



LIFE12 ENV/GR/000427 LIFE reclaim "Landfill mining pilot application for recovery of invaluable metals, materials, land and energy"

**TECHNICAL REPORT - ACTION A3
FOR THE POLYGYROS LANDFILL, IN THE MUNICIPALITY OF
POLYGYROS, CHALKIDIKI**

SUBJECT:

**BASELINE ENVIRONMENTAL AND SOCIAL
CONDITIONS REPORT**

STUDY : ENVECO S.A.



Municipality
of Polygyros



NTUA
School of
Mining &
Metallurgical
Engineering

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Abbreviations

ELSTAT: Hellenic Statistical Authority

FODSA: Solid Waste Management Bodies (local/regional)

MSW: Municipal Solid Waste

NAP: National Solid Waste Management Plan

PESDA: Planning for Solid Waste Management

RBD: River Basin District

RBMP: River Basin Management Plan

RCM: Region of Central Macedonia

SAC: Special Areas of Conservation (NATURA 2000)

WFD: Water Framework Directive

WWTP: Wastewater Treatment Plant



CHAPTER 1. EXECUTIVE SUMMARY

This report provides the Baseline Environmental Conditions of the Project area, serving as the basis for Impact Assessment and for monitoring the LIFE12 ENV/GR/000427 reclaim project impacts. The environmental information concerns air, water, land, soil, ecosystems, as well as the manmade environment. The data was acquired through assessment of relevant literature, site visits, collection of primary data and consultations with authorities. The Municipality of Polygyros is defined as the broader Study area, for which the assessment takes place. The immediate study area is the Polygyros Municipality District and the intervention area is the Polygyros Landfill.

The climate in the study area is characterized as transitional between the continental climate of Central Europe and the Mediterranean climate. The study area belongs to the attenuated mesomediterranean bioclimate, while the most mountainous parts of the area belong to the submediterranean bioclimate. In terms of bioclimatic zones, the region comprises of three (3) different areas, i.e. the subhumid bioclimatic zone with a mild winter in the coastline, subhumid bioclimatic zone with cold winter on the inland and subhumid bioclimatic zone with very cold winter in the mountainous area. The rainfall and the temperature of the area are examined through data from the Meteorological Station (M.S.) of Polygyros, the M.S. of Rizes, the M.S. of Plana, the M.S. of Arnaia, the M.S. of Megali Panagia, and the M.S. of Ormylia.

Morphologically, the study area is characterised by the presence of the Mount Holomontas, located centrally within the area. The natural beauty of the mountain gives a special morphological quality to the landscape and the landscape of the immediate study area remains mainly untouched despite of continuous human activities taking place (agriculture in the plains, open pit mining in the southern and eastern areas). The water element is abundant and presents much morphological and topological interest. The hydrographic network grows naturally around the main trunks of watercourses with numerous small streams. The intervention area is located 3,2 km north of the town of Polygyros, at the "Cagri" hill. The surrounding area is hilly, with elevations greater than 600m offering visual coverage of the Landfill. The main range of hills in the area are developing east and northeast of the position of the landfill site with a general direction of N, NW to S, SE and it forms a dividing mass between two river basins.

The geological formations of the study area are consistent and have a background of metamorphic rocks, with frequent phyllites, quartz and sandstone schist with no disintegration zone. The area belongs to the western Serbomacedonian zone and specifically, the Polygyros landfill is situated on the Svoulas group. The area forms a basin with gentle slopes of the terrain to the west. In general, the phyllitic formulations are impervious with very small primary porosity. Aquifers in these formations are only found in fracture zones, which do not exist or are not detected macroscopically in the region. Based on the data from the Soil Atlas of Europe, (2005), the intervention area of Polygyros Landfill is dominated by Eutric Cambisol, a common Mediterranean and highly productive topsoil. The study area falls within the Main River Basin (MRB) of Chalkidiki (GR05).

The conservation status of the study area is high as many environmentally protected regions exist, such as:

- The Natura 2000 Special Protection Area (SPA) - GR 1270012 'Mount Cholomontas';

-
- The Natura 2000 Special Areas of Conservation (SAC) GR1270001 'Mount Cholomontas';
 - The Natura 2000 Special Protection Area (SPA) - GR1220009 'Lakes Volvi-Langada (or Koronia-Ag. Vasiliou) and Rentina Gorge (or Makedonika Tempji)';
 - The Important Bird Area (IBA) - GR033 'Mount Cholomontas' and more.

The vegetation in the study area, comprises of forrests, riparian vegetation, shrubs and cultivated areas. There are also many feeding, nesting, breeding, wintering and refuge habitats for bird species located in the wider area, thus the surrounding hilly and mountainous area supports a large number of bird species.

The broader study area (Municipality of Polygyros) has a total surface of 951.97 km² and it includes 27 settlements. 51.4% of the broader and 100% of immediate study area is covered by land of forest character. It is an area of rich history and culture, going back to 432BC when the ancient settlement of Apollonia was part of the Chalcidian League. Many archaeological, byzantine and other monuments are scattered throughout the whole region.

The population of the broader study area is 22.048, according to the 2011 census. Polygyros serves as a central transportation hub in Chalkidiki and is traversed by many roads of different levels. The public transportation is by bus and 100% of the people are serviced by the local by electricity and water supply networks. Sewage is mainly collected in septic tanks and wastewater collection and treatment is limited only to some settlements and the existing large tourist lodgings. The management of solid waste is realised according to the Regional Planning for Solid Waste Management. The entire study area is serviced by the Polygyros landfill for solid waste disposal. Home composting initiatives and recycling schemes have only recently been introduced.

The social infrastructure is considered adequate but rather limited. The available health amenities include a hospital in Polygyros and 5 health centers at the biggest settlements of the region. Also, the athletic facilities are rudimentary and the whole area has 12 school units. The cultural infrastructure is small, considering that the area is located at a one-hour distance of Thessaloniki which is a large cultural center.

The main air quality pressures of the area are transportation, industry and heating. Pollution is mainly produced from the combustion of liquid or solid fuels for energy needs. The study area, with the exception of the Polygyros landfill itself, presents mainly agro-pastoral character combined with artisan activities. From these sources of pollution, it is estimated that particulate emissions are the main factor of degradation of the environment, while the remaining pollutants in conjunction with the prevailing climatic conditions and the morphological characteristics of the region do not cause any issues of air pollution.

As for the acoustic environment, taking into account the dynamics and operations of the Municipality of Polygyros, it is possible conclude that there might be some disturbance from the noise by the movement of wheeled vehicles within the residential area of cities and towns, which is not expected to be exceeding the statutory limits of noise and vibration, disturbance from vehicular traffic in the immediate vicinity of the highway of Polygyros - Arnaia - Ierissos could be possible and industry is not highly developed and is mainly confined to statutory industrial areas on the outskirts of the urban - semi-urban centers so no disturbance is expected.

The main anthropogenic pressures on the environment are: extensive agriculture, urbanisation of Polygyros, landfills and old waste dumpsites of the area, wastewater treatment facilities, mining and quarrying activities, livestock farms, individual industrial units, etc. The development trend of the region is estimated to be positive for the average income, but also for the general welfare of the residents. The study area priorities, according to the current developmental policies are the upgrading of port infrastructure, the upgrading and modernisation of road infrastructure, the support alternative forms of tourism, the development of mountainous areas, the rational management of natural resources and the natural environment and the improvement of the living environment for residents.

To sum up, the study area has many areas of high environmental value. Many steps must be taken to improve the environmental and social status of the area in the future. Through the Spatial Plans, it is evident that Polygyros will be established as a hub for all Chalkidiki. Finally, its population increase, waste production increase, limited separation of waste, pressures from other regions and increased demand for land are all favourable parameters to encourage innovative solutions in the solid waste management sector, such as the ones proposed by the LIFE reclaim project.



CHAPTER 2. INTRODUCTION

2.1. Report context and Objectives

This present report is the Deliverable of Action A3 of the Life reclaim Project “Landfill mining pilot application for recovery of invaluable metals, materials, land and energy”, which is being funded by the European Commission through Life+ 2012 vehicle, under the contract LIFE12 ENV/GR/000427.

The objective of this report is to provide the baseline environmental conditions (status quo) of the Project area. The assessment serves as the basis for Impact Assessment and for the project impact monitoring. The environmental information required regards all media (air, water, land, soil, ecosystems), as well as all sector of the manmade environment. These were acquired by the Analysis Team (ENVECO SA) through the following steps:

1. Assessment of related literature
2. Site visits in the wider area
3. Collection of primary data (climate, soils, vegetation) from relevant databases and organizations
4. Consultations with relevant authorities (land planning service, environmental services, the municipality, the regional authorities etc)
5. Final assessment and reporting

The social information was collected through census data for the Project Area and the wider region of Chalkidiki and Central Macedonia. Data were compared to national and EU census data in order to enable evaluation of social status. Furthermore, data on social welfare and social services was collected. The analysis gives a clear insight on the social profile of the area.

Finally, data on public infrastructure and technical services, such as water, sanitation, waste management, transportation was collected to enable the analysis of the potential for improvement.

2.2. General information on Life+ reclaim

2.2.1. Project objectives

The Project aims at building a temporary pilot application on productive scale to mine parts of existing landfills and to separate useful materials and produce suitable products (concentrates), both ferrous and non-ferrous, which can be fed into a metallurgical process. The application will include preprocessing and processing production line, as well as a beneficiation stage for non-ferrous metals, introducing innovation elements from the mining industry. The basic objective is to turn landfill mining (LFM) into a useful tool for the recovery of:

- useful materials, especially ferrous and non-ferrous metals
- space, which equals to extra landfill capacity and lifetime in cases of expansion

-
- soil material, which has been disposed off along with the waste and which is a natural resource valuable to local ecosystems as well as to landfill industry itself
 - recyclable materials, like plastic and paper products, which can be either post-processed in a suitable recycling plant or burned in modern incinerators
 - land, in the case of old landfills, which will lead to a successful rehabilitation scheme with minimal environmental footprint which in turn, can be easily adapted to different waste compositions and site conditions.

At the same time the Project objectives include the familiarization of the public with the issue of post-disposal-processing of waste and with the potential of the procedure for metal recovery (thus lessening the need for mining interventions) and site rehabilitation, resulting in a cleaner environment and rational waste management. The abovementioned objectives of material and/or energy recovery are widely known today in the waste processing industry and precede disposal, but have not been so far utilized in connection to (a) a wider program of waste post-disposal processing and (b) material beneficiation for valuable metals, by means of ore processing methods.

2.2.2. Actions and means

In order to establish LFM as a standard waste management procedure there are two basic tasks to be completed:

- LFM consolidation and application: Detailed elaboration on all technical aspects of LFM, from designing the waste mining operation to creating alternative final products (metal concentrates) that can be directly fed into metallurgical plants.
- Environmental and Social analysis: Detailed approach on the foreseeable socioeconomic impacts of adopting LFM practices.

More analytically, the Project includes the following Actions:

1. Preparation: International experience in LFM, Permitting of additional activities in Polygyros Landfill (PL), Baseline environmental and social conditions
2. Implementation: Landfill inventory, Exploitation plan, Design of production line, Sub-contracting procedures, Pilot-scale Demonstration Unit, MSW mining, operation and tests, Environment rehabilitation plan
3. Socioeconomics: EIA Study, Financial and socioeconomic analysis, Action Plan and Master Plan elaboration
4. Monitoring the environmental & socioeconomic impacts of project Actions
5. Dissemination Actions
6. Project management Actions

7. After-life communication plan

2.2.3. Expected results

According to existing literature, there is considerable experience in waste mining regarding energy and soil recovery, but not regarding non-ferrous metals, since the waste requires further processing which very few have attempted to undertake. It is expected that the Project will help consolidate knowledge, give practical experience in the field and contribute to the adaptation of an innovative production line under, various site conditions and waste compositions. Specifically, the Project is expected to bring the following results:

- Web GIS database for operational landfills and dump-sites in Greece combined with a Website during and after the duration of the Project, connected with the web-GIS database application
- Processing of waste for the production of different separation samples
- Two field environmental economics surveys on the acceptance of LFM
- Action plan on national level for LFM and Strategic Environmental Assessment on national level
- Socioeconomic analysis of LFM
- Publication of one bilingual book/album on LFM
- Dissemination of the experience and information gained, through conferences (2 national and 1 international) as well as through proper dissemination material

All results will be supported by respective Technical Reports (one of which is the present one), with documentation on the background, methodologies, alternatives examined and relevant results. In addition, a special report regarding the carbon footprint of the Project will be submitted in order to support the footprint minimization policy of the project.

2.3. The Study Team

This Report has been elaborated by the following Life reclaim collaborators:

- Spyros Papagrigoriou, Civil Engineer, Environmental Engineer, Dipl., MSc., MLitt
- Yanis Katselis, Mineral Resources Engineer, Environmental Engineer MSc, Business Administration MBA
- George Tentis, Mining Engineer MEng (NTUA), MSc in Hydrology environmental management of water resources

- Zoi Gaitanarou, Mining Engineer NTUA, MSc Environmental Engineering and Business Management , Imperial College of London
- Kyriaki Manitaras, Chemical Engineer, Engineering-Economic Systems (MBA)
- Xenophon Bakouras, Environmental Engineer, MSc Environmental Technology, Imperial College of London

2.4. Report content

The Report describes and analyses the Baseline Environmental and Social Conditions of the study area where the main actions of the Life reclaim Project are taking place. The immediate and broader Study Area (**Chapter 2**) is firstly defined geographically.

Chapter 3 is an analysis on the Abiotic Environment of the area, which includes climate and meteorology, the morphology and landscape, its geology and soil characteristics. In **Chapter 4** the Biotic Environment is analysed covering the area's conservation status, the flora and fauna. The social conditions are emphasised in **Chapter 5** which describes the Manmade environment and in particular the main Land Uses, the Town Planning, the History of the area, its archaeological sites, its financial conditions, general demographics, technical infrastructure, and its aquatic, air and acoustic environment as well as anthropogenic stresses on the environment.

Chapter 6 analyses any recognized Environmental Trends that exist in the study area and how this can affect the environment in the future.

Finally, the overall Conclusions of the present report are given in **Chapter 7**.

CHAPTER 3. STUDY AREA

The definition of the study area was based on the following criteria:

- The area should include all the individual technical projects included in the project design
- The area should include the administrative boundaries of municipalities which own projects.

For a better description of the current environmental and social state, is the following distinction :

1. **Intervention Area** is the total area which is occupied by elements of the Project. In our case, this is the site where Polygyros Landfill is operating.
1. **Immediate study area** is the defined limits the Polygyros Municipal Section, where the area of intervention belongs. A particular section of 2km around the landfill has been identified as immediate study area for the purposes of the ecological study (chapter 4)
2. The **broader Study area** is composed of the municipality containing the immediate study area, i.e. the municipality of Polygyros.

The final boundary of the study area is given on all maps of the study, and in **Figure 2-1**.



Figure 2-1: Determination of the study area (Image source: Google Earth, 2014)

The yellow line represents the administrative boundaries of Polygyros Municipality (limit of broader study area). The green line gives the limit of the immediate study area (Polygyros Municipality District). The red marks represent the intervention area (Polygyros Landfill).

The study area is also given in the Map of orientation (Map 1 of Appendix 1)

CHAPTER 4. ABIOTIC ENVIRONMENT

4.1. Climate and Meteorology

The climate in the study area is characterized as transitional between the continental climate of Central Europe and the Mediterranean climate. The study area belongs to the attenuated mesomediterranean bioclimate, while the most mountainous parts of the area belong to the submediterranean bioclimate. In terms of bioclimatic zones, the region comprises of three (3) different areas, i.e. the subhumid bioclimatic zone with a mild winter in the coastline, subhumid bioclimatic zone with cold winter on the inland and subhumid bioclimatic zone with very cold winter in the mountainous area.

In this study we analyze the time series of rainfall and temperature from six different Meteorological Stations of Chalkidiki, presented in the map of Figure 3.1-1 below: the M.S. of Polygyros, the M.S. of Rizes, the M.S. of Plana, the M.S. of Arnaia, the M.S. of Megali Panagia, and the M.S. of Ormylia.



Figure 3.1-2: The six Meteorological Stations of Chalkidiki, near the study area (Image source: Google Earth, 2014)

4.1.1. Rainfall - Temperature

M.S. of Polygyros

In **Figures 3.1-1** and **3.1-2** you may see the average monthly rainfall and the average temperature for each month for the period 2006-2014 for the M.S. of Polygyros (source: *National Observatory of Athens*). The data shows that the average, maximum and minimum annual rainfall is respectively 515 mm, 757 mm and 338 mm and the average temperature of the year is 14,3° C. The maximum monthly temperature (27° C) was observed in July of 2012, while the minimum (1,8° C) observed in the month of January of the same year (2012). Generally, the coldest month is January presented (mean 8 year average monthly price equal to 5,3° C) and the warmest August (average 8 year average monthly price equal to 24,9° C).

