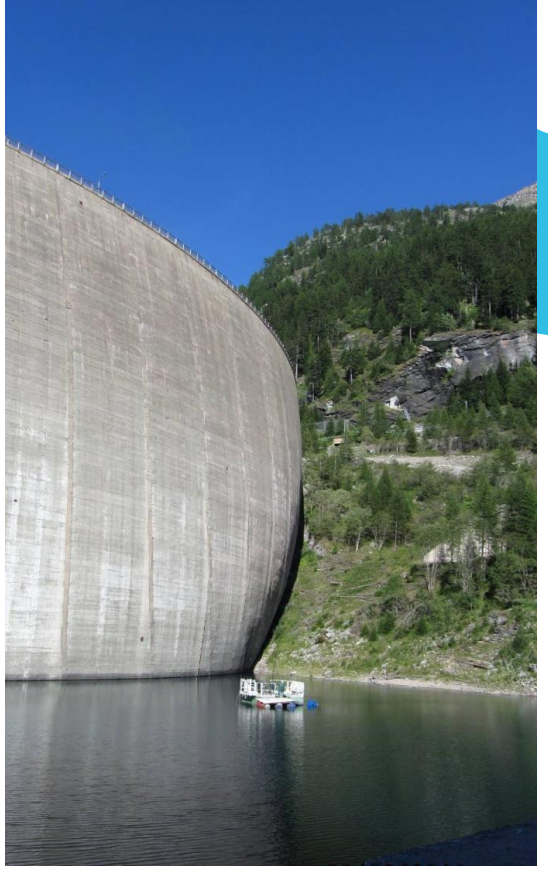



BEFORE THE DEMOLITION OF THE UPPER ARCHES
GRAVITY ARCH DAM
FILLING OF THE RESERVOIR - The final test certificate 1969
POST-DEMOLITION
GRAVITY DAM
The final test certificate 2019
Beauregard Dam

Height (L. 584/1994) = 107 m
Crest length = 394 m





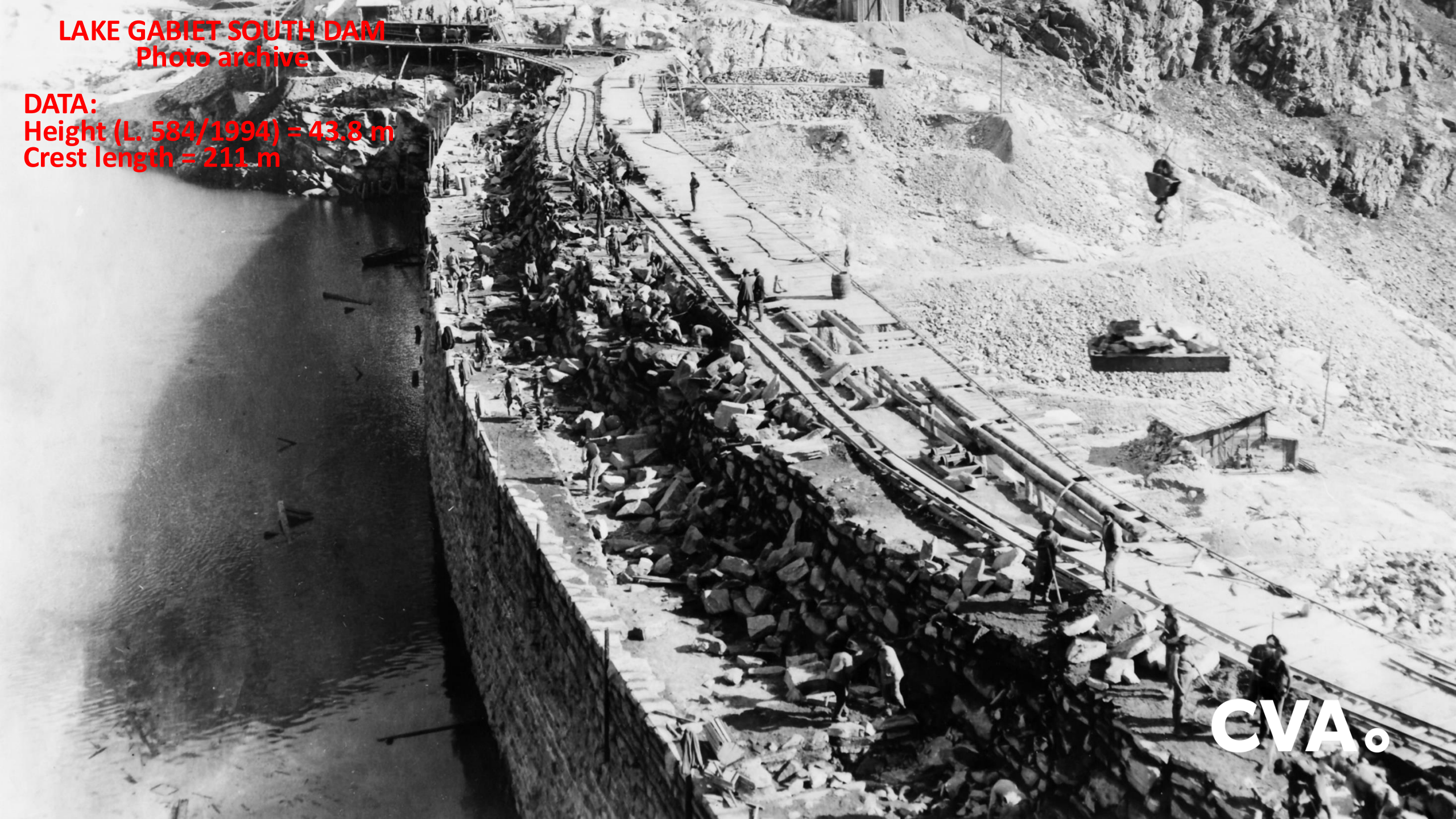




Height (L. 584/94) = 35 m
Crest length = 185 m

SEASONAL RESERVOIR
GRAVITY DAM
FILLING OF THE RESERVOIR - The final test certificate 1938



