

Water Management and its Judicial Contexts in Ancient Greece: A Review from the Earliest Times to the Roman Period

Jens Krasilnikoff¹ and Andreas N. Angelakis²

¹ Department of History and Classical Studies, School of Culture and Society, Aarhus University, 8000 Aarhus C, Denmark; hisjk@cas.au.dk

² Institute of Crete, National Foundation for Agricultural Research (N.AG.RE.F.), 71307 Iraklion and Hellenic Union of Municipal Enterprises for Water Supply and Sewerage, Larissa, Greece; info@a-angelakis.gr

Abstract: Ancient Greek civilizations developed technological solutions to problems of access to and disposal of water but this prompted the need to take judicial action. This paper offers an overview of the judicial implications of Ancient civilizations developments or adaptations of technological applications aimed at exploiting natural resources. Thus, from the earliest times, Greek societies prepared legislation to solve disputes, define access to the water resources, and regulate waste- and storm-water disposal. On the one hand, evidence suggests that from the Archaic through the Hellenistic periods (*ca.* 750-30 BC), scientific progress was an important agent in the development of water management in some ancient Greek cities including institutional and regulations issues. In most cities, it seems not to have been a prerequisite in relation to basic agricultural or household requirements. Previous studies suggest that judicial insight rather than practical knowledge of basic water management became a vital part of how socio-political and religious organizations dealing with water management functioned. The evidence indicate an interest in institutional matters, but in some instances also in the day-to-day handling of water issues. Thus, the aim of this review is to follow the development of water law and institutions and their technical solutions in the Greek states during the Archaic through the Roman periods. In addition, it demonstrates that the need for water management regulations is not a modern creation, but there is a long tradition for solving complex issues of water supply and use with rather sophisticated legal measures.

Keywords: Irrigation; water codes; Laodicea; The Law Code of Gortyn; the Laws of Solon; Magistrates and superintendents of water

PROLEGOMENA:

Ancient Environmental Legislations from Mesopotamia to Greece

Scholars have repeatedly pondered the possibility that some of the water management knowhow that emerged in the Greek Bronze Age and in the Archaic and Classical periods is of a Mesopotamian origin (e.g. Chatelain 2001). Undoubtedly, Greeks visited the Levant, Egypt, and the heartlands of Sumerian and Babylonian civilizations, but it remains a crux to determine whether the development of a Greek judicial practice concerning the handling of water issues is of a Mesopotamian origin.

Sumerians established the first known laws, which mainly focused on social and economic aspects, as they contained rules for proper compensation for damage done to others or their property. The laws of Ur-Nammu (*ca.* 2112-2085 BC) mandated compensation in silver for taking out a man's eye, and the code of Lipit-Ishtar (*ca.* 1934-1924 BC) set a negligence standard for property damage to houses. The Sumerian city-state of Eshnunna developed a legal code (*ca.* 1900 BC) that expanded upon the principles of compensation for damage done to others, addressing conflicts over sunken boats, goring oxen, biting dogs, and collapsing walls (Goetze 1951-1952). It is, however, not entirely clear, whether this involved types of damage caused by someone failing to maintain water works or discharging wastewater onto neighboring property.

The earliest regulations explicitly related to water management and especially irrigation, however, date back to the era of the Babylonian King Hammurabi (*ca.* 1792-1750 BC). Hammurabi had several laws listed pertaining to irrigation, possible negligence of irrigation systems, and water theft (Hatami and Gleick, 1994). Based on previous Sumerian laws, Hammurabi created his own code of laws, which consisted of 282 regulations and was enforced throughout his kingdom (Breasted, 2003), and supposedly ensured farmers' participation in the construction of infrastructure and a fair distribution of water to avoid conflicts. This early code covered: (a) distribution of water proportionally based on acres farmed; (b) the farmers' responsibilities in maintaining canals on their property; and (c) water apportionment and policy on irrigation arrangements as a collective responsibility of beneficiary farmers (Harper, 1904; Richardson 2004). These concepts constituted the foundation of irrigation in the

region, and although some of them were neglected during certain periods, new policy in many countries mirrors these principles as a feasible way of ensuring good management through farmers' participation. It is disputed among legal historians whether early Greek law was inspired by these early Mesopotamian examples. Moreover, it is disputed whether a 'unity of Greek law' developed sometime during the Archaic period – i.e. whether early Greek *poleis* (city-states) developed a uniform judicial response to solving conflicts. Rather, when we look at the part of the legislation devoted to regulating various forms of water management, it seems as if the *poleis* of the Archaic and Classical periods created ad hoc solutions to acute problems regarding access to water resources and disposal of waste- and storm-water.

The first laws and indications of an established court system in the Greek world emerged in Crete during the Archaic age (Gagarin 1986), and the diversity in the way different Greek societies chose to create their judicial systems was apparent from early on. The first legal inscription from Dreros in Crete dates to the middle or second half of the seventh century BC. The inscription explicitly states that *polis* enacted the regulations, which was almost certainly new, although it may originate from older oral judicial tradition. In Classical Athens during the democratic period (*ca.* 507-322 BC), the 'people's courts' supposedly developed their vital elements beginning with the reforms of Solon (594 BC), and were further adjusted and expanded during the democratic reforms of Cleisthenes (*ca.* 508/7 BC). Throughout the Classical period from Cleisthenes to the death of Alexander the Great, however, the Athenians continued to rethink their judicial system (Hansen 1991).