A combined ombrothermic diagram is drawn from the rainfall and temperature data for the M.S. of Polygyros, shown in **Figure 3.1-3**. This diagram presents 1 warm and dry period, from the end of June until early September.

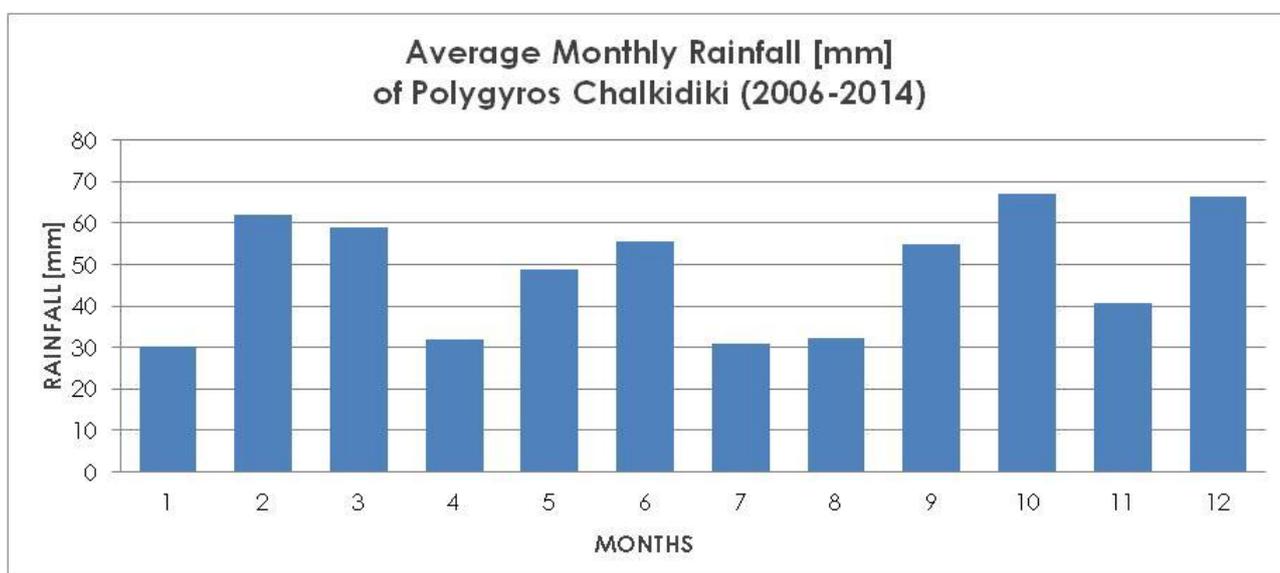


Figure 3.1-1: Average monthly rainfall for the period 2006-2014 for the meteorological station of Polygyros
(Source: National Observatory of Athens)

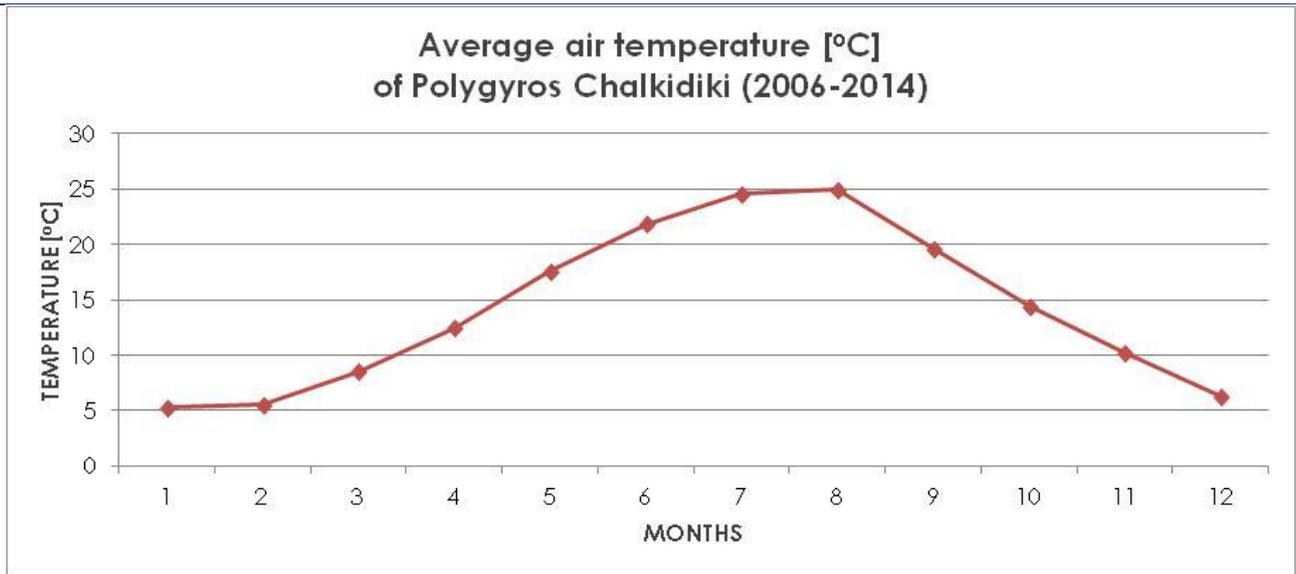


Figure 3.1-2: Average air temperature for the period 2006-2014 for the meteorological station of Polygyros (Source: National Observatory of Athens)

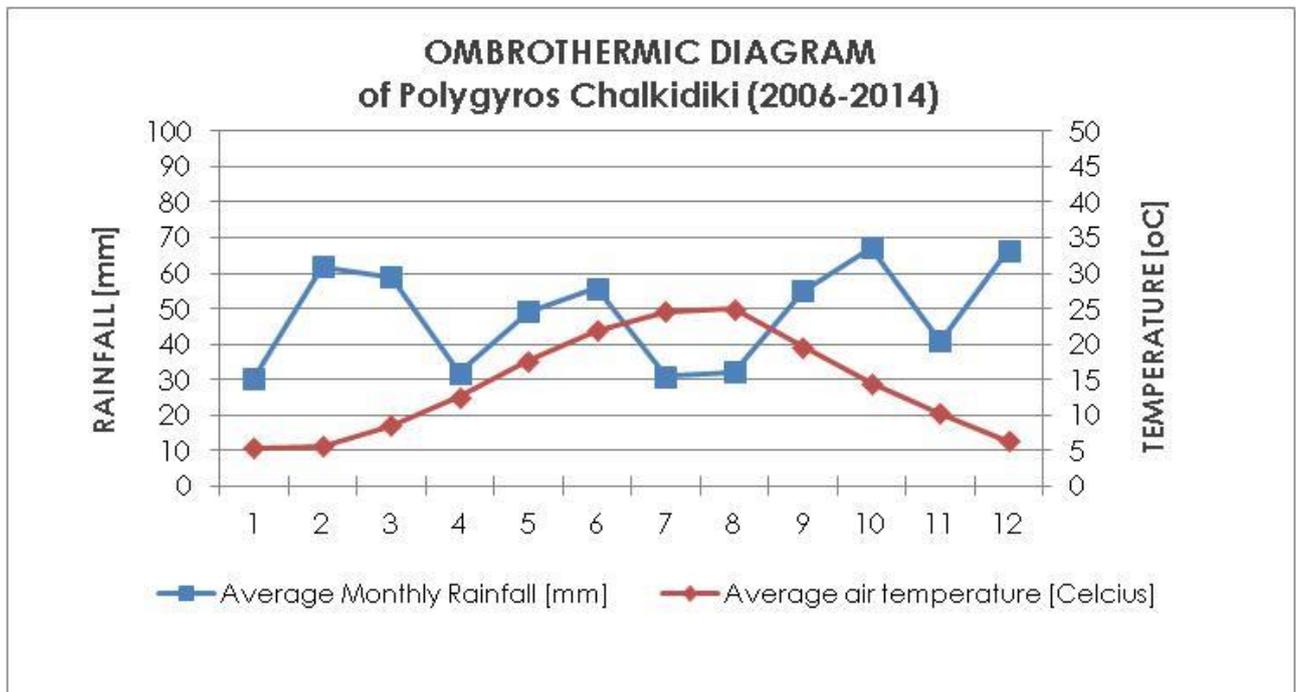


Figure 3.1-3: Ombrothermic diagram for the period 2006-2014 for the meteorological station of Polygyros (Source: National Observatory of Athens)

M.S. of Plana

In **Figures 3.1-4** and **3.1-5** you may see the average monthly rainfall for the period 1975-2010 and the average temperature for each month for the period 1991-2010 for the M.S. of Plana. The data

shows that the average, maximum and minimum annual rainfall is respectively 523 mm, 727 mm and 315 mm and the average temperature of the year is 14,3° C. The maximum monthly temperature (27,2° C) was observed in August of 2010, while the minimum (2,1° C) observed in the month of January 2000. Generally, the coldest month is January presented (mean 19 year average monthly price equal to 5,3° C) and the warmest August (average 35 year average monthly price equal to 24,5° C).

A combined ombrothermic diagram is drawn from the rainfall and temperature data for the M.S. of Plana, shown in **Figure 3.1-6**. This diagram presents 1 warm and dry period, from early June until late September.

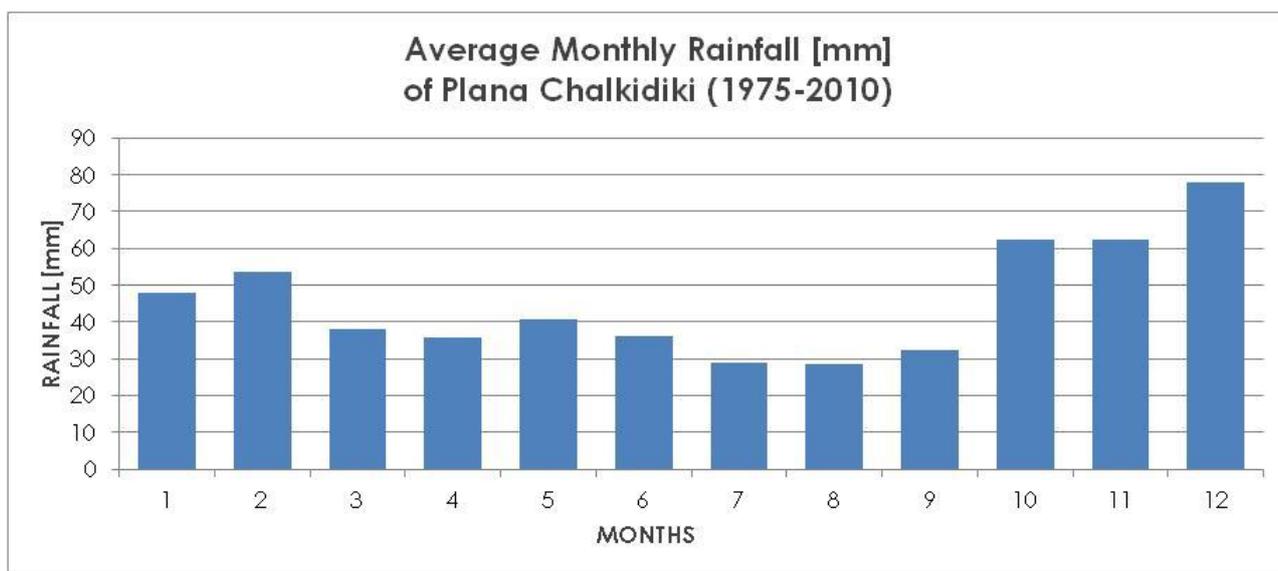


Figure 3.1-4: Average monthly rainfall for the period 1975-2010 for the meteorological station of Plana (Source: Hellenic Ministry of Rural Development and Food)

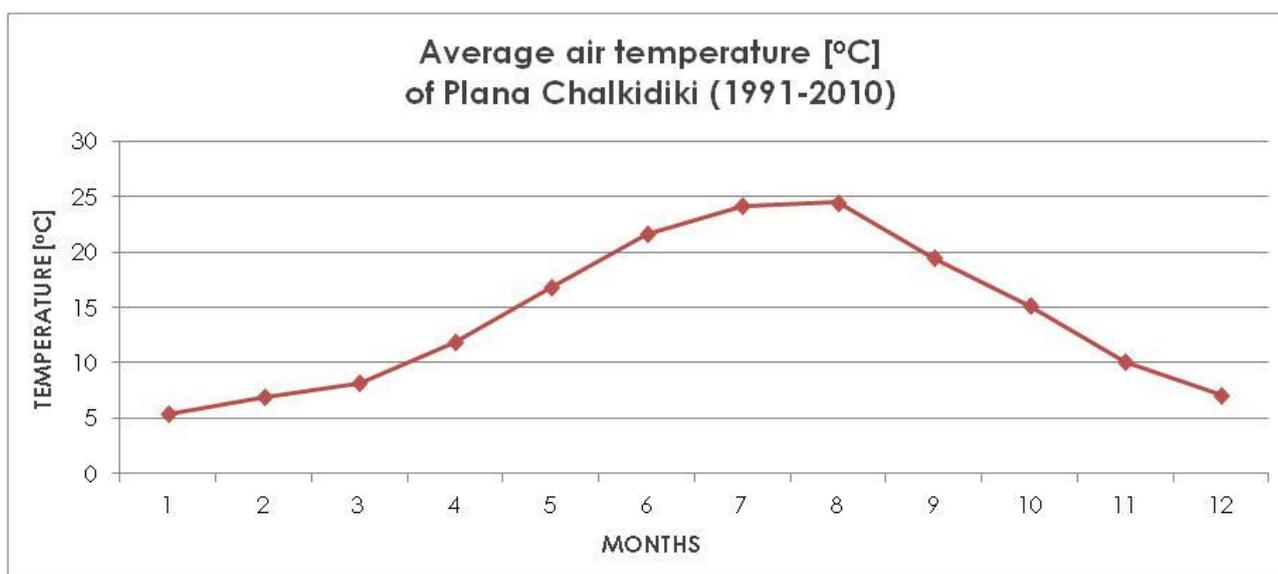


Figure 3.1-5: Average air temperature for the period 1991-2010 for the meteorological station of Plana
(Source: Hellenic Ministry of Rural Development and Food)

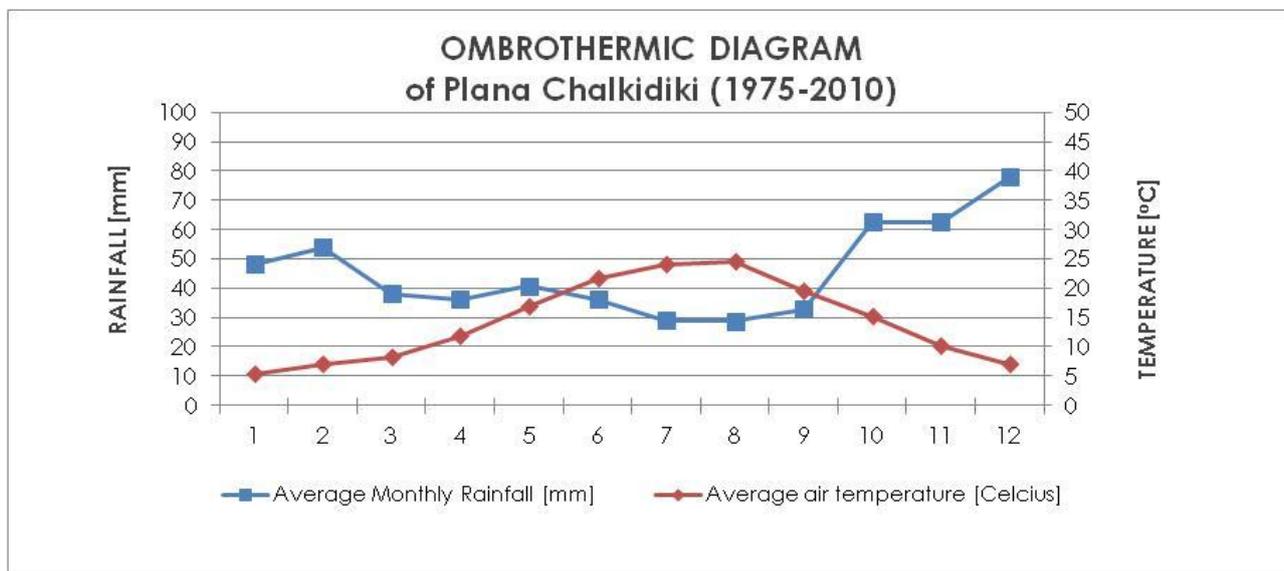


Figure 3.1-6: Ombrothermic diagram for the period 1975-2010 for the meteorological station of Plana
(Source: Hellenic Ministry of Rural Development and Food)

M.S. of Ormylia

In **Figures 3.1-7** and **3.1-8** you may see the average monthly rainfall for the period 1975-2010 and the average temperature for each month for the period 1991-2010 for the M.S. of Ormylia. The data shows that the average, maximum and minimum annual rainfall is respectively 440mm, 748mm and 221 mm and the average temperature of the year is 16,4° C. The maximum monthly temperature (28,5° C) was observed in July of 2007, while the minimum (3,5° C) observed in the month of January 2006. Generally, the coldest month is January presented (mean 19 year average monthly price equal to 6,2° C) and the warmest July (average 19 year average monthly price equal to 26,4° C).