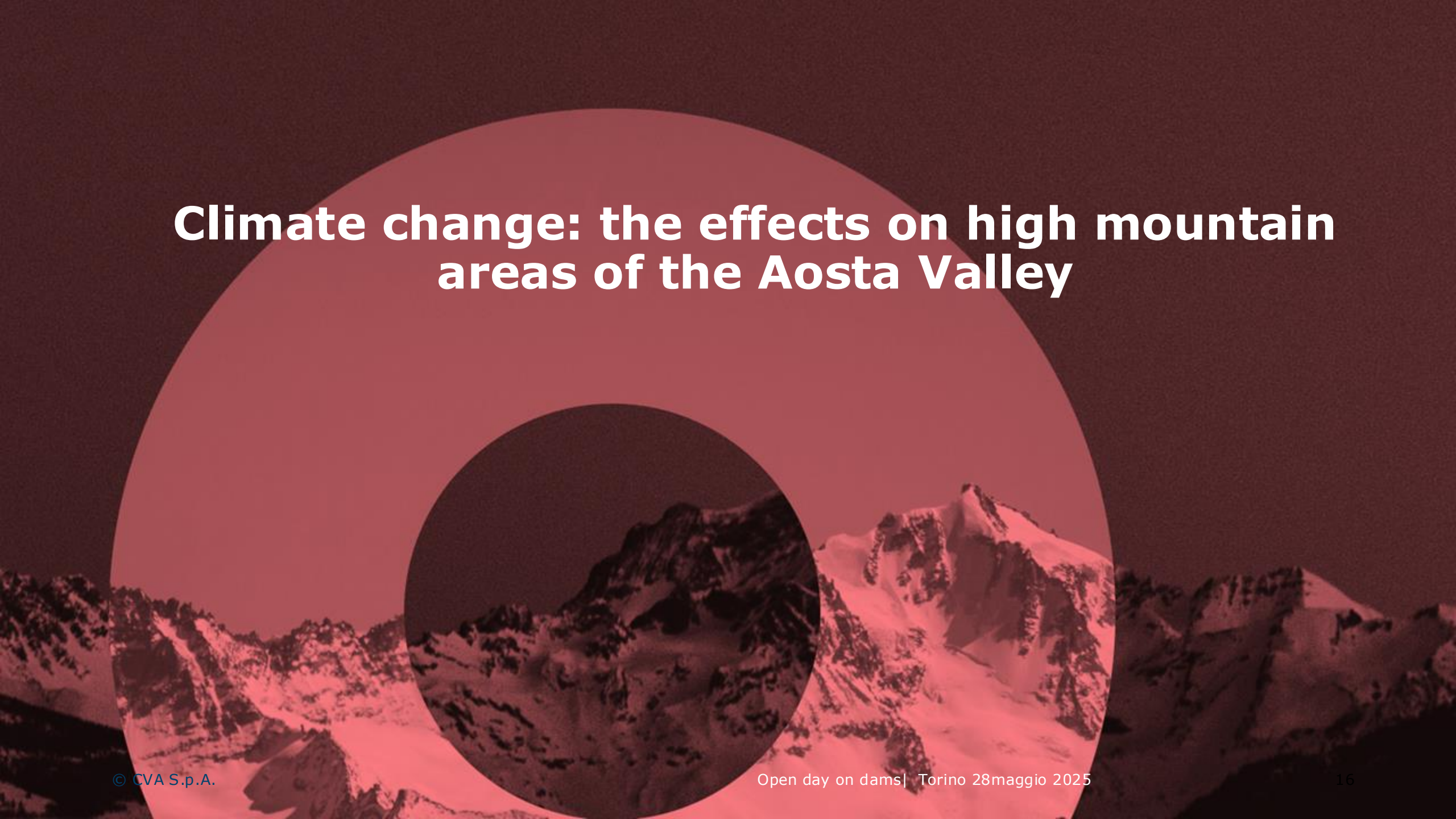

LAKE GABIET SOUTH DAM
Photo archive
DATA:
Height (L. 584/1994) = 43.8 m
Crest length = 211 m
CVA


SEASONAL RESERVOIR
GRAVITY DAM
FILLING OF THE RESERVOIR - The final test certificate 1952
Data
Height (L. 584/1994) = 38.6 m
Crest length = 367.65 m
Lago Goillet
Dam


SEASONAL RESERVOIR
MAIN GRAVITY DAM
FILLING OF THE RESERVOIR - The final test certificate 1929
Main dam data:
Height (L. 584/1994) = 55.50 m
Crest length = 401.78 m
Dams of Cignana


DAILY RESERVOIR
GRAVITY DAM
FILLING OF THE RESERVOIR - The final test certificate 1943
Height (L. 584/1994) = 22.75 m
Crest length= 59.40 m
Perrères Dam
CVA

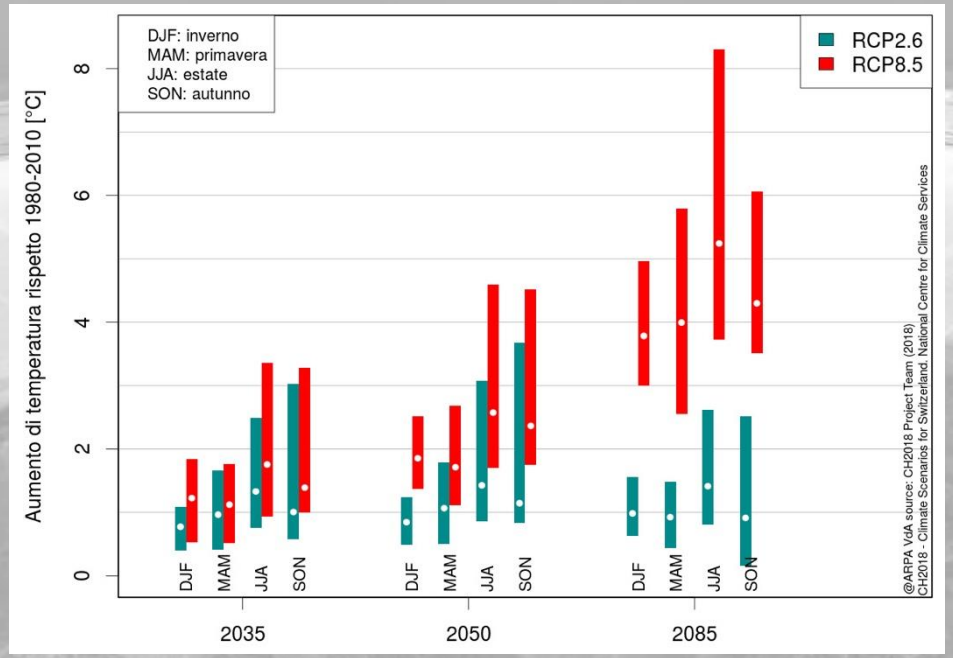
Climate change: the effects on high mountain areas of the Aosta Valley



Climate change – Focus Valle d'Aosta

Temperature

- **Temperature is increasing by +1.0°C to +4.1°C** depending on greenhouse gas mitigation scenarios, mid-century.
- Increased warming in summer and autumn.
- **Invariability of the total overall amount of precipitation (+2%/+5%) but concentrated in more intense events**



Source – Impacts of climate change on the hydrological regime of Valle d'Aosta – Arpa Fondazione CIMA Centro Funzionale RAVA and Fondazione Montagna Sicura – April 2021