The Ancient Greeks had no official punishments or laws after the early Dark Ages. Presumably, in Iron Age societies, capital offences would often result in endless blood feuds, and the Greeks did not begin to publish laws on stone slabs (*stelai*) until the middle of the 7th century BC. Aristotle informed in his *The Athenian Constitution* that the lawgiver Draco wrote the first Athenian laws handed down to us in *ca.* 621-620 BC. According to this law, death was the punishment for willful homicide and exile for involuntary homicide. This law was the only one of Draco's laws maintained in 594 BC, when the Archon Solon, an appointed lawgiver, revised the Athenian law corpus. Allegedly, as the new lawgiver, Solon created a variety of laws that fitted into the four Ancient Greek law categories (Aristotle, *The Athenian Constitution*, *ca.* 350 BC; Stroud 1968).

Solon reformed the so-called ‘Draconian Constitution’ and according to later traditions, he introduced the principle of sharing the limited water resources of Attica for the benefit of those farmers in need of water (Plutarch, *Solon* 23.4). In addition, from the 7th century onwards, the civic governments of the Greek city-states published laws as inscriptions on stelae in order to solve and prevent disputes between citizens. Thus, from an early date water management and its many different complications had the attention of the civic authorities. In addition to different types of injury laws, Solon also wrote laws for the placement of houses, ditches, and wells (Aristotle, *The Athenian Constitution*). We hear of no legal disputes over water rights from the Spartan context, however. Expert colleagues and in particular the Laconia survey suggest that the Spartan economy rested on the relative fertile and well-watered nature of the Laconian heartland and subdued Messenia (Cartledge 1979; Cavanagh *et al.* 2002).

A few examples involving human interaction with the natural environment survive from the 4th century Athenian forensic evidence. Most of these, however, is primarily concerned with religious issues. Thus, the trial against one Athenian citizen for cutting down an olive trunk sacred to Athena deals with a possible case of *asebeia* – ‘ungodliness’ – not an example of protecting the environment (Lysias 7. 3, 32, 41; Also Demosthenes 43, 71 on the cutting of any olive tree in Attica; Isager & Skydsgaard 1992). Moreover, additional locations were sacred to specific Gods of the Athenian pantheon (Hughes 1994). One such example was the *Hiera Orgas* at the border between Athens and the neighboring city-state Megara. Here, a sacred precinct for the Goddesses Demeter and her daughter, Kore (Persephone) gave rise to quarrels between the two city-states prior to the Peloponnesian War (431 – 404 BC). Amongst the complaints raised at the outbreak of the Peloponnesian war, the Athenians accused the Megarians for cultivating the precinct, which was to be left untouched. In the 4th century BC, the precinct tricked yet another controversy between two Athenian fractions on whether to leave the precinct uncultivated or to commence cultivation (Rhodes & Osborne 2003, no. 58).

In the Roman period, a special reference to the protection of the environment was included in Julius Pollux *Onomasticon* (7. 146. 1-4), presumably dealing with the Athenian context:

Do not burn, or subtract their stems, or saw, or cut the grove, nor subtract wood or stripped branches (i.e. trees); if anyone is arrested for cutting from the grove, he is punished with fifty lashes.

This paper intends to show that the study of the environment and its judicial contexts focusing on water management issues in ancient Greece may be useful for understanding the historical roots of our modern water resources legislation. The development of institutions and regulations making on issues concerning water management in the urban and rural areas (*i.e. poleis*) of the Archaic through the Classical, Hellenistic and Roman periods are considered. These judicial contexts represents the beginnings of a conscience development of water resource legislation, whose key-elements remained relevant throughout European history - and the best proof that *the past is the key to the future*.

PREHISTORIC GREECE

There is next to no relevant information on the development of water management and its judicial implications from prehistoric Greece. Early prehistoric civilizations flourished in plain areas close to rivers, where water for agricultural development was readily available (e.g. Mesopotamians near the rivers Tigris and Euphrates in Asia, Egyptians near the Nile in Africa, Indians near Indus River, and Chinese civilizations near the Yellow and Yangtze River basins). To the contrary, but with the exception of the Minyan culture at Gla, by the Lake Kopais in central Greece, the majority of the earliest Greek societies avoided the establishment of their major urban centers close to rivers, lakes, or rich springs (Angelakis *et al.* 2016). Close observation of the locations of these centers suggests that the Ancient Greeks chose to establish most of them in the driest areas (Fig. 1). The exact reasons for this are not clear, but we can assume that ancient Greeks of the prehistoric periods considered a dry climate as more convenient or healthier; ostensibly, this choice of location offered good protection from floods and water-related diseases (Koutsoyiannis 2012; Koutsoyiannis *et al.* 2008). One recent survey by Crouch suggests, however, that an alternative to locations close to major watercourses was to choose regions with rich karst formations. Although Crouch's focus was on the development of Classical Greek urban centers, much speaks for the idea that this logic applied to Bronze Age societies as well. The implication of this is that from an early date, storage of water

Recently, Angelakis (2017) demonstrated that the Minoans developed advanced infrastructure for integrated water resources management with provision for matching demand and supply and possible increased future needs. Apparently, one significant characteristic of the Minoan civilization was its peaceful living with the environment and neighboring societies. The Minoans dominated the Eastern Mediterranean for almost two millennia, and apparently, according to later tradition echoed in the work of the 5th century BC historian Thucydides, they took an active part in restricting some of the conflicts that occurred in the region by forming a *Thalassokratia* – or ‘sea power’ (Angelakis 2017). For that reason, A. Evans (1921-1935) associated the Minoan era with *Pax Minoica* (or Minoan peace). Although there are strong indications that the Minoans lived in harmony with the environment and that they accomplished significant advancements in technology, art, and culture, new advances in studies of cultural exchange in the ‘Minoan World’ demonstrate different developments in the Southern and Eastern Aegean, respectively (Gorogianni *et al.* 2016). In addition, Angelakis (2017) argued that the Minoans developed advanced infrastructure for integrated water resource management with provision for matching demand and supply and possible future increased needs.