A combined ombrothermic diagram is drawn from the rainfall and temperature data for the M.S. of Ormylia, shown in **Figure 3.1-9**. This diagram presents 1 large warm and dry period, from the middle of May until late September.

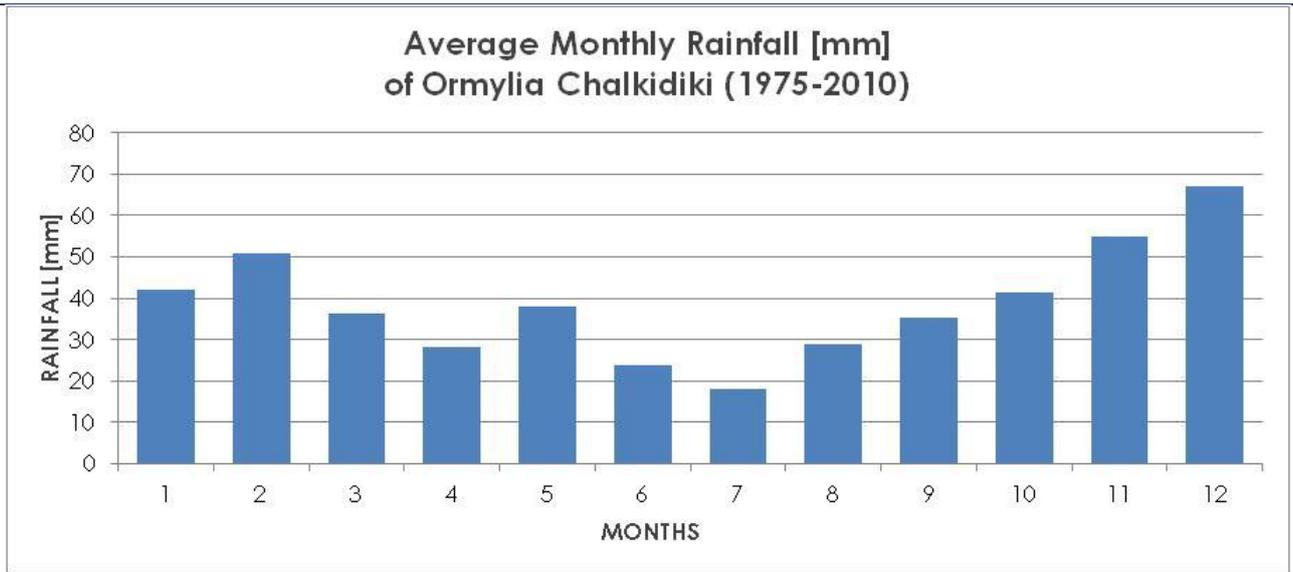


Figure 3.1-7: Average monthly rainfall for the period 1975-2010 for the meteorological station of Ormylia
(Source: Hellenic Ministry of Rural Development and Food)

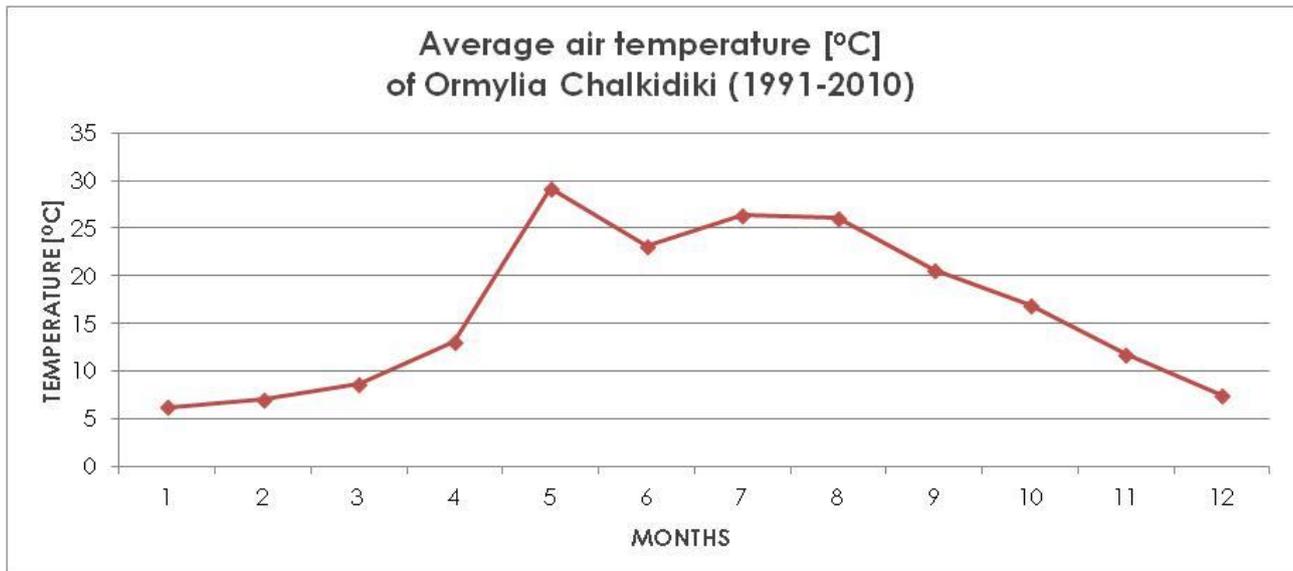


Figure 3.1-8: Average air temperature for the period 1991-2010 for the meteorological station of Ormylia
(Source: Hellenic Ministry of Rural Development and Food)

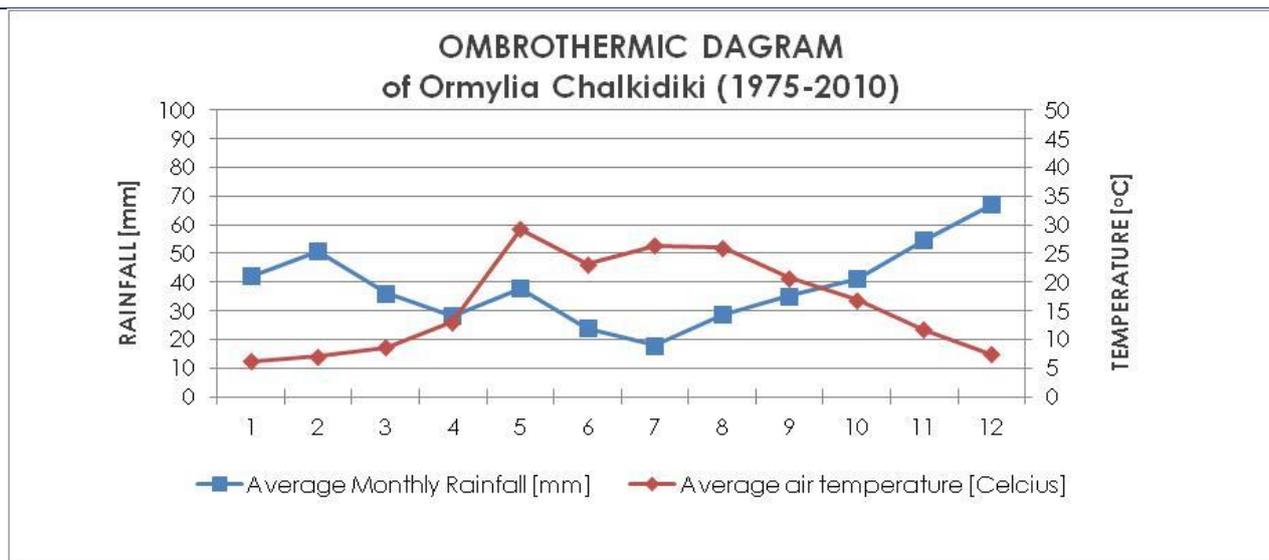


Figure 3.1-9: Ombrothermic diagram for the period 1975-2010 for the meteorological station of Ormylia
(Source: Hellenic Ministry of Rural Development and Food)

M.S. of Rizes

In **Figures 3.1-10** and **3.1-11** you may see the average monthly rainfall and the average temperature for each month for the period 1993-2010 for the M.S. of Rizes. The data shows that the average, maximum and minimum annual rainfall is respectively 663mm, 801mm and 537mm and the average temperature of the year is 15,2° C. The maximum monthly temperature (28,8° C) was observed in August of 2010, while the minimum (1,5° C) observed in the month of January 2000. Generally, the coldest month is January presented (mean 17 year average monthly price equal to 5,1° C) and the warmest July (average 17 year average monthly price equal to 26,0° C).

A combined ombrothermic diagram is drawn from the rainfall and temperature data for the M.S. of Rizes, shown in **Figure 3.1-12**. This diagram presents 1 very small warm and dry period, between July and August.

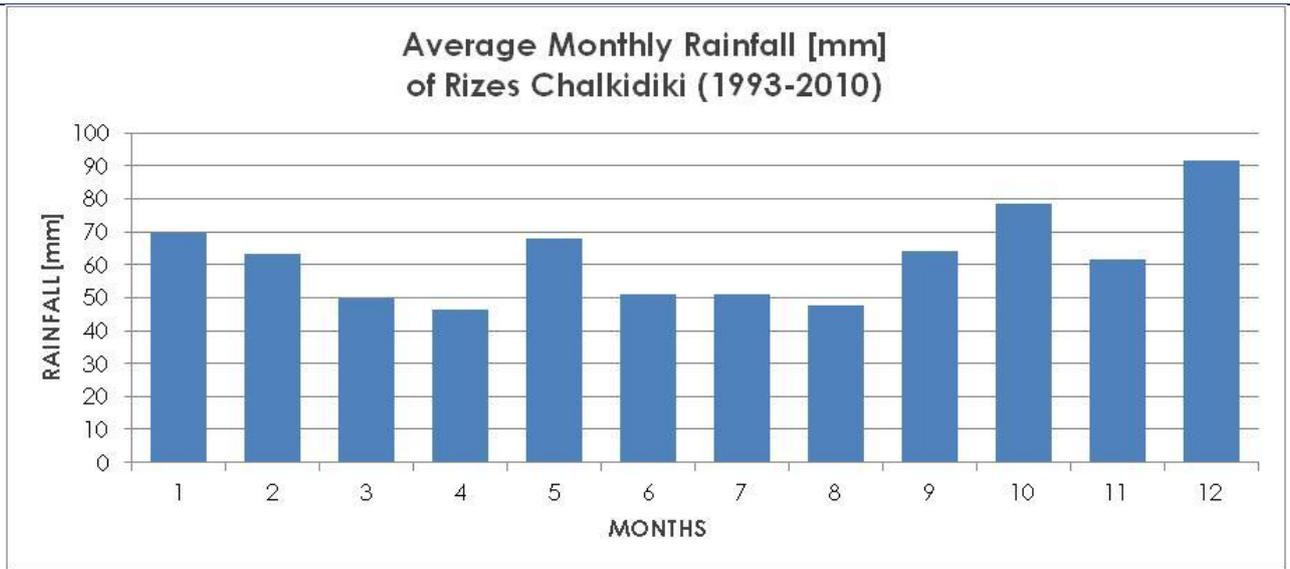


Figure 3.1-10: Average monthly rainfall for the period 1993-2010 for the meteorological station of Rizes
(Source: Hellenic Ministry of Rural Development and Food)

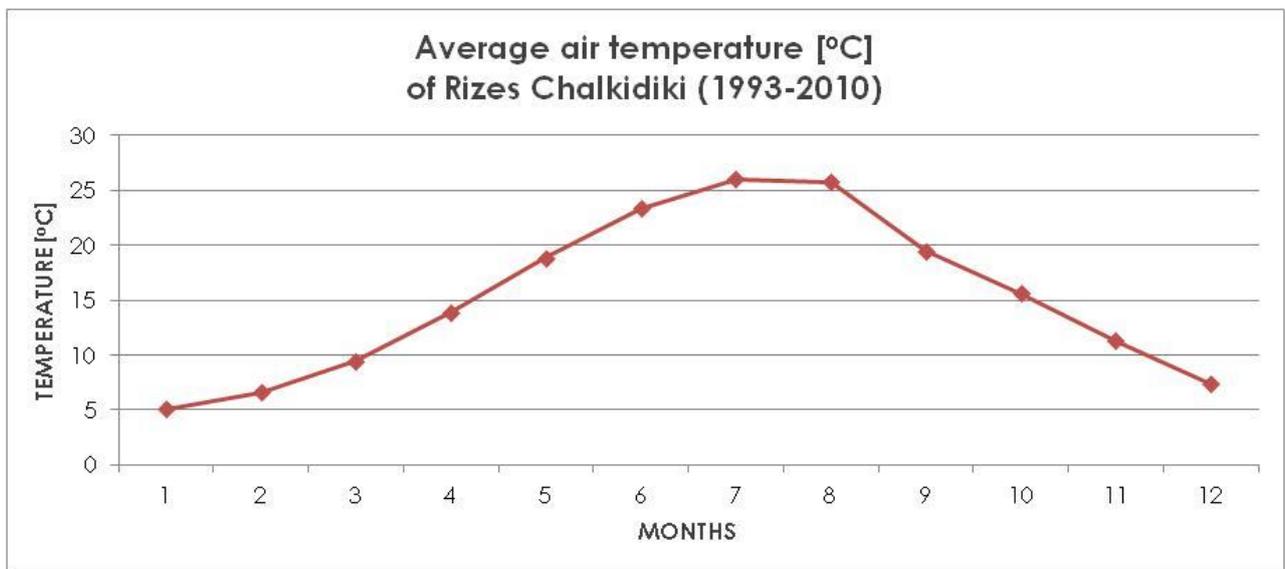


Figure 3.1-11: Average air temperature for the period 1993-2010 for the meteorological station of Rizes
(Source: Hellenic Ministry of Rural Development and Food)

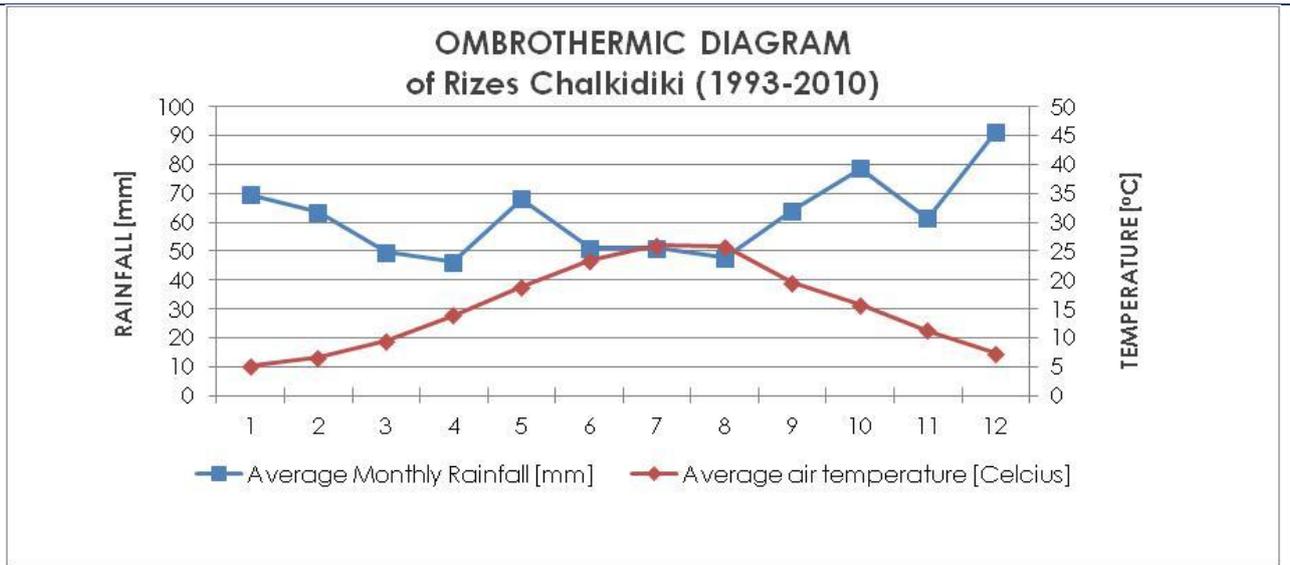


Figure 3.1-12: Ombrothermic diagram for the period 1993-2010 for the meteorological station of Rizes (Source: Hellenic Ministry of Rural Development and Food)

M.S. of Megali Panagia

The available data from the M.S. of Megali Panagia were only about the average monthly rainfall for the period 1975-2010. The data shows that the average, maximum and minimum annual rainfall is respectively 636mm, 1008mm and 265mm.