Figures: Seasonal temperature increase compared to the period 1980-2010

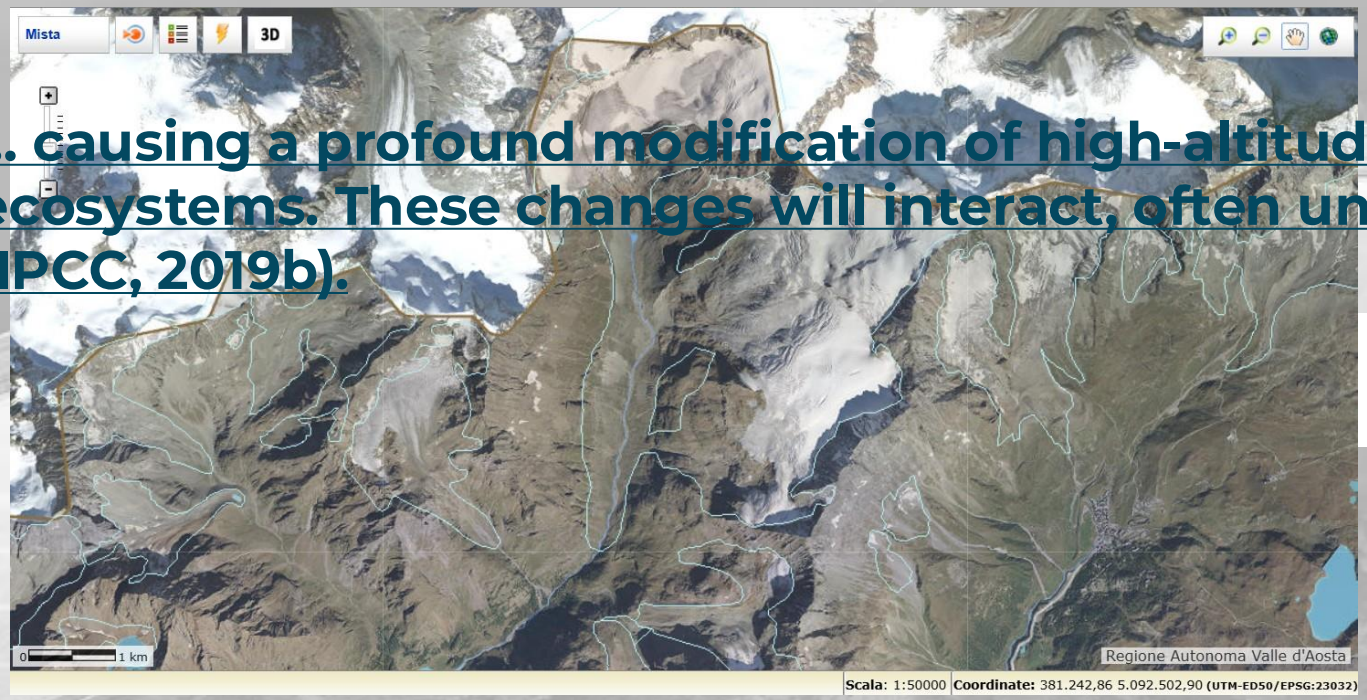
(RCP2.6 and RCP8.5 are the optimistic and pessimistic emissions reduction scenario, respectively)

Climate change – focus on Valle d'Aosta

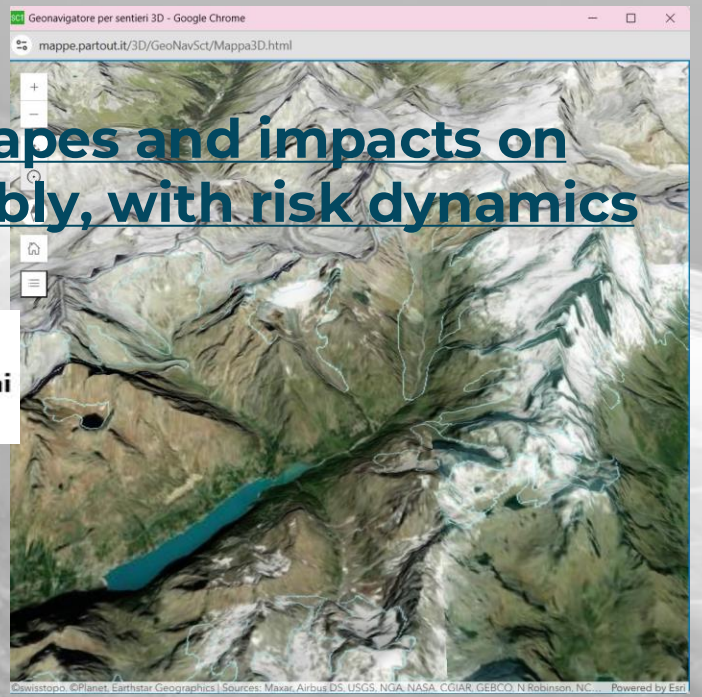
What does this increase in temperature mean on the territory?

- In Aosta Valley, over the last 20 years, the glacial surface has decreased from 154 km^2 in 1999 to 120 km^2 in 2019, thus also exposing a larger area of territory to erosion phenomena
- In the next twenty years **we will lose about 25/30% of the residual water reserve** contained in the glaciers.
- **The glaciers will continue to retreat.** Many glaciers below 3.000/3.500 m s.l.m. will disappear….

… causing a profound modification of high-altitude landscapes and impacts on ecosystems. These changes will interact, often unpredictably, with risk dynamics (IPCC, 2019b).



Glaciers of Grandes Murailles - Orthophoto



Glaciers of Grandes Murailles - 3D visualization

Dams are resilient

© CVA S.p.A.

Dams are resilient



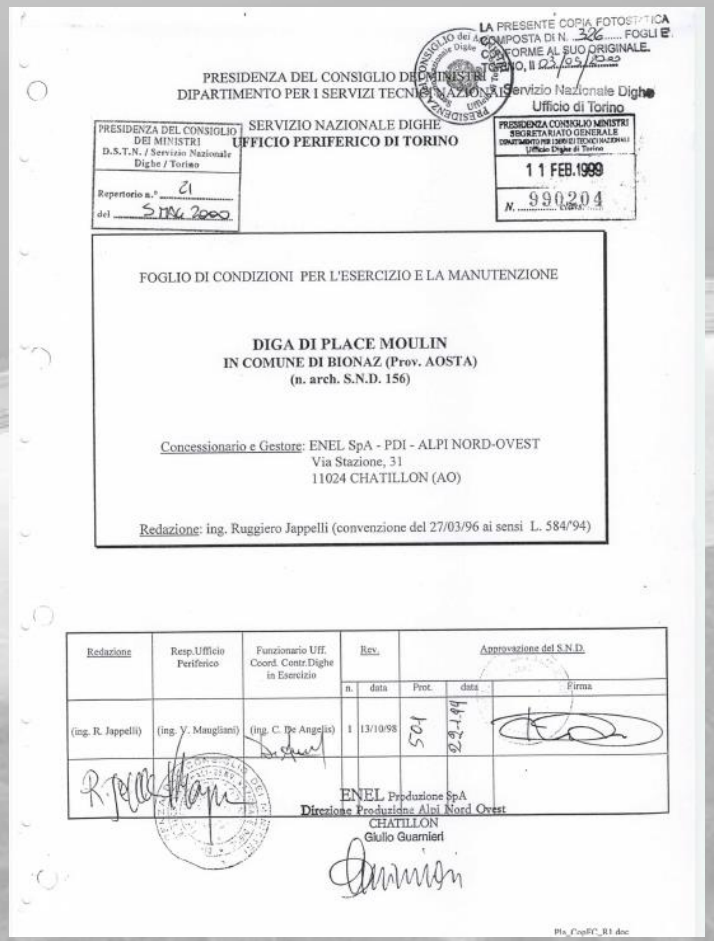
Dams play a fundamental role, making them extremely versatile. In fact, they lend themselves to performing various functions:

