PROJECT	**:**	**•PRELIMINARY & DETAILED DESIGN OF PLATY DAM, PREFECTURE UNIT OF RETHYMNO AND DETAILED DESIGN OF WATER TRANSMISSION PIPELINE IN MESSARA • PRELIMINARY & DETAILED DESIGN OF THE IRRIGATION NETWORK IN PLATY IN THE PREFECTURE UNIT OF RETHYMNO**
EMPLOYER	**:**	**MINISTRY OF RURAL DEVELOPMENT AND FOOD/ DIRECTORATE OF TECHNICAL STUDIES AND CONSTRUCTION, Department A**
STUDY	**:**	**ENVIRONMENTAL IMPACT STUDY**

NON-TECHNICAL SUMMARY

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1 GENERAL PROJECT AND STUDY DETAILS

The present Environmental Impact Study is prepared for the environmental permitting of the projects of "Preliminary Study & Detailed Design of the Irrigation Network in Platy in the Prefecture Unit of Rethymno", "Preliminary Study & Detailed Design of the Dam in Platy in the Prefecture Unit of Rethymno" and "Detailed Design of the Water Transmission Pipeline in Messara".

This project refers to the following:

- ✓ Dam - Reservoir of the Platy River (Rethymnon Prefecture Unit, Crete) with a capacity of approximately 21.2x10^6 m^3
- ✓ 18.435 km long closed water pipeline (including 2 tunnels 3.4 km long), from the area of Platy dam to the area of Messara, Prefecture Unit of Heraklion, Crete
- ✓ Gerakari Dam - Reservoir on the Lygiotis Stream (Rethymnon Prefecture Unit, Crete) with a capacity of approximately 1.73x10^6 m^3
- ✓ Irrigation network, which is located within the limits of the hydrological basin of the Platy river and will cover an area of 4500 hectares to be irrigated using the water of the reservoirs the Platy and Goferakari dams.

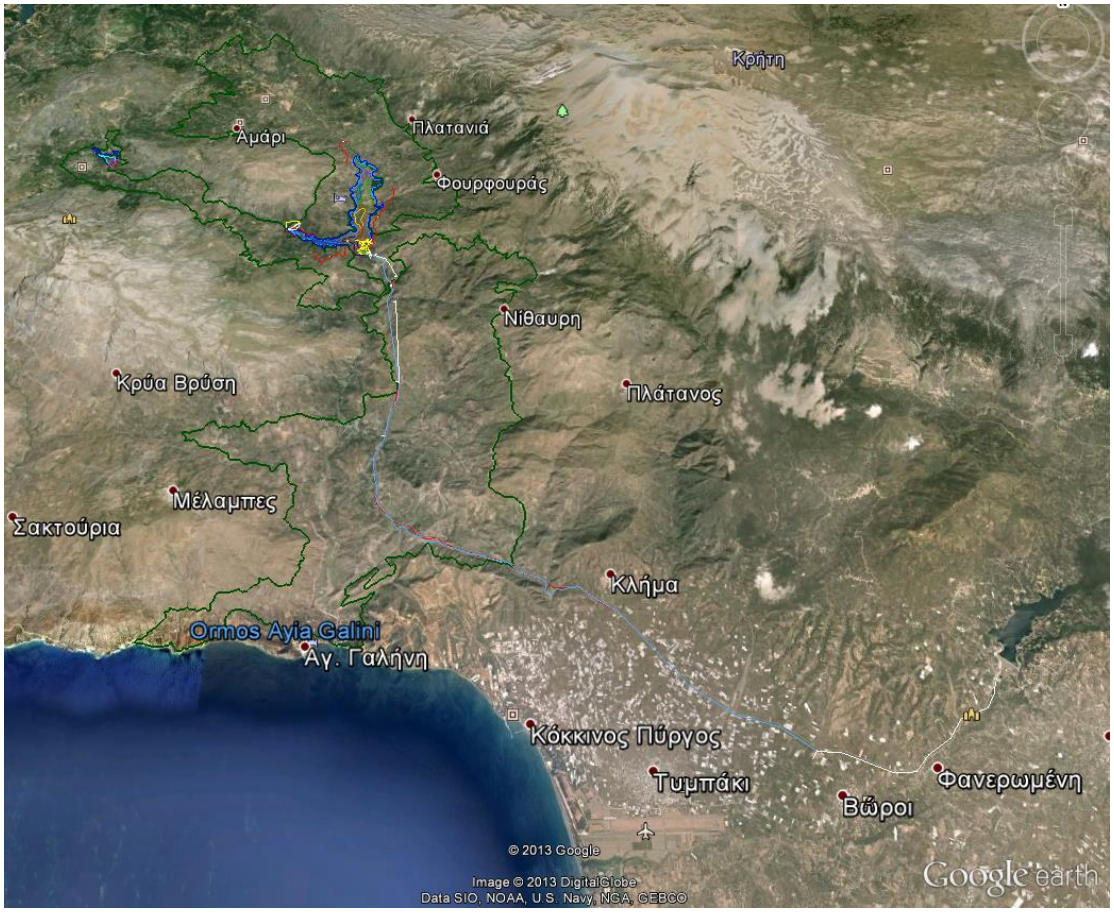
The purpose of the project is

- ✓ The irrigation through the network for an area of approximately 4500 hectares within the hydrological basin of Platys RIver of the Prefecture Unit of Rethymno.
- ✓ The transport of the surplus average annual water volume of approximately 18x10^6 m^3, with pipeline which operates with gravity, to the western area of the large plain of Messara in order to strengthen its water balance which currently is in deficit, with additional water volumes of the Faneromeni reservoir
- ✓ The artificial enrichment of the underground aquifer of the Messara plain, when the reservoir of Faneromeni is full.
- ✓ The indirect increase of irrigating agricultural lands in the area of Messara without creating a problem in the water table of the plain.

The study was prepared by "ENVECO SA, Protection, Management and Economy of the Environment", "HPC Passeco Monoprosopi Ltd" and the "Anna Papadakis" office, which are specialized offices in issues related to the identification, assessment, mitigation of environmental impacts of projects and activities.

2 GEOGRAPHICAL LOCATION, OBJECTIVE, SIGNIFICANCE AND NECESSITY OF THE PROJECT – RELATIONSHIP WITH OTHER PROJECTS

The locations of the Platy and Gerakari dams, as well as of the irrigation networks, are administratively under the Rethymno Prefecture Unit, while the water transport pipeline starts from the Rethymno Prefecture Unit and reaches the area of Messara which administratively belongs to the Heraklion Prefecture Unit. The proposed projects as well as their associated facilities are located within the administrative boundaries of the Municipalities of Amari, St. Vassiliou and Phaistos. The first two belong to the Prefecture Unit of Rethymnon, while the last one to the Prefecture Unit of Heraklion. The location of the main elements of the project is shown in the figure below.



The importance and necessity of the proposed project is twofold since on the one hand it is related to covering the irrigation needs of important areas in the area of Platys river and on the other hand to supplying the necessary quantities of water to cover irrigation in the area of the Messara plain.

At the same time, regarding the plain of Messara, which is the largest plain in Crete and is located on the west of the Platy basin, it has been identified that further development of agricultural production should now be based on irrigated agriculture because, especially in Crete, the period without rain lasts from May until October, period during which the water needs of crops are increased due to high temperatures.

No surface waters are available to cover the large water needs for irrigation in the months of May - October in Western Messara, because the Geropotamos stream that crosses the plain and the streams that flow into it have zero runoff. Therefore, in order to secure water resources during the irrigation season, storage works are needed to save the winter and spring runoff of the streams and pipelines to transport the water to the reservoirs of the irrigation networks. As far as underground water resources are concerned, already from the 1960s has been examined the possibility of pumping water from the underground aquifer formed in the plain of West Messara, however its capabilities are limited and can cover only a small percentage of the irrigation needs of the West Messara.

3 ALTERNATIVE PROJECT IMPLEMENTATION SOLUTIONS

Before developing the Project with the proposed design, alternative solutions were considered regarding the following:

- Location for construction of the Platy dam
- Locations for construction of the Gerakari dam
- Water pipeline routes (regarding the proposed location of the dam) and the parallel with the pipelines road route
- Locations of borrow pits and disposal sites
- Alternatives solution for road works
    i. access roads to the dam
    ii. roads to be rehabilitated
- Locations of irrigation networks

In addition, the Zero Solution was examined, i.e. the scenario of not implementing the Project, and it is evaluated in relation to the scenario of its implementation.

The Zero Solution is related with the non-construction of the dams and therefore the reservoirs, the water transport pipeline and the irrigation network, which will result in the continuation of the existing situation in the area of the prefecture unit of Rethymno, as well as in the area of Messara. More specifically, the Zero Solution states that the Projects under study will not be constructed and consequently, the needs related to them will be met through existing or other resources and projects, while at the same time there will be no change in the time of the distribution of the runoff of Platys river downstream of the proposed dam.

In case of non-implementation of the proposed project, it is estimated that the following impacts will occur:

- There will be an increase in groundwater demands in the area of the Platys hydrological basin, which will not be able to be adequately covered since there will not be sufficient groundwater availability during the period when they occur

- It will not be possible to strengthen the water potential of the West Messara and achieve the recovery of its underground aquifer which will gradually lead to the stop of irrigated agriculture in the area of Messara, given that the underground water will become brackish and will not be suitable for the irrigation of the agricultural lands

- The pumping of water from irrigation wells, which is energy consuming, will continue, placing a significant burden on the region's energy networks

- The primary sector (agricultural production) of the area of the southern part of the Rethymno Prefecture Unit will not be strengthened due to the non-implementation of the irrigation projects (maintenance of dryfarm crops of reduced yield), as a result of which the competitiveness of the region of Crete and in general of the country will not to be enhanced in a period of economic crisis.

Based on the above and taking into account the objectives of the proposed project, it is estimated that the Zero Solution should be rejected and the proposed Project should be implemented.

3.1 Alternative dam locations

- Position (Φ1). This position is located at a narrow point, where the crest length is approximately 280 m

- Position (Φ2). This position is located upstream of the previous one at a distance of 500 m, with a crest length of about 350 m.

Waters

K1. Length of the river Platys along which the flow is disturbed. It has to do with the length of the river and its branches which are expected to be covered by the impoundment basin upstream of the dam, as well as the part of the river downstream of the dam, since the hydromorphological characteristics will change in these lengths. The solution that will be preferred is the one with the shortest length of water stream that is disturbed.

K2. Catchment area occupied by the impoundment basin. This is the area of the impoundment basin in the Maximum Operation Level. The solution with the smallest reservoir area is more preferable.

K3. Reservoir storage capacity, i.e. the volume of water that can be stored annually and is directly related to the volumes of water that will be diverted for use annually. It also has to do with the

possibility of water abstraction in each alternative, while the most preferable solution is the one with the greatest possibility of storage and therefore disposal of water.

Natural environment

K4. Reduction of sediment yield of the river Platys. This is related to the maintenance of the flow regime of debris and nutrients in the downstream part of the dam. Hence, it has to do with the concentration of nutrients in the deltaic formation, as well as with the natural material balance of the coastal zone. The solution with the smallest reduction in debris is preferable.

Morphology – Landscape

K5. Mirror surface of the impoundment basin. This is usually visible from the high points surrounding the reservoir. The change of the landscape should be as little as possible. The solution with the smallest area is preferable. [This criterion is equivalent to K2, only modified and applied for a different environmental means].

K6. Dam volume as it is related with the materials to be extracted from the borrow bits and their disposal sites. The solution with the least volumes and therefore the smallest intervention in the borrow pits and disposal areas is preferable.

Soil - Land Uses - Geological Features

K7. Intervention area for implementing the project. The solution with the smallest total area is preferable.

K8. Areas of cultural value likely to be affected. The archaeological sites of the area should be affected as little as possible by the Project. The solution that affects the smallest area of archaeological or sites of cultural value is preferable.

K9. Geological conditions of the dam foundation surface. A safe solution with the least expected seepage is preferable. To make it possible to compare alternatives Φ1 and Φ2 based on criterion K9, the required waterproofing works of each alternative are compared. In other words, the surface of the cement injection diaphragm is compared, while the solution with the smallest surface is preferable.

Based on the technical characteristics of dams Φ1 and Φ2, it was found that alternative Φ2 was better than Φ1 in six out of the total of nine criteria concerning the selection of an alternative dam location,

i.e. K2, K3, K4, K5, K7 and K9. For the remaining three out of the nine criteria, alternative Φ1 is preferable. Based on the above, it is estimated that the alternative of dam location Φ2 is "environmentally" preferable to Φ1 at the level of assessment of the potential impacts of each alternative solution on the environment and therefore it is proposed to develop the project at location Φ2.

3.2 Alternative solutions of Gerakari dam

Two different positions were examined in the project area, which are about 360 m far from each other (Φ1 and Φ2) for the selection of the position of Gerakari dam.

Applying the environmental criteria used in the Platy Dam in the case of the Gerakari Dam ‘s alternatives, it was found that the two alternatives for the dam location are equivalent in terms of their potential impacts on the environment with a slight "environmental" lead for the proposed solution Φ1. However, it must be emphasized that the establishment of the project in the location Φ1 is mainly proposed due to the better (compared to Φ2) geotechnical conditions prevailing in the bearing area of the abutments of the axis of Φ1 (the geological conditions in the right abutment of the axis of Φ2 are assessed as sufficient), and not so much based on environmental criteria.

3.3 Alternatives for the pipelines

The alternative of the pipelines (Λ-1, Λ-2, Λ-Ι) include among others the required road construction works required for the implementation of each solution. It is emphasized that a study has not been carried out to examine the required associated road network in each alternative route of the pipeline (except for the road construction in parallel to the proposed pipeline route solution), so for the needs of the present study, an initial evaluation of the new roads required to be opened for each alternative route of pipeline was carried out.

Secondly, it has to be underlined the fact that the proposed alternative routes of the pipeline have been examined and evaluated based on technical and economic criteria during the first stage of the project " Preliminary Study & Detailed Design of the Dam in Platy in the Prefecture Unit of Rethymno” and Detailed Design of the Water Transmission Pipeline in Messara ».