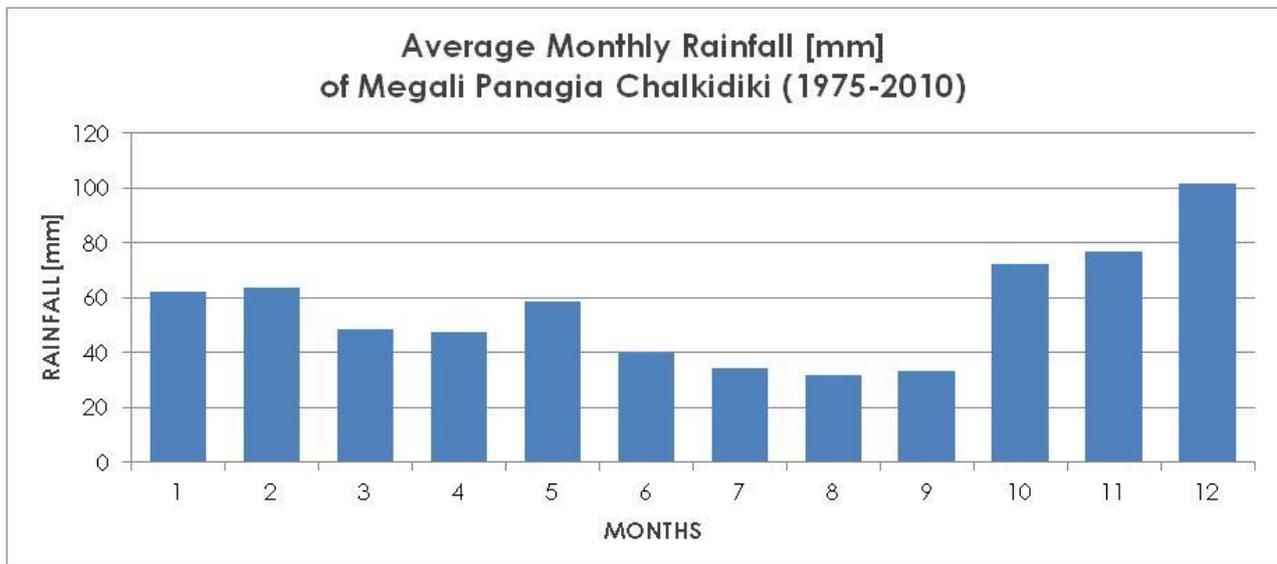


Figure 3.1-13: Average monthly rainfall for the period 1975-2010 for the meteorological station of Megali Panagia (Source: Hellenic Ministry of Rural Development and Food)

M.S. of Arnaia

In **Figures 3.1-14** and **3.1-15** you may see the average monthly rainfall and the average temperature for each month for the period 1978-2004 for the M.S. of Arnaia (unfortunately, more recent data were not available). The data shows that the average, maximum and minimum annual rainfall is respectively 638 mm, 1011 mm and 181 mm and the average temperature of the year is 12,5° C. The maximum monthly temperature (25,6° C) was observed in July of 1988, while the minimum (-2,5° C) observed in the month of January 2000. Generally, the coldest month is January presented (mean 27 year average monthly price equal to 2,6° C) and the warmest July (average 27 year average monthly price equal to 22,8° C).

A combined ombrothermic diagram is drawn from the rainfall and temperature data for the M.S. of Arnaia, shown in **Figure 3.1-16**. This diagram presents 2 warm and dry periods, one during June and one the months of August - September. The month of July is characterized as sub-arid ($2 T < P < 3 T$).

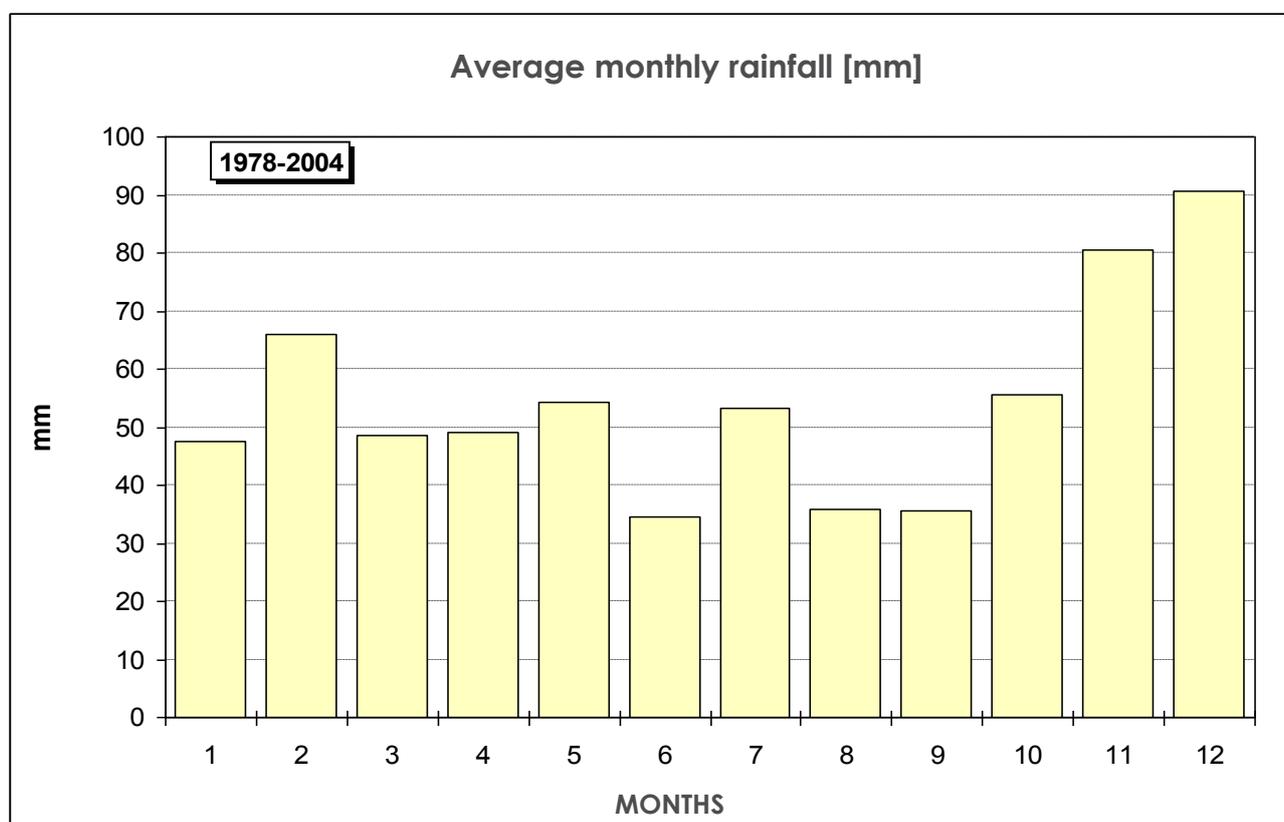


Figure 3.1-14: Average monthly rainfall for the period 1978-2004 for the meteorological station of Arnaia
(Source: National Agricultural Research Foundation)

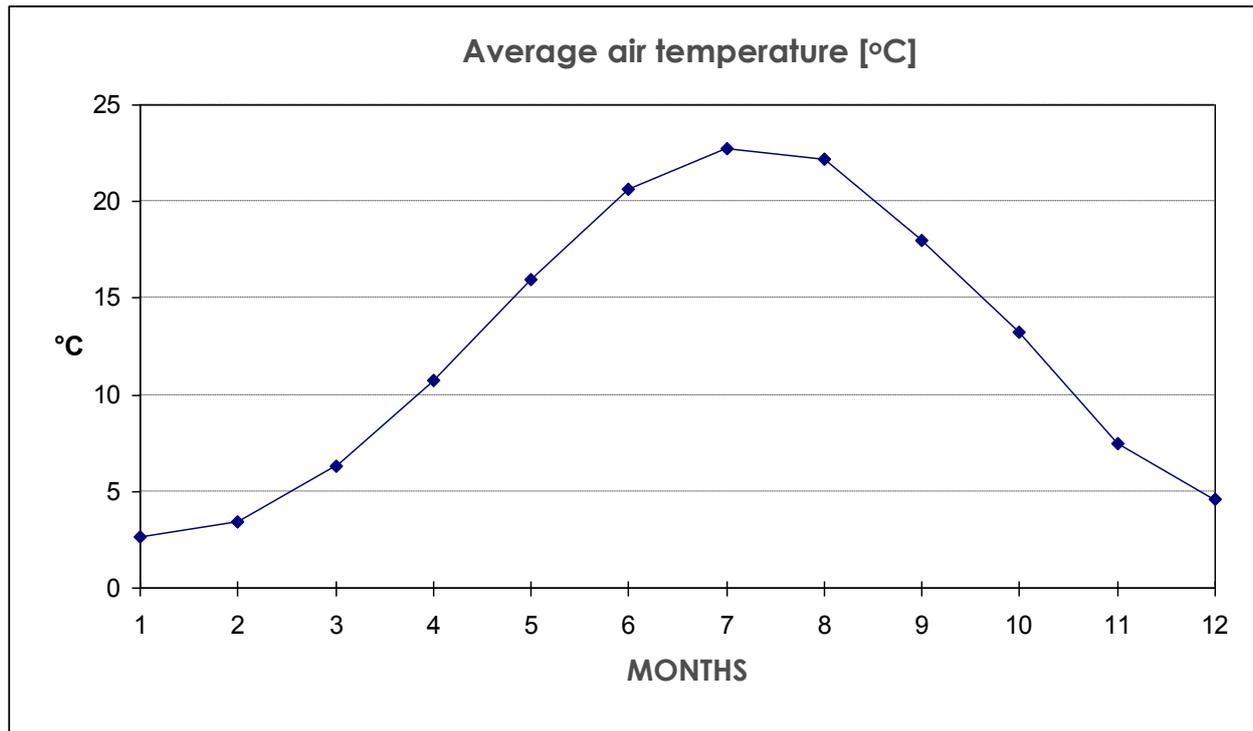


Figure 3.1-15: Average air temperature for the period 1978-2004 for the meteorological station of Arnaia
(Source: National Agricultural Research Foundation)

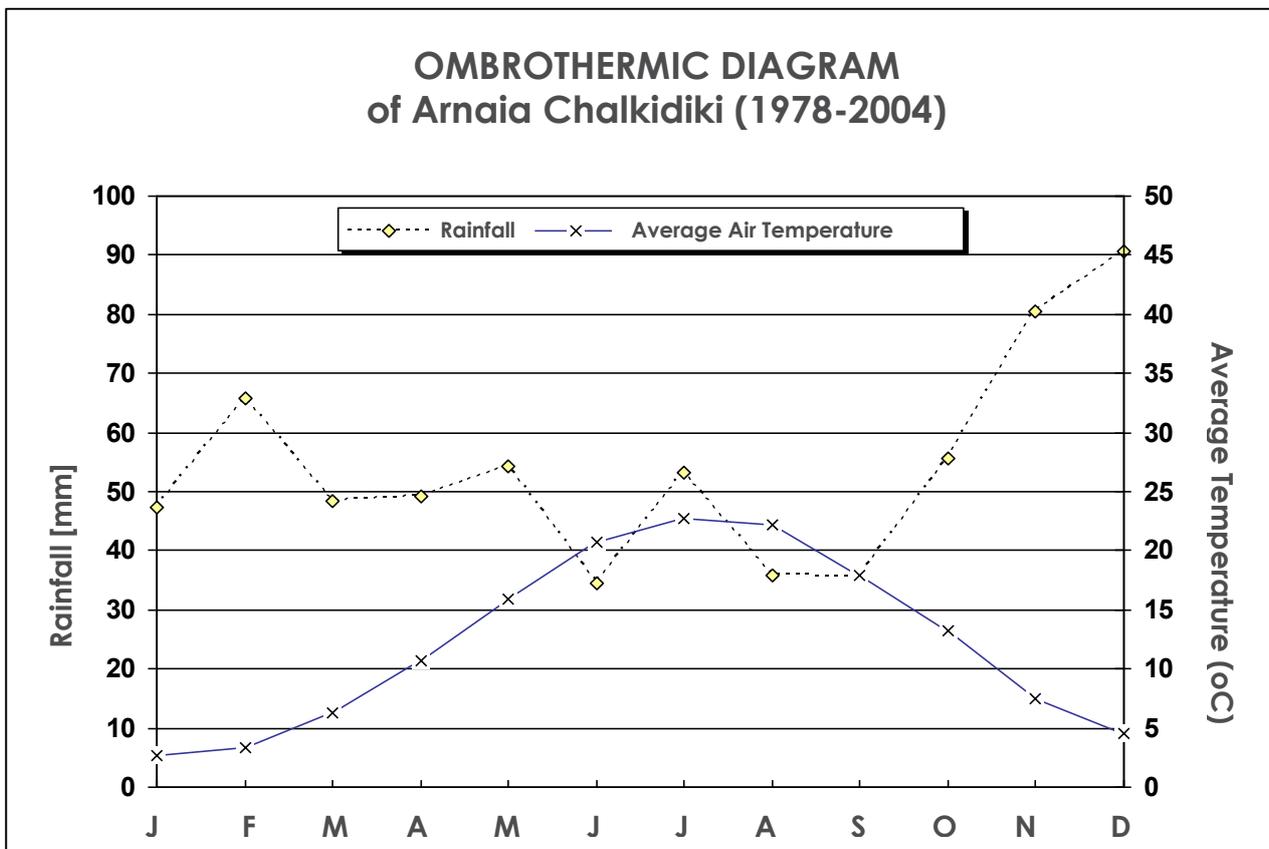


Figure 3.1-16: Ombrothermic diagram for the period 1978-2004 for the meteorological station of Arnaia
(Source: National Agricultural Research Foundation)

4.1.2. Relative humidity - Evaporation

Table 3.1-17 shows the monthly average relative humidity recorded by the meteorological station of Ormylia for the period 1991-1999.

Table 3.1-17: Average monthly values of humidity of Ormylia Meteorological Station (Source: Hellenic Ministry of Rural Development and Food)

	J	F	M	A	M	J	J	A	S	O	N	D	Average/Total annual
Relative air humidity (%) [1991-1999]	94	94	92	88	91	85	82	84	90	88	92	91	89

Table 3.1-18 shows the monthly average relative humidity and evaporation recorded by the meteorological station of Arnaia for the period 1978-1997.

Table 3.1-18: Average monthly values of meteorological parameters of Arnaia Meteorological Station (Source: National Agricultural Research Foundation)

	J	F	M	A	M	J	J	A	S	O	N	D	Average/Total annual
Relative air humidity (%)	85	83	80	73	71	66	65	67	72	80	85	86	76
Evaporation* (mm)	20	20	34	51	59	76	82	79	61	39	20	23	564

4.1.3. Wind

Relative to the wind conditions prevailing in the region, their main characteristic is the complete dominance of low intensity winds (up to 3 Beauforts). Their directions are primarily northwestern and southeastern. **Table 3.1-19** shows the annual frequency of winds of the M.S. of Polygyros. Their distribution seems to be dominated by NE and SE winds of 2 and 1 Beaufort.

Table 3.1-19: Frequency of power and direction of Polygyros Meteorological Station (Source: National Observatory of Athens)

Annual frequency (%) of power and direction of wind (Beaufort Scale)										
Beaufort	N	NE	E	SE	S	SW	W	NW	Calm	Total
Calm	-	-	-	-	-	-	-	-	0,6	0,6
1	1,2	9,2	5,4	7,6	6,1	6,9	0,6	1,3	-	38,3
2	4,6	13,4	9,3	7,6	3,8	2,0	0,2	1,3	-	42,2
3	3,6	5,3	2,4	3,1	0,3	0,1	0,0	0,4	-	15,2
4	1,0	1,0	0,6	0,8	0,0	0,0	0,0	0,1	-	3,5
5	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,0	-	0,2
Total	10,4	29,0	17,8	19,1	10,3	9,1	0,8	3,1	0,6	100,0

Table 3.1-20 shows the annual frequency of winds (M.S. of Arnaia). Their distribution seems to be dominated by NW and SE winds of 1 Beaufort.