- ability to **restart the national electricity system** in the event of a *blackout*
- **Flexibility and production programmability** thanks to storage
- it lends itself **to the multiple use** of water resources, with particular attention to the irrigation sector, influenced by climate change
- Territorial security tool **(flood control)**
- **climate resilient**

© CVA S.p.A.

Dams are resilient

Dams require specific checks and maintenance pending on F.C.E.M. (Sheet of Conditions for Operation and Maintenance) issued by Ministery of infrastructure



LA PRESENTE COPIA FOTOSTATICA COMPOSTA DI N. 326 FOGLI E' CONFORME AL SUO ORIGINALE.
TORINO, li 23/05/2000

PRESIDENZA DEL CONSIGLIO DEI MINISTRI
DIPARTIMENTO PER I SERVIZI TECNICI NAZIONALI - Servizio Nazionale Dighe
Ufficio di Torino

PRESIDENZA DEL CONSIGLIO DEI MINISTRI
D.S.T.N. / Servizio Nazionale Dighe / Torino
Repertorio n.° 21
del 5 MAG 2000

SERVIZIO NAZIONALE DIGHE
UFFICIO PERIFERICO DI TORINO

PRESIDENZA CONSIGLIO MINISTRI
SEGRETARIATO GENERALE
DIPARTIMENTO PER I SERVIZI TECNICI NAZIONALI
Ufficio Dighe di Torino
11 FEB.1999
N. 990204

FOGLIO DI CONDIZIONI PER L'ESERCIZIO E LA MANUTENZIONE

DIGA DI PLACE MOULIN
IN COMUNE DI BIONAZ (Prov. AOSTA)
(n. arch. S.N.D. 156)

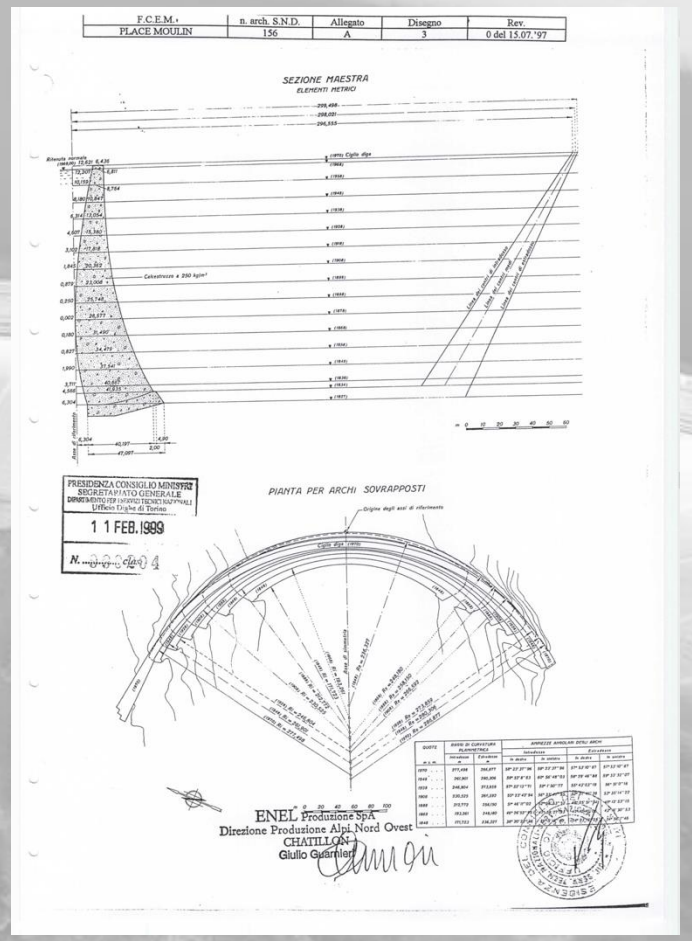
Concessionario e Gestore: ENEL SpA - PDI - ALPI NORD-OVEST
Via Stazione, 31
11024 CHATILLON (AO)

Redazione: ing. Ruggiero Jappelli (convenzione del 27/03/96 ai sensi L. 584/'94)

Redazione	Resp.Ufficio Periferico	Funzionario Uff. Coord. Contr.Dighe in Esercizio	Rev. n.	Rev. data	Approvazione del S.N.D. Prot.	Approvazione del S.N.D. data	Approvazione del S.N.D. Firma
(ing. R. Jappelli)	(ing. V. Maugliani)	(ing. C. De Angelis)	1	13/10/98	501	22/1/99	

ENEL Produzione SpA
Direzione Produzione Alpi Nord Ovest
CHATILLON
Giulio Guarnieri

Pia_ConFC_R1.doc



F.C.E.M.	n. arch. S.N.D.	Allegato	Disegno	Rev.
PLACE MOULIN	156	A	3	0 del 15.07.'97

SEZIONE MAESTRA
ELEMENTI METRICI

PRESIDENZA CONSIGLIO MINISTRI
SEGRETARIATO GENERALE
DIPARTIMENTO PER I SERVIZI TECNICI NAZIONALI
Ufficio Dighe di Torino
11 FEB.1999
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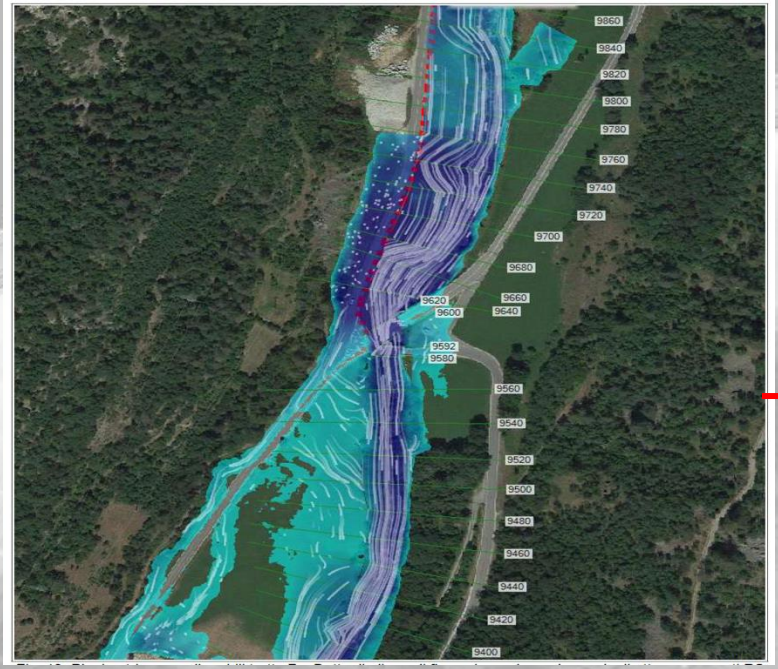
PIANTA PER ARCHI SOVRAPPOSTI

