

Water resources management in the framework of sustainable development

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Abstract

Two of the greatest problems of the human society are those related to water shortage and the degradation of the environment. The main causes of water shortage problems are (i) the demographic explosion, (ii) the rising of living standards, (iii) the short-term climatic changes and (iv) the management of water resources. It has been made clear that the measures taken so far have not solved the problem. This failure is connected to the following: (i) Anti-flooding protection is regarded independently from water-shortage problems. (ii) The overflow of rainwater during wintertime is left unexploited. The application of the artificial recharge of the aquifers would clearly improve the situation, not only in a quantitative but also in a qualitative way.

Water is also necessary for the conservation of hydrotopes and hydro-biotopes, mainly those developing around the Deltas. The construction of dams results in the retention of the sediment load, thus leading to problems in areas of Deltas.

Our proposals: (i) The application of the artificial recharge of the aquifers should be encouraged since it does not affect the sediment load. (ii) The existing and the programmed works should be reconsidered and adjusted to the spirit of the 2000/60 E.U. Directive.

Keywords: Water resources; Water shortage; Management; Sustainable development; Artificial recharge; 2000/60 E.U. Directive

1. The problem of water shortage

It is known that two of the greater problems of the modern society are the water shortage and the degradation of the environment. These two problems are directly related to the following factors (mainly):

- (i) The abrupt and uncontrollable, up to this time at least, increase of the world population, a phenomenon that is known as the “demographic explosion”. We should not forget that the world population has tripled over the previous century (20th century) and

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that the 4/5 of this increase was observed after 1950.

- (ii) The unusual socio-economic development, particularly after the 2nd World War, that resulted to the rise of the living standards.
- (iii) The small scale climatic changes [1].

It has been estimated that, when the world population doubles, the suitable water reserves of our planet will not suffice to cover the water-supply, irrigation, industrial and other needs. We could claim that, almost everywhere, a regime of water shortage has been established, which is more severe in some areas.

The water sufficiency, however, is not only a quantitative problem, i.e. it is not only connected to the precipitation, but it is also a qualitative one. This happens because it is possible, even in regions where, due to the favorable climatic conditions, there is water sufficiency, nevertheless, for various reasons, the water, surface and/or groundwater, is polluted in such degree that it has become inadequate for water supply, as well as for other uses, depending on the type of pollution.

Of course, in Greece the rate of population increase is one of lowest and it is not predicted to change over the next decades. In our country, given the Mediterranean climate, the problem of water shortage is connected mainly to the rise of the living standards, to the urbanization, to the irrational water use in the agricultural and industrial activities, as well as to the lack of “proper” environmental policy. All these factors lead to the pollution of the surface and ground water, as it happens, for example, with the excessive (and unnecessary) use of fertilizers.

2. Confrontation of the water shortage phenomenon

Up to now, the confrontation of water shortage consists of the construction of new irrigation and/or water supply drills, or the construction of

dams, where water is accumulated in reservoirs, and from there it is transported in the regions to be irrigated using pipes, or other means. Thus, in all cultivable plains, there are a great number of drills from which enormous quantities of ground water are drawn, without taking into account neither the true potential of the aquifers, nor the distance between the neighboring drills, etc.

Undeniably, many efforts of “proper” management have taken place; however, the results continue to be far from satisfactory, if examined in the long term. There is a continuous fall of the aquifers water level, as it happens in Thessaly (Greece) for example, where the water level falls continuously over the last years. For example, in Ypereia and Orfana basins (located at the borders of Karditsa and Larissa Prefectures), the mean fall of water level in some cases has been measured to 4–5 m/year, during the last years (Fig. 1) [2].

However, the great fall of water level has various consequences, which, unfortunately, are not taken into consideration. We could say that the drop of the ground water level creates a “chain reaction” of physical and geological consequences that can lead, in the future, to enormous socio-economic repercussions, the most important of which are the following:

- The abrupt depletion of the aquifers, with still undefined consequences.
- The abrupt decrease in springs yield, with all that this involves.
- Ground surface subsidence in large scale, which is usually accompanied by surface ruptures, sometimes of great extend. It is a phenomenon that progresses with the continuous fall of the groundwater level.
- Destruction of settlements because of the surface ruptures.

If the fall of water level is great in coastal plains, then the phenomenon of the salination of the aquifer occurs (sea water intrusion), as is the

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