Table 3.1-20: Frequency of power and direction of Arnaia Meteorological Station (Source: National Agricultural Research Foundation)

Annual frequency (%) of power and direction of wind (Beaufort Scale)										
Beaufort	N	NE	E	SE	S	SW	W	NW	Calm	Total
Calm									1,00	1,00
1	1,10	1,10	5,90	24,30	7,50	1,20	1,20	25,60	-	67,90
2	0,20	0,30	3,10	5,50	4,30	0,50	0,30	7,90	-	22,10
3	0,00	0,40	1,30	1,50	1,80	0,50	0,00	2,90	-	8,40
4	0,00	0,00	0,05	0,20	0,05	0,00	0,00	0,20	-	0,50
5	0,00	0,00	0,05	0,00	0,00	0,00	0,00	0,05	-	0,10
Total	0,30	1,80	10,40	31,50	13,65	2,20	1,50	36,65	1,00	100,00

4.2. Morphological and landscape characteristics

The Study area is characterized by the presence of the mild mountainous mass of Mount Holomontas, the main development of which is located centrally within the study area. These mountains give a special morphological quality to the landscape because of their natural beauty.

Despite continuous and lengthy human activities taking place (agriculture in the plains, open pit mining in the southern and eastern areas), the landscape of the immediate study area remains mainly untouched, creating a positive image.

Mount Holomontas, with a direction development from SW to NE, occupies the central part of the region. The section of the mountainous massif Holomontas develops in the region the most important topological characteristics of high mountains: wild landscape, intense steep slopes, steep folds, deep and meandrous canyons.

The mountains in the area show no evidence of degradation (by fire or other causes), except for the eastern part of the area, eastern of Vavdos town, where a large-scale operation of open-pit mining has taken place. In general, land uses developed are compatible with each other, the vegetation is well preserved and there exist visible signs of rational management and protection of the Forest agency. The dense network of forest roads which have been drilled in the area are minimal and there are no obvious signs of deterioration of the landscape by buildings or other activities.

The water element, which is abundant in the area, is aesthetically dominant and presents much morphological and topological interest. The hydrographic network grows naturally around the main trunks of watercourses with numerous small streams that contribute to them along the course (see **Chapter 3.4**, Aquatic Environment).

To the northwest of the study area, Holomontas reaches until the development of the mountainous volume of Hortiatis, allowing the formation of two semi-mountainous areas and plains around them, one in the west (Galatistas area) and one in the northeast (Paleochora area), with characteristic smooth slopes and croplands. Throughout the region, however, the thalwegs hosting the watercourses of the area are steep with canyone-like features.

The lowland coastal zone is dominated by flat morphology, characterized by very small to zero gradients, smooth development landscape and absence of folds of soil or other notable visual morphological characteristics, especially in the area of Olynthus and Kalives Polygyrou but also at the Ormilía municipality section.

The study area is located approximately 3,2km north of the town of Polygyros, north of the hill "Castrí." The surrounding area is relatively intense, hilly terrain, with elevations greater than 600m, which offer good visual coverage. The main range of hills in the area are developing east and northeast of the position of the landfill site with a general direction of N, NW to S, SE and it forms a dividing mass between two river basins of which the eastward one drains to the north, while the west is drained to the west.

The southern limit of the landfill site is at an altitude of 680m, while the northwest at an altitude of 580m. The thalweg developed in the central part of the site has a general direction from SE to NW. The direction of flow of the surface waters is to the NW. The site is very close to the watershed. The terrain of the basin has gentle slopes to the west. The ground slopes in the area of the site is 38% in the north-eastern part of the site and 36% in the Southwest. The catchment area formed by the watershed east of the landfill site and north of the hill "Castrí" is less than 5 acres.

4.3. Geological - tectonic characteristics

4.3.1. Geology - Hydrogeology

The background of metamorphic rocks is revealed throughout the region, with frequent geological formations phyllites and quartz - sandstone schist. This rock formation is found on the surface of the soil and there is no disintegration zone. The formations are consistent with typical layering and slopes with an E-NE direction. Loose and unbound materials, prone to landslide are not existent.

The study area is geotectonically located in the western part of the Serbomacedonian zone. In this region the Perirodopiki Zone also stretches which consists of individual modules and interior parts of the area of westward Paeonia zone. The sections shown on the main core of Chalkidiki is the Aspri Vrysi - Chortiati section, the Melissohori – Holomontas section and the northern Deve Koran - Doubia section. The Melissohori – Holomontas section extends from Melissochori to Cholomonta and up to the peninsula of Sithonia. It is of Alpine origin and it has undergone a metamorphosis in conditions of greenschist face. The main formations that have emerged are marble, quartz, phyllites and psammitic limestones.

The area of the Polygyros landfill is situated on the quartz – phyllite layer belonging to Svoulas group with individual fine to middle-grained geological dark ash - chestnut quartz, limestone and quartz sandstones with intercalations of ash – brown ash phyllites with graphitic schists and black-dark ash phyllites. The Aspri Vrysi - Chortiatis section consists of metamorphic rocks, sericitic - epidotite - chlorite gneisses, greenschists, clay schists, phyllites and at some places tectonic interference of solid marble. The Chortiatis section is in tectonic contact with the series of gabbro rocks of the ophiolitic section of western Chalkidiki. The surrounding area is characterized by rifts of NW - SE direction and they constitute at the same time the main front of upthrust of Alpine Unity of the Perirodopiki, with direction always to the west.

The area forms a basin with gentle slopes of the terrain to the west. The direction of flow of the surface water is to the NW. The elevation at this location is approximately 600m. The geological formations encountered are phyllites and schists (mainly quartz and sandstone). The rock is encountered on the surface of the soil and there is no significant disintegration or mantle zone. The formations are consistent with typical layering and inclinations towards the E- NE. In general, the phyllitic formulations are impervious with very small primary porosity. Aquifers in these formations are only found in fracture zones. Major fault zones do not exist or are not detected macroscopically in the region.

4.3.2. Soil

Based on the data from the Soil Atlas of Europe, 2005 (**figure 3.3-1**), the intervention area of Polygyros Landfill is dominated by Eutric Cambisol ('Be' in the following figure), a common Mediterranean and highly productive topsoil, used for crops or as grazing land.



Figure 3.3-1: Soil Atlas of Study Area and Legend (source: Soil Atlas of Europe, 2005)

According to the soil classification of the Soil Atlas of Europe (2005), Eutric soils form a base saturation of more than 50 percent, in some part between 20 cm and 100 cm depth from soil surface. More dominant soils in the study area are Chromic Luvisol (well-developed soil with an argic sub-surface horizon, with a reddish colour) and on the west Calcari-chromic Vertisol (Seasonally cracking soil, rich in swelling clays, with a calcareous nature and reddish hue). Other smaller-scale areas are covered with Calcaric Fluvisol (highly productive soil type, frequently located along past or present rivers, of calcareous nature at least between 20 and 50 cm from the soil surface), Dystric Cambisol (a productive topsoil used for mixed arable farming, with a base saturation (in 1M ammonium acetate at pH 7.0) of less than 50 percent, at some part between 20 and 100 cm from the surface) and Calcaric Regosol (very weakly developed mineral soil in unconsolidated materials with only a limited surface horizon, of calcareous nature).

The geology of the study area is shown in detail in Map 2 (Geological map) of Appendix 1, while the Soil Map (Map 3) is presenting the soil cover of the study area.

Also, based on the study of River Basin Management Plan (RBMP) of Central Macedonia (2014), the hydrogeological map of the study area is given in **figure 3.3-2** below.



Figure 3.3-2a: Hydrogeological map of the Study area and Legend (source: RBMP of Central Macedonia, 2014)

Legend

- 42 Impervious formations or formations of small thickness under which develop significant aquifer systems
- 111 Micro-permeable formations (sedimentary formations of high-capacity, covering large area)
- 121 Micro-permeable formations (small-scale formations with local importance or formations of medium capacity, covering large area)
- 211 Macro-permeable formations (sedimentary formations of high capacity covering large area)
- 212 Macro-permeable formations (igneous formations of high capacity covering large area)
- 213 Macro-permeable formations (metamorphic formations of high capacity covering large area)
- 221 Macro-permeable formations (small-scale sedimentary formations with local importance or formations of medium capacity, covering large area)
- 222 Macro-permeable formations (small-scale igneous formations with local importance or formations of medium capacity, covering large area)
- 223 Macro-permeable formations (small-scale metamorphic formations with local importance or formations of medium capacity, covering large area)
- 311 Semi-permeable formations (sedimentary, porous formations)
- 312 Semi-permeable formations (igneous, porous formations)
- 321 Semi-permeable formations (sedimentary, cracked formations)
- 322 Semi-permeable formations (igneous, cracked formations)
- 323 Semi-permeable formations (metamorphic, cracked formations)
- 411 Non-permeable formations (practically impervious sedimentary formations)
- 412 Non-permeable formations (practically impervious igneous or volcanic sedimentary formations)
- 413 Non-permeable formations (practically impervious metamorphic formations)
- 2111 Macro-permeable formations (Limestones and dolomites of high-capacity, covering large area)
- 2132 Macro-permeable formations (Marbles of high-capacity, covering large area)
- 2211 Macro-permeable formations (small-scale limestones and dolomites with local importance or formations of medium capacity, covering large area)
- 2232 Macro-permeable formations (small-scale marbles with local importance or formations of medium capacity, covering large area)

Figure 3.3-2b: Hydrogeological map of the Study area and Legend (source: RBMP of Central Macedonia, 2014)

Concerning the hydrogeological formations of the study area, the intervention area is mainly dominated by semi-pervious, cracked metamorphic formations (code 323). Dominant in the study area are also macro-permeable igneous formations (code 222) and impervious formations or of small thickness with significant water systems under them (code 42). At a smaller scale, there are macropermeable metamorphic formations of great capacity (code 213), macropermeable limestone and dolomite formations (code 2111) and practically impervious sedimentary formations (code 411).

4.4. Aquatic environment

Based on the Ministerial Decision 706/2010 (Official Gazette 1383/B/2010) the boundaries of river basins in the Greek territory were determined (the Annex II of the Ministerial Decision was corrected by the Error Correction Official Gazette 1572/B/2010). The study area falls within the Main River Basin (MRB) of Chalkidiki (GR05) which:

1. **From a hydrological viewpoint**, belongs to the Water District (WD) of Central Macedonia (GR10),
2. **From a soil taxonomy viewpoint**, it belongs to the Region of Central Macedonia
3. **From an administrative viewpoint**, belongs to the Region of Central Macedonia, Municipality District of Chalkidiki.

Additionally, the RBMP for the WD GR10 has been approved by the Special Secretariat For Water of the Ministry of Environment, Energy & Climate Change and the Basin Management Plan (BMP) and the Strategic Environmental Assessment of the BMP are in force, in accordance with the requirements of the Water Framework Directive 2000/60/EC, and the following Greek Law 3199/2003 and Presidential Decree 51/2007. The depiction of the current situation of the aquatic environment of the study area is based upon the aforementioned studies as well as the data collected by the on-site investigation.

The construction of new water management projects related to the protection or management of water within the study area is not planned.

4.4.1. River Water Bodies

The area is rich in water resources, which is particularly important for the agricultural production of the region, which is the main activity of the inhabitants. In the project area there are no dams or reservoirs and surface runoff ends in the main streams like Kavrolakkos stream. The surface waters are being used exclusively for agricultural and farming purposes by local residents.

Based on Article 2 of the Water Framework Directive, a **river** is the whole internal system of water bodies which flow mainly on the surface of the soil or also underground, for a specific length of its course. The study area has is traversed by **21 rivers and streams**. In **Table 3.4-1** and **Figure 3.4-1**, you may see the rivers of the study area with their water basins (**figure 3.4-2**) and their encodings are presented, according to the study of RBMP of Central Macedonia (2014). Also, you will see all the river bodies of the area in Map 5 of Appendix 1.

According to the study of RBMP of Central Macedonia (2014), in the whole Study area, there are no heavily modified and artificial Surface Water Bodies detected. Also, in the study area there are no lake water bodies.

Table 3.4-1: Presentation of the river water bodies of Chalkidiki River Basin (GR05), based on the "Implementation of the Article 5 of the WFD 2000/60/EC" for the Water District of Central Macedonia

Code of Water Body	Code on map (figure 3.4-1)	Description
GR1005R000206013N	62	Holomontas
GR1005R000206014N	63	Koutsikarli stream
GR1005R000206216N	65	Holomontas
GR1005R000208017N	67	Megalo
GR1005R001700030N	81	Anthemous
GR1005R002701035N	86	Vatonias
GR1005R002702038N	87	Vatonias
GR1005R002703036N	88	Vatonias
GR1005R002704039N	89	Vatonias
GR1005R002704040N	90	Vatonias
GR1005R002705037N	91	Vatonias
GR1005R002900041N	92	Zamouni
GR1005R003101042N	93	Havrias
GR1005R003102048N	94	Kaprinikia
GR1005R003103043N	95	Havrias
GR1005R003104049N	96	Miliadino
GR1005R003104050N	97	Miliadino
GR1005R003105044N	98	Havrias
GR1005R003106051N	99	Xinoneri
GR1005R003107045N	100	Havrias
GR1005R003110053N	103	Havrias



Figure 3.4-1: Overview of the study area with all its river water bodies (source: RBMP of Central Macedonia, 2014)

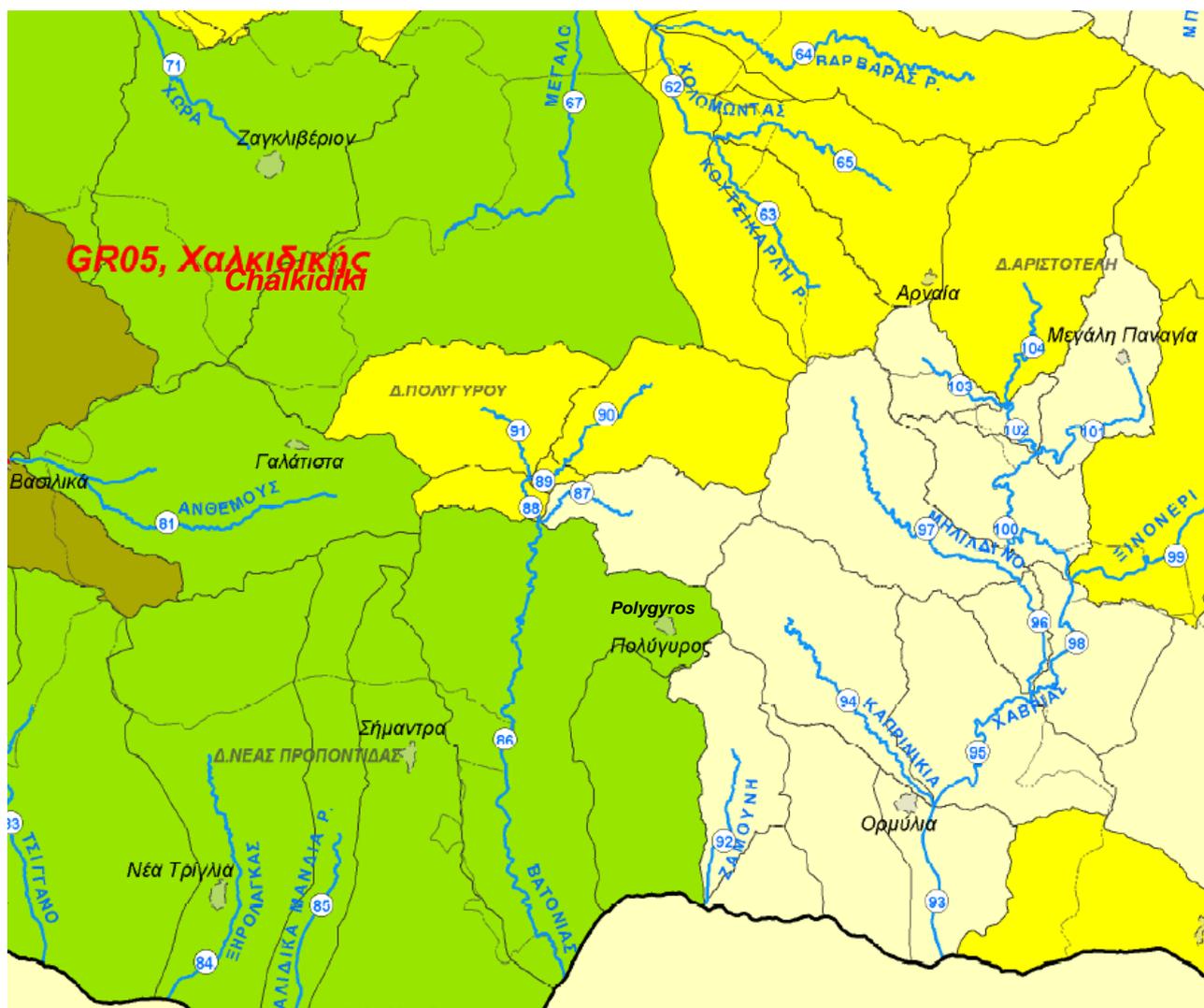


Figure 3.4-2: Overview of the study area with all its river water basins (source: RBMP of Central Macedonia, 2014).