The environmental criteria applied for the selection and evaluation of the alternatives are as follows:

ΚΑ-1. The length of the pipeline placed within the broad riverbed of the Platys River. The solution with the shortest length within the riverbed is preferable.

KA-2. The existing road network for the installation of the water pipeline. The criterion consists of three sub-components, i.e. a) the percentage of the length of the pipeline that runs along an existing road, b) the total length of new roads that will need to be built, and c) the difficulty expected to be encountered in constructing the new roads. Alternative routes in the last criterion were scored as big, medium, and small. it was also considered possible to widen the road network that already exists.

KA-3. The land uses through which the alternative pipelines will pass. The most preferable solution is the one that mostly passes through lands that are abundant in the wider area and lands where the intervention is expected to be small and reversible. Such areas, based on the Corine 2000 classification, are for example olive lands (code 223) and Vineyards (code 221). Alternative routes in terms of this criterion (intervention in different land uses) were evaluated and scored as mild, moderate, and severe.

KA-4. The length and the cross-section of the pipeline, based on the elevation difference between the water level of the Platys water abstraction project and the water level in the Faneromeni Reservoir. The solution with the shortest pipeline length is preferable, as this implies less soil and morphological interventions.

It is noted that each alternative route of the water pipeline includes the opening of new roads required.

Regarding alternative Solution Λ-I (proposed), the route of the water pipeline under pressure has a diameter of 1,200 mm, starts from the Platy Dam, heads south, passes through the "Portes" mountainous area via a 1,100 m long tunnel and continues until the entrance of the St. Ioannis tunnel (chainage 2+100 km). Downstream of the tunnel exit (chainage 4+400 km) the pipeline heads south and at the 9+100 km passes through the Mandres hill. The pipeline then heads to the southeast, descends to the plain of Messara near the settlement of Klima (approx. Chainage 14+000 km) and then passes north of the settlements of Tymbaki, Voroi and Faneromeni and ends at the Faneromeni Dam (approx. Chainage 24+200 km).

Alternative solution Λ-2 was used during the Preliminary environmental process for the irrigation networks and the route of the transmission pipeline, and was environmentally licensed, while it has similar characteristics to the route of alternative 1. The differences of alternative 1) to alternative 2) are mainly in the tunnels and in the road design up to point ΣΤ, where the route of the pipeline of the two solutions is common (route on an existing rural road). The first 300 meters or so of the tunnel at Portes are common for both solutions 1 and 2, while then the route of solution 2 moves south towards the riverbed. The tunnel of St. Ioannis in solution 2 is located at an average distance of approximately 300 meters from the proposed tunnel. Subsequently, and up to point Γ the route of the pipeline of

alternative 2 coincides with the one of route of alternative 1 with slight changes at some points due to the modification of the route of road E.

Regarding Solution Λ-1, the pipeline is under pressure along its entire length. The pipeline starts from the Platy Dam, passes through positions A and B and heads south to the St. Galini following a parallel route to the eastern bank of the Platys River. Then the pipeline diverts to the east, follows a coastal road to the point where it meets the provincial road Mandres – Tymbaki and follows it. Just before Tymbaki, it diverts to the north east and following rural roads, it meets the rural road Klima - Faneromenis Dam, which follows until position H. There, it meets the constructed section of the Dikleida – Faneromeni pipeline, 4880 meters long.

Based on the evaluation, it was concluded that solutions ΛI and Λ2 are superior to alternative solution Λ1 from the environmental point of view. Evaluating ΛI and Λ2 solutions, they are assessed to be equivalent environmentally, however, the LI solution is proposed since its route passes through areas that do not require additional technical works for the safe transport of water under pressure to Messara. Finally, Solution ΛI is chosen as environmentally acceptable but is also technically and economically more advantageous than the other solutions.

3.4 Alternative locations of borrow pits - quarries – disposal sites

The following environmental criteria were used for the evaluation of the borrow pit's positions:

PE1. Position of borrow pit related to impoundment basin. Preferable location from the environmental point of view is the case where the alternative location of the borrow pit is located within the impoundment basin of the Platy reservoir. It is noted that this criterion has the greatest weight and could be a criterion for excluding some alternative location of the borrow pits under evaluation.

PE2. Type of land uses that the borrow pits lie in, which are outside the impoundment basin. The alternative sites with the smallest area in productive land uses are considered as environmentally preferable. It is noted that the borrow pits which are located entirely within the impoundment basin (or even the area where the dam is located) are not evaluated based on this environmental criterion since the occupation of land from the reservoir is strongly related with the implementation of the project.

PE3. Distance of settlements from the boundaries of the alternative borrow pits under evaluation. The best solution from the environmental point of view is the one that is located at a greater distance from the boundaries of the settlements.

The location of the borrow pits as well as the type of potentially obtainable materials are briefly described in the following paragraphs, while a more detailed description takes place in the main text. The locations of the alternative borrow pits are presented in a map at the appendix of the study.

Borrow pit A: It lies in the wider area of the deposits of the Platys River on both sides of the dam, upstream and downstream. It has a total area of about 130,185m^2, an average length of about 710m and an average width of about 185m.

Borrow pit B:It lies in the wider area of the alluvial deposits of the secondary branch which contributes to the area of the impoundment basin from the West (Lygiotis river). It has a total area of about 60,000m^2, an average length of about 960m and an average width of about 62m.

Borrow pit Γ: Borrow pit Γ is located at the most southern part of the borrow pits wider area, downstream of the dam in the excavation zone of the spillway's stilling basin. The excavation materials of the shafts include the deposits of the materials of the terrace and have an average thickness of about 2.00m. The borrow pit has a total area of about 15300m^2, an average length of about 155m and an average width of about 100m.

Borrow pit Δ:Borrow pit Δ lies in the wider area of the terraces of the river Platys, upstream of its confluence with Lygiotis river and in the regolith of the mudstone flysch. It has a total area of about 140,570m^2, an average length of about 440m and an average width of about 320m.

Borrow pit ***E:*** It lies further on the north from borrow pit Δ, at an average distance of about 500m from the axis of the dam, within the deposits of the terraces of the river Platys. It has a total area of about 101550m^2, an average length of about 720m and an average width of about 140m.

Borrow pit ΣΤ:It lies further on the north from borrow chamber E, at an average distance of about 700m from the axis of the dam, within the deposits of the Platys river terraces and the terrestrial terrace. It has a total area of about 84245m^2, an average length of about 343m and an average width of about 245m.

Borrow pit Z:It lies further north from borrow chamber ΣΤ, at an average distance of about 900m from the axis of the dam, within the deposits of the Platys river terraces and the terrestrial terrace. It has a total area of about 154900m^2, an average length of about 795m and an average width of about 195m.

Borrow pit H:It lies on the west of borrow pit Z and in the deposits of the river terrace, while the boundary between these two borrow pits roughly coincides with the bed of the Platys River in this

section. It has a total area of about 42880m^2, an average length of about 550m and an average width of about 80m.

Borrow pit Θ: It is the most northern borrow pit and is located at a distance of about 1200m from the location of the dam. It has a total area of about 36130m^2, an average length of about 250m and an average width of about 145m.

Borrow pit EN-D1[1]:Borrow pit EN-D1 is located south and downstream of the dam at a distance of 350m.

Borrow pit EN-D2:Borrow pit EN-D2 is located downstream of the axis of the dam at a distance of 600 to 1500 meters.

Borrow pit EN-D3:The area of the borrow pit EN-D3 is located in the western part of the impoundment basin of the dam, downstream of the villages of Petrochori - Labiotes. The area is being developed on the borders and upstream of the future lake. The distance from the dam varies from 1500m to 2000m.

Borrow pit EN-D4:The Borrow pit EN-D4 borrow is located in the northern part of the flood basin. The area is being developed on the borders and upstream of the future lake. The distance from the dam is about 2600m.

Borrow pit EN-D5:The borrow pit EN-D5 borrow pit area is located north of the impoundment basin, about 800m from the future lake. The distance from the dam is about 3500m.

Borrow pit ΕΛ: The total area of the individual areas that constitute the borrow pit Λ is at least 60000m^2. Estimating a minimum thickness of extractable quantities of 5.0m, the total quantities are calculated to 300000 m^3. This borrow pit is characterized by the development of rocky limestone materials.

Disposal sites: For the disposal needs of the excavations that will not be used in the construction of the dam and its associated works, four locations for disposal sites were examined. The disposal areas ΑΘ1 and ΑΘ2 lie on the terraces on both sides of the river downstream of the dam. The disposal site ΑΘ2 lies on the borders of the borrow pit Γ, while the disposal site ΑΘ1 is inside the riverbed of the Platys river downstream of the dam. The disposal site ΑΘ3 is proposed at the western border of the

[1]The prefix EN- denotes an alternative solution and the rest of the code the loan room to which the alternative solution refers.

impoundment basin of the Lygiotis branch. The proposed area is developed on flysch layers in contact with the ΕΛ2 borrow pit.

Three criteria were used for the environmental assessment of the borrow pits. The first has the greatest weight and has to do with whether and to what extent the location of the borrow pit is within the impoundment basin of the Platys dam (grading range: inside, outside, partially), the second with the type of land uses occupied by the areas of the borrow pits (grade based on the areas in hectares), while the third is related to the anthropogenic environment of the area and has to do with the minimum distance of each borrow pit from the boundaries of settlements (grade based on distances in meters/partially).

All borrow pit locations positions are in principle equivalent to each other since the areas expected to be occupied have to do with the following land uses: non-irrigated arable land, olive groves, complex cropping systems, land covered by agriculture with significant areas of vegetation, natural pastures, and sclerophyl vegetation. These lands are abundant in the immediate and wider study area, which means that none of the locations of the borrow pits can be characterized as preferable, with the exception of the borrow pits located partially or entirely within the impoundment basin, since with the beginning of the project, these areas will be flooded and therefore any land uses within the reservoir will be radically and permanently changed. In conclusion, regarding the criterion of land uses, the borrow pits that will lie totally or partially in the flood basin are proposed to be used in terms of priority.

3.5 Alternatives for the access roads

Alternatives regarding road works include roads rehabilitation for the connection of settlements located in the impoundment basin and roads that lead to the crest of the dam. Some roads are completely new alignments, while some others are not completely new alignments, having in several places improvements.

Alternative solutions for access roads to the Platy dam: Four alternatives were considered. The first two are related with the access to the eastern side of the axis of the dam (ΟΔ-1 and ΟΔ-2), while the other two are related with the access to the western side of the axis (ΟΑ-1 and ΟΑ-2).

Alternatives for road restoration: Regarding the roads rehabilitation in the area around the dam, two alternative solutions (ΟΚ-1 and ΟΚ-2) were examined. The first (ΟΚ-1) consists of two sections, while also has a prerequisite the design of ΟΔ-1 and ΟΑ-1 solutions, which are expected to operate in a

complementary manner. The second alternative consists of only one section and follows the perimeter of the impoundment basin.

The following environmental criteria were used to evaluate the alternatives:

PK-1: Passing through existing land uses. Passing through barren land is preferable.

PK-2: Length of new alignment proposed in each alternative as these are directly related to the earthworks expected to be required for the implementation of each alternative. A road with a longer length of new construction implies larger volumes of excavation. The solution with the shortest length of new alignment is preferable.

PK-3: Use and/or widening of existing road network. The solution with the greatest possible use of the existing roads is preferable.

PK-4: Crossing within archaeological sites. The solution with the smallest (or zero) crossing such areas is preferred.

It is proposed to choose the alternative solution ΟΔ-1 as an access road to the west side of the dam axis. Additionally, it is proposed to choose alternative solution ΟΑ-1 for an access road to the west side of the dam axis. These options are aligned with the solution proposed by the consortium team that prepared the road study.

The selection of the alternative solution ΟΚ-1, which consists of the sections ΟΚ-1a and ΟΚ-1b, is proposed as the most environmentally friendly solution for road restoration in the area around the Platy Dam reservoir. This option is aligned with the solution proposed by the consortium team that prepared the road study.

3.6 Alternatives for the irrigation networks

The alternatives for the irrigation network were based on the alternative layouts of the water pipeline from Platy to Messara.

Taking into account the topographical charactersitics of the pipeline route and the elevation of the ground in the area of the route, we could observe the following:

1. As for the proposed Solution I, the route of the pipeline of Messaras is more symmetrical, regarding the irrigation networks of Zones Z1 to Z8b that it serves, than the one proposed for Solution

1. This could mean that the required water supply works of the networks in Solution I will be better operational with a shorter length of pipelines and lower pumping heights. On the contrary, as far as Solution 1 is concerned, the required length of the pipelines to cover most of the zones would be much longer. Consequently, the water supply works will be more cost efficient both in terms of construction and operating costs for the proposed Solution I.

2. The irrigation zones to be served have a very pronounced relief with very high and low altitudes and very steep slopes. The pipeline in Solution 1 lies on the eastern bank of Platys river where the ground elevations are much lower than those of the most part of the irrigation zones. This would probably lead to additional pumping and much higher pumping heights compared to Solution I. However, this also depends on the hydraulic operation of the pipeline (piezometric heights, etc), for which currently there are no data.

Regarding the irrigation network and the proposed way of operation, an alternative solution is presented which concerns the northern part of the network.

The water storage tanks Δ13, P1, Δ14, Δ15, Δ16, P2, Δ17, Δ18, Δ19, Δ21, Δ22, Δ23, Δ24α and Δ24β of the respective Zones of Area (3) as well as tank Δ14α of Zone Z14α of Area (1) will be supplied by pumping from the ΑΠ pumping station that will be built downstream of the Platy Dam water abstraction works.

Two solutions have been considered for the way of supplying the tanks mentioned above.

Solution A (recommended solution): The ΑΠ Pumping Station supplies with a discharge pipeline, of 700mm diameter and 820 m long, the ΔΠ1 tank, which is placed at an altitude of +360 m. From the ΔΠ1 tank, a gravity pipeline begins, with a gradually decreasing diameter and a length of 8,525 m.

Alternative Solution B: From the ΑΠ Pumping Station which is to be built immediately downstream of the water abstraction works of the Platy Dam, a 9350m long central discharge pipeline. supplies via branches the tanks of the Zones of the area.

