PRE-FEASIBILITY STUDY FOR THE CONSTRUCTION OF FLUVIAL PLANTS USING "GIAR" TECHNOLOGY FOR THE GENERATION OF RENEWABLE ENERGY FROM RIVER CURRENTS

GIAR Energy Srl B.C. – ……. …..

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Contract GIAR Energy Srl B.C. – ……. ….. dated …../…../…….

Preliminary Project	**Anchoring system (river)**
Preliminary Project	**Metallic carpentry system (river)**
Preliminary Project	**Electrical and transformation system & Network connection Cabin**
Preliminary Project	**2 MW Turbine Plant**
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Design Engineer:	**Benedetto D'Ambrosio**

Technical Report

The project consists of an innovative system for the production of electricity from the river flow.
The system is made up of a series of rotors (turbines) positioned side by side, which have the purpose of channeling the river flow generating an increase in the height of the water level at the fluid's inlet, thus increasing the potential energy of the river flow itself which is then transformed into mechanical energy during the passage through the turbines.
This difference in height helps to improve the navigability of the river upstream of the plant, while improving the replenishment of the aquifers and contributing to the reduction of the saltwater intrusion due to the increased pressure on the river bed.
The main components of the project are:

1. Floating modules longitudinal to the river flow;
2. Floating modules transversal to river flow;
3. Support bodies of the rotors (turbines) mounted inside the floating system;
4. Anchoring pylons for the floating system.

The purpose of the floating modules (longitudinal and transversal) is, in addition to constituting the structural part of the entire system, to intervene by making the system safe when the river level exceeds a certain height, so as to leave the passage of the fluid free, restoring the balance (same height) between the upstream part and the downstream part of the fluid stream, as shown in Figure 7.
In addition, the turbines can be lifted both individually (in case of maintenance by closing the passage bulkheads) and jointly (when securing the system keeping the bulkheads open to increase the passage section).

Preliminary Project – Anchoring system (river)

The anchoring system of the structure, for rivers less than or equal to 48 meters wide, consists of two pylons external to the river bed which, by means of tie rods, support the thrust that the system exerts due to the creation of the water height difference upstream and downstream of the plant.
The pylons allow the vertical movement (lifting) of the system in case of floods for safety purposes.

Figure 2 shows a schematic plan view where the main components that make up the plant and the anchoring system are highlighted.

Figure 3 presents an alternative configuration for the anchoring tie rods.