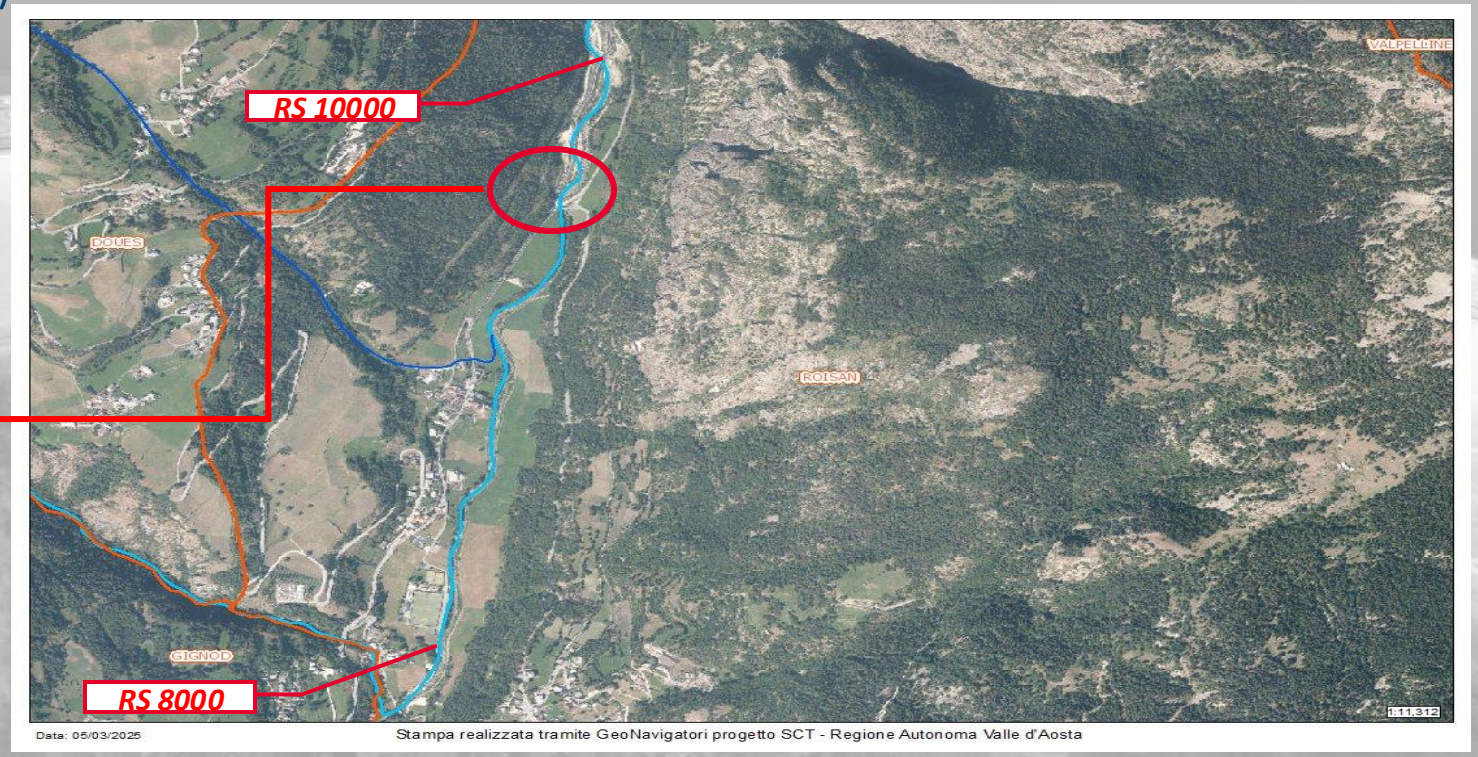
ENEL Produzione SpA
Direzione Produzione Alpi Nord Ovest
CHATILLON
Giulio Guarnieri

Dams are resilient

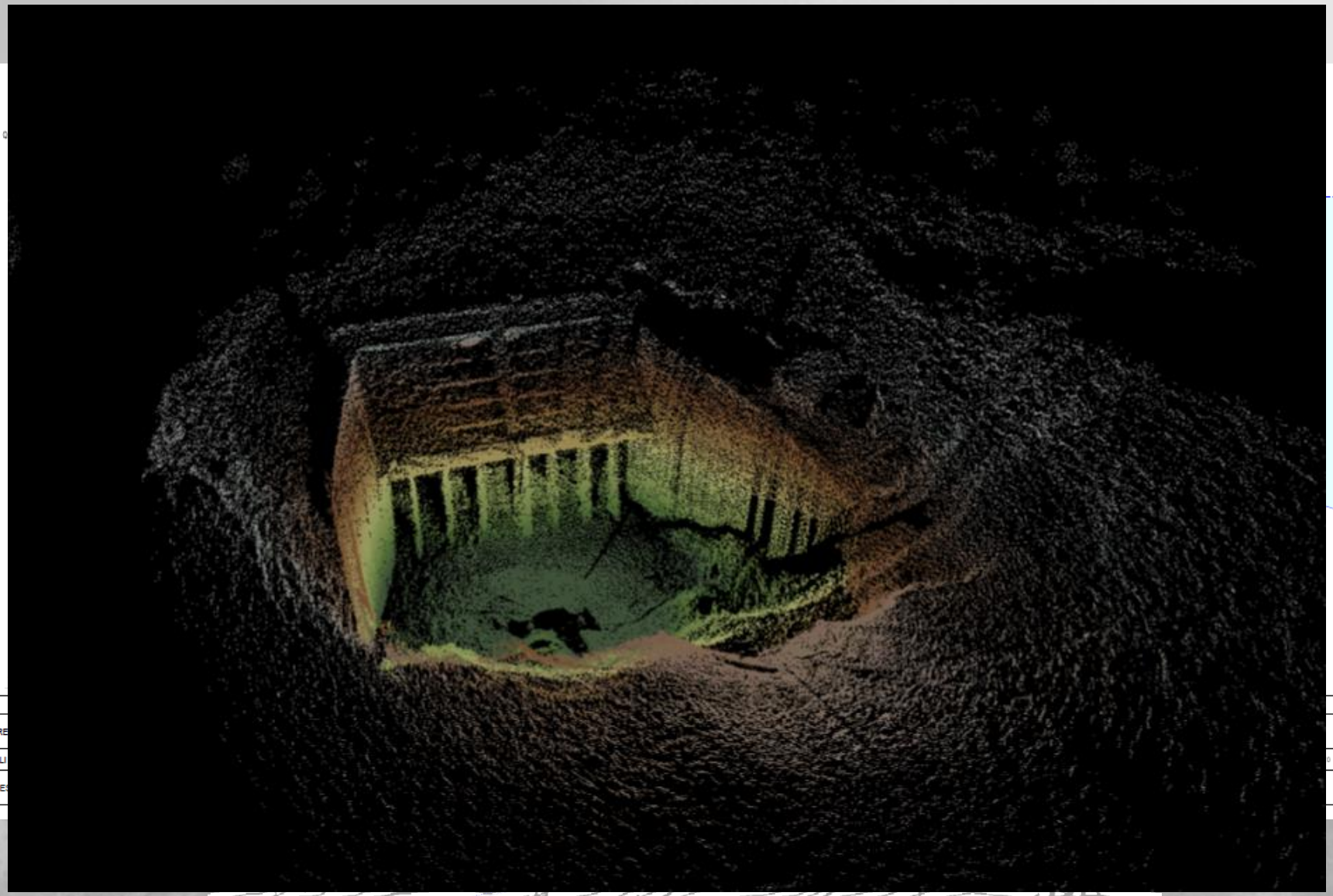
They are particularly attentive in terms of checks and maintenance -> F.C.E.M. (operating and maintenance conditions sheet)

