Flood control and river training works

- **Hydrologic and Hydraulic studies for the support of the Environmental Impact Assessment of Attikio Odos Motorway (2025).** The subject of the study is:
  - the Preliminary assessment of the hydraulic adequacy of the Attica Motorway works taking into account recent rainfall data and climate change conditions.
  - The alignment of the EIA study to the National Climate Law (Law 4936/2022)" for the adaptation of the project to flood phenomena in climate change conditions,

  Client: ANODOS S.A.

- **Detail Hydraulic design of the required flood protection woks in sections of the Ionia Highway (Zesti river, Agrilia River, Old National Road collector, Xaliki interchange receiver and Chrisoveri West river (2025)**
  The subject of the contract is the preparation of final hydraulic design for the construction of the required flood protection works and interventions along the following sections of the Ionia Odos Motorway:
  - from the Antirrio Interchange to the former Dimikos stream: Receiving watercourse for the wider area of the Chaliki Interchange (Chrysovergi Stream – West).
  - Messolonghi Plain area: Zesti Stream, Agrilia Stream, and the collector drain along the Old National Road.

  The design work comprises a hydrological study to determine flood discharge rates, as well as hydraulic, structural, and geotechnical studies.

  Client: EURO IONIA Joint Venture

- **1st Supplementary Contract for the hydraulic design of Flood Protection works in Areas of the Ionia Odos Motorway in the Messolonggi Plain**
  The subject of the project is the preparation of final design studies (hydraulic/structural, electromechanical, and geotechnical) for:
  A. The construction of two (2) flood-control pumping stations in the Messolonghi area:
  - at the Aitoliko torrent: a station designed to lift water from drainage ditch T11-7 over the existing Aitoliko torrent embankment; capacity of approximately 3.2 m^3/sec and a total dynamic head of approximately 5.5 m.
  - at the outlet of drainage ditch PT3-4 into the Agrilia stream: a station designed to discharge water from the ditch over the stream's right-bank embankment during periods of high water levels in the Agrilia stream.

  B. The final design works for connecting DEYAM's boreholes to the existing water supply pipeline of the city of Messolonghi via the new Evinos River bridge.

  Client: EURO IONIA Joint Venture

- **Main designer for the implementation of the project: "Training of Eschatia stream, Section from the junction of the Euphiridon pipeline to Parnithos Avenue"**
  The scope of the contract is the provision of supervision services during the construction of the works and the implementation of the final design that has already been prepared by the Contractor.

  Client: Directorate of Flood Control & Land Reclamation Works (DAEE), Ministry of Infrastructure & Transport.

- **Trikala High Voltage Substation (KYT) Flood Protection Study (2023):** A detailed hydrological study calculating flood flows impacting the Trikala High Voltage Substation (KYT) site was completed. The study covered the entire Lithaios River basin affecting the KYT and included hydrological scenarios for various return periods (50, 100, 1000 years). Based on design flood flows, protective works for the KYT were proposed, along with an indicative cost estimate. Client: IPTO (Client: Independent Power Transmission Operator).
- **Arachthos High Voltage Substation (KYT) Hydrological Study & Hydraulic Design (2023):** A hydrological study calculating flood flows impacting the Arachthos KYT site from northern and eastern directions was completed. It also performed hydraulic calculations and design for necessary protective works (e.g., external perimeter ditch, internal drainage channels) to safely collect and divert flood flows away from the site. This included a technical report with assumptions, hydraulic calculations for dimensioning works, technical specifications, and detailed drawings. (Client: Independent Power Transmission Operator).
- **Flood Protection Works for Kerasia and Kanalia Settlements in Thessaly region (2023):** This project involved two main components:
  - Inlet Works for Collector S6: An implementation study was completed to redesign the inlet works to Collector S6, ensuring the structure's resilience against extreme flood events exceeding original design scenarios. Deliverables included a technical report, hydraulic calculations, detailed drawings of protective works (re-designed inlet, new spillway, embankment redesign, T6.1 ditch design, Kerasiotis old riverbed modification), and preliminary cost estimates.
  - Kerasiotis Stream Works (Upstream of Kapsala Footbridge): An implementation study for restoring damages and designing protective works along the Kerasiotis stream, considering updated flood flows. Deliverables included a technical report, hydraulic calculations, detailed drawings of proposed protective works (gabion slope protection, gabion steps), and preliminary cost estimates.