CLASSICAL AND HELLENISTIC GREECE

The Minoan technological achievements passed on to the Mycenaeans, but we cannot establish a direct lineage of Archaic and Classical Greek societies inheriting Bronze Age achievements. However, it is a possibility that during the Dark Ages (*ca.* 1100-750 BC), the technological achievements of the Bronze Age were not totally forgotten. ‘Bridges’ from the past to the future are sometimes present, albeit oftentimes, they are invisible to those who cross them. The several types of cisterns developed in Minoan and Mycenaean times provide a characteristic example of survival, as they are still widely used on many anhydrous islands (Angelakis *et al.*, 2013). In addition, Angelakis (2017) has recently argued that one of the great achievements of the second millennium Hellenic cultures was to instigate technological developments that were unprecedented in world history, displaying numerous paradigms on water resources technologies, their uses as well as household, water and waste and storm water management.

In the Classical through the Hellenistic periods, ancient Greek societies managed to establish balances between structural and nonstructural (institutional) measures to

improve water management. These involved both large-scale (e.g. the Peisistratean aqueduct of 6th century Athens) and small-scale (wells and cisterns) projects. In addition, throughout this period, public interest in large-scale waterworks grew in parallel with a private interest in the development of small-scale waterworks to underpin local needs for water management (Koutsoyiannis *et al.* 2008). In Athens, for example, the two main streams, Ilisos and Kephisos, and the small springs in the area could not meet the demand of the city. Consequently, the Athenian *demos* saw to the establishment of a water supply based on both public and private wells (Fig. 2). Archaeologists have identified more than 400 wells with a great variation in depth, ranging from 2.5 to 37 m, dating from the early Classical to the Roman periods (Angelakis *et al.* 2016). For long, scholars have recognized the well-known aqueduct attributed to Peisistratos' tyranny (546-527 BC) as the most important public hydraulic construction work of that time. In addition, from around the same period the famous Eupalinean aqueduct known as *ὄρυγμα* (tunnel) was constructed on the Aegean island Samos (Vudouris *et al.* 2016).

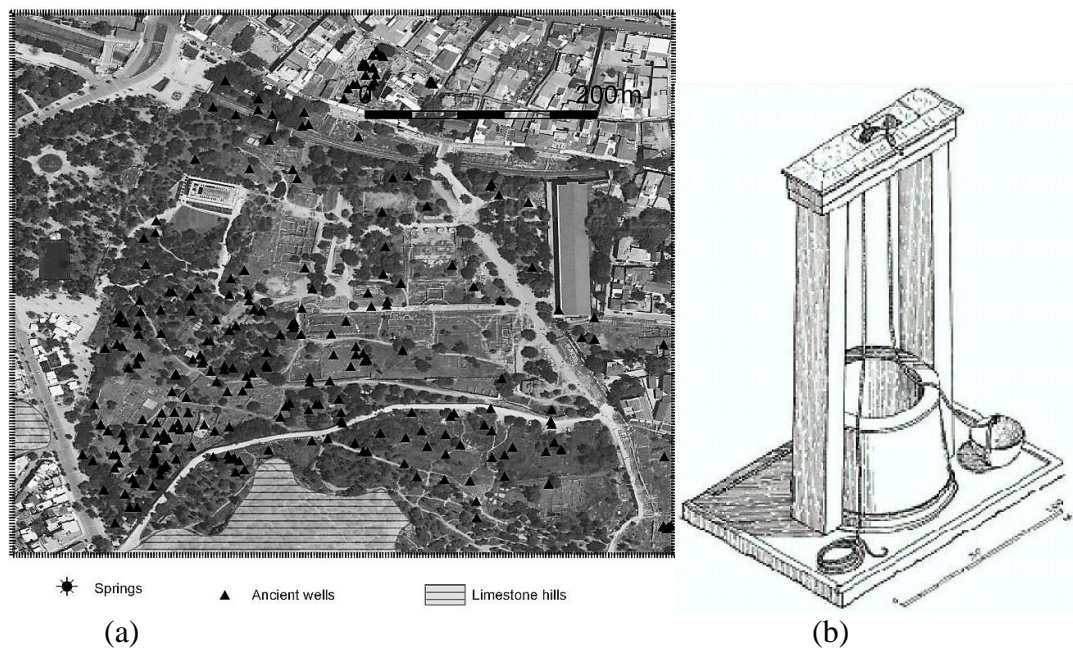


Figure 2. Wells from the Classical period: (a) Distribution of ancient wells around the Athenian Agora (data from the American School of Classical Studies at Athens) (Chiotis and Chioti 2012) and (b) Sketch of a typical well (Camp 2002).

After the introduction of egalitarian rule or democracy in Athens in 508/7 BC, wells gradually complemented or replaced cisterns. The construction of cisterns was a

known practice in earlier periods; for instance, several cisterns originating from the 6th century BC have been found inside the Acropolis wall to the left of the Propylaea (Koutsoyiannis *et al.* 2008). Moreover, the principle of constructing water cisterns became a widespread practice in many Greek communities in the Hellenistic period.

Apart from developing applied technologies for the construction of adequate water supply as well as drainage and sewerage systems in urban centers, several city-states developed legislative frameworks for water management. Ostensibly, Solon, the Athenian political leader and poet, who was elected Archon in 594 BC and shaped a legal system by which he reformed the economy and politics of Athens (Angelakis *et al.* 2016; Koutsoyiannis and Patrikiou 2013), introduced the earliest extant regulations. According to the late source Plutarch (45 – 120 AD), Solon established, among others, a legal system to regulate and encourage the use of wells:

“Since the country was not supplied with water by ever-flowing rivers, or lakes, or copious springs, but most of the inhabitants used wells which had been dug, he made a law where there was a public well within a *hippikon*, a distance of four furlongs, that should be used, but where the distance was greater than this, people must try to get water of their own; if, however, after digging to a depth of ten fathoms on their own land, they could not get water, then they might take it from a neighbour’s well, filling a five-gallon jar twice a day; for he thought it his duty to aid the needy, not to provision the idle” (Plutarch. *Solon*, 23.5. Translation by Bernadotte Perrin. Cambridge, MA. 1914.).