Solution A' has the following advantages: (1) The requirement for the ΑΠ Pump Station is to raise the water to half of the manometric height. (2) The pressures provoked do not exceed 16 atm. (3) The management of the system is much more simple. The disadvantage of solution A’ is the need to build seven (7) additional small pumping stations.

Solution B' has the advantage that requires the construction of one pumping station, but has in the same time many disadvantages. In particular: (1) The construction of a substation will be required and

possibly the reinforcement or installation of power transmission lines, while the use of electricity for its operation may create problems of brownout in the area. (2) The requirements of pipes and pumps and all types of valves such as air valves, check valves, etc., taking into account the water hammer action that may happen, far exceeds 25 atm. (3) In the event of an accident of burst of the pipes, due to the high pressure, the damage that will be caused to the surrounding area will be significant and the possible injuries that may be caused, important and even fatal. (4) From the energy point of view, the efficiency of the pumps at such pressures is at least 30% lower than the efficiency of the pumps operating at the pressures of Solution A'. (5) The operation of the system is complex and multiparametric. Finally, the automatic operation of the pumping station requires special software.

Based on the evaluation above, Solution A' is proposed.

4 PROJECT DESCRIPTION

4.1 Main characteristics of the project

The main features of the project include the following:

Platy Reservoir

Maximum Operation Level (MaxOL)	+289.00
Minimum Operation Level (MinOL)	+272.00
Maximum Flood Level (MFL)	+293.30
Total storage volume in MaxOL	~21.2 hm^3
Total storage volume in MFL	~26.2 hm^3
Useful volume	17.2 hm^3
Exploitable annual volume p=97%	28.56 hm^3
Reservoir surface in MaxOL	162 ha

Gerakari Reservoir

Maximum Operation Level (MaxOL)	+578.00
Minimum Operation Level (MinOL)	+565.00
Maximum Flood Level (MFL)	+581.00
Total storage volume in MaxOL	~1.73 hm^3
Total storage volume in MFL	~2.25 hm^3
Useful volume	1.43 hm^3
Exploitable annual volume p=100%	1.6 hm^3

Reservoir surface in MaxOL 15,4 ha

Water Transmission Pipeline

Total pipeline length of 1,200 mm diameter 18.4km

Number of tunnels 2

Length of tunnels 3.4km

Irrigation Network

The surface areas, according to measurements on a map with a scale of 1:5,000, can be calculated as below:

Total gross perimeter area 7166 ha

Areas with infrastructure, etc. 2221 ha

Total Irrigated Area 4935 ha

Currently irrigated area (Existing network of Local Organization of Land Improvement, Municipalities) 474 ha

Additional area to be irrigated area from the new network 4461 ha

Irrigation - Area 1:

The area is divided into eleven (11) irrigation zones, Z1, Z2, Z3, Z4, Z5, Z6, Z7a, Z7b, Z8, Z8β and Z14α. The existing irrigation network of St. Galini is included in zone Z1. Each zone has its equalization tank. The storage tanks of all zones are supplied with water by the Messaras pipeline by gravity, through water abstraction points that are placed on it (YAM1 to YAM8) except for the tank of zone Z14α which is supplied with water by a pumping station from the Platy Dam.

Irrigation - Area 2

The area is divided into four (4) irrigation zones, Z9, Z10, Z11 and Z12. Each zone has its equalization tank: Δ9, Δ10, Δ11, Δ12. The tank Δ9 of zone Z9 is supplied by the Platy Dam, from the ΑΠ pumping

station placed at the base of the dam. Similarly, tanks Δ10, Δ11 and Δ12 of the respective zones are supplied by the Gerakari Dam, from the ΑΓ pumping station located at the base of the dam.

Irrigation - Area 3

The area is divided into sixteen (16) irrigation zones, Z13, Z13α, Z14, Z15, Z16, Z17, Z17α, Z17β, Z18, Z19, Z20, Z21, Z22, Z23, Z24α and Z24β. The irrigation networks of Vizari (Z13α and Z17β), Monastiraki (Z24α) and Genna (Z24β) have already been constructed and are operating. Each zone has the its equalization tank: Δ13, P1, Δ14, Δ15, Δ16, Δ17, P2, Δ18, Δ19, Δ20, Δ21, Δ22, Δ23, Δ24α, Δ24β. Out of these, P1, P2 and Δ24β are constructed as parts of the existing irrigation networks of Vizari, Monastiraki and Genna.

Irrigation Zones

The area under the project is divided into thirty (30) irrigation zones, each of which is served by an independent irrigation network.

Equalization tanks

Pumping stations

Transmission Pipes

Underground Pipe Networks

Pipes, Check Valves, Anti-Shock Valves, Vent Valves, Discharge Devices, Irrigation abstraction points, Shafts, Associated Road Works

Road construction

Roads for rehabilitation of existing roads	6.61km
Road for water transmission pipeline	10.8km

Platy spillway

Crest length	50m.
Maximum Flood Level (MFL)	+293.33

Peak outflow	970m3/s
Length of initial canal	100m
Length of drop channel	181m

Gerakari spillway

Drainage tunnels

Length at left abutment	305 m
Length at right abutment	210 m

Diversion pipe and Water Abstraction - Conduit

The flow of the Platy and Lygioti rivers is foreseen to be diverted during the construction phase of the project and the water to be drained downstream through a pipeline.

Regarding the Platy dam, two independent pipelines are proposed to be installed (one for diversion and one for water abstraction-discharge) at the foot of the right abutment. More specifically, the installation of an independent concrete pipeline for diversion and a steel pipe for water abstraction and discharge was chosen. In the case of the Gerakari dam, a rectangular cross-section of 4x4 m is foreseen in open excavation.

Valve box

At the outlet of each water abstraction-discharge pipe, a valve box is placed for the installation of the control and safety devices.

Borrow pits and disposal sites

Borrow pit A:surface about 130,185m^2, average length about 710m and average width about 185m.

Borrow pit B:surface about 60,000 m^2, average length about 960m and average width about 62m.

Borrow pit Γ:surface about 15300 m^2, average length about 155m and average width about 100m.

Borrow pit Δ:surface about 140,570 m^2, average length about 440m and average width about 320m.

Borrow pit E:surface about 101550 m^2, average length about 720m and average width about 140m.

Borrow pit ΣΤ:surface about 84245 m^2, average length about 343m and average width about 245m.

Borrow pit Z:surface about 154900 m^2, average length about 795m and average width about 195m.

***Borrow pit* H:**surface about 42880 m^2, average length about 550m and average width about 80m.

Borrow pit Θ:area about 36130 m^2, average length about 250m and average width about 145m.

Borrow pits Λ:The total area of the individual areas that make up the borrow pit Λ is at least 60000m^2. Estimating a minimum thickness of extractable quantities of 5.0m, total quantities are equal to 300000 m^3 .

Disposal sites: Disposal sites ΑΘ1 and ΑΘ2 are located on the terraces on both sides of the river downstream of the dam immediately after the spillway' s stilling basin. The disposal site ΑΘ2 is placed at the boundary of the borrow pit Γ. The disposal site ΑΘ3 is proposed at the western boundaries of the amoundment basin of the Lygiotis branch and is in contact with the borrow pit Λ2.

4.2 Description of the construction phase

The construction process of both dams will be carried out over time as follows:

1. Construction of the diversion pipe upstream of the dam
2. Construction of a coffer dam upstream of the dam, close to the mouth of the diversion pipe.
3. Construction of preliminary works and of the diversion pipe
4. Installation of construction sites
5. Start of dam foundation works
6. Construction of the dam and spillways
7. Start of construction of individual sections of the pipeline to Messara and tunnels
8. Completion of other works of spillway, water abstraction point and stilling basin

9. Deforestation of the part of the watershed that will be flooded

10. Blockage of the diversion tunnel and flooding of the amoundment basin

11. Completion of the pipeline to Messara with the parallel beginning of construction of the irrigation tanks

12. Construction of pumping stations and of connecting pipelines to the tanks

13. Completion of the irrigation network

During the construction phase, a significant amount of generation of earthworks and aggregates is expected. All of the materials for the construction of the dam will practically result from surface exploitation, while there will also be a significant amount of materials from the upper layer of the soil with organics and roots (topsoil) which will have to be removed and placed in a disposal site outside the impoundment basin. The estimate for the amount of this material with a depth of 0.30 to 0.40m is 230,000-300,000m^3.

4.3 Description of the operation phase of the project

Water pipelines are related both with the irrigation networks in the hydrological basin of Platys river, and the operation of the Faneromeni reservoir as well as the irrigation networks in the area of Messara. As far as Gerakari reservoir is concerned, the annual runoff is 7.871x10^6 m^3, while part of it, equal to 1,73x10^6 m^3, of the upper part of the Lygioti basin (including the evaporation volume of 0.33x10^6 m^3) will be stored in the Gerakari reservoir to be used during the irrigation season for gravity irrigation of the upper zones within the Platy basin (outflows for irrigation and environmental flow 1,344x10^6 m^3).

As far as Platy reservoir is concerned, the annual runoff is 33,214x10^6 m^3, while part of it will be stored in the Platy reservoir for covering the water needs of the irrigation networks of the Platy basin (9.55x10^6 m^3, approximately 88% of the total irrigation needs), for water transport (17,68x10^6 m^3) through the pipeline in Messara and for environmental flow (0.63x10^6 m^3) to Platys river. It is also noted that the safety volume for more than one year operation amounts to 1.5x10^6 m^3.

With the beginning of the irrigation season, the section of the water transmission pipeline within the Prefecture Unit of Rethymno will transport water from the Platy reservoir and fill by gravity in daily basis the equalization tanks of the irrigation networks within the Platy basin, downstream of the reservoir. Also, the pipeline will transfer water (17.68x10^6 m^3) from the Platy Reservoir to the Faneromeni Reservoir (MaxOL +157, MinOL +128, Useful V=18x10^6 m^3) while at the same time will

supply with water the existing irrigation networks of Messara, to cover water needs for the irrigation of greenhouses. The excess water will be available for the recovery - in suitable places - of the aquifer there, where the level has progressively dropped by 40 m in the last 40 years, such as in Phaistos where is at sea level.

The irrigation network of each zone operates by gravity and has been designed in terms of the diameters of the pipelines to better serve the farmers for 16-hour operation, i.e. the farmers can irrigate their lands within only 16 hours. Each tank has been designed so that during the peak period of the irrigation season (July - August) functions as a daily equalization tank, with a 24-hour supply period (from a pumping station or by gravity) and a 16-hour use. During the rest of the irrigation season when the consumption is lower, the volume of water in the tank is sufficient for more days, and therefore the operation time of the pumping stations is respectively reduced. The pumping stations that fill the tanks with water operate automatically with level sensors in the tank.

Because properties that are irrigated are small, each water abstraction point serves more than one farmer. To this end, as it is common in Crete, a special device (collector) is placed at the head of each water abstraction point from which up to 12 farmers can receive water. A flowmeter is placed on each connection to control water consumption. Irrigation is planned to be done with the drip irrigation method for reasons of water saving or for certain crops (up to 20% of the total crops) with the method of low pressure artificial rain.

4.4 Description of possible emergency events and relevant mitigation measures during the operation phase of the dam

The main causes of breach for rockfill dams are (1) by overtopping, (2) by piping, and (3) various other causes, such as foundation defects due to reduced strength of construction materials, foundation materials, or excess seismic load.

Overtopping occurs when the water level upstream of the dam rises higher than the crest of the embankment. The result of the overflow is the erosion of the crest of the dam and gradually of the embankment. To prevent overtopping, each dam has a spillway or suitable outlet works so that excess water is channeled downstream in a controlled manner. Despite the good construction and operation of such works, there are cases where the capacity of the dam's spillway is not sufficient to channel a large flood, resulting in overtopping of the dam.

Failure by internal erosion or piping begins when the velocity of water percolating through an embankment or abutment becomes high enough to drift fine-grained materials of the dam. As the

particles are removed, the water passage widens resulting in an increase of the flow rate. Thus, more and more particles are drifted with the widening of the passage. The end of this process is the formation of a "tube" within the body of the dam or abutment of sufficient size to destroy it. Rockfill dams have multiple zones of materials with different physical characteristics of permeability and grain size grading, some of which aim at reducing the amount of water that percolates, others at channeling the water leakages outside the embankment and others at retaining the materials and protecting them from erosion. In order to monitor the behavior and operation of the dam, movement and pressure measuring instruments are placed on the embankment and abutments, the outcomes of which must be reported regularly.

The reduced strength of dam materials affects the dam stability, having as impacts: (a) macroscopically, slope sliding, and (b) microscopically, the progressive erosion of internal erosion that may place it vulnerable to piping or trigger macroscopic material slip phenomena.

Any weaknesses in the foundation of a dam can cause a breach, regardless of its type. The existence of faults in the foundation zone is an important parameter to be examined during the study phase. The construction of a dam changes the distribution of loads in the area, resulting in possible movements of the foundation on which the dam is founded. In case of existence and relative movement of a fault due to the additional loads, these movements are often much greater than tolerable, resulting in a possible breach of the dam.

As it is well known, dam failures are a very rare phenomenon, not only in Europe but also in the rest of the world. In particular, based on data from the International Commission on Large Dams Database (ICOLD), dam failures reported worldwide are 178 out of a total of 17406 dams[2].

It is noted that out of these, 117 were dams built before 1950 (2.2% out of a total of 5268), while 59 were dams built after 1950 (0.5% out of a total of 12138). It should also be mentioned that 82 (46%) were in the USA while 22 (12%) were in India.

Regarding the possibility of emergency events that may be provoked, as well as the size and type of such events during the operation phase of the project, it is noted that in the context of the Detailed design, the Dam Breach and Flood Wave Propagation Study has been prepared for Platys dam. This study presents dam failure scenarios (piping and overtopping), as well as mapping of wave propagation through areas of interest, as well as predictions about mitigation measures to deal with any such extreme and dangerous events that may occur.

[2]Statistical Analysis of Dam Failures, ICOLD Bulletin 99, 1995

4.5 Project budget

Budget for the dams and water pipeline works: 67.99 million euros.