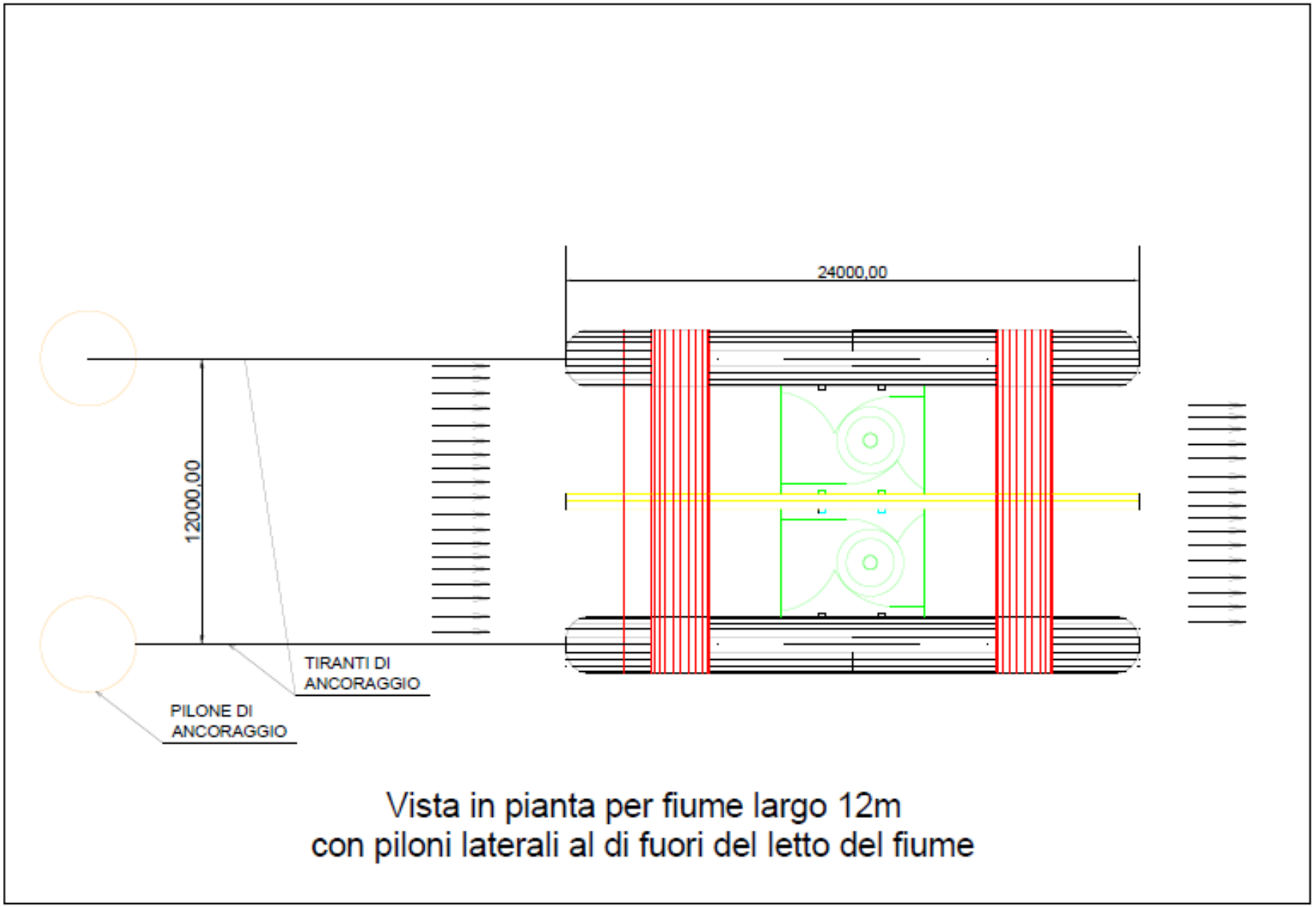


Figure 1: Plan view – 12m Module

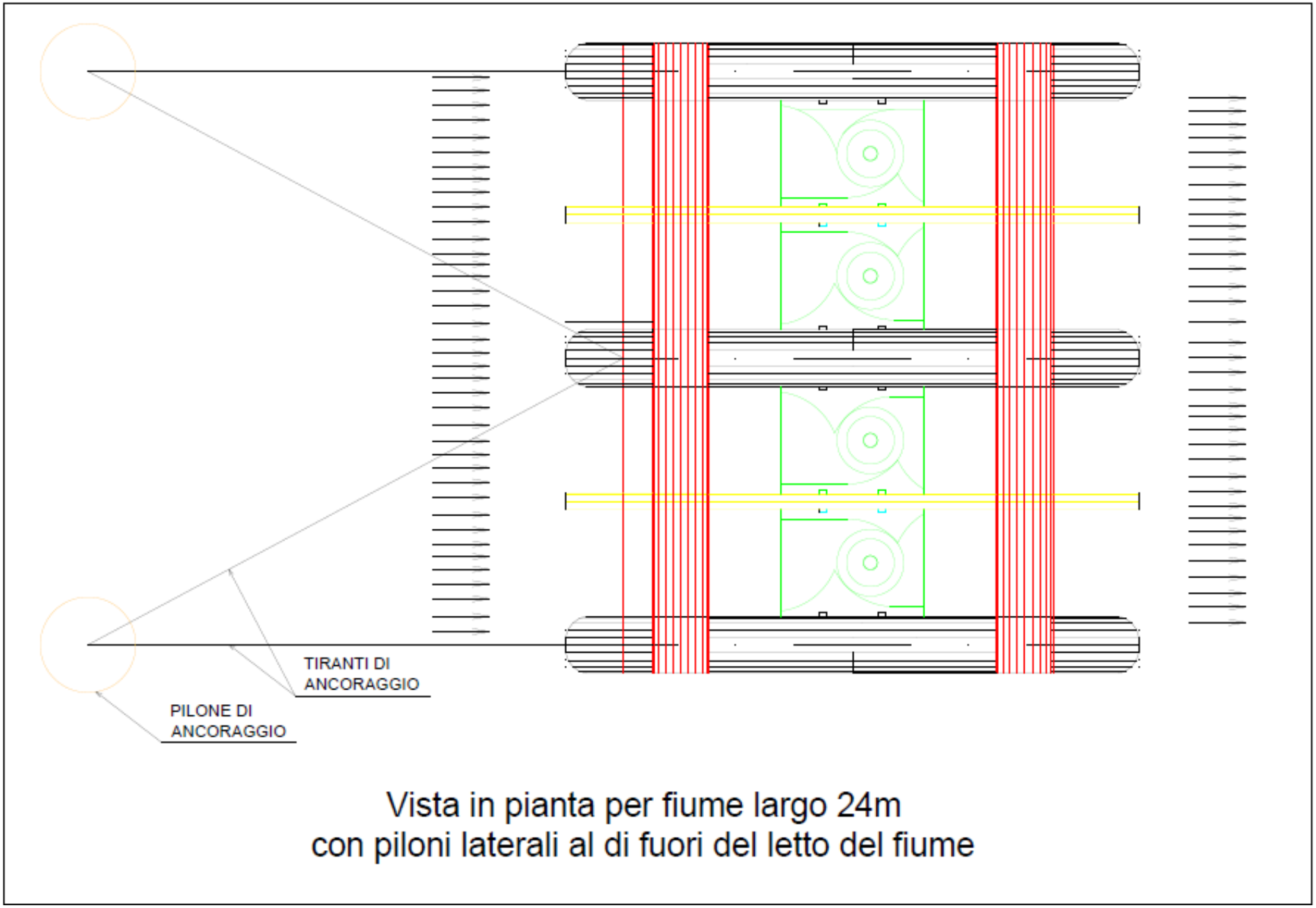


Figure 2: Plan view – 24m Module

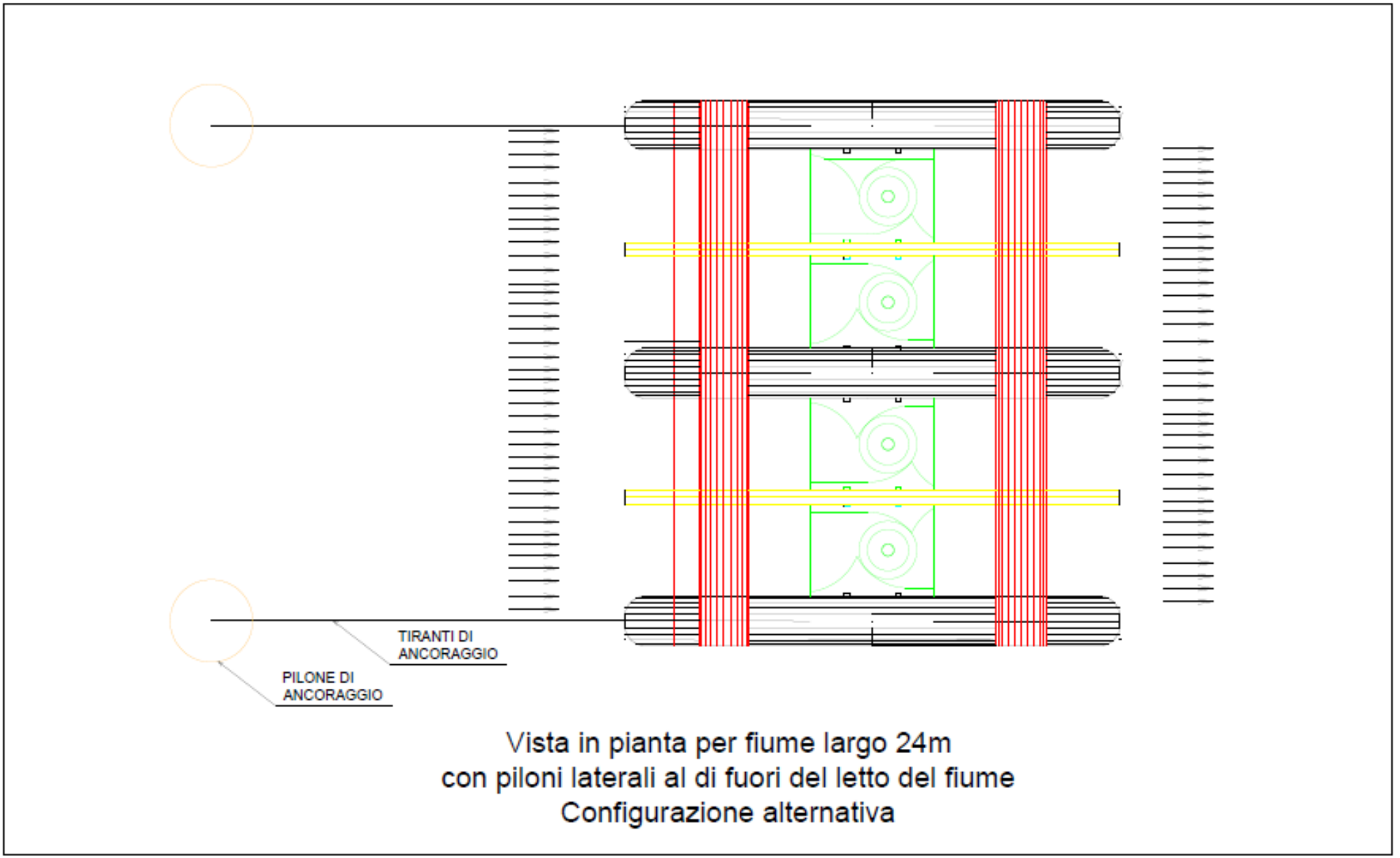


Figure 3: Plan view – 24m Module, Anchoring alternatives

Preliminary Project – Metallic carpentry system (river)

Le strutture principali di sostegno e galleggiamento vengono realizzate in acciaio, hanno una forma tubolare (a sezione cava) e sono in grado di sostenere i corpi turbina e le spinte da trasmettere ai piloni.
Le componenti secondarie sono realizzate mediante travi e sistemi reticolari in acciaio.

La Figure 4 mostra una vista frontale di un tratto dell'impianto in cui si evidenziano la serie di corpi turbina, i galleggianti longitudinali e trasversali e i piloni di ancoraggio.
La struttura è modulare e pertanto consente di adattarsi a qualsiasi larghezza del fiume.
I moduli si compongono di due corpi turbina ciascuno, con turbine controrotanti in modo da bilanciare i momenti torcenti che si generano.

La Figure 5 è una sezione schematica dell'impianto in condizioni operative, in cui viene creato il dislivello della vena fluida, che ne mette in evidenza i principali componenti strutturali.
In condizioni operative i galleggianti longitudinali poggiano sul letto del fiume, così da forzare il fluido a passare attraverso le turbine.

La Figure 6 evidenzia le strutture reticolari secondarie che hanno la funzione di dividere i moduli in due, così da consentire il posizionamento di due turbine per ogni modulo.

La Figure 7 mostra il sistema in condizioni di messa in sicurezza in caso di piene o alluvioni.
Si evidenzia il sollevamento del modulo galleggiante (grazie alla spinta di Archimede) che si verifica al superamento di un determinato livello della vena fluida.
In queste condizioni il dislivello tra la vena fluida in entrata e la vena fluida in uscita dall'impianto si annulla.