Scholars disagree on whether or not Solon’s reforms and individual laws had any relevance for the conditions in the Classical period (e. g. Foxhall 1997). The fact remains that no evidence supports the idea that Solon’s regulations were in fact used to eliminate or reduce problems of water deficiency in the Classical period – let alone in his own days. More acute is the question of how 5th century Athens and Attica were able to sustain the growing population in the aftermath of Persian wars (499-479 BC), including the question of water resources (Raaflaub 1998).

During the so-called Golden Age, Athenian culture flourished under the leadership of Pericles (495-429 BC). During this period, the Athenians built mainly small-scale constructions to facilitate household requirements, as well as developing an institutional framework for the sustainable management of water (Koutsoyiannis *et al.*, 2008). Furthermore, there was at least one public official responsible for waterworks even in the early 5th century BC, named *κρουνών Επιμελητής*, (i.e.

superintendent of fountains). The aim of his appointment was to secure the operation and maintenance of the city's water supply system, to monitor the enforcement of the regulations, and to ensure the fair distribution of water. He was (according to Aristotle, *The Athenian Constitution*, 43.1) one of the few city magistrates, who was not appointed by lot, but was elected by vote, such was the importance of this functionary's honesty and know-how (Tassios 2002). Demosthenes and Themistoclēs among others had served in this post. Moreover, it may indicate that suitable candidates for this magistracy would need special skills in order to be successful candidates to this important job of overseeing the water supply. An Athenian decree concerning the Athenian water supply involving Pericles' family is shown in Figure 3 (Krasilnikoff 2016). The so-called 'Springhouse Decree', probably issued no later than 430 BC, included regulations regarding the Athenian water supply. Woodhead (1973-1974) observed that: "The meagre remains of lines 5 and 7 make it evident that there is a problem of water-supply or drainage; line 8 stresses a need for economy in the financing of what is to be done; lines 9 and 10 reflect some intention to press ahead quickly with the business in hand. Lines 14-16, in the second amendment, relate the matter to Perikles' sons Paralos and Xanthippos, to the phoros (tribute) derived from the Athenian allies, and to some thing or things apparently customary or statutory in relation to this". Moreover, according to Mattingly (1996), the decree "...demonstrates that Pericles' family and his wards had offered to defray its costs, but the Assembly decided that it would be paid for out of current tribute". He takes this decree as an example of the strife where 'the oligarchs' prevented the Periclean family from exploiting this situation to promote and extend their patronage bonds (*JG I*³ 49. Mattingly 1996, 508-9; see also pp. 24-25 and 193-194 for new reading of the Greek text).

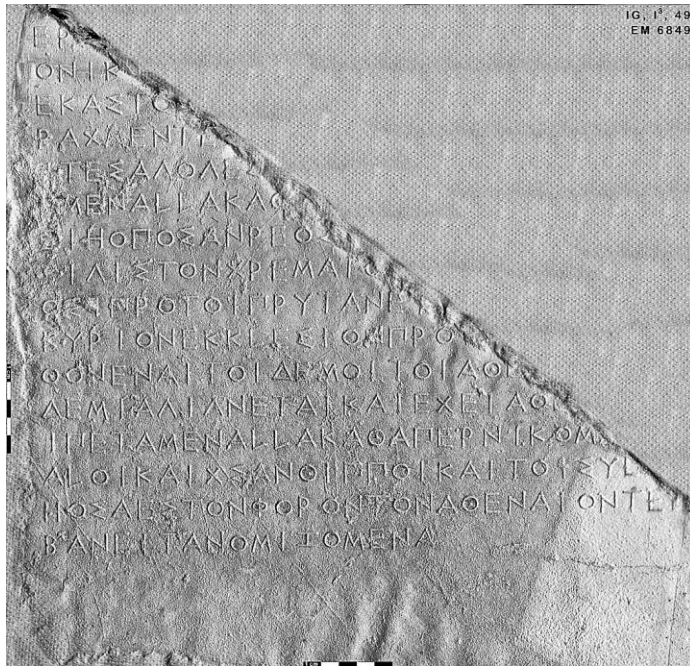


Figure 3. An Athenian decree (IG I³ 49) concerning the Athenian water supply and the involvement of Pericles' family (The Center for the Study of Ancient Documents, Oxford, UK).

Moreover, several city-states in the Classical period successfully implemented public projects. In that case, the *demos* announced the project specifications on stelae in public sites so that everyone would have access to all project details, and this procedure also made it difficult for both parties involved to breach the project contract:

(a) An interesting paradigm is the contract for the construction of a flood drain at the sanctuary of Amphiareion, dedicated in the late 5th century BC to the healer-hero Amphiaraos. It is situated in the hills of Oropos, located 37 km northeast of Athens, and the contract dates back to 335-322 BC (Appendix 1).

(b) Another interesting paradigm is the contract for draining and exploitation of the lake Ptechae in Eretria in central Greece (probably identified with the lake Dystos in southern Euboea). A summary of the main contract is presented in Appendix 2). Walker (2004) recently suggested that an additional advantage of draining the lake was to prevent malaria.