Budget for the irrigation network: 39.93 million euros

5 DESCRIPTION OF ENVIRONMENTAL BASELINE

5.1 Study area

For a better description of the environmental baseline as well as of the assessment of environmental impacts, the following terms have to be clarified:

- **Intervention area** includes all the surfaces occupied by the main Project, i.e. the dam, the Platy and Gerakari reservoirs, the water transport pipeline to Messara, as well as the irrigation network (including the necessary tanks and pumping stations). In this area, the associated facilities also exist, which mainly include the borrow pits, disposal sites and the road construction works.

- **Immediate study area includes** the area of Platys river basin, the areas to be irrigated and the area that extends at a distance of 1 Km on both sides of the water transport pipeline.

- **Wider study area** includes the Municipal Units, within which parts of the immediate study area lie in, i.e. the Municipal Units of Lampi, Sivritos, Koureton, Tympaki, Moira and Zaros and the coastal areas that fall within them.

5.2 Climatic and bioclimatic characteristics

The climate of the wider study area belongs to the Mediterranean type and is characterized by hot and dry summer as well as mild and rainy winter. Winter begins in November and the rainfalls observed are usually of low intensity and long duration, while rainfalls of high intensity and short duration will be observed rarely. The months with the highest rainfall are December and January. Spring is short - from April to mid-May - and is usually dry with little rainfall. Summer lasts until the end of September or longer and is hot and dry. The warmest months are July and August. Autumn is warm and humid and its duration is short.

5.3 Morphological and topological features

The terrain of the prefecture of Rethymnon is mountainous, with an extremely sharp relief in the eastern part, where Psiloritis mountain rises, having as its highest peak, Timios Stavros (2,456 m.) and the lowest peaks of Kourouna (1,855 m), Sitaras (1,575 m), Hameni (1,281 m), Timbanatoras (1,491 m), Skinagas (1,752 m) etc. Southwest of Psiloritis mountain and almost in parallel rises Kedros mountain (1,777 m.), which extends to the north with the peaks of Soros (1,186 m.) and Fortetsa (658 m.) stretches A lower range of mountains stretches on the south-west of Kedros and almost parallel to it, such as Vouvala (947 m.), the slopes of which drop steeply into the Gulf of Messara, while it

continues to the north with Siderota (1,136 m.), the Xiro Oros (904 m.), Kouroupa (984 m.) and Krioneriti (1312 m.), which is the most eastern peak of the White Mountains, that lie in the prefecture unit of Chania. The few lowlands of the prefecture unit are formed in the coastal areas and between the mountain ranges, such as the valley of Amari, between Psiloritis and Kedros Mountains, and the valley of Mylopotamos between Psiloritis and Kouloukona Mountains (1,083 m.).

The relief of the area is particularly intense, while it presents strong folds. More specifically, the areas to be irrigated do not form one and only area but are divided into different areas and in particular cover:

1. The hilly area around the settlement of St.Galini, which is defined in its perimeter (East-North-West) by the settlements of Mandres, Rizikas, St.Paraskevi, Orne, Melampes and St. George. The area is crossed by the river Platys and includes hilly outcrops with peaks with altitudes varying from 150 to 300 m.

2. The narrow valley, which is crossed by the upper stream of the river Platys (or Geros river). On the perimeter of the area are the settlements of Chordaki, Ano Meros, Drygia, Vryses, Kardaki, Gorgouthes, Gerakari, Mesonissi, Helenes, Smiles. Altitude wise, the area extends from 300m. up to about 600 m with slopes of 15% to 40%.

3. The wider valley of the river Lygiotis (or Geniano stream), which is a tributary of the river Platys The settlements of Petrohorion, Labiotai, Monastirakion, Obsigias, Amarion, Meronas, Genna, Apostoloi, Thronos, Kalogeros, Moni Asomatoma Vistagi, Platania, Vizarion and Fourfouras lie on the perimeter of the area. In terms of altitude, the area extends from 300m. up to about 550 m., with gradient from 8% in the central area to 20% on the slopes.

5.4 Geology, tectonic and soil features

A Geological study has been prepared for the project area with the aim of investigating the geological structure of the wider and narrower area of the project as well as the technical geological conditions that prevail taking into account the design of the project as well (M. Lionis and Aik. Lyon, July 2010).

According to the bibliographic data and the co-evaluation of the data that resulted from the preparation of the geological maps in the context of this study, both the alpine as well as the post-alpine formations that mainly cover the lowland and semi-lowland areas are found in the wider study area. The formations that lie in the wider area are briefly the following:

QUATERNARY – HOLOCENE Fluvial deposits of loamy materials with a significant percentage of loose gravels and cobbles

PLEISTOCENE Terraces

NEOGENE conglomerates, marlstone, sandstone sands

Fragment of limestones of various sizes and less chert. Their origin is mainly from the Pindos zone

INTERNAL ZONES

VATOS COVER Metabasalt metasediments: schists, metaradiolarites, marbles, serpentinous schists

ARBIS COVER Mudstones and margaic limestones

TRIPOLI ZONE Upper Jurassic dolomitized limestones and dolomites unbedded to thick-bedded gray to black

EXTERNAL ZONES

PINDOS ZONE (ETHIAS) Flysch: sandstone-siltstone. Transition layers. They consist of alternations of thin-plate limestones, sandstones, siltstones and locally chert. Tabular limestones: They are folded and fragmented.

PHYLLITE SERIES (CARBONIFEROUS-UPPER TRIASSIC) .It consists of a set of metamorphic, mainly pararocks with a few interspersed orthorocks. The pararocks are represented by schists (mica-chloritic, chlorite-muscovite, quartzite with sericite and hematite, carbonaceous-mica, graphitic-mica), phyllites (mainly carbonaceous-chlorite) and quartzites.

The geological formations that are present today and form the area of the Platy Hydrological Basin correspond to stratigraphic sections of certain geological units of Crete, most of which are presented in the form of tectonic rifts and which we list in similar order to their stratigraphic arrangement, from inferior to superior parts as follows:

- Section of Tabular Limestones
- Phyllite – Quartzite unit
- Unit of Tripoli
- Pindos zone
- Cover Arbis
- Cover Vatos

The newer Neogene and Quaternary sediments, which are represented by cobbles, marls, limestones, sandstones, clays, etc. are on top of these geological formations

5.5 Seismicity

The wider area of the study and more generally the area of Crete is located in the southern part of the Hellenic Arc which is one of the most active seismic areas along the convergence zone between Eurasia and Africa, which shows intense seismic activity associated with earthquake events both at higher and intermediate depths. According to the New Greek Anti-Seismic Regulation, the area of interest is included in the second seismic risk zone (II). The resulting ground acceleration related with the gravity acceleration is α=0.24.

5.6 Surface and Groundwater

Surface Waters

Platys river in the north eastern part of the Prefecture Unit of Rethymno has an average annual surface runoff of $51*10^6$ m^3, which is the largest of any other river or stream in Crete and which is directed and ends up in the waters of the Libyan Sea.

The hydrological basin of the river Platys, which is part of the immediate study area of the project, is included in the drainage basin of the Southern Streams of the Chania - Rethymno - Heraklion Section (GR40).

The average annual volumes of atmospheric precipitation that supply it with water amounts to $279x10^6$ m^3 and after the losses from evapotranspiration ($129x10^6$ m^3 (46%)), flow on the surface with the final recipient being the sea ($51x10^6$ m^3 (18% - the largest basin runoff of Crete), while $99x10^6$ m^3 (36%) penetrate the permeable and semi-permeable geological formations of the basin, move underground and also discharge into the sea, far away from the coast.

Due to the unfavorable hydrogeological conditions within the Platys hydrological basin, only a very small percentage of the groundwater, of about 3% only, is recovered by pumping through wells to cover the water supply needs of its settlements and the irrigation of small isolated areas, when due to the dry climate of Crete - with a period of 6 months without rain - non-irrigated crops are currently not exploited. In this context, the construction of both dams and the water pipeline, which will transport the surplus volume of water (estimated at approximately $20x10^6$ m^3 per year) by gravity from the Platy dam to the Faneromeni dam and the Messara plain, is considered particularly necessary.

According to the Platys Basin Hydrological Study, the hydrometric stations 'St. Galini' (located near the mouth of the Platys River to the sea) and the 'Aylakas' station (located a little downstream of where the construction of the dam is planned) were used for the hydrometric data for Platys River. For the

'St. Galini' station, there are data of average monthly and annual runoff volumes of Platy river in 10^6 m^3 for the period 1968 - 2003, while for the 'Aylaka' station, the date provided cover the period between 1982 - 1997.

There is no runoff at any of the two hydrometric stations in August and September.

Runoff is recorded at the "Aulakas" station, but not at the "St. Galini" station in periods of low flows, mainly in the months of October, June and July. This is due to the fact that there are permeable formations downstream of the "Aulakas" position, having as a result that downstream the low runoff will penetrate as a total and will not recorded on the surface in "St. Galini".

Based on the Draft River Basin Management Plan of the Water Division of Crete (GR13), the study area includes the following river water bodies:

Code	Description	Type
GR0013000400260110N	PLATYS River	MID-MC
GR0013000400260100N	PLATYS River (downstream)	LOW-MS

There are no lake bodies in the study area, but there is a lake body outside the area as follows:

Code	Description	Type
GR001300030030H	ARTIFICIAL LAKE OF FANEROMENI	MID – D – S - S

This body is indirectly affected by the proposed Project, as it is connected to the irrigation activity in the Messara plain, as the Faneromeni reservoir does.

The coastal water bodies, which are related to the study area are listed below:

Code	Description	Type	Condition
GR1340C0022N	Coasts of the Libyan Sea – Chania/Rethymnon	deep hard	Good
GR1340C0018N	Gulf of Messaras	shallow mobile	Good
GR1340C0017N	Coasts of the Libyan Sea - Asterousia	deep hard	Good

The specially modified bodies are the following:

Designation	Type	Observations
ARTIFICIAL LAKE FANERWMENIS	MID-DSS	Inland reservoir
KOUTSOULIDI STREAM	LOW-M-S	From the Faneromeni dam to the confluence at Geropotamos river

Underground water

The geological formations in the catchment area of Platys river located upstream of the site of the examined dam were classified based on their hydrolithological behavior and divided into the following categories:

Karst formations:The circulation of water happens through secondary porosity (cracks, karst voids). They are distinguished as:

1. Limestones, dolomites, crystalline limestones, marbles of high to medium permeability, as well as limestones of medium to low permeability

2. Granular Formations: mainly alluvial deposits, of varying water permeability, but also deposits of moderate to low water permeability , such as sandstones, cobbles and margaic limestones

3. Practically impermeable or formations of selective circulation: flysch formations, but also formations of selective circulation of low to very low permeability

The main elements of the hydrogeological conditions that develop in the catchment area are concentrated in the flysch layers, which generally have low permeability and do not allow the development of significant underground aquifers. Hydrogeological basins of small area and low potential develop in the disintegration mantle, locally interbedded with the lateral logs, and in its tectonic stress zones and are discharged through springs at various altitudes. In case sandstone layers have important presence in the area, they also contribute to the development of the small individual hydrogeological basins.

The watercourses that can be distinguished in the catchment area of the Platys river are the following:

Karst aquifers

Psiloritis mountain is a karst system with rich water potential. The discharge of the system is mainly to the north and secondarily to the south east. The main discharge of the system to the north east is also connected to the gradient of the carbonates to the north east with relevant significant discharges of groundwater (Almyros spring in the north east section). The western-southwestern part of the karst volume of Psiloritis mountain is located in the hydrological basin of Platy river. No springs of significant flow are observed in the part of Psiloritis that is located within this basin, but only sources of relatively small flow. The Kefalovryso and Maha springs are found in the Fourfouras area, which emerge from lateral logs that cover the Tripoli carbonates.

The aquifer that develops in the Karst volume of Kedros is discharged at various altitudes, either at the contact of the carbonates of Tripoli with the underlying phyllites, or of the carbonates of Pindos with the stratigraphic discontinuities of the unit (flysch, chert) that play the role of an impermeable background and the base of the karst aquifer.

Mountain Samitos is mainly composed of carbonate rocks of the Pindos unit and is surrounded by flysch of the same unit. The contact of the two formations is tectonic due to the faults that submerge the rocks of the flysch. These faults separate Samito from the Kedro massif and the basin between them is covered on its surface by flysch. The northern part of Mountain Samitos is discharged through springs on the Lambiotes – St. Marina - Monastiraki – Amario axis. It is possible that a part of the underground karst aquifer discharges into Lygiotis river which forms a canyon within the limestones.

5.7 Sediment yield

The average annual debris flow depends on many factors, such as climate, soil type, land use, topography, the existence of reservoirs, etc. Measurements of debris have not been made anywhere in the wider area of the project, and therefore there are no accurate data for the calculation of the annual flow.

To calculate the sediment yield of an area, an empirical equation has been used, taking into account relevant assumptions for the average annual amount of rain and the erosivity of geological formations.

The outcome resulted in a calculation of about 1200 tons of debris per km^2 of the basin per year, that is, for 50 years, about 6.8 million tons or 3.8-4 million m^3 in total.

5.8 Habitats – Vegetation categories

The natural environment of the Prefecture Units of Rethymnon and Heraklion is characterized by a remarkable diversity, a fact that is fully justified by their geomorphology, which is a composition of mountainous masses, intense river meanders, plains and coastal formations. Its remarkable ecological value is enhanced by the existence of diverse agro-habitats, with the presence of a multitude of species of flora and fauna, but also by its geographical location and importance.

Various habitats that are formed based on the existing floristic formations, habits of the fauna species, the hydrographic network - hydrological regime, as well as on the anthropogenic modifications and changes of the environment are observed in the wider area of the study, i.e. in the Municipal Units of Lampi, Syvriton , Koureton and Tympaki. More specifically:

- Terrestrial – natural habitats (forest, scrub, maquis and garrigue),
- Artificial habitats of cultivated land (agro-habitats),
- Natural rivers and riparian habitats

5.9 Habitat types

The NATURA 2000 area 'Prassano Farangi - Patsos - Sfakoryako Rema - Rethymnon Beach and Geropotamos Estuary, Akr. Lianos Kavos, Perivolia (SCI - code GR4330004)' is to the north and outside the area of intervention, while the NATURA 2000 area Mountain Idi (SCI- code GR4330005)'. is to the east, within the immediate study area and at the border of the intervention area.