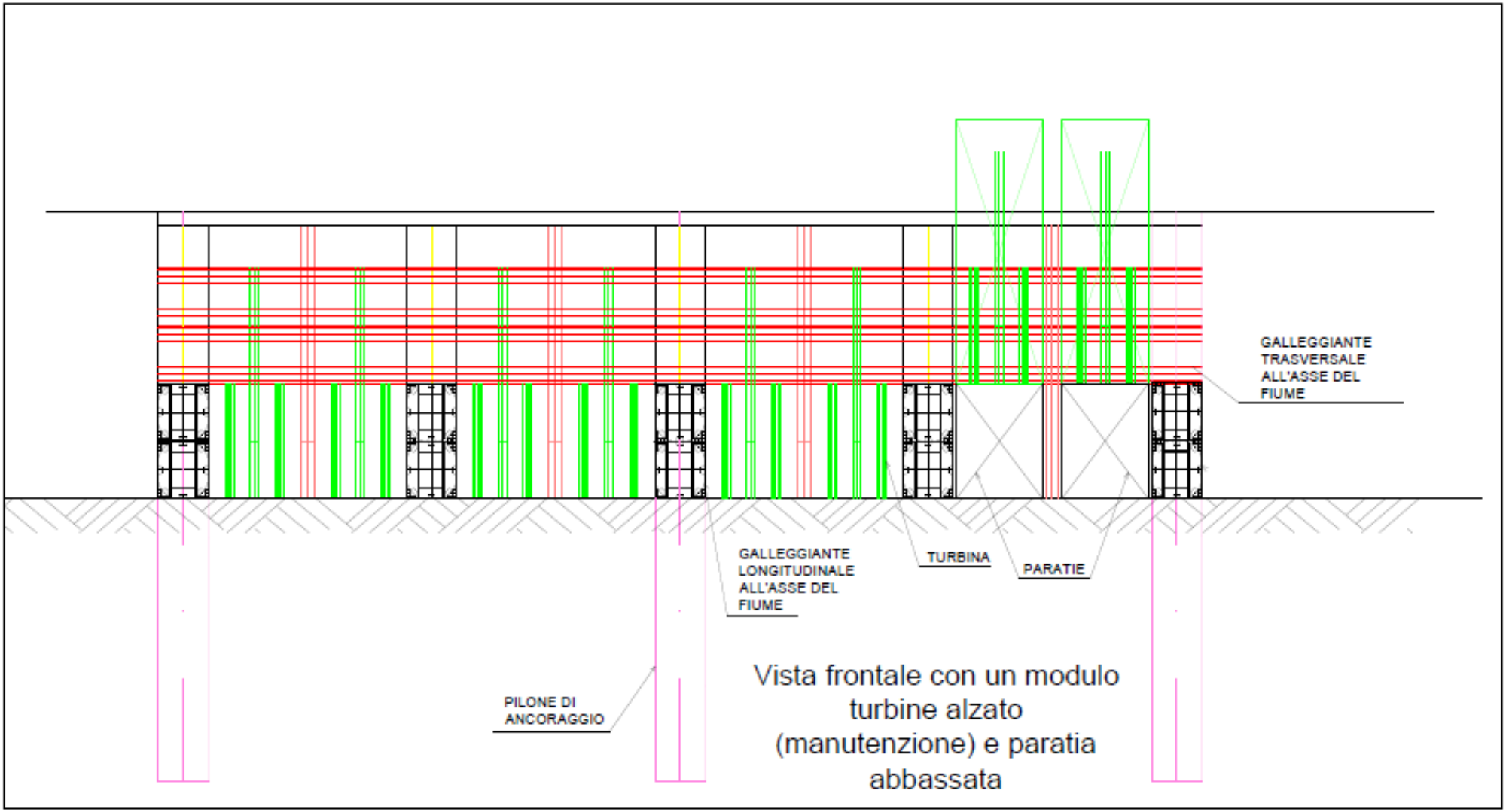


Figure 4: Front view along the river axis – 48m Module

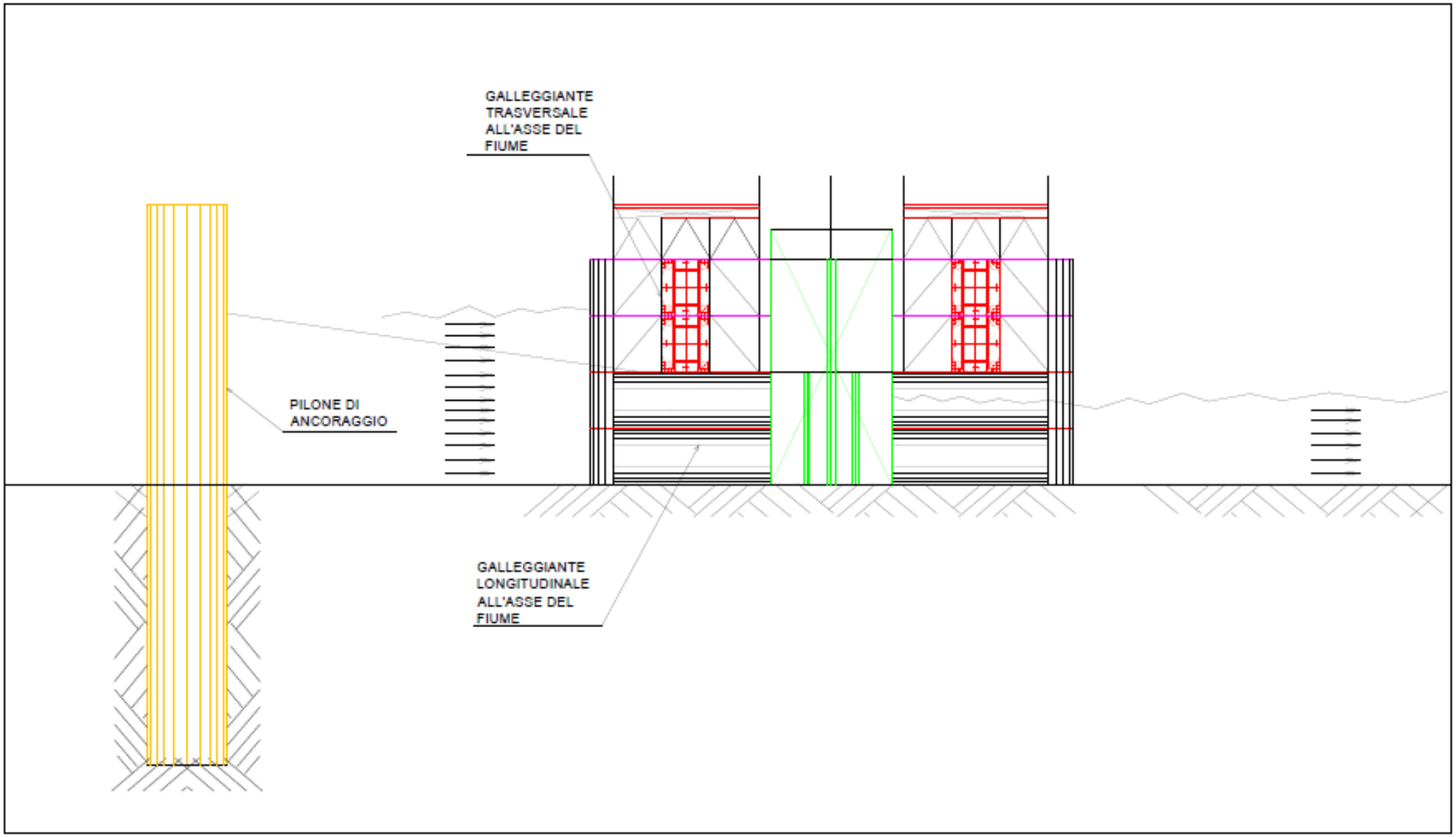