Other regulations protected surface waters from pollution (MacDowell, 1978). An epigraph from *ca.* 440 BC contains a *law for tanners* who were enforced not to dispose of their waste in the Ilissos River (*Supplementum epigraphicum Graecum* III, 18; Pappas, 1999).

As the urban public systems grew and aqueducts transferred water to public fountains, private installations like wells and cisterns tended to be abandoned. As the latter would be necessary in times of war because the public water system would be exposed, the owners were forced by regulation to maintain the wells in good condition and ready to use (Korres 2000).

The entire water regulation and management system in Athens must have worked exceptionally well and been close to what we today call sustainable water management. For example, modern water resource policymakers and, at recent international conferences, hydraulic engineers have emphasized the nonstructural measures in urban water management and the importance of small-scale structural measures like domestic cisterns. Such cisterns have two advantages: They reduce storm water quantities and potential flood risks and increase the water availability by providing a source of water for use (such as watering of gardens) (Angelakis 2016).

As mentioned above, in the course of the Classical period, larger city-states felt it necessary to introduce superintendents and/or magistrates to oversee specifically the various parts of the city's water supply, wells, and wastewater. This is most clearly mirrored in Plato's *Laws*, where the *astynomi* (city wardens) are instructed to secure a stable and clean water supply for Plato's 'ideal' city (Plato *Laws*, 759 a7-8, 763 d1-6).

A number of laws designed to preserve the scarce resources of the city and individual farmers originate from 5th century Gortyn, Crete. First, a regulation instructs individuals – probably farmers engaged in irrigation – not to extract water from the river Litheos to prevent the water level from going below the mark set on the bridge. Surely, the Litheos river was vital for Gortyn's water supply, and the regulation undoubtedly reflected that the river supplied both farming and household activities in the city (extract from the 5th century BC inscription from Gortyn on the island of Crete) (Fig. 4) (Krasilnikoff 2002). The city extended on both sides of the river Litheos.

«Θιοί· τὸ ποταμὸ αἶ κα κατὰ τὸ μέτρον τὰν ῥοὰν θιθῆι ῥῆν κατὰ
το Ὶὸν αὐτό, θιθεμένῳι ἄπατον ἤμην. Τὰν δὲ ῥοὰν λείπεν ὄττον
κατέκει ἄ ἐπ' ἀγορᾶι δέπυρα ἢ πλίον, μεῖον δὲ μῆ.»

Tran

Gods; if anyone makes the flow of the river run from the middle of the river towards his own (property), it is without penalty for the person so doing. (He is) to leave the flow as

wide as the bridge at the agora holds, or more, but not less (Translation, Davies 1996, 51).



Figure 4. Regulation to preserve a minimum water level in the Litheos river.

Two additional inscriptions from Gortyn reflect the other concern of ancient Greek lawmakers, which was to prevent damage caused by farmers channeling drainage water into neighboring fields causing damage to construction works and crops (ICret IV 73 A, ICret IV 52 A and 52 B, 1-6; Krasilnikoff 2010). The latter problem is also the issue in a forensic speech by the Athenian politician and logograph Demosthenes (55, against Meneclous), presumably from the middle of *ca.* the 4th century BC.

ROMAN TIMES

Generally, after establishing Roman provinces in mainland Greece in the 2nd century BC, and no longer being prohibited by strict city-state boundaries, local and Roman authorities improved the water supply of several cities by constructing long-distance aqueducts (Alcock, 1993).

The redefinition of boundaries also created a room for local dignitaries such as the second century Athenian elitist Herodes Atticus. Herodes excelled in projects of euergetism, including several which involved construction of water supply in Athens and the outlet of an aqueduct, the Nymphaeum or ‘Exedra’, provided drinking water for attendants at the Olympic games (Tobin 1997).

A marble block with a ‘water law’ from the early 2nd century AD has been unearthed in the ancient city of Laodicea in the western province of Denizli, Turkey

(Hurriyet Daily News 2015). Laodicea was an ancient city built on the river Lycus (Çürüksu) located in the Greek-speaking regions of Caria and Lydia, which later became the Roman Province of Phrygia Pacatiana.

The block, which is 90 cm in length and 116 cm in width, displays how the use of water in the city was managed by virtue of law and how culprits were punished by penalties ranging from 5,000 to 12,500 denarius. The ‘water law’ marble block dating back to 114 AD includes strict measures regarding the use of water coming from the Karcı Mountain through channels to the city, as well as the use of a fountain dedicated to the Roman Emperor Trajan (Fig. 5). Allegedly, the rules were instated by the Anatolian State Governor Aulus Vicirius Matrialis (Daily News 2016). Some of the rules included the following (Miller 2015):

“Those who divide the water for his personal use, should pay 5,000 denarius to the empire treasury; it is forbidden to use the city water for free or grant it to private individuals; those who buy the water cannot violate the Vespasian Edict; those who damage water pipes should pay 5,000 denarius; protective roofs should be established for the water depots and water pipes in the city; the governor’s office [will] appoint two citizens as curators every year to ensure the safety of the water resource; nobody who has farms close to the water channels can use this water for agriculture.”



Figure 5. The ‘water law’ marble block (Daily News, 2016).

EPILOGUE

There is evidence that the Greeks developed advanced infrastructures for the management of their scarce water resources since the prehistoric times (Angelakis 2017). By comparing the water infrastructures used later on in Classical urban areas (e.g. in Athens) to those elaborated on in Minoan Crete (e.g. Knossos) a couple of millennia BC, Wilson's (2000) conclusion is justified – the individual elements of the water supply and drainage systems appear relatively early and remain largely unmodified until the Middle Ages. However, the development of the water management strategies in the 2nd millennium Bronze Age Greek societies was not accompanied and clarified by written evidence for their judicial implementation. It was not until the emergence of the city-state in the Archaic period that evidence of a 'water law' and associated institutions emerged in a form which allows for further studies. Moreover, the pattern to emerge in the Classical period focused on solving the growing problems of providing water to the large populations of the cities as well as disposal of waste- and storm-water, and finally on preventing damage caused by water in densely farmed regions. Thus, larger city-states instructed magistrates and/or superintendents (*astynomoi* and *agoranomoi*) to oversee the water laws of the city. In the Roman period, the institutions of the Classical period survived, but were accompanied by initiatives from the central authorities, which ensured that large-scale waterworks, i.e. long-distance aqueducts, were constructed.