They guarantee the hydraulic safety of downstream territories over time -> D.C.P. (Civil Protection Document)





Dams are resilient



maintenance

D.C.P. (Civil

Dams are resilient

They are particularly attentive in terms of checks and maintenance -> F.C.E.M. (operating and maintenance conditions sheet)

They guarantee the hydraulic safety of downstream territories over time -> D.C.P. (Civil Protection Document)

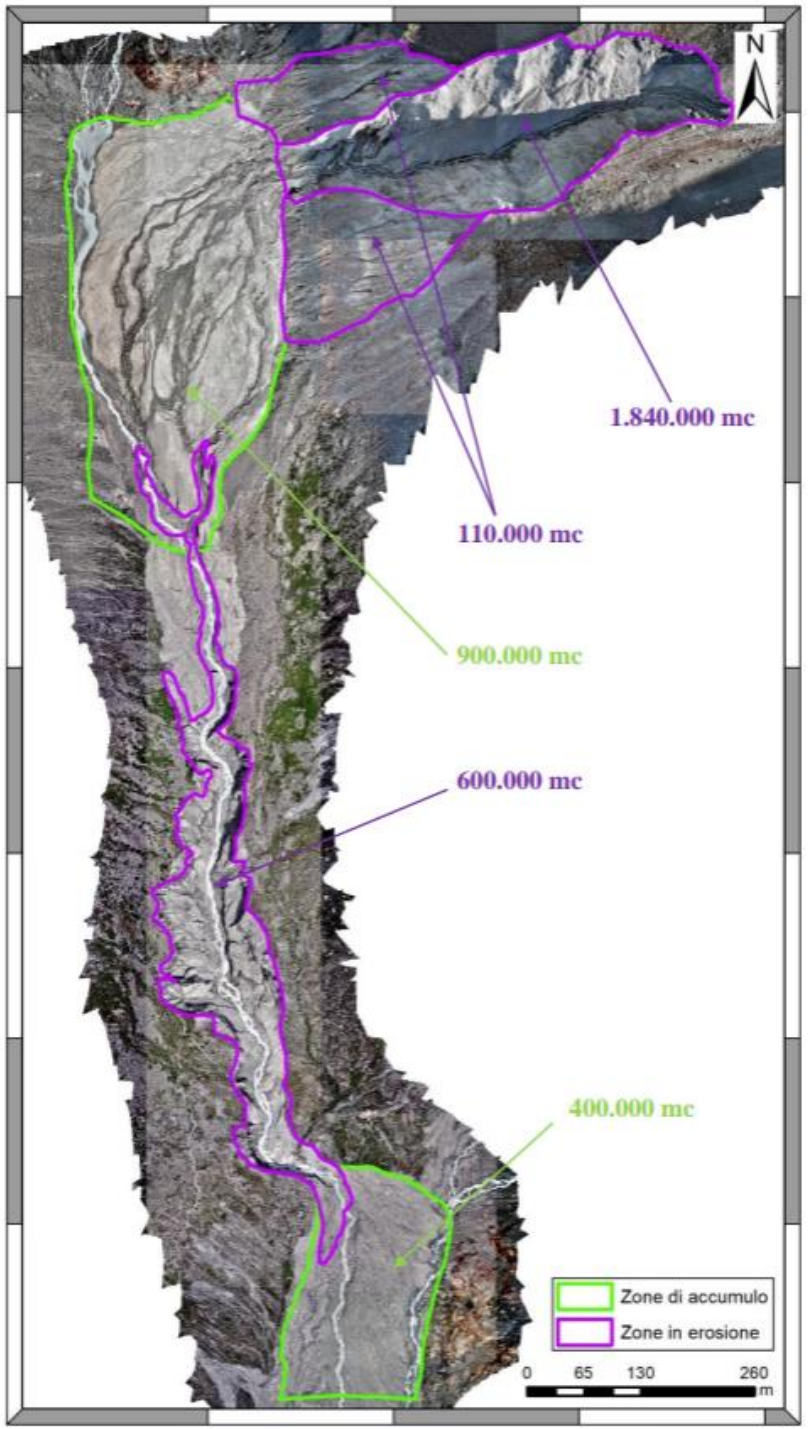
Environmentally friendly -> River solid material handling (Projet Management of river solid material)

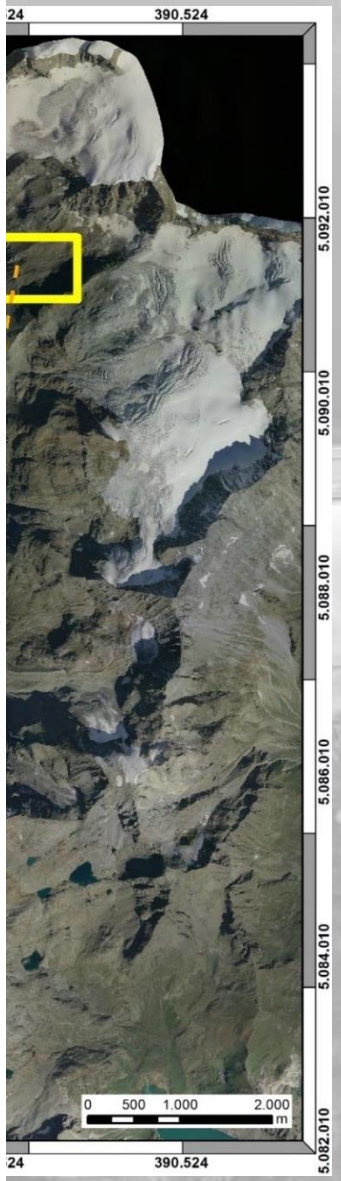
They play a fundamental role in flood management -> Flood control plan