  Client: DOMIKA construction company
- **Flood Protection Study – Melas (Mavropotamos), Pastelikas, and Potamaki Rivers (32km total length) (2022):** This comprehensive study included:
  - River Delineation: Official delineation of 36 km of river boundaries according to current legislation.
  - Local/Partial River Delineation & Flood Protection Works: Design of localized river Delineation and flood protection works across an estimated 12 km, determining optimal sections and forms (cross-sections, linings). This involved a hydrological study for design flow determination, followed by preliminary and final hydraulic designs.
  - Supporting Studies: Topographical mapping (1:500 scale for 32 km), cadastral mapping (1:1000 scale for construction areas), expropriation diagrams and tables, a single-stage Environmental Impact Study (EIS) for both technical works and delineation approval, a Health & Safety Plan (SAE) and File (FAY), and preparation of tender documents.

  Client: Region of Central Greece, Directorate of Technical Works, Boeotia Regional Unit.
- **Voudoros River delineation Study in Evia island (Approx. 3700m) & Damage Restoration works (2022):** This study focused on regulating the Voudoros (or Kirefs) River to mitigate flood risk following the devastating 2021 wildfires and subsequent floods. The project specifically targeted the Krya Vrysi settlement. Hydraulic calculations using HEC-RAS software informed the technical solution, which included open trapezoidal sections with gabion lining, sheet pile protection for the downstream river section, and breakwaters at the river mouth (as part of maritime works). A hydrological study for flood runoff estimation was also completed. Client: SICAP.

- **Kerasiotis River & its Tributaries Training, and water drainage Collector S7 Update study (2021):** This study involved necessary flood protection works for: (a) the Kerasiosis River and its tributaries (from Kapsala footbridge to Collector S6 outlet), and (b) the completion of Collector S7, a crucial component for flood protection east of the Karla reservoir. The project delivered preliminary and final hydraulic designs with tender documents for immediate construction and defined boundary lines. It also identified flood-prone areas for immediate population protection. Detailed sub-studies included a hydrological study (T=50, T=100 return periods), a delineation study, design of main storm collectors and river training within residential areas (for Collector S7), design of unlined river training works outside residential areas, preliminary and final designs for Kerasiosis river training, and preparation of tender documents and H&S files. Client: Directorate of Technical Works, Region of Thessaly.

- **Arachthos River Flood Protection works & Arta City Bypass of flood flows (Recent):** This project focused on maturing flood protection works for Arta city and the broader plain from Arachthos River floods (downstream of Pournari II dam to Amvrakikos Gulf). Key studies included:
  - Main Riverbed Training: Designing training works for the Arachthos River's main channel.
  - Diversion/Bypass Works: Designing works to divert a portion of flood flow away from Arta city.
  - River Delineation: A delineation study for the Arachthos River section from the dam to its outflow. Alternative solutions were explored at the preliminary design stage. Final designs, tender documents, and economic-technical studies were prepared for the selected solution to ensure readiness for tender.

  Client: Directorate of Flood Control & Land Reclamation Works (DAEE), Ministry of Infrastructure & Transport.

- **Agios Ioannis Stream Training, Thriasio Plain (Attica) (Recent):** This study aimed to provide flood protection for areas impacted by the Agios Ioannis stream in the Thriasio Plain. The hydraulic design focused on training the stream from chainage 1+400 to 6+125 (Attiki Odos), covering a catchment area of 32 km^2. The project addressed severe flooding issues in the lowland sections, particularly downstream of the railway lines, where the riverbed has disappeared, causing frequent flooding of the New Athens – Corinth National Road near Halyvourgiki. The study also included the design of eight culverts on the main stream bed, four culverts on its branches, and the final hydraulic design of a pipe (PA) designed to collect runoff from a 2.5 km^2 catchment area east of the Agios Ioannis stream.

  Client: Directorate of Technical Works, Region of Attica.

- **Pinios River to Karla Lake Water Transfer System Interventions Study (Recent):** This study identified and proposed necessary interventions to increase the conveyance capacity of the existing canal/ditch system (2D-6T-7T-2T-S4) to ensure safe and adequate water transfer from the Pinios River to Karla Lake. Following a technical-economic evaluation of alternatives, proposed works included:
  - Lining earthen ditches (6T and 7T) with concrete.
  - Constructing a right embankment on ditch 2T, accompanied by a parallel ditch (2T') for drainage of western lowlands.
  - Replacing four road crossings that impeded water flow.
  - Additional works, such as local elevation of ditch 2D with a 0.50 m reinforced concrete wall for safety, and connecting walls for the Soterio bridge to the 2T embankments.