Finally, as the review above indicates, the need for legal regulation of water management is not a modern creation and there is a long tradition for solving complex issues of water management with rather sophisticated legal measures. It should be noted that about 10 % of the world population have not access to improved drinking water and some 2.4 billion people do not use improved sanitation facilities; of these, 1 billion people still practice open defecation (UN Water 2016). However, there is a vast need for sustainable and cost-effective water supply and sanitation facilities, particularly in developing cities. Thus, reevaluation of selected ancient Greek and Roman institutional regulations of water management may prove useful and work as inspiration for some contemporary developing societies. And remember that:

The farther back you can look, the farther forward you are likely to see.

Winston Churchill (1874-1965)

ACKNOWLEDGEMENT

Critical comments offered by Prof. Anna Strataridaki, Dept. of History and Education, Univ. of Crete, Greece, Rethymnon, Greece are gratefully acknowledged.

REFERENCES

1. Alcock, S. (1993). *Graecia Capta: The Landscapes of Roman Greece*. Cambridge University Press, Cambridge, UK.
2. Angelakis, A. N., (2017). Hydro-technologies in Minoan Era. *Water Sci. and Techn.: Water Supply* 17 (4), 1106-1120; DOI: 10.2166/ws.2017.006.
3. Angelakis, A. N. (2016). Evolution of Rainwater Harvesting and Use in Crete, Hellas through the Millennia. *Water Sci. and Techn.: Water Supply* 16 (6), 1624-1638. DOI: 10.2166/ws.2016.084
4. Angelakis, A.N., Dialynas, M.G., and Despotakis, V. (2012). Evolution of Water Supply Technologies in Crete, Greece Through the Centuries. In: *Evolution of Water Supply Throughout Millennia*, A. Angelakis, L. W. Mays, D. Koutsoyiannis, N. Mamassis, (eds.). IWA Publishing, London, UK pp. 227-258.
5. Angelakis, A.N., Koutsoyiannis, D. and Tchobanoglous, G. (2005) Urban wastewater and stormwater technologies in ancient Greece. *Water Res.* 39, 210-220.
6. Angelakis, A. N., Voudouris, K., and Mariolakos, I. (2016). Groundwater Utilization through the Centuries with Emphasis on Hellenic Civilizations. *Hydrogeology J.* 24, 1311–1324. DOI 10.1007/s10040-016-1392-0.
7. Angelakis, A. N., De Feo, G., Laureano, P., and A. Zourou, A. (2013). Minoan and Etruscan Hydro-technologies. *Water* 5, 972-987.
8. Breasted, J. H. (2003). *Ancient Time or a History of the Early World, Part 1*. Kessinger Publishing LLC, P.O. Box 1404, Whitefish, MT 59937, USA, ISBN 0-7661-4946-3. OCLC 69651827.
9. Camp, J. (2002). *Wells and cisterns in ancient Athens*. 7 Days of Kthemerini 24-3-2002, Athens, Greece (in Greek).
10. Cartledge, P. (1979). *Sparta and Laconia. A Regional History 1300 – 362 BC*. Routledge, London, UK.
11. Cavanagh, W., J. Crouwel, R. W. V. Catling and G. Shipley (Eds.) (2002). *Continuity and Change in a Greek Rural Landscape: the Laconia Survey, vol. I*. Supplementary volume no. 26, The British School at Athens, Athens, Greece.
12. Chatelain, T. (2001). Assèchement et bonification des terres dans l'Antiquité grecque, l'exemple du lac de Ptéchai à Érétrie: aspects terminologiques et

- techniques. In: *Irrigation et drainage dans l'Antiquité, qanats et canalisations souterraines en Iran en Égypte et en Grèce*. Séminaire tenu au Collège de France sous la direction de Pierre Briant. *Persika* 2. Thotm, Paris, pp. 81 – 108.
13. Chiotis, E. D. and Chioti, L. E. (2012). Water supply of Athens in Antiquity. In: *Evolution of Water Supply Throughout Millennia*, (A. Angelakis, L. W. Mays, D. Koutsoyiannis, N. Mamassis, Eds.). IWA Publishing, London, UK, pp. 407-442.
 14. Crouch, D. (2003). *Water Management in Ancient Greek Cities*. Oxford University Press, Oxford.
 15. Daily News (2016). *Ancient 'Water law' unearthed in Laodicea*. Ancyra, Turkey, 12 August 2016.
 16. Davies, J. K. (1996). Deconstructing Gortyn: When is a Code a Code? In: L. Foxhall and A. D. E. Lewis (eds.), *Greek Law in its Political Setting. Justifications not Justice*. Clarendon Press, Oxford, pp. 33 – 56.
 17. Dijksterhuis, E. J. (1987) *Archimedes* (translated by C. Dikshoorn). Princeton University Press, Princeton, N.J., USA, pp. 457.
 18. Foxhall, L. (1997). A View from the Top: Evaluating the Solonian Property Classes. In: *The Development of the Polis in Archaic Greece*, P. J. Rhodes and L. Mitchell (eds.). Routledge, London, UK, pp. 113 – 36.
 19. Gagarin, M. (1986). *Early Greek Law*. University of California Press, Berkeley and Los Angeles.
 20. Goetze, A. (1951 - 1952). 'The Laws of Eshnunna', *The Annual of the American Schools of Oriental Research*, Vol. 31, pp. v+vii-x+1-197.
 21. Gorogianni, E., P. Pavúk & L. Girella (eds.) (2016). *Beyond Thalassocracies: understanding processes of minoanisation and mycenaeanisation in the Aegean*. Oxbow Books, Oxford and Philadelphia.
 22. Hansen, M. H. (1991). *The Athenian Democracy in the Age of Demosthenes. Structure, Principles and Ideology*. Transl. by J. A. Cook. Oxford: Blackwell.
 23. Harper, R. F. (1904). *The Code of Hammurabi, King of Babylon, About 2250 BC* (translated), University of Chicago Press, Chicago, USA.
 24. Hatami, H. and Gleick, P. (1994). Chronology of Conflict over Water in the Legends, Myths, and History of the Ancient Middle East. In: *Water, war, and peace in the Middle East. Environment* 36 (3), 6-42. Heldref Publishers, Washington DC, USA.