Figure 5: Cross section at the longitudinal floating modules

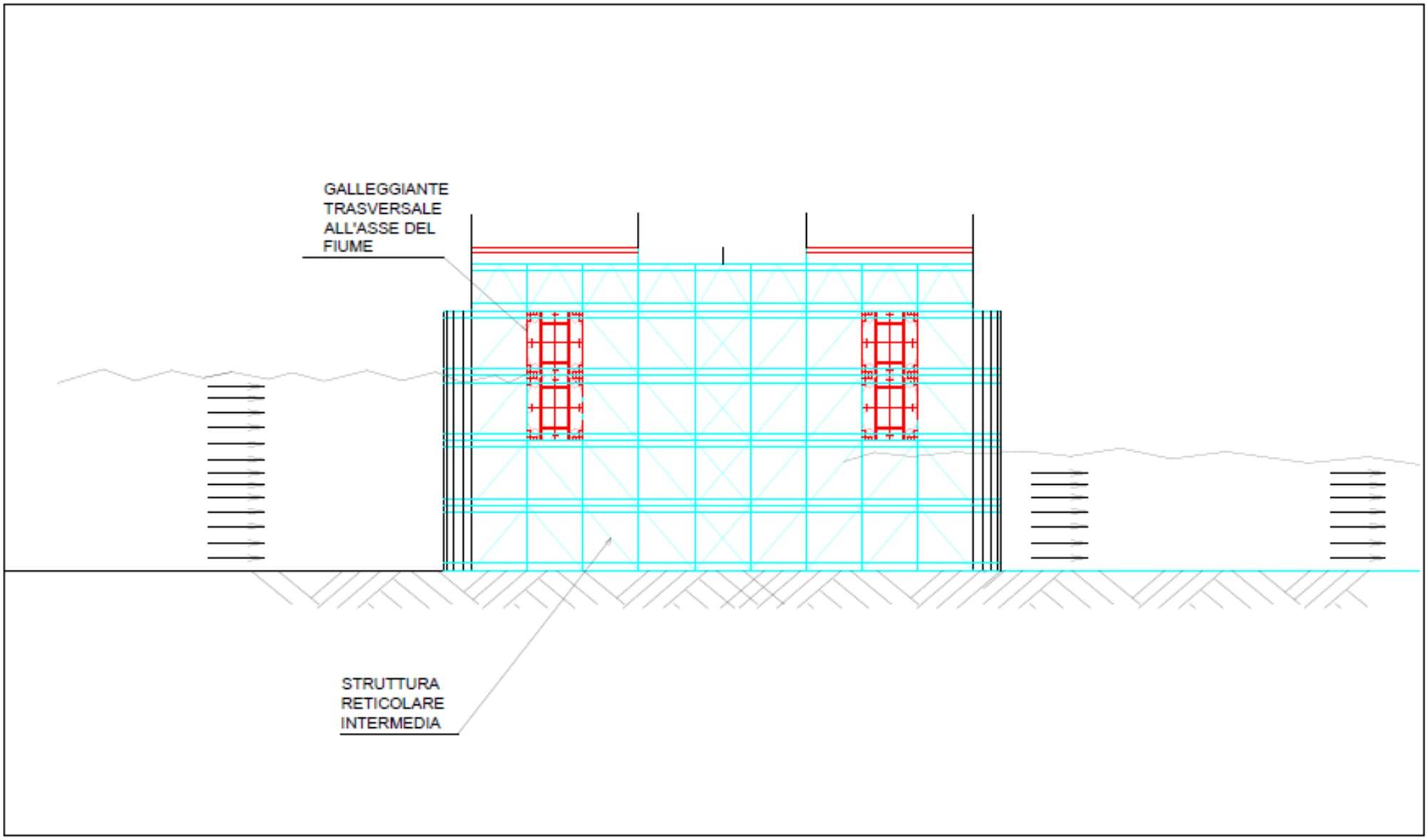


Figure 6: Cross section at the intermediate reticular structures