Colours indicate the intensity of the stress on these areas: light yellow is “Low”, yellow is “Medium”, green is “Significant” and dark olive is “Very Important”.

In the intervention area of the study (Polygyros landfill) a small runoff basin is formed, with a total area of less than 0,05km². The surface runoff in this basin is very limited, and, although no direct measurements exist, it is expected below 6000 m³/y. It is known from literature data that the infiltration rate for the metamorphic rock formations which are encountered in the area ranges from zero (for healthy rock formations) and it gradually increases proportionally to the degradation of the rock, until 15-30%. From empirical observations no ponds of still water are formed in the immediate area, not even after long-hours of rainfall.

Quality of river systems

Within the context of the Water Framework Directive 2000/60/EC, all the water bodies of Greece were classified according to their quality state. The findings were presented in the study of RBMP of Central Macedonia (2014). For the Study area, the quality of the surface water bodies is presented in **table 3.4-2** and in **figure 3.4-3** below:

Table 3.4-2: Presentation of the ecological and chemical coding of the river water bodies, based on the "Implementation of the Article 5 of the WFD 2000/60/EC" for the Water District of Central Macedonia

Code of Water Body	Code on map (figure 3.4-3)	Description	Natural / modified / highly modified	Ecological status / ecological potential	Chemical Status
GR1005R000206013N	62	Holomontas	Natural	Unknown	Unknown
GR1005R000206014N	63	Koutsikarli stream	Natural	Unknown	Unknown
GR1005R000206216N	65	Holomontas	Natural	Unknown	Unknown
GR1005R000208017N	67	Megalos	Natural	Poor	Unknown
GR1005R001700030N	81	Anthemous	Natural	Unknown	Unknown
GR1005R002701035N	86	Vatonias	Natural	Unknown	Unknown
GR1005R002702038N	87	Vatonias	Natural	Unknown	Good
GR1005R002703036N	88	Vatonias	Natural	Unknown	Good
GR1005R002704039N	89	Vatonias	Natural	Unknown	Good
GR1005R002704040N	90	Vatonias	Natural	Unknown	Good
GR1005R002705037N	91	Vatonias	Natural	Unknown	Good
GR1005R002900041N	92	Zamouni	Natural	Unknown	Unknown
GR1005R003101042N	93	Havrias	Natural	Good	Good
GR1005R003102048N	94	Kaprinikia	Natural	Good	Good
GR1005R003103043N	95	Havrias	Natural	Good	Good
GR1005R003104049N	96	Miliadino	Natural	Good	Good
GR1005R003104050N	97	Miliadino	Natural	Good	Good
GR1005R003105044N	98	Havrias	Natural	Good	Good
GR1005R003106051N	99	Xinoneri	Natural	Good	Good
GR1005R003107045N	100	Havrias	Natural	Good	Good
GR1005R003110053N	103	Havrias	Natural	Good	Good

All river water bodies of the study area are natural and have not been modified in any way. Also, all the river bodies of the general Havrias basin (no. 93 to 103) have good ecological quality, while only "Megalos" (no. 67) has poor quality and all the rest have not been investigated thoroughly. These findings are also presented in **figure 3.4-3**.

As far as their chemical status is concerned, all except one of the river bodies of the Vatonias main basin (no. 87 – 91) and all the river bodies of the general Havrias basin (no. 93 to 103) have good chemical status, while all the rest is unknown. These findings are also presented in **figure 3.4-4**.

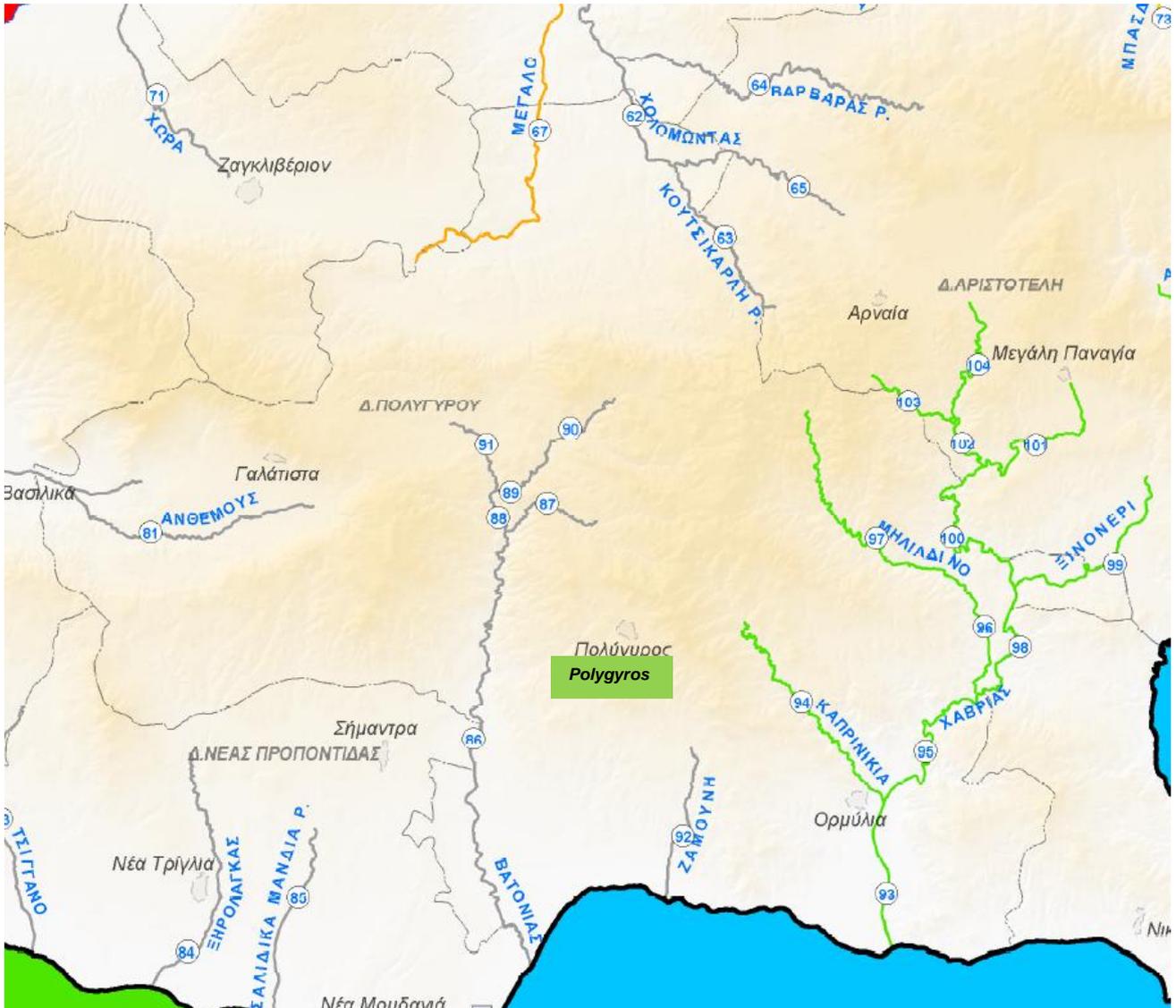


Figure 3.4-3: Ecological quality of the river water bodies of the study area (source: RBMP of Central Macedonia, 2014).

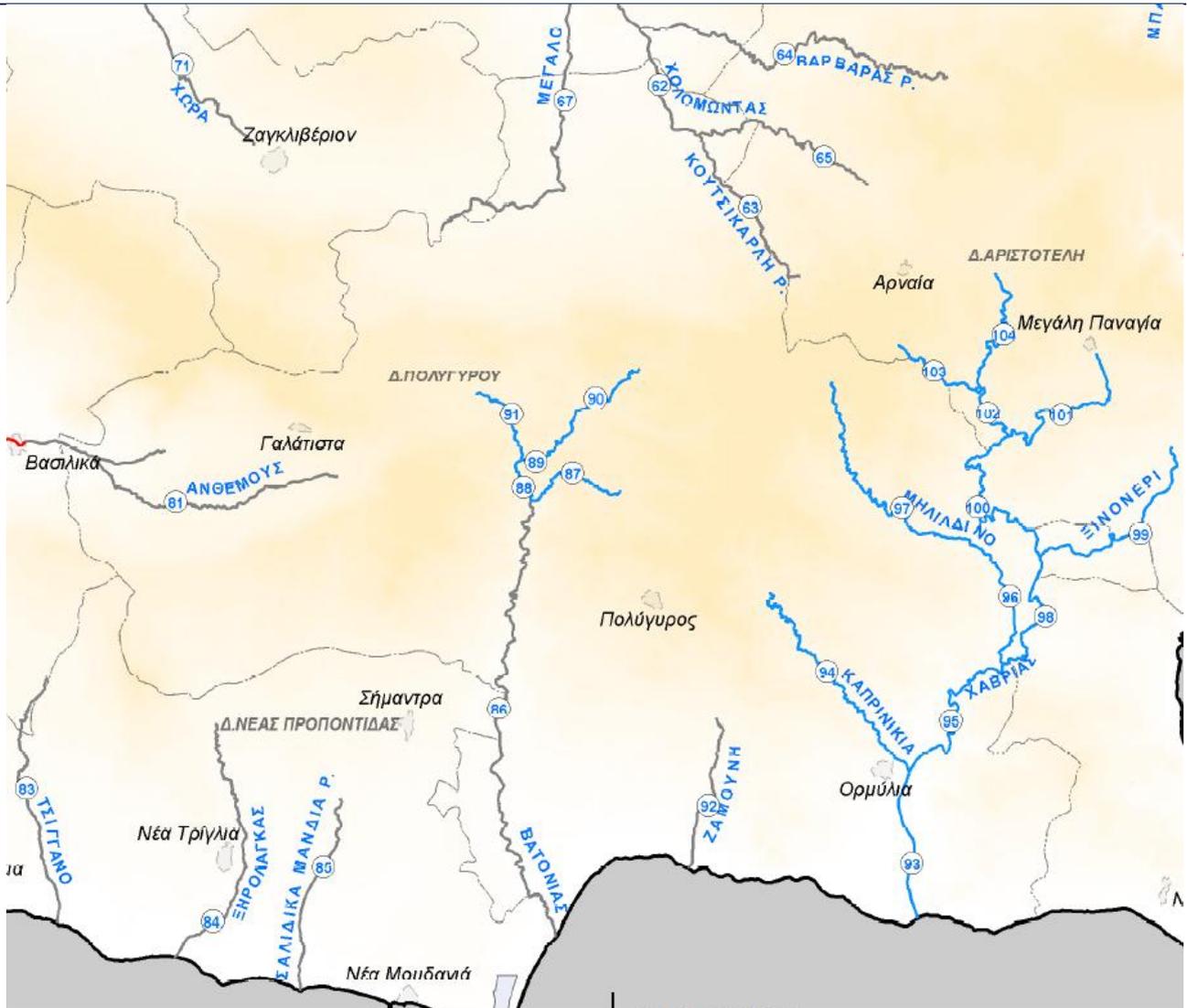


Figure 3.4-4: Chemical status of the river water bodies of the study area (source: RBMP of Central Macedonia, 2014).

4.4.2. Groundwater bodies

According to the study of RBMP of Central Macedonia (2014), the main catchment of Chalkidiki (GR05) is divided into six (6) major and six (6) secondary Groundwater Bodies (GWB). In particular, the intervention area is situated on top of the GR1000193 "Holomontas Oraikastro Sub Catchment" GAS. The whole list of the GAS, which are included in the Study area, is presented in **table 3.4-3** and they are visible in the maps in **figures 3.4-5** and **3.4-6**.

Table 3.4-3: Presentation of the Groundwater Bodies of the Study area (source: RBMP of Central Macedonia, 2014)

Code of GAS	Description	Related surface water systems	Total Surface (km2)
GR1000193	Sub Catchment of Holomontas Oraiokastrou (cracked)	Rivers Havrias, Holomontas, Anthemountas, str. Vatonias, Petrenio, Varvaras, Aspropetra, Miladino, Xiropotamos, Xinoneri, Koutsikarli, Kaprinikia, Zamouni	1.597,38
GR1000060	Epanomis - Moudanion		681,77
GR1000061	Sub Catchment of Epanomis – Moudanion (grany)	Streams Zamouni, Xirolagkas, Tsiggano, Salidika Mandria, Vatonias	647,95
GR1000062	Sub Catchment of Nea Triglia (karstic)	-	33,81
GR1000070	Mygdonias (grany)		579,99
GR1000072	Sub Catchment of Volvi (grany)	River Rihios, Holomontas, str, Aspropetra, Varvaras, Derveni, Kerasias, Koutsikarli, Megalo, Potamia, Hora	495,38
GR1000080	Anthemountas (grany)	River Anthemountas	309,45
GR1000082	Galarinou – Galatistas (grany)	-	40,21
GR1000083	Thermis (N) – N. Rysiou (S) (grany)	-	177,01
GR1000100	Ormylias (grany)	River Havrias, str. Kaprinikia	42,18



Figure 3.4-5: Presentation of the Groundwater Bodies of the Study area (source: RBMP of Central Macedonia, 2014)

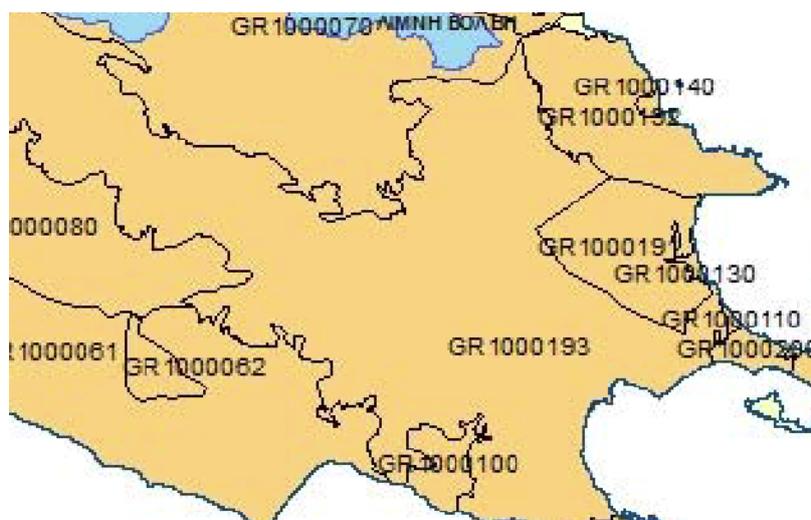


Figure 3.4-6: Groundwater Bodies of the area (source: Strategic Environmental Impact Report, 2013)

Quality of Groundwater Bodies

In the main catchment of Chalkidiki (GR05), 12 GAS have good chemical status while the following 5 are showing bad chemical state. In particular, in the study area, the GAS that present problems are the following:

4. The system GR1000070: grany of Mygdonia, which is then divided into two sub-systems, the Koroneia one (GR1000071) and the one of Volvi (GR1000072). These sub-systems are showing locally increased values of NO₃ and cinductivity / chloride ions from historic industrial pollution (paintshops). Some decline in the water level is located mainly in the Koroneia sub-system.
5. The system GR1000080: grany of Anthemountas, which is showing increased values of nitrates locally. Also, there is evident diminishing of the aquifer and the partially pressurized water beds, with declining trends and a developping zone of salination.
6. The system GR1000060: grany of Epanomis-Moudanion, which is showing seriously increased values of nitrates in its NW part (which has been incorporated into the Registry of Areas Vulnerable to Nitrates) and in its SW part (mostly outside of the Study area). It also presents decline in its water level and salination, due to excess pumping.
7. The system of Ormylia (GR1000100) where a decline on the aquifer level near the coast is detected

These findings are summarised in **table 3.4-4** and **figures 3.4-7** and **3.4-8** which follow.