25. Hughes, J. D. (1994). *Pan's Travail. Environmental Problems of the Ancient Greeks and Romans*. The Johns Hopkins University Press, Baltimore and London.
26. Isager, S. and J. E. Skydsgaard (1992). *Ancient Greek Agriculture. An Introduction*. Routledge, London.
27. Klingenberg, E. (1976). *Platons NOMOI GEORGIKOI - und das positive griechische Recht*. Berlin, Germany.
28. Koerner, R. (1974). Zu recht und verwaltung der Griechischen wasserversorgung nach dem inschriften. *Archiv für Papyrus Forschung* 22-23, 155-202.
29. Korres, M. (2000). *The Water supply of Athens in antiquity*. Workshop: "Water and Environment", EYDAP, Athens, Greece (in Greek).
30. Koutsoyiannis, D. (2012). Water control in the Greek cities. In: *Water systems and urbanization in Africa and beyond*. Uppsala, Univ. of Uppsala, Sweden, 1-2 March 2012.
31. Koutsoyiannis, D., and Angelakis, A. N. (2004). *Agricultural hydraulic works in ancient Greece*. The Encyclopedia of Water Science, B.A. Stewart and T. Howell, (eds.), Markel Dekker New York, N.Y., USA, pp.1-4.
32. Koutsoyiannis, D. and Patrikiou, A. (2013). Water control in Ancient Greek cities. In: *Water and Urbanization*, T. Ostigard, (ed.). pp.130–148.
33. Koutsoyiannis, D., Zarkadoulas, N., Angelakis, A.N. and Tchobanoglous, G. (2008). Urban water management in ancient Greece: Legacies and lessons. *ASCE, Journal of Water Resources Planning and Management* 134, 45-54.
34. Krasilnikoff, J. A. (2002). Water and Farming in Classical Greece: Evidence, Method and Perspective. In: *Ancient History Matters: Studies Presented to Jens Erik Skydsgaard on His Seventieth Birthday, April 16, 2002*. *Analecta Romana Instituti Danici, Supplementum XXX*, K. Ascani, V. Gabrielsen, K. Kvist & A. Holm Rasmussen, (eds.). L'Erma di Bretschneider, Rome, Italy, pp. 47-62.
35. Krasilnikoff, J. A. (2010). Irrigation as innovation in ancient Greek agriculture. *World Archaeology* 42 (1), 108-121.
36. Krasilnikoff, J. A. (2014). Innovation in Ancient Greek Agriculture: some Remarks on Climate and Irrigation in Classical Attica, *Classica et Mediaevalia* 64, 95 – 116.

37. Krasilnikoff, J. A. (2016). *Water Management and Law in Ancient Greece: State of the Art and Future Avenues*. NewsLetter of IWA SG on WWAC.
38. MacDowell, D. M. (1978). *The Law in Classical Athens*. Thames and Hudson, London, UK.
39. Mattingly, H. B. (1996). *The Athenian Empire Restored. Epigraphic and Historical Studies*. University of Michigan Press, Ann Arbor, Michigan, USA.
40. Miller, M. (2015). *Marble slab inscribed with 1,900-year-old Water Law unearthed in Turkey*. Ancient Origins, Ancyra, Turkey, <http://www.ancient-origins.net/news-history-archaeology/marble-slab-inscribed-1900-year-old-water-law-unearthed-turkey-003682>
41. Pappas, A. (1999). *The Water Supply of Ancient Athens*. Eleuphtheri Skepsis, Athens, Greece (in Greek).
42. Raaflaub, K. A. (1998). The Transformation of Athens in the Fifth Century. In: *Democracy, Empire, and the Arts in Fifth-Century Athens*, (D. Boedeker and K. A. Raaflaub, Eds.). Center for Hellenic Studies Colloquia 2. Cambridge, Massachusetts, pp. 15-41.
43. Rhodes, P. J. and R. Osborne (eds.) (2003). *Greek Historical Inscriptions 404 – 323 BC. Edited with introduction, translations and commentaries*. Oxford University Press, Oxford.
44. Richardson, M. E. J. (2004). *Hammurabi's laws: text, translation, and glossary*. London and New York, T & T Clark.
45. Stroud, R. (1968). *Drakon's Law on Homicide*. Berkeley and Los Angeles.
46. Tassios, T. P. (2002). *From Peisistratean to Evinos (Από το Πεισιστράτειο στον Εύηνο)* Kathimerini, March 24, Athens, Greece (in Greek).
47. Tassios, T. P. (2006). Selected topics of water technology in ancient Greece. In: *Proc. of 1st IWA International Symposium on Water and Wastewater Technologies in Ancient Civilizations*, Iraklion, Greece, 28-30 October 2006, pp. 3-26.
48. Tobin, J. (1997). *Herodes Attikos and the City of Athens: Patronage and Conflict under the Antonines (Archaia Hellas, vol. 4)*. Brill, Amsterdam, The Netherlands.
49. UN Water (2016). *The United Nations World Water Development Report 2016: Water and jobs/ Facts and Figures*. UN, New York, NY 10017, USA.