  Client: Directorate of Technical Works, Region of Thessaly.

- **Karditsomagoula - Agia Triada Road Completion Study (2021):** This project involved a hydrological study and final hydraulic design for all roadworks aimed at ensuring a safe and reliable road

connection between Karditsomagoula, Karditsa Municipality, and other municipal districts. It also included connecting the Karditsomagoula – Agia Triada axis to the E65 Central Greece Motorway at the Proastio interchange. The scope included hydrological calculations for flood flows (T=50 and T=100 return periods), evaluation of existing streams and the main drainage ditch, hydraulic design of new bridges (Mega Rema and Vouvoulina River), and hydraulic design of the main drainage ditch along the road. Deliverables included a technical report, hydraulic calculations, detailed drawings (plan views, longitudinal sections, cross-sections, details), and preliminary cost estimates.

Client: Region of Thessaly / Karditsa Regional Unit / Directorate of Technical Works.

- **Stream Delineation & Urban Plan Adjustment of the streams in Rafina-Pikermi Municipality (2021):** This study focused on the delineation and training of streams within the approved urban plan areas of the Agios Spyridon and Dioni building cooperatives. It involved delineating streams over a total length of 11,000 m, with simultaneous planning for stream training sections and adapting/revising the approved urban development plan. Client: Technical Services of Rafina-Pikermi Municipality.
- **Ionia Odos Motorway (Mesologgi Plain): Flood Protection Works Studies (2021):** This contract involved preparing:
  - Hydrological Studies : Calculation of flood flows.
  - Final Training Studies: Final designs for approximately 16.5 km of stream training works, including structural design for about 41 culverts.
  - Pumping Station Rehabilitation: Study for the structural renovation and the increase of pumping capacity of four flood protection pumping stations (Motivo, Gipedo, Ghirokomio, and B1 TOEV).

  Client: EURO IONIA Joint Venture
- **Hydraulic Study to ensure compatibility of the coverage of Klimos stream with the provisions of the Flood Risk Management of Cyprus (2016).** The study included:
  - Reviewing and updating hydraulic design of the Klimos stream (HEC-RAS modeling)
  - Mapping existing stormwater infrastructure
  - Proposing technical modifications (e.g. cross-section changes, retention structures)

  Client: Water Development Directive Cyprus
- **Drainage and disposal systems of the areas west of the Messologhi and Aetoliko Lagoons (2013)**

  The Messologhi-Aetoliko lagoons complex is located in the north part of the Gulf of Patras in the central west coast of Greece. It is one of the most important Mediterranean lagoons. It is a shallow area of 150 km^2, extended between the Acheloos and Evinos rivers. It is protected by the Ramsar Convention and it is also included in the Natura 2000 network. The purpose of study is the pollution dispersion and better freshwater distribution around the perimeter of Messolonghi-Aetoliko lagoons to improve the physical state of the aquatic ecosystem of the area.

  The study provides for the following projects:

  1. Diversion of the runoff and irrigation drainage water from the existing canals TI & TII, that presently dispose the water in the Aetoliko lagoon, to the Mesologgi lagoon, to avoid reducing the salinity of Aetoliko lagoon.
  2. Repair works to the existing pumping station D1 with a capacity of 9.00 m^3/sec and disposal of runoff and irrigation drainage to the Messolonghi lagoon through a canal along the shoreline of about 2 Km length with side weirs.
  3. Repair works to the existing pumping station D2 with a capacity of 30.3 m^3/sec and disposal runoff and irrigation drainage to the Messolonghi lagoon, through:
     - controlled flooding of the adjoining land and subsequent overflow to the lagoon, and

- disposal of drained water through a canal along the shoreline of about 2 Km length with side weirs.