The Natura 2000 area of 'Mountain Kedros (SCI- code GR4330002)' lies in the western part of the immediate study area. Part of the intervention area (775.36 hectares - irrigation network) lies within the area in question. The categories of habitat types of this Natura 2000 area have been identified under the program "Identification and description of habitat types in areas of interest for nature conservation" which was prepared by the National Centre of Wetlands, in collaboration with research offices and the Universities of Athens, Patras and Thessaloniki (Ministry of Natural Resources and Environment 2001).

5.10 Flora

Crete has a rich and varied flora. It is estimated that around 2000 different plant species thrive on the island, several of which (10%) grow exclusively on it, such as the well-known evergreen *Platanus orientalis*. The flora of Crete is particularly rich in herbs such as: thyme, labdanum, and oregano. *Organium Dictamus* is one of them, which is a herb already known by Aristotle for its healing properties. Another unique characteristic of the flora is the variety of plane trees (*varietus cretica*), which remain green and retain their foliage throughout the year.

There is also a wide variety of flowers such as: tulips, cyclamen, orchids, etc. Due to the relief but mainly due to the climate, the flowering period lasts more than six months (from March to September).

Crete is known for its rich natural vegetation. The most rare plants of Crete thrive in the ravines and steep mountain slopes, such as in the gorge of Imbro, near the Kalergi refuge and the Spili Plateau. Such plants are *Ebenous cretica, Linum arboreum, Campanula pelviformis, Stachelina arborea and Petromarcula arboreum*. Cypress, plane, chestnut and oak-trees also thrive, as well as various wild flowers such as: anemones, daffodils, osiers, and grasses of the *ranunculus genus*. Other plants such as *tulipa bakeri, tulipa saxalatis, anchusa caespitosa, scabiosa alborinca and scabiosa minoana* thrive in the plains and high mountain peaks. Some African trees such as cedar and palm trees are also found in the coastal areas. The famous palm groves in Vai are a typical example of unique beauty, where the palm tree (*Phoenix theophrastu*) thrives. Other rare plant species are found along the coasts, such as *pancratium maritime, centaurea pumilio, anthemistomentell and Anthemis filicaulis (chamomile)*.

5.11 Fauna

Due to the geographical position and the paleogeographical and geological history of Crete, a particularly diverse fauna is found, consisting of species of heterogeneous geographical origin. Its strong morphology, characterized by mountain masses, gorges and caves, offers unique habitats for

shelter, foraging and rest. The same applies to fauna as to flora, since its development depends both on environmental factors as well as altitude and temperature.

5.12 Classification of ecological status of Platys river

Directive 2000/60/EC requires the classification of surface bodies to reflect the ecological status or ecological potential of surface bodies, as determined through biological, hydromorphological, chemical and physicochemical parameters. These parameters differ depending on the type of surface body. The target for surface waters was to have a good ecological status and chemical status by 2015. The concept of good ecological potential is used, instead of good ecological status for the highly modified or artificial aquatic habitats.

According to the Article 2 of the Directive:

- **surface water status** is the overall expression of the state of a surface body, determined by the lowest values of their ecological and chemical state.
- **ecological status** is the qualitative expression of the structure and function of aquatic habitats associated with surface water, which is assessed according to Annex V.
- **ecological potential** is the state of a highly modified or artificial aquatic habitat, which is classified according to Annex V.

5.13 Protected – ecologically sensitive areas

The boundaries of the protected areas near the immediate study area are described based on data obtained from the National Register of Protected Areas of the Ministry of Environment and Climate Change (website:www.ypeka.gr). Parts of four protected areas of the Natura 2000 network are being developed within the Platy Basin, two of which are Sites of Community Importance (SCI), in accordance with the Directive 92/43/EOK and the other two are Special Protection Zones (SPA), in accordance with the Directive 79/409/EOK. The boundaries of the areas included in the FYSI 2000 network are presented in the EIA Maps. In addition, there is a wildlife refuge in the area and P. Platys river, which is considered an important wetland according to the Census of Wetlands as Natural Resources of National Centre of Wetlands.

The protected areas within the immediate study area are as follows:

- GR4330005: Mountain Idi (Vorizia, Geranoi, Kali Madara) (SCI)

- GR4330002: Mountain Kedros (SCI)
- GR4330009: Mount- Psiloritis (southwest part) (SPA)
- GR4330006: Zoros – Agathi – Kedros (SPA)

5.14 Spatial Planning - Land Uses

The Municipality of Moira has an approved General Urban Plan with Gazette number 752D / 28.08.1997 as well as an Urban Planning Study with Gazette number 389/D / 05.05.2006.

The settlement of St. Galini of the Municipality of Lampi has a General Urban Plan with the Gazette number 797/D / 03/08/1994. Regarding the spatial planning of the Municipalities of Koureton and Zarou, spatial plans of organization of settlements of open cities have been assigned and their completion is expected, while regarding the Municipality of Tympaki, the General Urban Plan study is in the final stage (to be approved by the prefecture's decision). Taking into account the data of the 1999-2000 census of the Statistical Office, it appears that there are 21881ha of permanent crops in a total area of 90999 ha of the wider project area. The project area is mainly characterized by olive groves and vineyards.

5.15 Housing

Based on the housing statistics of the Statistical Office for the former Municipalities of Lampi, Sivritos, Koureton, Tympaki, Moira and Zaros which constitute the wider study area of the project, the buildings are approximately 24000 and in a percentage greater than 70% are used for a single exclusive use.

5.16 Historical and cultural environment

In the wider area of the project

There are several monuments of archaeological and cultural interest in the wider area of the project, i.e.:

1. "The ruins of a Minoan palace outside the settlement of Apodoulou" (Government Gazette 527/B/24.8.1967).
2. "Vaulted tomb close to the Apodoulou settlement" (Government Gazette 605/B/16.9.1965).

3. "The ruins of a Greek-Roman city on Kastri hill about 4 km to the SW of Apodoulou settlement" (Government Gazette 527/B/24.8.1967).

4. "The ruins of Roman buildings under the temples of St. John and St. Sofias" (Government Gazette 527/ B/24.8.1967).

5. "The ruins of a Minoan mansion at "Kartsali" or "Lake" 200m. south of the church of St. Sofias" (Official Gazette 527/B/24.8.1967 and Official Gazette 290/B/30.5.1983).

6. "The ruins of a Roman city in Ellinika, closer and to the west of the settlement of Vizari" (Government Gazette 527/B/24.8.1967).

7. "The ruins of a Greek city one kilometer south of the hill above Ellinika settlement" (Government Gazette 527/B/24.8.1967).

8. "The remains of a Minoan settlement excavated by the Germans at Harakas, near Monastiraki" (Government Gazette 473/B/17.12.1962).

9. "The ruins of a Roman settlement close to the monastery of Asomaton" (Government Gazette 527/B/24.8.1967).

10. "Minoan settlement and house on the peak of hills of Petri and Koryphi of Koukogiannis about 500m. to the NE of the Helenes settlement" (Government Gazette 527/B/24.8.1967).

11. "Hellenistic farmhouse in Merodiana on the foot of the hill, which lies on the NE of Helenes settlement" (Government Gazette 527/B/24.8.1967).

12. "The prehistoric and classic cave in Margieles, about 1 km. to the east of the Helenes settlement" (Government Gazette 527/B/24.8.1967).

13. "The ruins of a prehistoric settlement at the site of St. Onufrios close to the Mesonisia settlement" (Government Gazette 527/B/24.8.1967).

14. "The prehistoric cave of Kalogerospilios close to the settlement of Mesonisia" (Government Gazette 527/B/24.8.1967).

The most important sites are: Apodoulou Settlement, Ancient City of Eleftherna, Mikro Valaneio, House 2, Hellenistic Bridge, Archaeological Site of Monastiraki, Syvritos, Byzantine Temples, and the Idaio Antro.

5.17 Socio-economic environment

The prefecture unit of Rethymnon, while is the smallest prefecture unit of Crete, is located between the White Mountains and Psiloritis Mountain. This unit is located west from the Prefecture Unit of Heraklion and East from the Prefecture Unit of Chania. Cretan Sea lies on its north side while the Libyan Sea lies on its south side. It has an area of 1,496 km^2 and a population of 85,609 inhabitants (Statistical Office 2011). The capital of the prefecture is Rethymnon, while it is divided into five municipalities administrately, i.e St. Vassilios with Spili as its capital, Amari with St. Fotini as its capital, Mylopotamos with Perama as its capital, Anogeion with Anogeia as its capital and Rethymno with Rethymno as its capital. It can be concluded from the available data that the change in the population for the Municipal Units of Kouretons, Moira and Tympakio is positive, while is negative for the Municipal Units of Lampi, Zarou and Sivritos.

The economically active population in the wider study area is approximately equal to 45% of the total population. The percentage of those employed in the wider study area is approximately equal to 91% of the economically active population.

Regarding:

- the Municipality of Koureton, the percentage of workers in the primary sector is approximately 63%, in the secondary sector 9% and in the tertiary sector 27%.
- the Municipality of Lampi, the percentage of workers in the primary sector is approximately 37%, in the secondary sector 11% and in the tertiary sector 47%.
- the Municipality of Sivritos, the percentage of workers in the primary sector is approximately 46%, in the secondary sector is 9% and in the tertiary sector 40%.
- the Municipality of Tympaki, the percentage of workers in the primary sector is approximately 52%, in the secondary sector it is 8% and in the tertiary sector 35%.
- the Municipality of Moira, the percentage of workers in the primary sector is about 40%, in the secondary sector it is 16% and in the tertiary sector 41%.
- the Municipality of Zaros, the percentage of workers in the primary sector is approximately 58%, in the secondary sector it is 14% and in the tertiary sector 26%.

The economy of these Municipalities is mainly based on the primary sector and all the activities that develop around it. Their production structure is completely different from that of the Prefecture Unit of Rethymnon and the Region of Crete. Approximately 80% of the active population is employed in the primary sector, which dominates compared to the other two productive sectors.

5.18 Infrastructures

There is a well developed provincial road network in the study area. There is also "Nikos Kazantzakis" airport, which is the main point of arrival for foreign tourists with direct flights. The sea connection in terms of passenger transport is mainly from Heraklion.

A thermal power plant currently exists in Linoperamata (Heraklion Prefecture Unit), while the construction of a thermal power plant in Rethymnon is planned.

Eighteen WWPs operate currently all over Crete. There are only two WWPs (Tympaki and Matala) in the catchment area of the Southern Section of Chania-Rethymno-Heraklion (GR40), where our study area lies in. These WWPs serve approximately 10,000 residents with an average annual wastewater inflow of 3239 m^3/day. All the settlements in the study area are served a water supply network, while the majority of settlements are not served by a sewage network apart from the large settlements such as St. Galini which are served by WWP (eg St.Galini).

Furthermore, most regions are served by private irrigation networks, while the public networks are larger in area and capacity, but only cover a small part of the region.

5.19 Anthropogenic pressures on the environment

Settlements, wastewater treatment plants and olive mills can be considered as point sources of pollution within the Platy basin.

The diffuse sources of pollution within the Platy basin are related both to land uses and mainly to agricultural production and animal husbandry activities. An estimate of the annual pollutant loads within the Platy basin from the above diffuse pollution sources per source is given in the main text of the EIA.

According to the hydrogeological study of the area, the geological, tectonic and hydrogeological conditions in the basin are not favorable for the utilization of its large underground water potential. It will be required in the future a "Special Hydrogeological Study" to be prepared to identify small exploitable aquifers for covering the needs of the wider area.

In order to evaluate the quality of the surface waters within the Platys hydrological basin, a chemical analysis of surface water samples from two sampling sites, one on the Platys river and the other on the Lygiotis stream (measurements on 24/04/2010) was carried out under a special water resource management study, from the Laboratory of Environmental Chemistry and Biochemical Applications of

Technical University of Crete. Based on the results, it can be concluded that the water quality of both samples was very good for both water supply and irrigation, as the water category for both samples was: C2-S1.

5.20 Acoustic environment and Radiation

There are no recorded measurements of the existing noise or vibration level in the wider area. As far as radiation is concerned, the most likely sources are telecommunications and (mobile phone) antennas.

5.21 Atmospheric environment

The quality of the atmosphere in the wider area of the project has not been systematically monitored through measurements of emitted pollutant loads, etc. The assessment of the existing situation can be carried out taking into account the existing land uses and the most important sources of air pollution in the study area. As a result of this judgement, it was found that the wider study area has negligible impact in terms of the quality of the atmosphere.

6 ASSESSMENT AND EVALUATION OF ENVIRONMENTAL IMPACTS

6.1 Climatic and bioclimatic characteristics

The construction of the dam, water transmission pipeline and irrigation network is only indirectly related to the climate of the study area. The construction of accompanying road works is also not expected to have an impact. Overall, no impacts related to the climatic and bioclimatic characteristics are expected to be provoked by the construction of the project.

When the water level of the reservoir drops, leading to a reduction of the surface area of the artificial lake, the whiteness increases slightly, and the tendency to evaporate decreases. The phenomenon is local, around the areas that will be near the transition zone, and in any case the fluctuations in humidity will have a fixed equilibrium point. Fluctuations in the surface will result in the respective fluctuations in evapotranspiration.

Evaporation, which was calculated based on the Penman method, corresponds to the absolute humidity, because it can also be calculated as a mass of water vapor to the volume of air that contains it. To estimate the impact of evaporation in the wider study area, data on the vertical and horizontal distribution of absolute humidity (evaporation) are required.

The influence of the reservoir and its operation is limited to the narrow area around the reservoir. Thus, any impacts are reflected in the atmospheric humidity of the area in the immediate vicinity of the artificial lake. The spatial extent of the atmospheric moisture change is very small (just a fraction of 0.7% - percentage of the total area of the Platys watershed occupied by the lake) to affect the climate of this semi-mountainous area. The only case where the change can perhaps be identified is in the summer months, where the change in relative humidity will be more intense.