Case study – The Place Moulin dam during the flood 29.06.2024

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Place Moulin Dam – June 2024 event





On June 30, 2024, the Place Moulin dam was affected by a massive debris flow phenomenon about **2.500.000 m³** whose triggering causes are given by the concomitance of several factors:

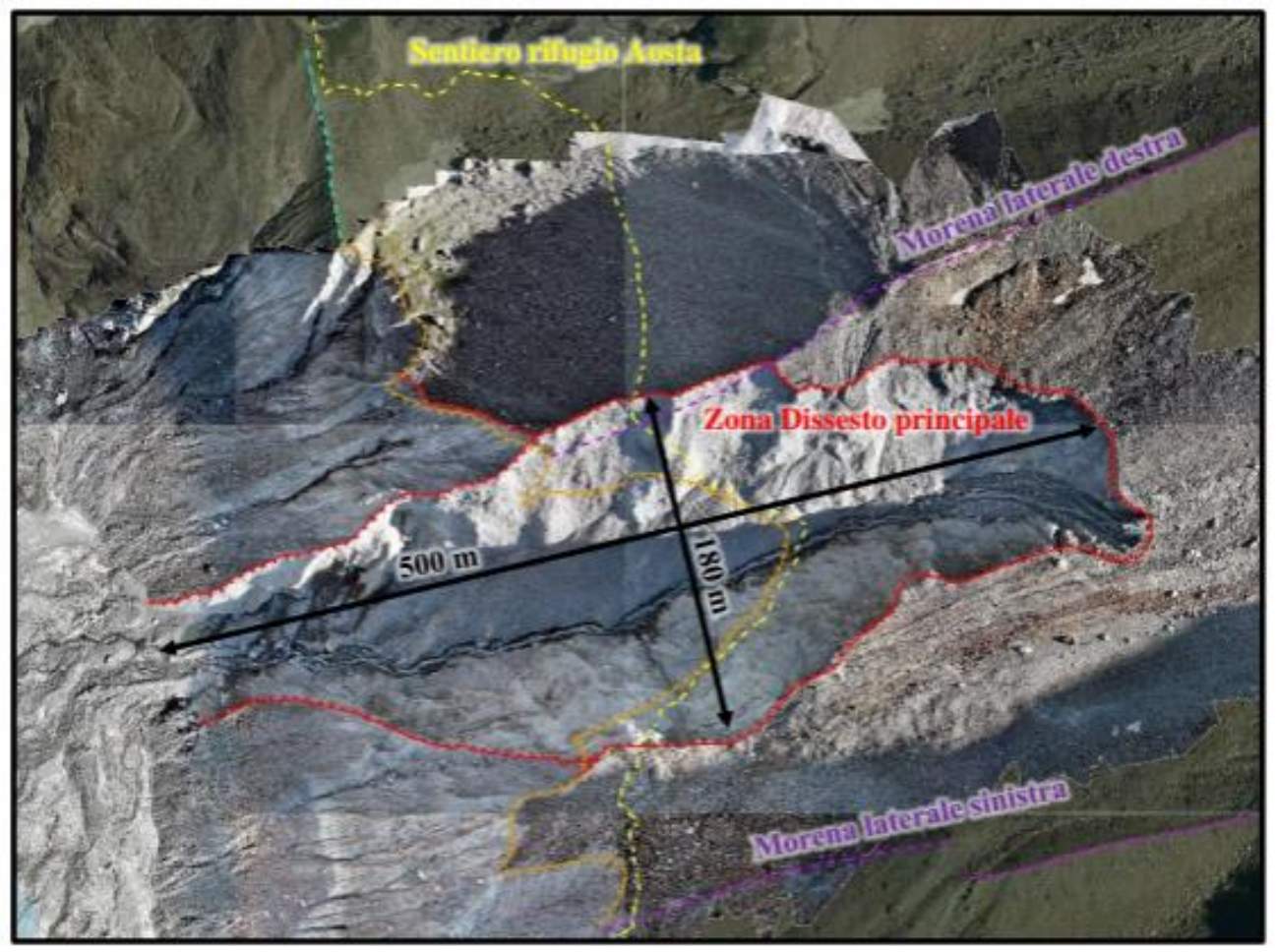
- Freezing point at high altitudes (4.000 – 4.500 m s.l.m.)
- The prolonged presence of a conspicuous snow cover
- Short but intense rainfall (40 mm in two hours. Corresponding to a return time of 100-150 years)
- In the path of the lava there was an intramoraine lake of 9000 m^2