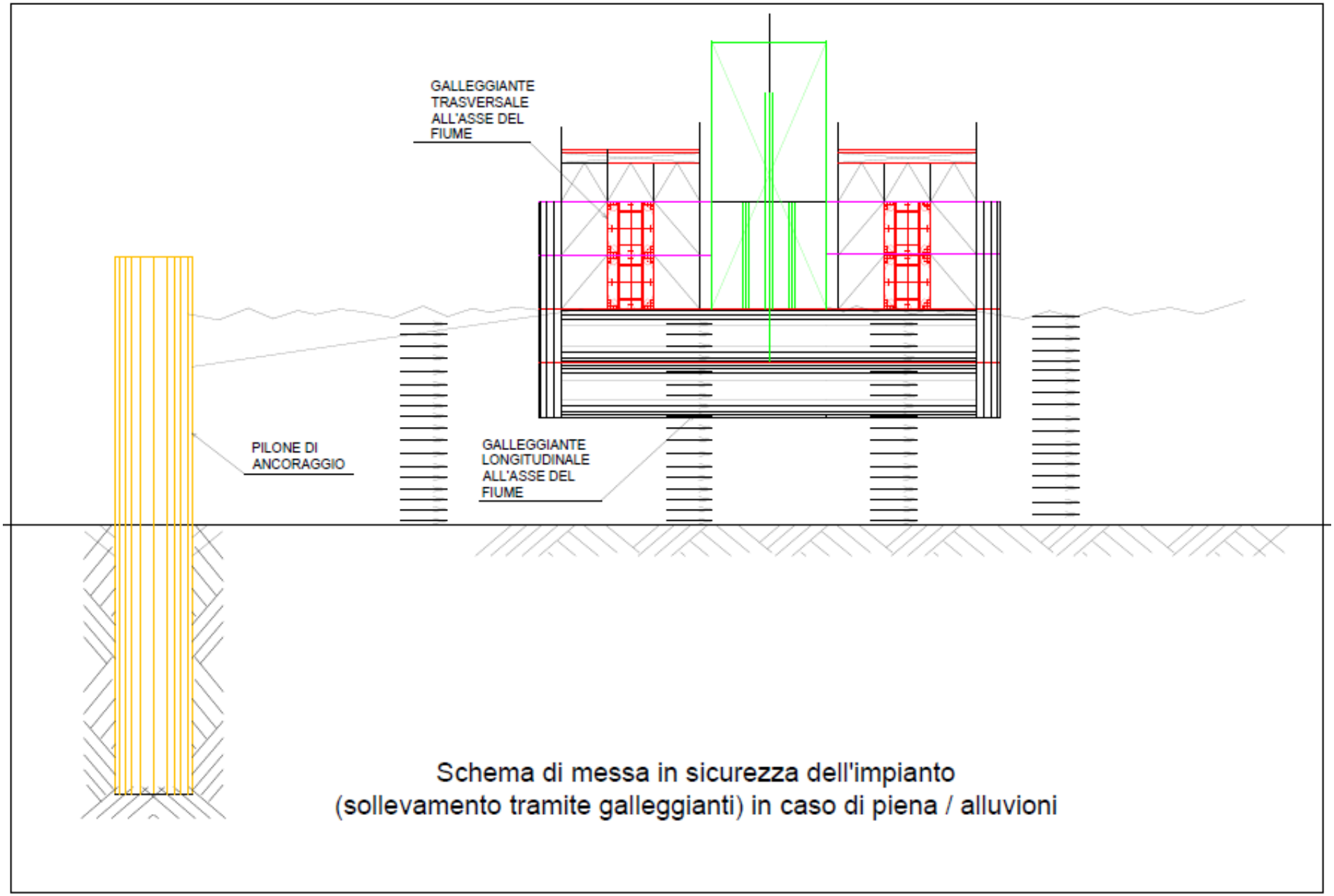
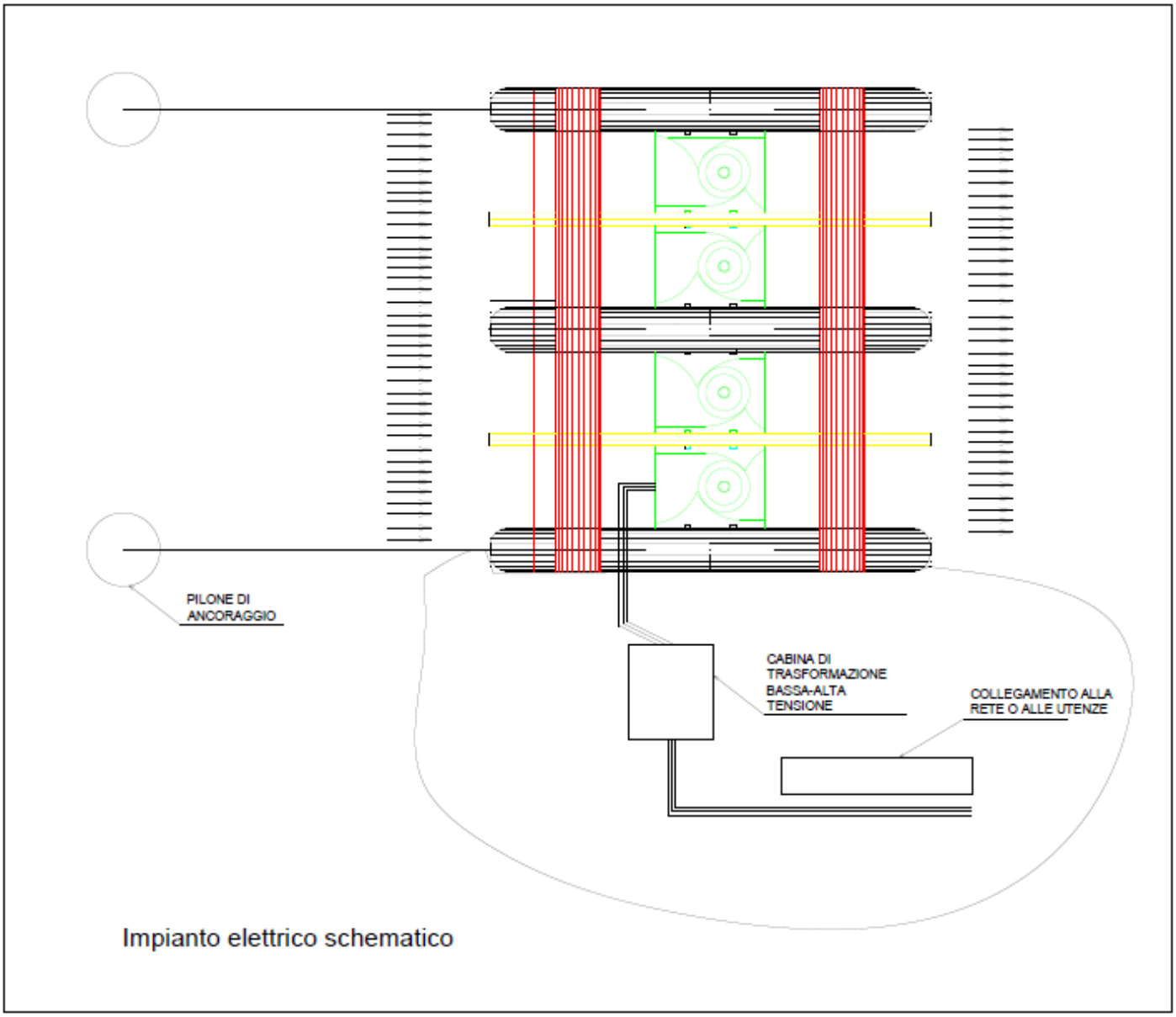


Figure 7: Scheme for securing the system (by lifting it via the floating modules) in the event of a flood

Preliminary Project – Electrical and transformation system & Network connection Cabin



Impianto elettrico schematico

Preliminary Project – 2 MW Turbine Plant