Additionally, a side effect of the increase in atmospheric humidity, which will be more intense during the early morning hours, is the increase in fog in the lakeside area. As for winds, the reservoir's influence is limited to the lakeside area, since winds in the wider area are dependent on larger-scale weather systems.

Based on the above, the expected impacts of the operation of the water saving works are assessed as not significant as they are not expected to significantly affect the climate of the area. However, they will be identified on certain days of the year.

6.2 Morphological, soil and landscape characteristics

During the construction of the Messara water transmission pipeline and the rest of the irrigation network (water transmission pipelines, pumping stations, reservoirs, etc.), local splits and displacements of the surface layer of the soil are expected, which will change the morphology and relief on a small scale. Wider-scale impacts are not probable, given that no projects will be implemented that involve the possibility of changing the erosion parameters or changing the composition, density and loading of the soil.

Excavations will be made for pits to be opened at the points where the pipelines will pass, resulting in small changes in the ground relief.

During the construction phase of the dams, two construction sites are planned to be established on both sides of the axis of the Platy dam (one upstream – one downstream).

Impacts from the construction sites will be temporary and not significant as they will only last for the duration of the construction works. Subsequently, the areas where the construction sites of the dams are located will be flooded, while all the construction sites located outside the impoundment basins will be restored and the landscape will return to its original state. The solid waste, apart from the municipal type of the workers on the construction site, is expected to be inert, coming from excavation materials, soil, rubble and other materials, parts of concrete, wood residues but also from materials of wells, tanks and cutting of pipelines. These impacts can be mitigated by the implementation of the foreseen measures which derive from the national and EU legislation for solid waste management.

In summary, taking into account the temporary nature of the construction period as well as the fact that the impacts can be mitigated by taking appropriate measures, the impacts of the project during construction are considered to be locally significant, temporary and partially reversible. However, as far as the floodplains of the dams are concerned, the impacts will be permanent and irreversible.

The construction of the Platy dam will inevitably lead to a complete change of the landscape in the area, since a water surface of 162 ha will be created. Accordingly, the Gerakari dam will lead to the formation of a surface of 15,4 ha

In particular, considering the morphological characteristics of the area, the settlements which are expected to have visual contact with the impoundment basin of the reservoir are the following:

- Platania
- Lampiotes

- Fourfouras
- Vizari
- Petrochori
- Ano meros
- Drygies

Out of these, the first five will have a visual contact with the north branch while Ano meros and Drygies with the north-northwest branch of the river. The settlements of Labiotes, Fourfouras, Vizari and Petrochori are expected to have full visual contact of the northern branch. The area of Fourfouras may have also visual contact to the other branch as well. Regarding the settlement of Platania, minimal visual contact with the reservoir is expected due to morphology, which at times is expected to be negligible due to the drawdown during the operation period. The settlements of Drygies and Ano Meros are expected to have full visual contact of the north-northwest branch, while Ano meros is expected to have partly visual contact of the northern branch. Accordingly, with the filling of the Gerakari reservoir, visual contact between the reservoir and the settlements is expected to be established with:

- Helenes
- Gerakari
- Mesonisia

It is estimated that all three settlements will have full visual contact with the reservoir in question.

The change of the landscape is not foreseen to degrade the aesthetic of the area, but on the contrary it will give to it a different character, as various examples throughout Greece prove that many times the impoundment basins have been a pole of attraction for agritourism activities and have been linked to the development of the area. However, it should be noted that within the year there will be a fluctuation in the level of the reservoir of the Platys and Gerakari Dam. Therefore, the respective areas of the impoundment basins will change, resulting in a more unfavorable picture from landscape point of view during the autumn period. It has to be also stated that the design of the project is such that the ecological flow will be ensured and the reservoirs will cope with the high volumes of runoff.

In any case, the assessment of the impact on the morphology, soil and landscape features is definitely important, in the sense that it forms a new landscape. Consequently the impacts are assessed as significant, permanent and irreversible.

During the operation of the remaining elements of the Project, it is not expected that there will be significant adverse impacts on the soil and topographic characteristics of the area.

Based on the above, the impacts that will arise regarding these environmental parameters from the operation of the water transmission pipeline, the irrigation network and the associated road construction works are assessed as moderately significant, permanent and irreversible.

6.3 Geological and tectonic features

There are neither active faults, nor any special geological feature in the wider area of the project that could potentially be affected by the construction work of the proposed project. Impacts on the geological and tectonic features of the area during the construction phase are expected to be practically negligible.

Regarding the hydrogeology of the area, and according to the existing data, no seepage is expected from the impoundment basin of the Platy dam to neighboring basins. It is estimated that the design of a grout curtain in the foundation surface of the dam, the depth of which will be determined after the completion of sample drilling and permeability tests, can prevent minor seepage from the foundation. Special attention should be given to the right abutment where stratified sandstone layers are developed when designing waterproofing measures.

In conclusion, there will be no problems in terms of geological stability both in the area of the project and around it, while any seepage due to hydrogeological -slightly adverse- conditions, are expected to be fully addressed with the proposed grout curtain.

Impacts on the erosion of exposed geological formations are likely to produce changes in the extent or thickness of soils. As these are located in lowland areas, they are burdened with debris during floods. During the operation of the Project, the debris are expected to decrease and therefore the lowlands will lack of natural enrichment. Given that some of these soils are connected to agricultural land, if relevant measures are not taken, quality degradation of the soils is possible, especially in areas where the water stagnates in winter. During the operation phase, no impacts are expected on the geological and tectonic characteristics of the areas where the water pipeline, the irrigation network and the road pass.

6.4 Surface and Groundwater

A key element in the construction of dams is the diversion of the waters of the watercourse in which the dam is placed in order for the construction work to take place. The diversion will be done in both

cases with a coffer dam and a diversion pipe on the left abutment, while a 0.3 km section of the Geropotamos stream and a 0.5 km section of the Platys river will be drained. These interventions are not expected to change the diet of the two watercourses in any part other than the drained ones, as the inflow of surface water is not significantly affected, since the length of the drained parts is only 4% of the length of Geropotamos (11.3 km in total) and 2.7% of Platy-Lygiotis length (total 22.4 km).

Regarding the interventions for road construction works and the installation of irrigation water transport and distribution pipelines, based on the routes that have been examined, it can be said that the works are expected to bridge elements of the hydrographic network at a total of 65 points (14 for the installation of networks and 51 for crossing roads), occupying a total of 5 ha of watercourse bed (0,5 ha for installation of networks and 4,5ha for crossing roads). Changes in the temporary flow of these water streams are not expected, but the water bodies and aquatic habitats of these places will be partly affected, given that the works will not be carried out in places important in terms of biodiversity.

An additional impact on the surface waters is expected from the pumping of water for water supply and other uses of the construction sites. Such uses are:

i. The on-site production of mortars
ii. The wetting of road surfaces and of borrow pits or disposal sites
iii. The maintenance and washing of vehicles and machinery

The amount of water that will be used in total is expected to reach 20,000 m^3 per year, i.e. about 0.05% of the annual flow of the Platys River. The environmental impact will be negative, but at the same time it will be negligible and temporary.

Regarding river water quality, the possible pressures during the construction phase of the Project are related to the drift of materials to the watercourses of the study area from the construction sites and areas such as borrow pits, disposal sites and dams. Common pollutants that may be washed away (usually by rainwater) are suspended solids, lubricants and petroleum products.

Cumulatively, the affected areas constitute about 0.01% of the river bed areas of the main watercourses of the study area[3], as well as 0.04% of the catchment areas. The impacts on the river waters of the study area are expected to be negative, insignificant, generally permanent and partially reversible, with the relevant adoption of remedial measures. In addition, these impacts are neither

[3]The estimate has been made with a total length of branches of 33.7 km and an average width of the basic bed of 8 m.

expected to change the status of the water bodies of the study area, nor to endanger the achievement of the objectives of the Water Framework Directive 2000/60/EC.

During the construction phase of the Project, no groundwater pumping is expected, while the river waters are not expected to be burdened by pollutants such as metal ions which may infiltrate into the groundwater downstream of the construction sites.

Regarding the flow regime at the river beds of Platys river and of Geropotamos stream, it is expected to change for a total length of 0.8 km, due to the diversion works (0.3 km and 0.5 km respectively). Given that in these sections the infiltration from the river bed is limited (this is why the positions are suitable for the construction of dams), the impact will be negligible and will have a strictly local character.

Based on the above, it can be concluded that the expected impacts on the groundwaters from the construction of the Project will be local, negligible, and temporary, while the status of the water bodies in the study area is not expected to change and the achievement of the objectives of the Water Framework Directive 2000/60/EC is not going to be affected.

Based on the scheduled works during the construction phase and the water impact assessment, zero to negligible impacts related to river water pollution are expected and no municipal sewage (treated or untreated) is expected to be released into river waters. At the same time, the expected impacts on groundwaters will be practically negligible. Therefore, the discharge of polluted or burdened waters of the Platys River to the sea is not expected, with the exception of the possible drift of suspended solids to the sea, with a more likely impact on the coloring of the waters and the increase in turbidity.

Also, the limited changes expected to occur in rivers and groundwater are not expected to alter the freshwater outflow regime in the delta (either surface or underground) since no water will be added or removed. Thus, the balance of fresh - salty water at the mouth of the river Platys is expected to be maintained at the current levels.

Interrupting the continuity of a river that preserves the natural and man made environment is a major intervention, which provokes changes in the hydrological regime in the part of the river that becomes a reservoir and in the part that is downstream of the dam. Therefore, subsequent changes and accompanying environmental impacts are expected. The flow dynamics of the Platys River will change in sections from the upstream boundary of the impoundment basin to the next confluence with the main branch downstream of each dam. This change corresponds to approximately 29% of the length

of the Platys River, while the respective impact on the Geropotamos stream will be of the same level (33%).

In addition, the section of Platys river downstream from Platy dam is cut off and the flow of water will be reduced. The new status will be a sum of the ecological flow of the dam and the flooding overflows during the winter season when the reservoir is full. Accordingly, the section of the Geropotamos stream downstream of the Gerakari dam is also cut off and the water flow is also reduced. The new regime is expected to be the sum of the ecological flow of the dam, the springs' discharges of the stream connected to the stream downstream of the dam and the flooding overflows during the winter season when the reservoir will be full.

The magnitude of floods downstream of each dam will be changed, resulting in a change in the operation of the flood plain but also a change in the function of the delta's wetlands. The smaller size of the floods in the downstream part of each dam creates dry conditions in areas that until now they were flooded a few times a year or a decade.

In conclusion, significant impacts on the river waters are expected due to hydromorphological changes in the Geropotamos stream and the Platys river, but also due to a change in the flow of nutrients and potential pollutants to the reservoirs and downstream. These changes are estimated to lead to the creation of water bodies which will have the characteristics of particularly modified bodies, as defined in the Framework Directive on waters 2000/60/EC and in Presidential Guideline 51/2007 which transposes the EU Directive into the Greek legislation. Therefore, the impacts on river waters during the operation phase are expected to be negative, significant, permanent and partially reversible by taking appropriate mitigation measures.

The reservoirs' filling and operation is expected to increase the reinjection of the aquifer systems which will come into direct contact with the reservoirs themselves. As for watertight plastic concrete diaphragms (blankets), their function is to isolate sections from permeable formations in order to reduce seepage from Platy reservoir abutments. Their function is combined with the minimization of the aforementioned infiltrations in places where the permeability of the flysch increases locally or the type of formations changes.

The reduction of runoff downstream of the two dams to the sum of flood runoff and ecological flow is expected to reduce infiltration in the bed deposits where some wells and water abstraction points are found today, both in the Geropotamos and Platy basins. It is likely that the remaining runoff will not be sufficient, resulting in the discharge of reduced quantities freshwater to the delta. This is possible

to affect the balance of fresh salty water in the Platys river delta, something that seems to be happening today since the flow of the river is hypodermic almost every year.

The replacement of the current irrigation systems which are found in natural springs in the southern branch of Geropotamos stream (which starts from the Aspa area and ends in the Agios Ioannis area, downstream of the Gerakari dam) by irrigation networks connected with the dam, is expected to release significant amounts of water during the summer season, which will contribute to the increase in the runoff of the stream and the increased availability of groundwater.

Therefore, it can be concluded that the construction of the two dams, the water transmission pipeline to Messara and the related irrigation networks of the Platy basin are expected to have major positive impacts on the groundwater of the study area, since they will contribute positively to the refilling of aquifers, some of which are today in an over-pumping regime, and the natural flow operation of the springs. Apart from this, limited negative effects are expected in the Platys river delta from the change in the balance of fresh - salty water, after the reduction of infiltrations in the river bed, downstream of the new dam. Therefore, the impacts on groundwater during the operation phase are expected to be generally positive, significant and permanent with some negative ones locally for which it is possible to take remedial measures.

The interventions of the Project during its operation related to impact on sea waters are limited to:

i. changes to freshwater discharges by the change in the groundwater flow regime in the Platys river delta and

ii. changes from the flow of debris, nutrients and pollutants due to the hydromorphological changes in the upstream parts of the basin.

In conclusion, the impacts on the marine waters of the study area during the operation phase are expected to be negative, local, insignificant, permanent and partially reversible.

6.5 Sediment yield

A reduction of the debris deposited in the river bed downstream and at delta area is expected. This reduction is estimated to change the delta's material flow balance, increasing the difference between materials transported annually by sea currents, in relation with materials transported annually by the river. Nevertheless, the magnitude of the change is not expected to be significant mainly due to the current state of disposal of the coarse grained materials in the area upstream of the Portes site.

Consequently, taking into account the limited duration of the construction period, this impact is considered to be insignificant and will be an indicator of the overall impact that the Project may have on the material flow balance of the Platy delta.

Furthermore, under normal equilibrium conditions of a river bed, debris is deposited along the river bed in a gradient. That is, the coarser grains are deposited in the more upstream zones and the finer grains, which are the erosion product of the coarse grains, travel along the river towards its mouth, contributing greatly to the formation of the dynamic balance of the river bed and acting as an energy consumer during the flow of the water. The construction of a reservoir and the presence of the debris within it has the consequence of strengthening the corrosive activity of the water downstream of the project. In this case, such an increase in erosion should be expected downstream of the project's stilling basin.