Place Moulin Dam – June 2024 event



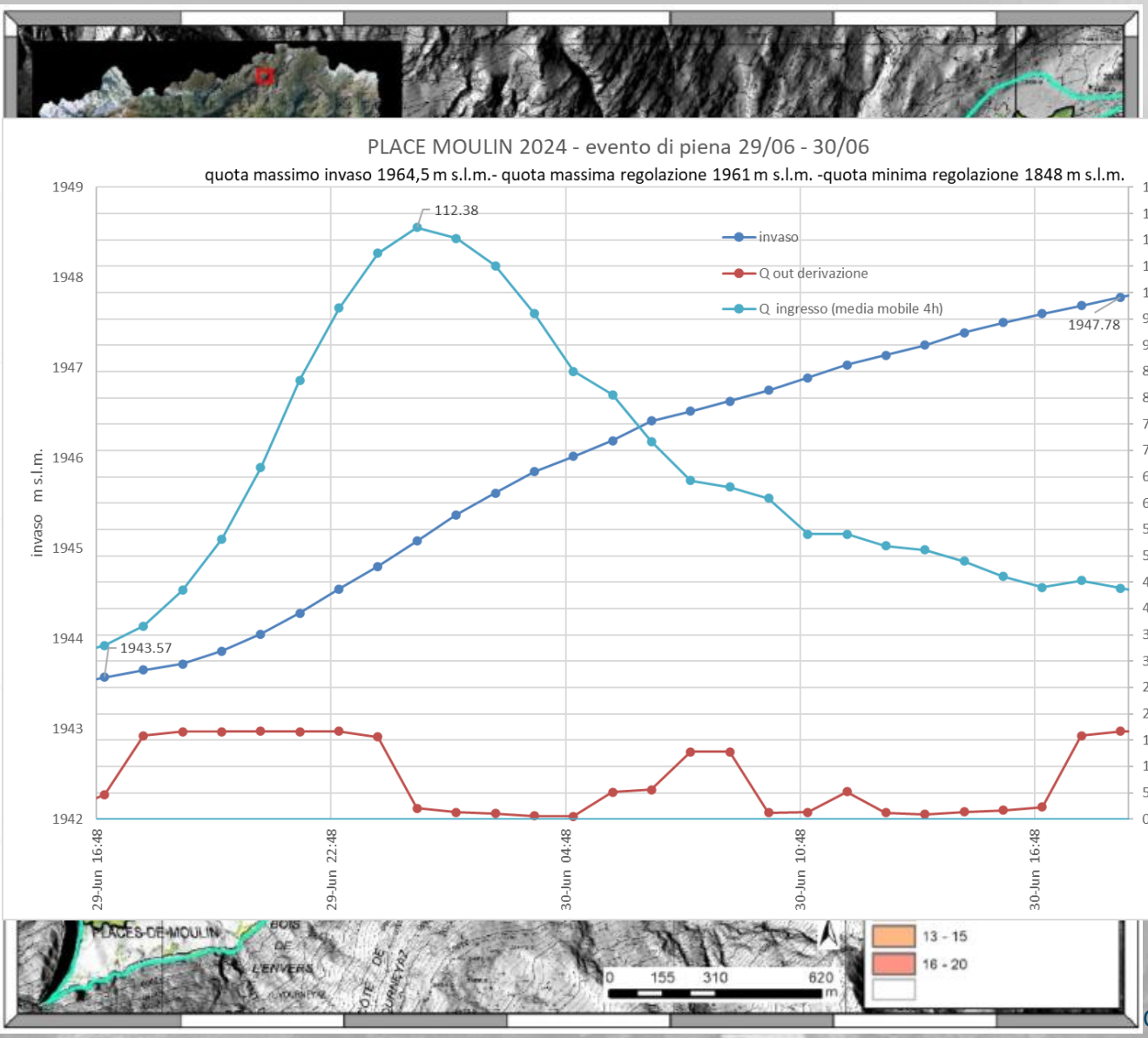
Place Moulin Dam – June 2024 event

In the main landslide area, a new valley has formed with dimensions of 500 x 180 meters and a maximum depth of 70 meters





Place Moulin Dam – June 2024 event



The propagation of the silty material took place in a manner similar to the turbidity currents that are generated in the underwater environment.

- ***Deposits on the entire reservoir estimated at about 850.000 m³***

- Reservoir level increased by 4,0 m in 24 hours below the authorised reservoir level 161,00 m s.l.m.

- Peak flow rate of 112 m^3/s

- Total volume entering the dam equal to 6 Mm^3 ***<u>entirely stored in the dam during the event</u>***

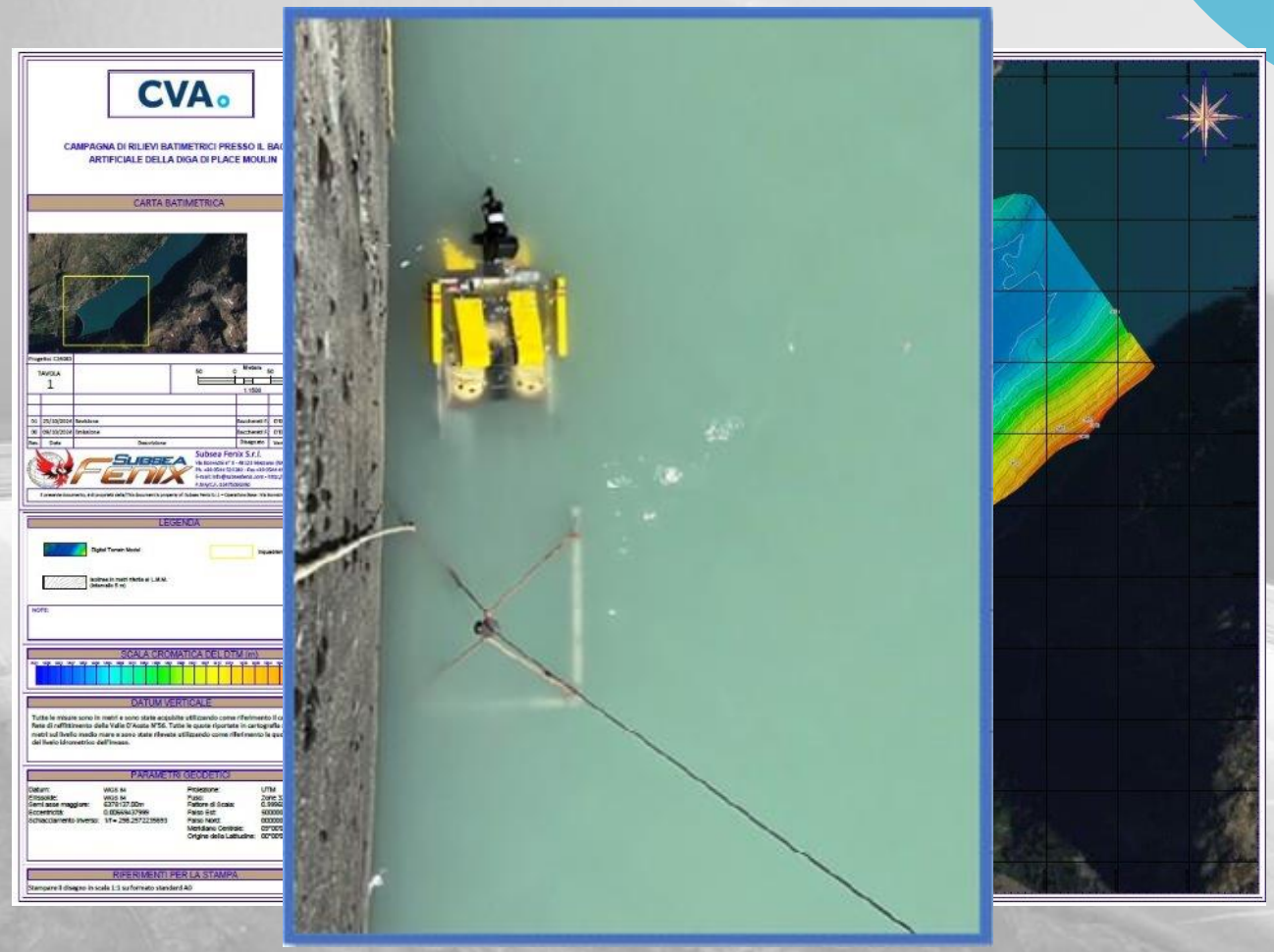
Post event – Safety and Monitoring - Development and opportunities in the world of dams

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Place Moulin Dam – post June 2024 event

Post-event activities:

- Multibeam batimetry
- ROV Underwater Inspection
- New operating procedure for the management of turbidity currents
- Experimentation - new sensors



The dam sector is dynamic

Job profiles with high technical skills and analytical skills

Thank you!

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