- **Updated Flood Study and research for the propagation of exceptional flood waves due to dams break in Arachthos River (2010).** The study was assigned by the Public Power Corporation S.A.- Hydroelectric Generation Department. The object of the study is:
  1. The determination of flood area downstream of Pournari I dam of PPC to Arachthos river up to the sea, in cases of discharging 500 m^3/sec, 1,100m^3/sec, 2,000m^3/sec, 3,500 m^3/sec and 6,000m^3/sec from the dam works. For the scenarios of 500m^3/sec and 1,100m^3/sec, the analysis was made considering steady flow conditions, using the hydraulic program for gradually varied flow, HEC-RAS ver. 3.1.2 of the U.S. Corps of Engineers, (Hydrologic Engineering Center, November 2002). For the scenarios of 2,000m^3/sec, 3,500 m^3/sec and 6,000 m^3/sec, flood analysis was made for outflow hydrographs with peak values of 2,000m^3/sec, 3,500 m^3/sec and 6,000 m^3/sec respectively. The mathematical model DAMBRK, developed by the National Weather Service of USA, was used for flood routing determination.
  2. The investigation of flood wave moving characteristics, caused by the potential dams break of Hydroelectric works of river Arachthos, including Pournari I Hydroelectric Station and Pournari II Hydroelectric Station. Three failure scenarios were examined:
     - Pournari I dam break due to overflow that may occur due to inefficiency and bad operation of the spillway.
     - Pournari II dam break due to piping failure or internal erosion, caused by inadequate embankment compaction or/and filter inadequacy or/and cracking due to precipitation.
     - Break of Pournari II dam due to piping failure.

  The mathematical model BREACH, developed by the National Weather Service of USA, was used for the assessment of the dam failure and the calculation of the flood hydrograph directly downstream of the dam. For each dam break scenario, the mathematical model DAMBRK was used to compute flood wave moving along Arachthos River. All the data that compose flood routing, such as maximum flow, maximum stage elevation etc., were investigated. Flood wave arrival time, time to maximum stage and flood area were computed. In the end, certain problems concerning flooding of settlements, bridges, roads and potential destruction due to flood waves, were noted and commented.

  In the Pournari I dam break scenario, there is overtopping of river embankments and losses of great volumes of water along the river are noted. This phenomenon is simulated as outflows through lateral overtopping of embankments. In case of Pournari I dam break, the following is noted: (a) Overtopping of the east river embankment leading to the dam (road embankment connecting Arta with the dam) and flood wave propagation towards east, at the valley that lays along the national highway to Athens – the flow is restricted by the slopes of the valley and is simulated as a separate branch.(b) Overtopping of the west river embankment and flood propagation wave towards Arta valley – this phenomenon requires two-dimensional flow ad has been approximately approached by DAMBRK model.

- **Final study for the restoration of stream in the area of Velestino junction of unequal level (2004).** The subject of this study is the restoration of the existing stream (Spartias stream) between Velestino Industrial Area and the 850m Railway Line Athens-Larissa-Volos, intending to flood protection of the road and the surrounded area. The work was designed considering a 50-year return period (maximum flow, Q=68.50m^3/sec). The study was made on behalf of Pantechniki S.A., in order to construct the junction of unequal level of B' Industrial Area of Volos and Velestino access road.

- **Study for the restoration of Kifisos river, at the section from upstream Tris Gefires to Kokkinos Milos.** The subject of this study is (a) to increase the flood capacity of Kifisos river, at the section between Kokkinos Milos and Tris Gefires (approximately 3km), (b) Acharnon stream, between the junction of Kifisos and the junction with Attica Road (1,500m length) and (c) the study of the capacity of Parakifisios central sewage pipe. A Preliminary study has been made that consisted of hydraulic control of the existing conditions considering 20-year return period (Q=375 m^3/sec) and 50-year return period (Q=580 m^3/sec), using a mathematical simulation. The hydraulic capacity of the existing bifurcation of Acharnon stream with Kifisos River has also been controlled. Four alternative cross sections have been designed and their hydraulic characteristics have been examined. For each cross section, an assessment of the construction cost has been made. The study was assigned by the Athens Water Supply and Sewerage Company (Project budget: 22,020,990€, 2002)).
- **Study for the hydraulic work of the old and new Pineios riverbed in Larissa.** This study concerns works for the restoration of the old and the new Pineios riverbed in Larissa (total length of 5.7 km and 2.3 km), with the aim to control flood totally and to regulate the flow of the old riverbed. The works concern completion and enhancement of the embankments of the external branch of Pineios. The project included complete preliminary study, final study and assessment of geotechnical works. The study was assigned by the Hellenic Ministry for the Environment, Physical Planning and Public Works. (Project budget: 24,074,830€, 1999).
- **Study for the additional Flood Control Constructions of Pineios river in Thessalia and tributaries.** This study concerns the investigation and design of necessary construction works, which have to be improved or reconstructed in the river Basin of Pineios River in Thessalia, an area that is affected by the recent floods and is still in risk of being affected in the near future. For the purposes of this study there has also been made an identification study, several preliminary studies as well as final studies. This study was assigned by the Hellenic Ministry for the Environment, Physical Planning and Public Works. (Project budget: 39,618,490€, 1999).