The impact is not considered significant, to the extent that it is mitigated, on the one hand by a river bed naturally shielded with suitable material (cobbles, etc.) and on the other hand by limits on flow velocity (or discharge). However, it can become important when there is human intervention through material disposals, which are actually enhanced by the flow regulation caused by upstream projects, or when flow velocities (or discharges) exceed certain limits. In general, the river bed downstream of the Platy Dam should be protected by reducing material disposal downstream and by harmonizing the hydrograph resulting from the operation of the dam.

It is estimated that the impacts of the change of sediment yield will be moderately significant and, to the extent that they occur, will be irreversible for any formation at the mouth of the river, both in terms of morphology and of the preservation of the river delta area. In addition, the impacts are expected to be permanent, given that they will exist for the entire duration of the project's operation.

6.6 Habitats – Flora

The expected impacts during the construction phase of the dams and associated facilities on the habitats, vegetation and flora of the intervention area are related to:

- Habitat loss and deforestation,
- Installation of construction sites, operation of machinery and movement of vehicles,
- Noise and particulate emissions.

The potential environmental impacts expected on the habitats, vegetation and flora species of the intervention area from the construction of the Project are related to the following interventions:

- Diversion of the stream and habitat loss of a part of the bed of the Geropotamos stream and areas near the bed for the construction of the dam
- Diversion of the river and habitat loss of a part of the Platy river bed for the construction of the dam
- Habitat loss and deforestation for the construction of associated road construction works, water transport and distribution pipelines

The expected impacts during the operation phase on the habitats, vegetation and flora of the study area are related to:

- Creating a new habitat in the area,
- Changes in downstream river diet,

During the operation phase, negative impacts are expected initially on the vegetation of the intervention area that will be flooded. However, they are characterized as partially reversible and partially to be mitigated due to the new conditions that will be created for the growth of vegetation, as well as taking into account additional horticultural work in the areas of the project that need planting (around the proposed impoundment basins and all road interventions, as well as in the crossing areas of the pipelines of the irrigation network).

6.7 Fauna

The impacts that may be caused to bird species during the construction phase are divided into those due to the habitat loss and those that cause disturbance to species of fauna that live in the immediate area of the works under construction. The habitats that will be occupied due to the construction of the works do not constitute sensitive habitats for fauna species. It is estimated that the most important bird species use the immediate study area more as a foraging area than as a nesting area.

The area of the Natura 2000 Network, Special Protection Area (SPA) 'Soros-Agathi-Kedros (code GR4330006)' lies in the western part of the immediate study area and within the intervention area. The presence of fourty two important species out of a total number of a hundred bird species is reported in this area. Within the Natura area in question, 0,19 hectares of natural vegetation is

expected to be occupied by the construction of tanks Δ10 and Δ12 and pipelines. As mentioned above, the sections of pipelines that will be built within the Natura area are placed next to existing provincial, community or rural roads and therefore the opening of new roads is not required.

During the operational phase, the proposed project is expected to occupy mainly areas with olive groves, with complex farming systems and land mainly covered by agriculture with significant areas of natural vegetation.

The negative impacts that may be caused to the species of fauna during the operation phase of the Natura 2000 area 'Soros-Agathi-Kedros (code GR4330006)' are separated into the direct ones, which are negligible due to the small area occupied by the project in the Natura area, and the fact that no sensitive habitat of fauna species is occupied in the wider area, and in the indirect ones which are also considered the most important ones due to the further intensification of crops from the increase in irrigation and therefore the increase in productivity which also leads to an increase of crop spraying to the environment and avi-fauna with pesticides.

Due to the nature of the project, the provoked impacts on the fauna by the operation of the reservoirs are characterized as minimal. Taking into account that the operation of the project does not require frequent human presence nor frequent vehicle traffic, it is concluded that during its operation phase no negative impacts are caused to the species of fauna in the impoundment basins.

In addition, the creation of the impoundment basins and reservoirs could even have positive ecological impacts on the species of flora, fauna and avi-fauna provided that:

- water will be managed efficiently so as to maximize the extent of the inundated area in the summer season and
- there is control to avoid drawdown in the reservoir so that the aquatic vegetation on the banks of the reservoir can develop and be conserved as a shelter and feeding ground for many species of fauna and avifauna

6.8 Land use

As far as the construction of the dams, the water transmission pipeline and the associated road construction works are concerned, the impacts are related with the land occupation that currently have other uses from the different parts of the project. In total, the lands that will be flooded during the creation of the reservoirs of the two dams amount to 177,4 ha and mainly are agricultural lands to

be expropriated. Therefore the character of these areas will gradually change until they are permanently modified (flooding).

During the construction phase of the water transmission networks, no change will be caused to the land uses of the area, since major part of the pipelines of the network will follow the alignment of the existing roads. Even in cases where the networks pass through rural areas or areas of undisturbed natural environment (few cases given the rural character of the area), the interventions for their construction will be small and immediately reversible (the pits that will be dug for the placement of the pipelines will be rehabilitated). Therefore, it is estimated that there will be no impact on land uses.

Consequently, impacts are estimated to be provoked mainly by the construction of the dams and are considered to be moderately adverse, taking into account the small area affected, permanent and irreversible.

During the operation of the project, changes in the land uses of the area are expected. In particular, the construction of the irrigation network will create the right conditions to convert the majority of dry farming in the area into irrigated ones.

However, there will not be significant changes in the classification of crops in the irrigated areas of the immediate study area. The purpose is to meet the needs of the main types of agriculture in the area such as olives, vineyards and vegetables.

6.9 Built environment

Taking into account the size and duration of the project, it is estimated that there will not be a significant need to increase the availability of residence for workers, given that the staff required for the construction of the project is expected to either come from the wider study area or stay in existing rooms for rent in the area. Therefore, the impact on the housing sector is assessed as negligible.

Although houses are not expected to be flooded by the creation of the two reservoirs, egg production facilities are expected to be flooded. It is emphasized that the creation of the impoundment basin is aligned with the project's objectives and that the flooding of the facilities in question is the only adverse consequence of the operation of the project.

In conclusion, the built environment of the area is not expected to change particularly, maintaining its predominant rural character.

6.10 Historical and cultural environment

The closest archaeological sites to the area of the dam works are the following:

the ruins of Roman buildings associated with the temples of St. John and St. Sofias, which are located near the location of the proposed tunnel of St. Ioannis

the ruins of the Roman city at the Greek site, close and on the south of the settlement of Byzari, the undefined boundaries of which are established by the autopsy carried out by the study team and representatives of the relevant archaeological authorities, lie in the basin that will be flooded.

The archaeological site "Margele's Cave" near the village of Helenes.

During the Preliminary Environmental Assessment procedure, field visits were carried out to all these three sites by the environmental team with archaeologists from the competent authorities in order to conduct an autopsy of the sites and prepare their opinions in written form under the environmental permitting procedure.

Regarding the irrigation network and the water transmission pipeline, the impacts on the cultural heritage of the wider area are considered negligible. It should be noted that the water pipelines will be placed mainly along the already opened roads (provincial network, rural roads and forest roads).

In addition, during the design phase of the irrigation network and its associated facilities, all suggestions according to the document with protocol number ΥΠΑΙΘΠΑ/ΓΔΑΠΚ/ΔΙΠΚΑ/ΤΑΧ /ΤΑΧ/121801/35369/7026/5514/14-11-2012 Decision of the Minister of Education and Religion, Culture and Sports as presented in Annex III of the EIA have been taken into account. More specifically, the design of the pipelines has been done in such a way that it does not pass through the archaeological sites in Monastiraki and in Skoufia.

With the beginning of the operation of the project, as it was identified from the study team that visited the study area, a small church (St. Eleftherios) that is located inside the impoundment basin will be flooded. A small bridge lies also in the north-northwest branch of the impoundment basin. Given the importance of the project under study and the resulting benefit of the project for the wider area, the impacts in question are evaluated as insignificant.

Based on the aforementioned, the negative impacts on the historical environment of the study area from the proposed project can be characterized as not significant at this stage, while they may become moderately significant after the completion of the archaeological excavations and investigations. Finally, they can be evaluated as permanent and irreversible.

6.11 Socioeconomic environment

During the construction phase of the project, the socio-economic impacts are estimated as positive, given that the project will provide several temporary jobs and will have a positive impact on the economic life of the wider area. The increase in the demand for labor force, materials, construction machinery, etc., will result in the strengthening of the economy in the construction sector.

The project under study is expected to have positive economic effects in the wider area, because it will contribute to improving the efficiency of the crops locally, to the intensification of production and consequently to the strengthening of the local economy. More specifically, the required quantities of water for irrigating the cultivated lands within the Platys river basin (4935 ha) will be ensured with the construction of the reservoirs, the water transmission pipeline and the irrigation network.

Irrigation in Messara plain will also be ensured without the need to pump groundwater – a practice that on the one hand leads to the degradation of groundwater, and on the other hand is energy consuming. In both cases (irrigation of agricultural lands: a) Platy and b) Messara), the operating costs of agricultural boreholes will be reduced. This will result in resource savings in rural areas and a possible increase in production due to excess water availability. This improvement in living conditions can encourage the residents of rural areas to remain in their homes and to prevent them from moving to the urban centers of the wider region.

In the field of flood protection, the Platy and Gerakari dams are expected to have a positive impact since they will provide the possibility to prevent the floods and to control the release of water in the riverbed. This will ensure the protection of the properties and the lives of the residents of the area, but also the minimization of the loss of agricultural land due to pick up.

During the operation phase, a small increase in employment is expected, due to the need for operation and maintenance of the projects.

In addition to the benefits to the immediate but also wider study area due to the sufficiency of water for irrigation, the reservoir that will be created by the construction of the dam is expected to be a pole of attraction for visitors in the area as it has happened with the construction of similar projects in other areas (e.g. Lake Plastira, etc). It is estimated that alternative forms of tourism, such as agritourism will emerge in municipal units that are far from the sea. The creation of the reservoir is expected to attract much more visitors to the area, something that will enhance the economic development of the municipal units in question.

6.12 Infrastructure

During the construction phase, there will be local traffic changes. Traffic on provincial roads will increase taking into account the movement of machinery and vehicles transporting aggregates as well as workers. Local traffic bypass will also happen on the existing road network. Since the immediate study area is not overloaded with traffic, the impacts are considered to be moderately significant.

It is estimated that the impacts of the construction of the project on the technical infrastructure of the area will be moderately significant, limited in time and partially reversible by taking appropriate mitigation measures.

The Project itself is a very important technical infrastructure project that is expected to contribute to the rational utilization of water resources, with particularly positive impacts, both for the immediate and wider study area, as well as for the area of Messara.

The construction of the irrigation network will be accompanied by an upgrade of the operation of the existing irrigation works that will be included in the network as it is expected to strengthen the existing irrigation networks by 30% of the total requirements and at the same time abolish groundwater pumping wells.

The operation of the project is expected to increase the traffic in the area due to the movements to and from the Platy and Gerakari dams. However, the existing roads are not overloaded with traffic and therefore the movements are not expected to provoke traffic problems.

As far as electricity is concerned, the operation of the project will cause a reduction in consumption since groundwater pumping for irrigation will be reduced. Therefore, there will be a small environmental benefit for the residents of the surrounding areas. Also, small-scale rearrangements are expected in the energy transmission networks that pass within the impoundment basin, which will be carried out after consultation between the project owner and the electricity provider in the area.

In conclusion, it is estimated that the impacts from the operation of the project on the technical infrastructure of the area will be positive, permanent and irreversible.

6.13 Noise

The assessment of site noise levels during the construction of the project can be done according to the British Standard 5228, Volume 1: 1984 "Noise control in construction and outdoor areas" (British Standards Institution).

Noise calculations during a typical project construction day for a construction machinery deployment length of approximately 200m is presented, based on BS5228

In order to calculate the noise from the construction works, the following assumptions are made regarding the machines and the operating times of the construction site:

- Ten hours of work per day (the mobile equipment is used for all or part of the ten hours)
- Mobile Earthmoving Equipment:
  - 3 excavators 30 kW (sound power: 116 Lwa), route 50m, 4 hours operation
  - 2 wheeled dozers 10 kW (sound power: 112 Lwa), path 50m, 4 hours operation
  - 1 wheeled loader 100 kW (sound power: 116 Lwa), distance 100m, 6 hours operation
  - Material transport trucks: 3 trucks 40 tn (sound power: 106 Lwa), route 200m, 10 hour operation
- Distance to the nearest receiver: 100m

Based on the assumptions and results provided in the study, the limit of Greek legislation is expected to be exceeded within a 210m wide zone. Given that the shortest distance from the construction site to a settlement is 400 meters (construction site location 5 from the settlement of St. Paraskevi), it is estimated that there will not be a noise problem in the settlements of the area.

Due to its nature, the reservoir does not produce noise during the operating phase. The main source of noise during the operation of the project is the operation of the electromechanical facilities, mainly in the pumping stations. However, by taking the appropriate protective measures (e.g. sound insulation) these impacts can be minimized.

6.14 Air

During the construction phase, an increase in traffic is expected, i.e related to both passenger vehicles for the transport of workers, and heavy vehicles for the transport of construction materials. This fact has as a direct consequence the increase in gaseous pollutant emissions in the project area from moving vehicles (greater number of heavy vehicles, reduced speeds, etc.), while dust emissions will also increase not only due to the movement of vehicles but also due to earthworks (excavation, deposits), the pick up of dust particles by the wind, and the transport, distribution and storage of aggregates. Regarding the emissions of particles from the operation of construction sites and the various construction works, these are expected to affect the quality of air in the immediate area.

For the estimation of the air pollution from the construction works of the new passenger station under study and the rehabilitation of the land zone (decommissioning and support of slopes) the exhaust gas emission coefficients based on the literature (US EPA, Ministry of Environment, Spatial Planning and Public Works-Greece) were used.

Based on the relevant results, the emissions of gaseous pollutants were found to be low and therefore their dispersion will have negligible concentrations in the wider area. As a consequence, the construction of the project under study cannot significantly affect the air quality. Also, it is estimated that the impacts of air pollutant emissions from the sources mentioned above will be of temporary duration (as long as the construction of the project lasts) and reversible, while by taking the appropriate measures, they can be mitigated.