50. Voudouris, K. (2012). Diachronic evolution of water supply in eastern Mediterranean. In: *Evolution of water supply through the Millennia*, A. Angelakis, L. W. Mays, D. Koutsoyiannis, N. Mamassis, (eds.), pp. 77-89.
51. Wallace, W. (1947). The Demes of Eretria. *Hesperia. The Journal of the American School of Classical Studies at Athens* 16(2), 115-146, Athens, Greece.
52. Walker, K. G. (2004). *Archaic Eretria. A Political and Social History from the Earliest Times to 490 BC*. Routledge, London, UK.
53. Wilson, A. (2000) Drainage and Sanitation, In: *Handbook of Ancient Water Technology*, (Ö. Wikander, Ed.), Brill, Leiden, The Netherlands, pp.151-179.
54. Woodhead, A. G. (1973-1974). The Date of the 'Springhouse Decree' (IG, I², 54), *Archeologia Classica*, 25/26 (1973 - 1974), 751-761.
55. Zarkadoulas, N., Koutsoyiannis, D., Manassis, N., and Angelakis, A. N. (2012). A Brief History of Urban Water Management in Ancient Greece. In: *Evolution of Water Supply Throughout Millennia* (A. Angelakis, L. W. Mays. N., D. Koutsoyiannis, and N. Manassis, Eds). IWA Publishing, London, UK, Ch. 10: 259-270.

Appendix 1. Contract for construction of flood drain at Amphiaraiion (from www.atticinscriptions.com/browse/bysource/IOrop/)

I Orop. 292 Date: 335-322 BC

Gods.

At the sanctuary of Amphiaraios, so that water might not be prevented by the ravine from flowing from the bath of the men's room, whenever it rains, but so that the bath might be usable,
 5 when the god raises a storm, to make^[1] a stone gutter, concealed, in length starting from the pavement of the bridge as far as the way down past the women's bathing room, digging a trench of the specified length,
 10 in breadth from the retaining wall of the ravine four feet, in depth three feet; he will place stones, setting them together in the ground cross-wise, fitting each other and firm in their bedding, pounding each stone down
 15 with lead or stone, dressing their upper faces and levelling them in the direction of the slope so that there might be a good flow; he will place upon them worked stones with their beddings even and immovable and all the joints, and he will hew the faces
 20 true; and he will place upright stones one and a half feet apart leaving a channel a foot in width, and he will place them firm in their beddings and joining with one another, linking all the joints; and dressing the upper faces, he will make a regular paving,
 25 composed of stones joining one another and placed firm in their bedding, not making anywhere any overlaps between the stones; he will pack alongside all the stones earth from the trench; he will make use also of stones from the theatre which is opposite
 30 the altar, procuring the stones himself for

the job, but if they are not sufficient, the managers will provide
as many as are necessary for the job;
he will undertake the work in units of four feet and
he will finish the job within twenty days from the day on which
35 he took the money; he is contracted per four feet
6 drachmas. Phrynos residing at Alopeke is contractor;
Telesias son of Tellias of Euonymon is guarantor.

Appendix 2. A summary of the main contract for draining and exploitation of the lake Ptechae, in Eretria (adapted from Koustoyiannis and Angelakis 2004 and Tassios 2006).

It will deal only with a well documented Build–operate–transfer (known as BOT) project, the first of such a "capitalistic" construction - scheme in history, i.e. the drainage of the lake Ptechae, belonging to the city of Eretria, in the peninsula of Euboea, in central Greece, during the *ca.* 4th century BC. The advantages of such a scheme are well known in our days:

(a) Between the city of the Eretrians representing the 31 municipalities of the Eretrian region and the contractor Chairephanes, a contract is signed concerning the draining of the lake in Ptechae. The whole text of the main contract is written on the stele EM11553, Museum of Epigraphic, Athens, Greece (Fig. A2.1).

(b) The draining works include the construction of drainage canals, sewers, and wells for the drainage of water to natural underground holes or cracks and miscellaneous protection works, including wooden or metallic railings.

(c) Irrigation works, such as the construction of a reservoir with side length up to 2 stadia (360 m) for storing irrigation water, and sluice gates, are included in the project.



Figure A2.1. Inscription of the treaty from the Epigraphic Museum of Athens (Tassios 2006).

- (d) A 4-year construction period is agreed, which can be extended in case of war.
- (e) The contractor is granted the right to exploit the dried fields for 10 years (extended in case of war), commencing by the finishing of the drying works.
- (f) The contractor is granted the privilege of customs free import of materials (stones and wood).
- (g) The contractor is obliged to: (i) pay all labor costs without any charge for the people of Eretria; (ii) pay the amount of 30 talents **to be paid to the city** in monthly instalments as a rental for the exploit of the project for 10 years; (iii) maintain all works for the exploitation period to be in good condition after the finishing of the contract; (iv) compensate the land owners by one drachma per foot of land area that is to be expropriated for the construction of works; and (v) avoid harm on private property as much as possible by locating the works in no cultivating land.
- (h) In case of death of the contractor, his heirs and collaborators will substitute him in the relations to the city.
- (i) Penalties are enforced against any person trying to annul the contract.
- (ia) The contractor is obliged to submit a good construction guarantee up to the amount of 30 talents.