Table 3.4-4: Presentation of the Groundwater Bodies of the Study area (source: RBMP of Central Macedonia, 2014)

Code of GAS	Description	Anthropogenic pollution		Chemical State	Quantitative state
		Nitrate Pollution	Salination		
GR1000193	Sub Catchment of Holomontas Oraiokastrou	NO	NO	GOOD	GOOD
GR1000061	Sub Catchment of Epanomis – Moudanion	NO (only locally)	YES	BAD	BAD
GR1000062	Sub Catchment of Nea Triglia	NO	NO	GOOD	GOOD
GR1000072	Sub Catchment of Volvi	NO (only locally)	NO	GOOD	BAD
GR1000082	Galarinou – Galatistas	NO	NO	GOOD	GOOD
GR1000083	Thermis (N) – N. Rysiou (S)	NO	NO	GOOD	GOOD
GR1000100	Ormylias	NO	YES	BAD	BAD

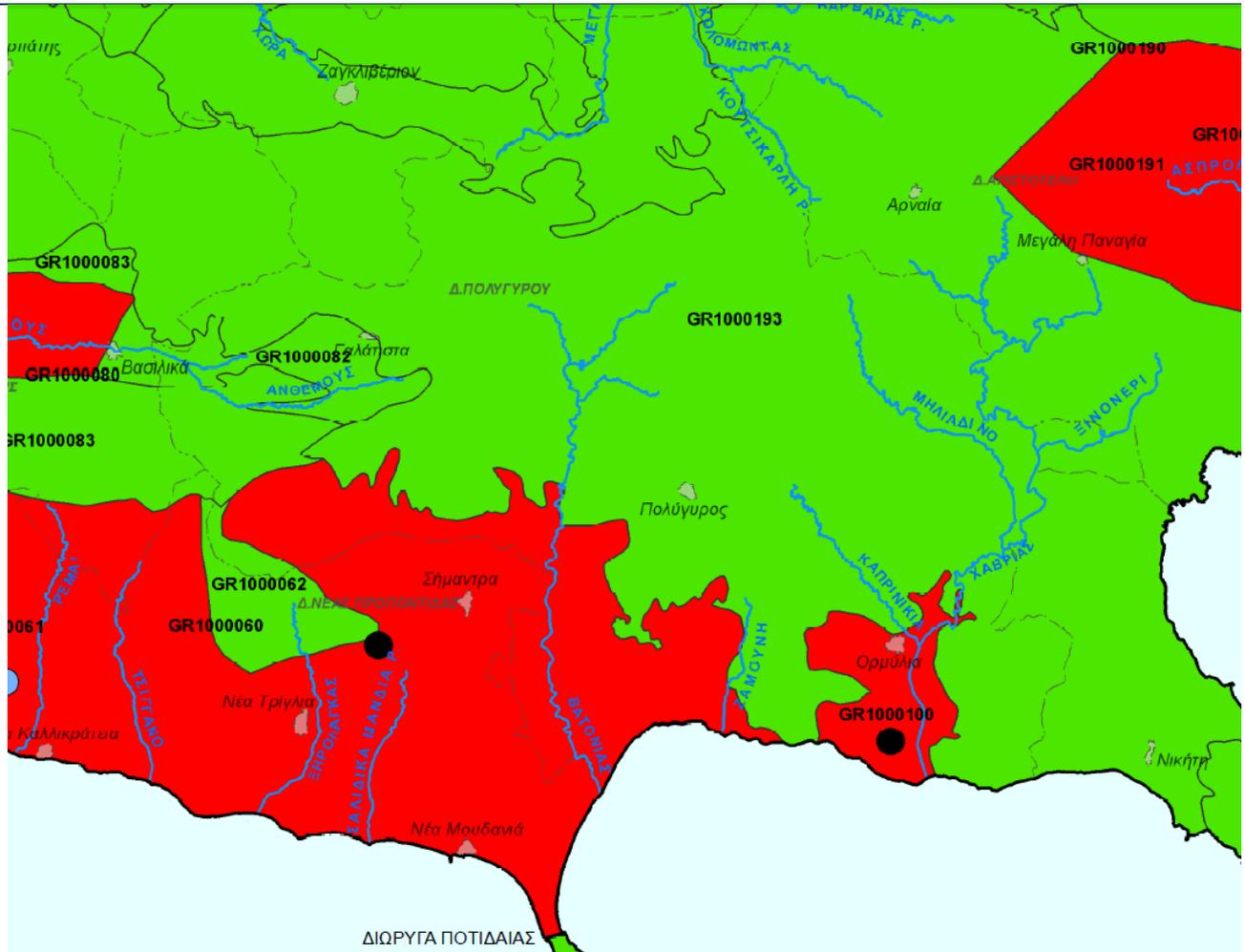


Figure 3.4-7: Chemical state of the Groundwater Bodies of the Study area (source: Strategic Environmental Impact Report, 2013), green colour indicates «good» state, red indicates «bad».

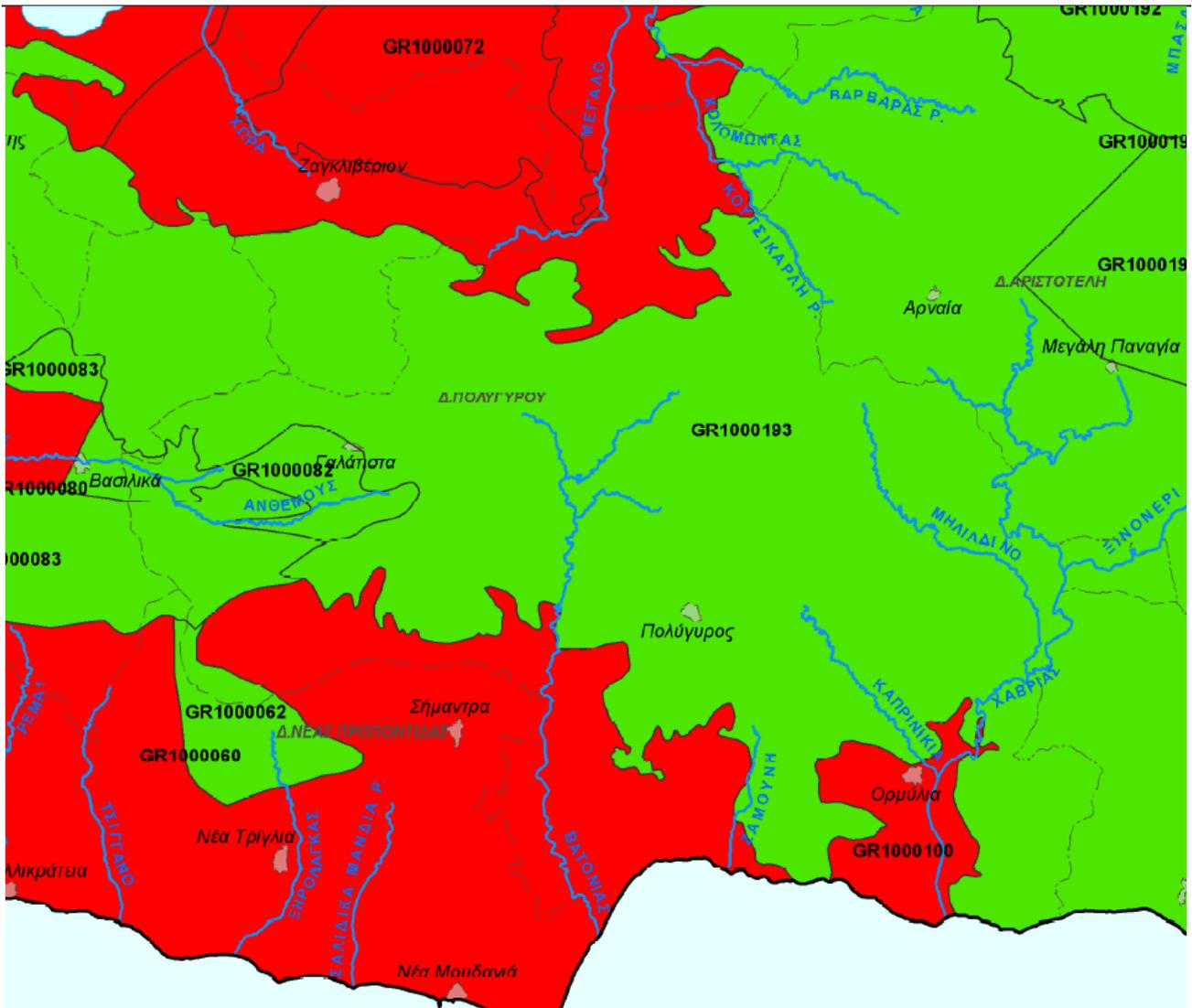


Figure 3.4-8: Quantitative state of the Groundwater Bodies of the Study area (source: Strategic Environmental Impact Report, 2013), green colour indicates «good» state, red indicates «bad».

4.4.3. Coastal water bodies

According to the Water Framework Directive on (2000/60/EC) coastal water is “surface water on the landward side of a line every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters”. As the study area does not include any transitional waters, all marine waters that surround it are classified as coastal waters. The study area, meaning the Municipality of Polygyros, has a coastline of about 25 Km on the south (see **Figure 3.4-9**).



Figure 3.4-9: Coastline of Polygyros and part of Gulf of Kassandra

The marine area related to the study area is the northern part of the Gulf of Kassandra. It is a generally large and very secluded bay, as presented in **figure 3.4-10**. Due to the topography and relatively closed system, usually low speed marine currents are prevailing inside the Gulf. Also, due to its nature, the water recirculates slowly to the Aegean sea, thus it is very much impacted by coastal activities and surface runoff from the inland.

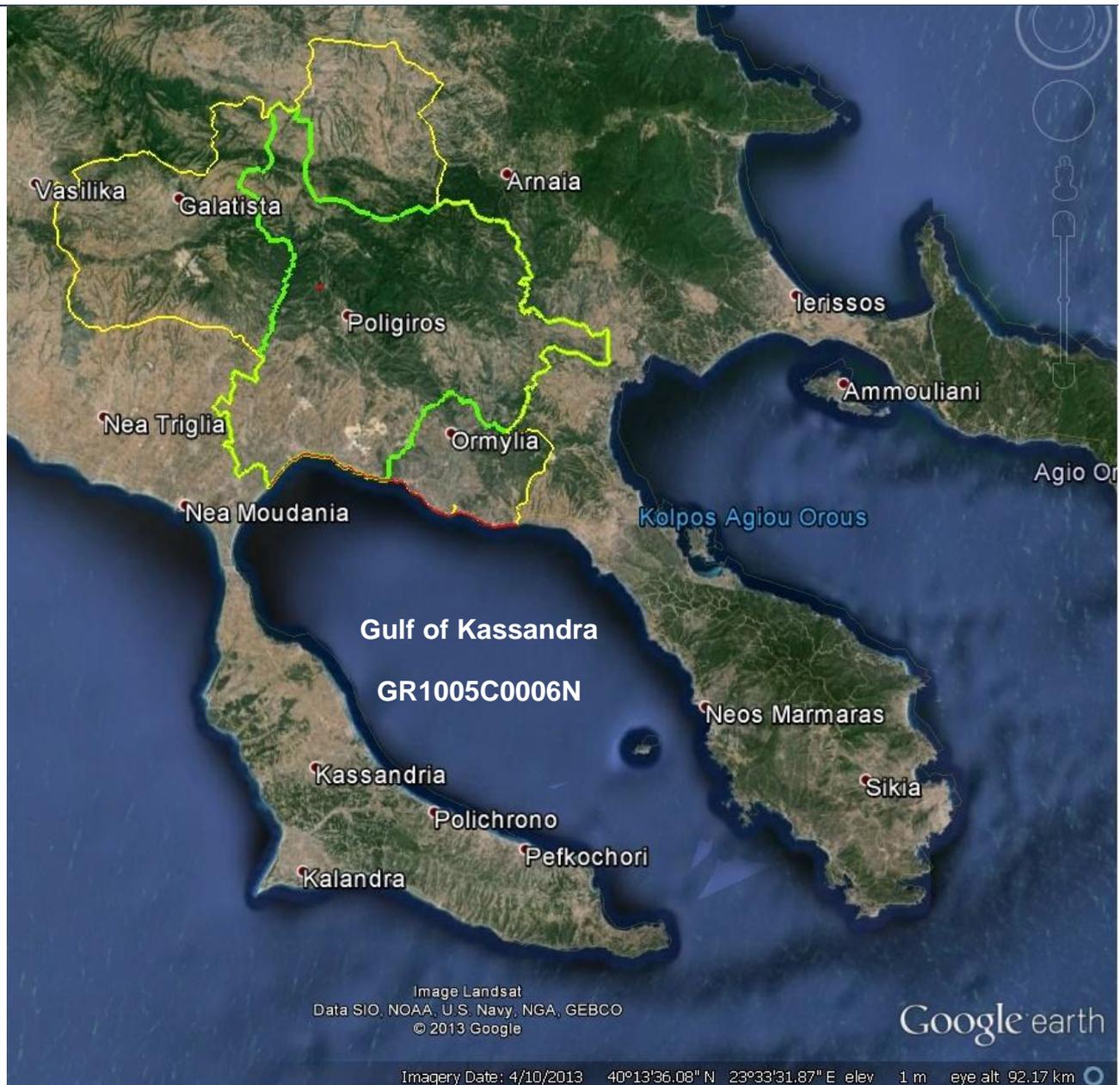


Figure 3.4-10: The total area of the Gulf of Kassandra (source: Google Earth)

Within the framework of the WFD, the Gulf of Kassandra is the only coastal water body encountered in the Municipality of Polygyros (study area). According to the study supporting the RBMP of Central Macedonia (2014), the Gulf of Kassandra (encoded GR1005C0006N) has a total area of 867 Km² and its quality of ecological state is high, while its quality of chemical state is “unknown”.

Protected water recreational areas are areas that have unique or rare characteristics that make them suitable for recreational activities, gather a significant number of visitors and active participants in such activities or have a fixed infrastructure, necessary for the implementation of these activities. In our study area, these are mainly bathing areas in marine waters.

The quality of bathing waters at the beaches of Greece is monitored systematically since 1988, in accordance with the Directive 76/160/EEC “concerning the quality of bathing water” (valid until 2014) and since 2010, monitoring is carried out in accordance with the succeeding Directive 2006/7

/EC “concerning the management of bathing water quality”, harmonized in the Greek legislation with the JMD 8600/416/E103/23.2.2009 (Official Gazette B' 356).

Along the coastline of the Study area, there exist 8 monitoring stations for bathing waters, in the following beach locations:

- GR1270010164010101: Gerakina Hotel
- GR1270010164010201: Vourla, opposite “Martha's House” hotel
- GR1270080164080101: Vatopaidi, Olympico
- GR1270080164080201: Vatopaidi, Sithon
- GR1270080164080501: Psakoudia, “Philippeo” Hotel
- GR1270080164080502: Psakoudia, “Philoxenia” Hotel
- GR1270080264080301: Metamorphosi, , Skala community beach
- GR1270080264080401: Metamorphosi, Sargani Hotel.

CHAPTER 5. BIOTIC ENVIRONMENT

5.1. Conservation status of the study area

The study area, as mentioned in more detail in chapter 2, is defined by the following limits:

- i. Intervention Area is the Polygyros Landfill.
- ii. Immediate Study area is the defined limits the Polygyros Municipality District.
- iii. Particularly for the biotic environment, a section of 2km around the landfill has been identified as immediate study area for the purposes of the ecological study.
- iv. The broader Study area is the whole Municipality of Polygyros.

The conservation status of the studied area is presented bellow. The protected areas within the study area or in the vicinity of it, includes the areas of the Natura 2000 network, the Important Bird Areas (IBAs) and the Corine Biotopes. All this information is also available in Map 4 vegetation Categories and Protected/Environmentally Sensitive Areas, in Appendix 1.