For the construction of the dams, 120 truck routes are required daily which are estimated to cover an average distance of 2.5 km (indicative distance). Consequently, the total dust emitted during the construction of the dams is estimated at approximately 1.75 kg/day. Accordingly, for the construction of the water transmission pipeline and the irrigation network, the total dust emitted is estimated at 2.35 kg/day (75 routes at an average distance of 6 km).Therefore, no significant impacts on the air are expected during the construction of the proposed project.

Due to the nature of the proposed Project, it is estimated that there will be no emissions of pollutants into the air. An exception to this, is the road parallel to the pipeline, which may contribute to an increase in the traffic load in the area, however it is an increase which is estimated to be limited. It is emphasized that the area on both sides of the road under study is poorly developed. Also, with the operation of the project, an increase in fuel consumption in agricultural operation is expected due to the intensification of production. However, due to the existence of irrigation networks, the pumping of underground water will be abolished and consequently, fuel consumption or energy in general would not be required for this. The atmospheric environment is not expected to be affected by the operation of the project.

7 Mitigation of impacts

7.1 Climatic and bioclimatic characteristics

Since no impacts on the climatic and bioclimatic characteristics of the area are expected from the construction of the project, no additional measures are required.

During the operation phase of the project, any expected impacts are mainly related to the dams and specifically will be insignificant in terms of humidity (causing fog) and temperature change (increase of minimum temperatures) at a local level.

7.2 Morphological, landscape and soil characteristics.

Dams: The mitigation measures mainly concern the impacts that derive from the change of the relief of the ground and the stability of the formations. Therefore, good construction of the project should be ensured so as not to cause failures and unstable situations.

Disposal areas: Before the final use of the material disposal areas, a Special Technical Application Study should be prepared. The Study will refer to all the disposal sites for surplus materials proposed by this study. A possible solution would be the disposal of suitable surplus materials to local construction activities which may have a need to be supplied with quarry materials and earthworks.

Road Construction: Taking into account the least environmental disturbance, the design of the road was carried out with the proposal of important technical works. The construction of road works includes cuts and embankments of a limited extent and size.

Special care should be taken by the contractor to cover the slopes of the cuts and embankments with topsoil to minimize aesthetic intervention to the natural environment and to protect the slopes from erosion. The slopes of the cuts must be covered with a thin layer of topsoil (30 cm) and then with plantings. The use of shotcrete should not be allowed to support the slopes. The use of a similar type of concrete will only be permitted as a temporary slope support measure at the mouths of the tunnels.

It should be pointed out that, during the construction phase, it is necessary to adopt measures that apply to the construction of the dam, as mentioned above and they are related with the

management of earthworks, the temporary disposal of materials, the collection of lubricants and other petroleum waste.

Special attention should be given for the management of materials derived from the dismantling of existing road surfaces with high content of bitumen and tar, as well as the demolitions. These materials should be collected separately and disposed in a suitable area or in special collection bins.

Water transport pipeline to Messara: Since the pipeline to Messara will be built along a new road, additional mitigation measures have been described and are related to those for the construction of the project. Also, regarding the pipeline, the measures described for the irrigation network aplly likewise.

Irrigation works (networks, reservoirs and pumping stations): The impact on the ground due to the construction works of the pumping stations and tanks has to do only with the site of the facilities and is therefore of limited spatial extent. Excavated materials resulting from the construction work of the prementioned buildings will be temporarily stored in low piles in a specific area to be determined within the boundaries of the field and will be used during landscaping.

Construction sites: During the construction phase, special care should be taken to collect all types of waste. This waste mainly is related with lubricants and petroleum products from the machines and trucks as well as municipal waste from the construction site personnel. Also, suitable absorbent materials (sand, sawdust) will be available on the construction sites to deal with possible oil spills, which, after use, will be managed as hazardous solid waste. The management of toxic and hazardous waste should be done in accordance with the provisions of the Joint Ministerial Decision 13588/725/2006 (Government Gazette 383B/28.3.2006). The municipal waste will be collected by the competent authority of the Municipality (where possible) or under the responsibility of the Contractor for disposal in appropriate areas.

The impact on morphology and topological features is certainly important, in the sense that a new landscape is formed due to the flooding of some areas. Consequently the impacts are assessed as significant. Nevertheless, the change of the landscape is not considered to degrade the area aesthetically, but on the contrary, it will give it a different character. No impacts are expected from the rest of the works and associated facilities, apart from those provoked by the dams, and therefore no measures are required.

7.3 Geology and tectonics

Impacts on the geological and tectonic features of the area during the construction phase are expected to be negligible.

The mitigation measures during the operation phase are mostly related with the operation of the dams to avoid any kind of breach.

7.4 Surface and Groundwater

The main proposed measures are the following:

- Maintaining the continuous flow of the river upstream and downstream of the dam area through the diversion channel throughout the construction period of the project

- Complete deforestation of the flooded area. The non complete deforestation of the plant communities that will be flooded will probably lead to anaerobic conditions in the reservoir due to the decay of the organics, which, by experience from other dams, leads to eutrophication and the release of CO_2 and CH_4, having as a final result the degradation of the quality of the of reservoir water.

- The ecological flow of about 10 l/s should be released from the Platy dam on a continuous basis, in addition to the expected overflows and water releases from springs.

- The ecological flow of about 3.5 l/s should be released from the Gerakari dam on a continuous basis, in addition to the expected overflows and the water releases from springs. The assessment was made based on the ratio of runoff at the Gerakari dam site compared to the one at the Platy dam site.

- It is recommended to carry out systematic measurements of the water quality within the impoundment basin at regular intervals (for some parameters with on-line systems) to avoid the risk of water quality degradation in the reservoir. Additionally, it is proposed that these measurements to be extended throughout the river basin. More specifically, upstream measurements should take place before the impoundment basin, while downstream at the bridge near Petrochori and in the delta area.

- Special measures should be taken to increase the nutrient flow, with periodic emptying of each reservoir during periods of reduced overflows (eg when October – December rainfall is less than 50% of the average rainfall over time)

- The water quality of the reservoirs should be protected by the relevant sanitary regulations that will be established by the Water Department of the Decentralized Administration of Crete and will refer to water disposal and treated liquid waste in surface receivers

- During the construction phase the freshwater-saltwater interface in the Platy delta should be monitored to obtain baseline data. Monitoring should continue during the operation phase, so that if it is found that the ecological flow and the surface runoff of the downstream basin are not sufficient to maintain the balance at the pre-operation levels, the ecological flow can be gradually increased until the desired balance is reached.

7.5 Sediment yield

The estimated impacts on sediment yield from the construction of the dam are expected to be insignificant, while those from its operation are expected to be moderately significant. In any case the impacts will be irreversible due to the permanent character of the works. Nevertheless, during the operation phase, specific technical measures are proposed which can contribute positively to mitigate the problem.

7.6 Natural Environment/ Flora and fauna

During the construction phase, the following measures mainly refer to the protection against pollution, the disturbance of habitats, fire protection and the rational organization of the construction site and are summarized as follows:

1. The occupation zone of the project to be limited to what is absolutely necessary for the construction of the project.

2. During the earthworks, apply methods to reduce the dispersion of dust, by wetting the soil, especially during the dry season.

3. Do not dispose debris, oil and other waste in any location.

4. The removal of topsoil in places where mechanical oils, lubricants, liquid fuels, etc have accidentally been released. It is proposed to dispose the unsuitable soil in designated areas for excavation materials disposal and it is considered necessary to mechanically mix it with the rest of the materials.

5. Any damage to vegetation should be limited to the minimum possible and the instructions of the competent Forestry Department should be strictly followed.

6. Regarding riparian habitats, special attention should be given to the restoration of the diet of the watercourses that are not flooded by the reservoirs and to the avoidance of strong drift of soil material after the completion of the construction works.

7. It should be noted that direct measures for the impacts of construction works on fauna do not exist. However, restoring the vegetation through tree plantings or facilitating natural regeneration indirectly, aims at re-attracting species of fauna both to satisfy living and nesting needs.

In order to mitigate the impacts on habitat types and flora species, it is proposed to maintain throughout the year the minimum ecological flow to the downstream part of the river, which is proposed to be 0.63×10^6 m^3/year (for dry years). It is noted that the project operator should have the capability of increasing this flow in case of hydrologically rich years under the framework of the water management planning of the reservoirs.

A program should be implemented to monitor the plantation and wetland vegetation in the areas of the project where phytotechnical works will be carried out as well as around the perimeter of the reservoirs. This program will include a recording and evaluation report of the plantings and the wetland vegetation every 3 years for a duration of 9 years.

In addition, during the operation phase of the project, all measures should be taken to maintain the plantings, since they contribute to the improvement of the landscape of the area. More specifically:

- ✓ In the first year after their planting, the gaps that may exist due to seedling necrosis will be covered. It is estimated that the number of losses in the first year will amount to 20% of the total number of seedlings planted.

- ✓ In the first year after planting, it is recommended to water the seedlings during the dry period. After the second year, no watering will be required because the plants are estimated to have developed a root system for their further survival.

It is proposed to take special measures to protect the avi-fauna during both construction and operation phaseS.

7.7 Land use

The project zone should be marked in time during the construction phase, so as to avoid unnecessary interventions, while the land clearings should be carefully planned and defined precisely. Before the beginning of the construction works, the nature of each area on which interventions will be carried out, as well as the possibility of approval decision for intervention should be examined by the competent forest office, as long as it is an area subject to its operational provisions.

During the operation phase, mainly positive changes are expected in the land uses of the area, since the appropriate conditions will be created to convert the majority of dryland crops in the area to irrigated ones. The two reservoirs to be constructed could potentially become areas of special environmental protection in order to be protected and promoted as areas of attraction for alternative types of tourism.

7.8 Built environment

During the construction phase, and as far as the pump stations are concerned, special attention should be given to integrate them as smoothly as possible into the environment. Furthermore, after the end of the construction, all types of site facilities (offices, warehouses, workshops, etc.) must be removed under the responsibility of the Contractor of the project and all intervention areas must be restored.

7.9 Cultural heritage

As mentioned above, the project due to its nature and size may be adjacent to or within areas of archaeological interest. Since a large amount of works involves excavation works, all excavation works will be carried out under the supervision of the relevant archaeological services.

Given that all the appropriate site checks will have been carried out during the construction phase, due to the nature of the project and taking into account that all the necessary measures aligned with the current legislation are in force, there will be no impact on areas of cultural and archaeological interest from the operation of the project and therefore no measures are required to be taken during the operation phase.

7.10 Socio-economic environment

Given that the socio-economic impacts are assessed as positive, due to the fact that the project will provide temporary jobs and will have a positive impact on the economic life of the wider region, no additional measures are required.

7.11 Infrastructure

During the construction phase, there will be local traffic changes which will need to be addressed with proper marking of any deviations and speed reduction signs.

In any case, the transport between the settlements should not be interrupted and traffic should not be obstructed.

7.12 Noise

It is obvious that the noise pollution should not exceed the limits and criteria as stated in the national and EU Legislation. The noise limits of the Greek legislation for construction activities are determined in detail by type of machine and activity in a series of legal documents.

Due to its nature, the reservoir does not produce noise during the operation phase. The main source of noise during the operation phase is the operation of the electromechanical facilities, mainly of the pumping stations.

However, with the use of sound insultation, these impacts can be minimized. Specifically, the measures have to do with the selection of machines, the anti-vibration background and the heat-insulating covers of the machines, etc. so that the noise produced does not exceed the limits.

7.13 Air pollution

During the construction phase, minor impacts on the atmospheric environment of the study area are expected mainly caused by the dust emissions from the earthworks. Because the release of dust from construction site activities is diffuse, it is not possible to control it after it has been emitted. Therefore, the measures to deal with this form of pollution must be preventive, ie preventing the release of dust, and not corrective.

During the operation phase, no additional impacts on the atmosphere of the area are expected, given that due to the nature of the project, there will be no emissions of pollutants into the atmosphere.

7.14 Natural hazards

To avoid the occurrence of abnormal situations during the construction phase, all safety measures should be taken to minimize the risks of construction site accidents. During the summer months, the Fire Service will be informed about the locations of the construction sites so that there is readiness for prompt intervention in any case of accident.

Necessary prerequisite for the determination of the measures to deal with abnormal situations is that the following studies will have been prepared by the competent bodies:

- Study of Dam Failure and Flood Wave Propagation
- Contingency Plan in case of dam breach
- Dam Maintenance and Operation Plan

8 ENVIRONMENTAL MANAGEMENT PLAN

According to the Annex II of Law 4014/2011 (minimum contents of the EIA), an EIA includes an Environmental Management Plan the purpose of which is to ensure the effective protection of the environment and the implementation of the proposed measures, which will also include the proposed monitoring program. The monitoring program to which the operator of the project or activity is committed includes mainly the parameters, elements and indicators of the environment monitored, the methods, place, time and frequency of recording.

The Project operator considers his social responsibilities as an integral part of his activities and a key factor in the achievement of his overall objectives and he is therefore responsible for the health and safety of the workers occupied in the Project, but also for the sensitivity towards natural and man-made environment and for the establishment of harmonious relations with the local communities.

This Environmental Management System (EMS) is a useful tool, both for monitoring environmental parameters and for meeting the corresponding requirements. In addition, it provides a method of recording and monitoring the environmental performance of the Project.

The EMS adopts the following strategy used in other quality systems as well:

- Plan implementation
- Identification of goals
- Assessment and monitoring of performance

This strategy, implemented on a cyclical basis, aims at the continuous improvement of the environmental performance. In particular, the main parts of the Environmental Management Plan, developed by the company, include the following:

- Commitment
- Environmental policy
- Environmental impact assessment
- Active participation of local communities
- Objects and targets (performance indicators)

- Environmental management program
- Data logging and archiving
- Operation and emergency procedures
- Responsibility organization chart and reporting
- Education and awareness
- Control of environmental impacts, of the compliance with the existing institutional framework and of the environmental performance during the construction and operation phases.

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