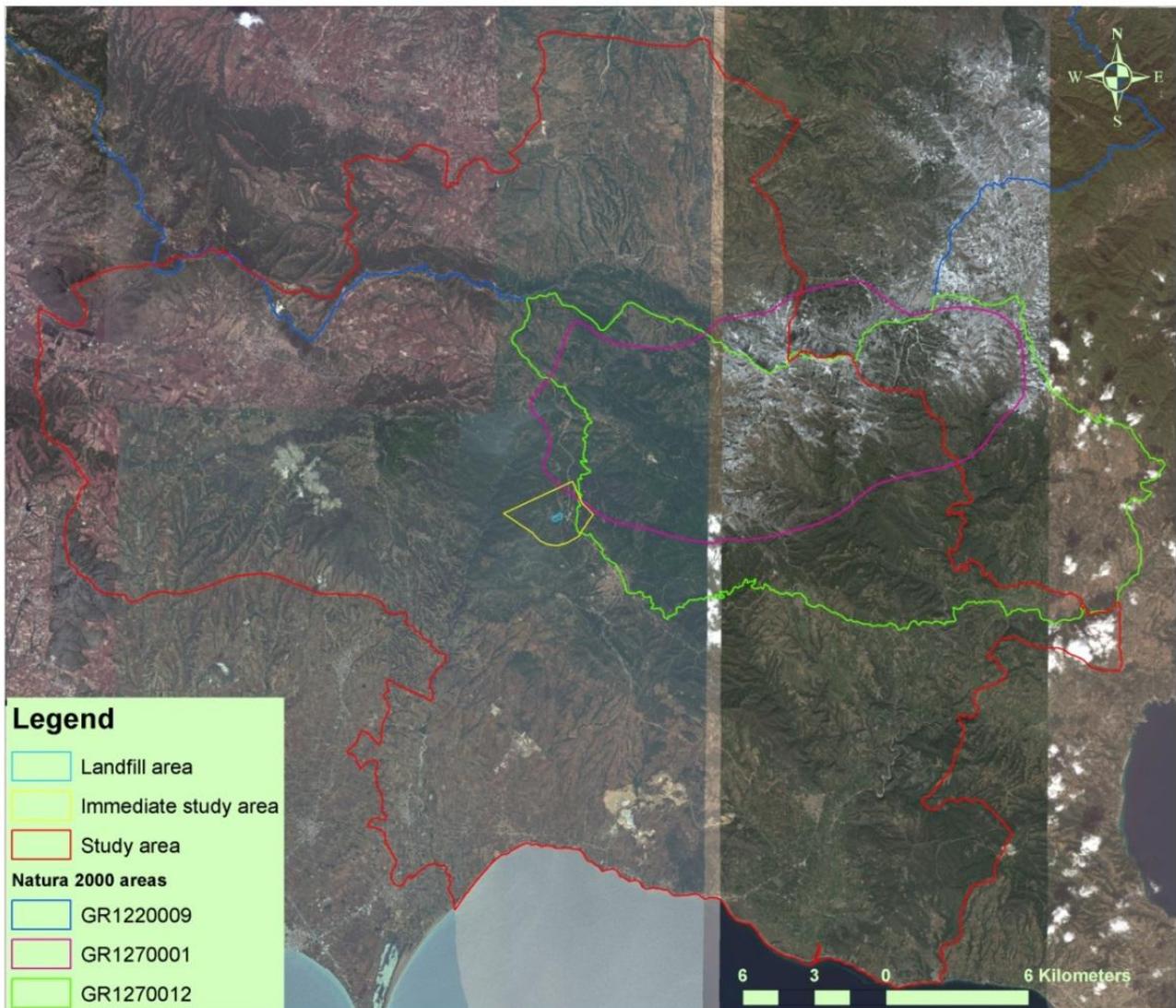


Figure 4.1-1 Natura 2000 sites in relation with the study area

5.1.1. Natura 2000 network

Special Protection Area (SPA) - GR 1270012 'Mount Cholomontas'¹

The region GR 1270012 'Mount Cholomontas' consists of forested hills with open forest structure and maquis, while within its boundaries the forest of Aristotelian Univ. of Thessaloniki (Department of Forestry and Natural Environment) is situated. Inside this forested area there are no rivers or lakes.

From a geological point of view Cholomontas belongs to the Serbo-Macedonian mass and Perirodope zone. The climate is the same as the inland areas of N. Greece. It is an intermediate climate type between those of the Mediterranean and the continent. The high altitudes (above 900 m) belong to the very humid zone, in winter, while the lower altitudes belong to the dry zone with mild winter climate. The biotope of *Fagion hellenicum* is without *Abies borisii regis*. A common hardwood type in NE Chalkidiki is a mixture of beech with oak and more rare with chestnut. These species because of their durability and strength is used for many items, ranging from boxes and coffins and materials for building construction. However, the more common use is for the mines of this region. Much more of a dozen of different hardwoods are found here and include *Carpinus duinensis*, *Ostrya carpinifolia*, *Tilia tomentosa*, *Acer campestre*, *Acer pseudoplatanus*, *Rhus coriaria* etc.

Concerning the quality and importance of the area, Cholomontas is a very important low mountain, near the city of Thessaloniki. Thus, a lot of people visit the region for the recreation. Native wildlife can be made a perceptible component of the forest scene by creating favourable habitats for birds and other small animals at roadside parks, rest areas and picnic sites. For larger species habitats should be created in glades, marshes or forest openings visible from the road. Details for the species of flora and fauna of this site are given in the following chapters.

Although some commercial spruce trees can be obtained from thinning operations on private or public woodlands, most trees are carefully raised on tree plantations which are met in many places of Cholomon. *Picea abies*, *Abies* sp. and *Pinus* sp. are the evergreen coniferous that are most often cultivated for these purposes.

The most important impacts and activities with high effect on the site are listed in the following table.

Table 4.1-1: Threats, pressures and activities with impacts on the site

Negative Impacts				
Rank	Threats and pressures [code]		Pollution (optional) [code]	inside/outside [i o b]
M	A01	Cultivation		i
M	A01	Cultivation		o
H	A04	grazing		o
L	A04	grazing		i
M	A07	use of biocides,		i

¹ <http://natura2000.eea.europa.eu/#>

Negative Impacts				
Rank	Threats and pressures [code]		Pollution (optional) [code]	inside/outside [i o b]
		hormones and chemicals		
M	A07	use of biocides, hormones and chemicals		o
M	A08	Fertilisation		o
M	A08	Fertilisation		i
L	B02.02	forestry clearance		i
L	C01.01	Sand and gravel extraction		i
H	C01.04	Mines		o
L	C01.04.01	open cast mining		i
M	C01.04.01	open cast mining		o
L	E01	Urbanised areas, human habitation		i
M	E01	Urbanised areas, human habitation		o
L	E02	Industrial or commercial areas		i
M	F03.01	Hunting		i
Positive Impacts				
Rank	Activities, management [code]		Pollution (optional) [code]	inside/outside [i o b]
M	A01	Cultivation		o
M	A07	use of biocides, hormones and chemicals		o
M	A08	Fertilisation		o
H	B	Sylviculture, forestry		i
H	B	Sylviculture, forestry		o
H	B01	forest planting on open ground		i

Rank: H = high, M = medium, L = low
Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,
T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

Special Areas of Conservation (SAC) GR1270001 ‘Mount Cholomontas’

As mentioned before and according to the Standard Data Form of the Special Area of Conservation (SAC) – GR1270001, Cholomontas is a picturesque mountain close to Thessaloniki with beautiful landscapes and breath-taking views. A lot of people visit the region for the recreation (mainly fans of alternative tourism and agrotourism), thus becoming an important attraction. It hosts a large number of animals and native wildlife can be made a perceptible component of the forest scene by creating favourable habitats for birds and other small animals at roadside parks, rest areas and picnic sites. For larger species habitats should be created in glades, marshes or forest openings visible from the road.

The most important impacts and activities with high effect on the site are listed on the following table.

Table 4.1-2 Threats, pressures and activities with impacts on the site

Negative Impacts				
Rank	Threats and pressures [code]		Pollution (optional) [code]	inside/outside [i o b]
M	A01	Cultivation		o
M	A01	Cultivation		i
L	A04	grazing		i
L	A04	grazing		o
M	A07	use of biocides, hormones and chemicals		i
M	A07	use of biocides, hormones and chemicals		o
M	A08	Fertilisation		i
M	A08	Fertilisation		o
H	C01.04	Mines		o
M	C01.04.01	open cast mining		o
M	E01	Urbanised areas, human habitation		o
M	F03.01	Hunting		i
Positive Impacts				
Rank	Activities, management [code]		Pollution (optional) [code]	inside/outside [i o b]
M	A01	Cultivation		o
M	A07	use of biocides, hormones and chemicals		o
M	A08	Fertilisation		o
H	B	Sylviculture, forestry		o
H	B	Sylviculture, forestry		i
L	B01	forest planting on open ground		i
L	B02.02	forestry clearance		i

M	F03.01	Hunting		i
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Rank: H = high, M = medium, L = low
Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,
T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

Special Protection Area (SPA) - GR1220009 'Lakes Volvi-Langada (or Koronia-Ag. Vasiliou) and Rentina Gorge (or Makedonika Tempji)

The north part of the study area is part of the Special Protection Area - GR1220009 'Lakes Volvi-Langada (or Koronia-Ag. Vasiliou) and Rentina Gorge (or Makedonika Tempji)'.

The two lakes of the site are connected to each other by a canal which today it is not functional. The malfunctioning of the canal, the rivulet embankments and the drainage works due to extensive cultivation, gradually drain off Koroneia (Langada) lake into Volvi Lake. The water level of the former has been reduced to 0,5 m. The latter, is also connected to the sea by Richeios river which passes through a gorge with precipices and rocks, surrounded by dense, high maquis of extraordinary composition and high plane trees along the river banks. The two lakes are characterised by dissimilar indexes of land uses, eutrophication and urbanization, with lake Langada (Koroneia) being more threatened. However, two large streams, i.e. Apollonia and Mellisourgos, flow into the lake Volvi and result in sedimentation. Locally extensive reed beds occur around the lakes and along the rivulet banks. Small linear and mosaic type wood areas are found within the site. Between the two lakes, the very old *Platanus orientalis* trees are found with important colonies of grey herons and the riparian forest of Apollonia, where a large number of animals, including birds, find refuge. The surrounding hilly and mountainous area, along with cultivated land, support good numbers of birds of prey (Lesser Spotted and Booted Eagle, Long-legged Buzzard, Lanner, etc) and other protected species such as the Black Stork, the Roller and the Calandra Lark.

Many feeding, nesting, breeding, wintering and refuge habitats for bird species are located in, along and close to the lake waters and Rentina gorge. Rentina gorge consists an important habitat for birds of pray and flyway for migratory bird species. In addition, the site is important from the archaeological point of view, since there are historical monuments in the area. Furthermore, the presence of two pairs of Sea eagle (*Haliaetus albicilla*) in both lakes and the presence of a wintering population of 5-7 birds indicates the significance of the area for this very rare species in Greece. Finally, the surrounding hilly and mountainous area supports good populations of raptors like the Lesser Spotted Eagle (*Aquila pomarina*), the Booted Eagle (*Hieraaetus pennatus*), Long-legged Buzzard (*Buteo rufinus*) and the Lanner (*Falco biarmicus*), as well as other protected species such as the Black Stork (*Ciconia nigra*), the Roller (*Coracias garrulus*) and the Calandra Lark (*Melanocorypha calandra*).

5.1.2. Important Bird Areas (IBAs)

Important Bird Areas (IBAs), are sites particularly important for bird conservation because they regularly hold significant population of one or more globally or regionally threatened, endemic or congregatory bird species or highly representative bird assemblages.

The area at north of the study area is characterized as IBA - GR032 'Lakes Volvi-Langada (or Koronia-Ag. Vasiliou) and Rentina Gorge (or Makedonika Tempj)' while part of study area is characterized as IBA - GR033 'Mount Cholomontas' (**Figure 4.1-2**).



Figure 4.1-2 Important Bird Areas (IBAs)

In the vicinity of the study area there are other sites under protection such as:

- Corine Biotores: Cholomontas Mountain (A00010018), Eastern Chalkidiki (A00060001), Havria estuary /Ormilja Region (A00010205), A00060010 Agios Mamas marsh , A00060002 Eastern Side of Mountain Stratonikos.
- Natural Monuments and Landmarks (law no. 996/71): M6 The plane tree at Geroplatanos of Chalkidiki (Official Gazette, law no. 738/B/75), M7 The plane tree at Vavdos Official Gazette, law no. 738/B/75).
- National Park of Koroneia – Volvi lakes (Official Gazette, law no. 248/05-03-04)
- Wetlands: GR127084000 Chavrias river, GR127085000 Chavrias estuary, GR127086000 Agios Mamas Marsh or Agios Mamantas Marsh. GR122062000 Anthemountas river.

5.1.3. Controlled Hunting Areas

The controlled hunting areas (Law No. 177/75, as amended by Law No. 2637/98) in the wider area are:

- K117 Zagliveri – Adam- Petrokerasa- Livadi (Law No. 673/B/85)

- K819 Mpara Agiou Mama at the Lorida location, Municipality of Nea Moudania (Law no. 570/B/16-5-01)
- K820 Petralona – Krini at the Katsika location, Triglia (Law no. 570/B/16-5-01)
- K880 Poligiros, Municipality of Polygyros (decision 2528/18-4-2001, Law No .570B'/16-5-2001)
- K840 Chavria Municipality of Arnaia & Panagia (Law no. 469/B/04-04-05)
- K841 Cholomontas of the Municipality of Arnaia (Law no. 864/B/06-07-01)
- K821 Ag. Prodromou – Vavdou, Municipality of Arnaia (dec. 2530/16-3-2001, Law No. 570/B/2001).

5.2. Vegetation categories and flora species

The vegetation zones of the study area (Vegetation zone in Greece, Mavromatis, 1980) are the following (Fig.3):

- Meso – Mediterranean (*Quercion ilicis*)
- Sub - Mediterranean (*Ostryo - Carpinion*)
- Subcontinental (*Quercion confertae*)
- Oro – Mediterranean (*Fagion - Abieton cephalonicae*)

These zones are formed based on flora composition, altitude, petrology, soil conditions, the exposure and incline of the slopes, air temperature and rainfall.



ΥΠΟΜΝΗΜΑ - LÉGENDE

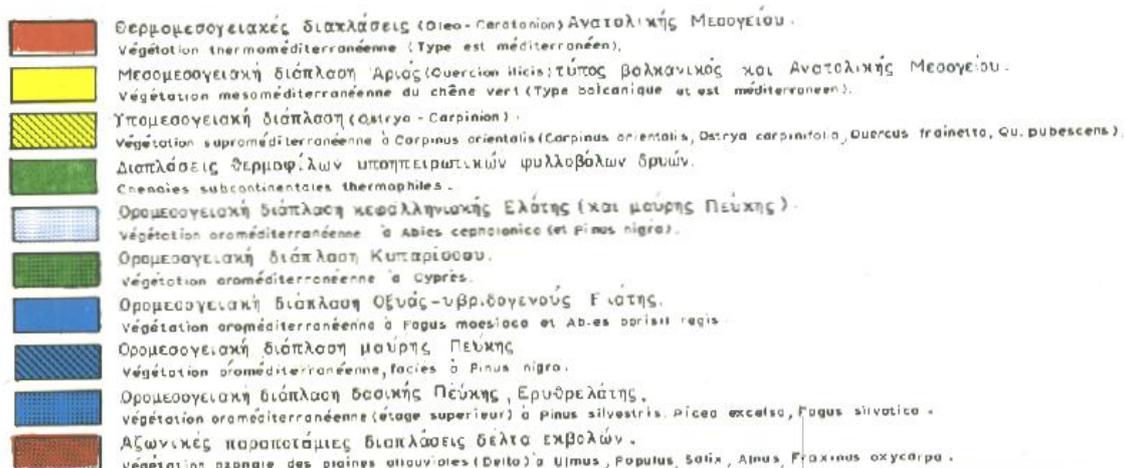


Figure 4.2-1 Vegetation zones of the study area

The vegetation in the study area, according to the Vegetation Map and Land uses of Greece (Department of Forestry Maps, Thematic Mapping based on aerial photography, 1979) comprise forrests, riparian vegetation, shrubs and cultivated areas as shown in the following table and figure.

Table 4.2-1: Vegetation type and land user of the study area and immediate area

Veg. type/land use	Study area		Immediate area	
	Cover	%	Cover	%
Barren land	10420.66	1.1%	-	-
Oak forests	104594.07	11.1%	-	-
Deciduous shrubs	223.88	0.0%	-	-
Cultivated areas	370119.57	39.1%	395.71	7.15%
Untended Cultivated areas	1412.43	0.1%	51.47	0.93%
Chestnut forests	320.06	0.0%	-	-
Other uses	66.08	0.0%	-	-
Meadows	10691.24	1.1%	-	-
Settlements	7601.70	0.8%	-	-
Beech forests	11373.66	1.2%	-	-
Riparian vegetation	6140.04	0.6%	-	-
Halepios pine forests	19743.11	2.1%	514.83	9.30%
Black pine forests	17380.09	1.8%	301.250	5.44%
Shrubs	385752.24	40.8%	4273.17	77.18%
Total cover	945838.84	100.0%	5536.44	100%

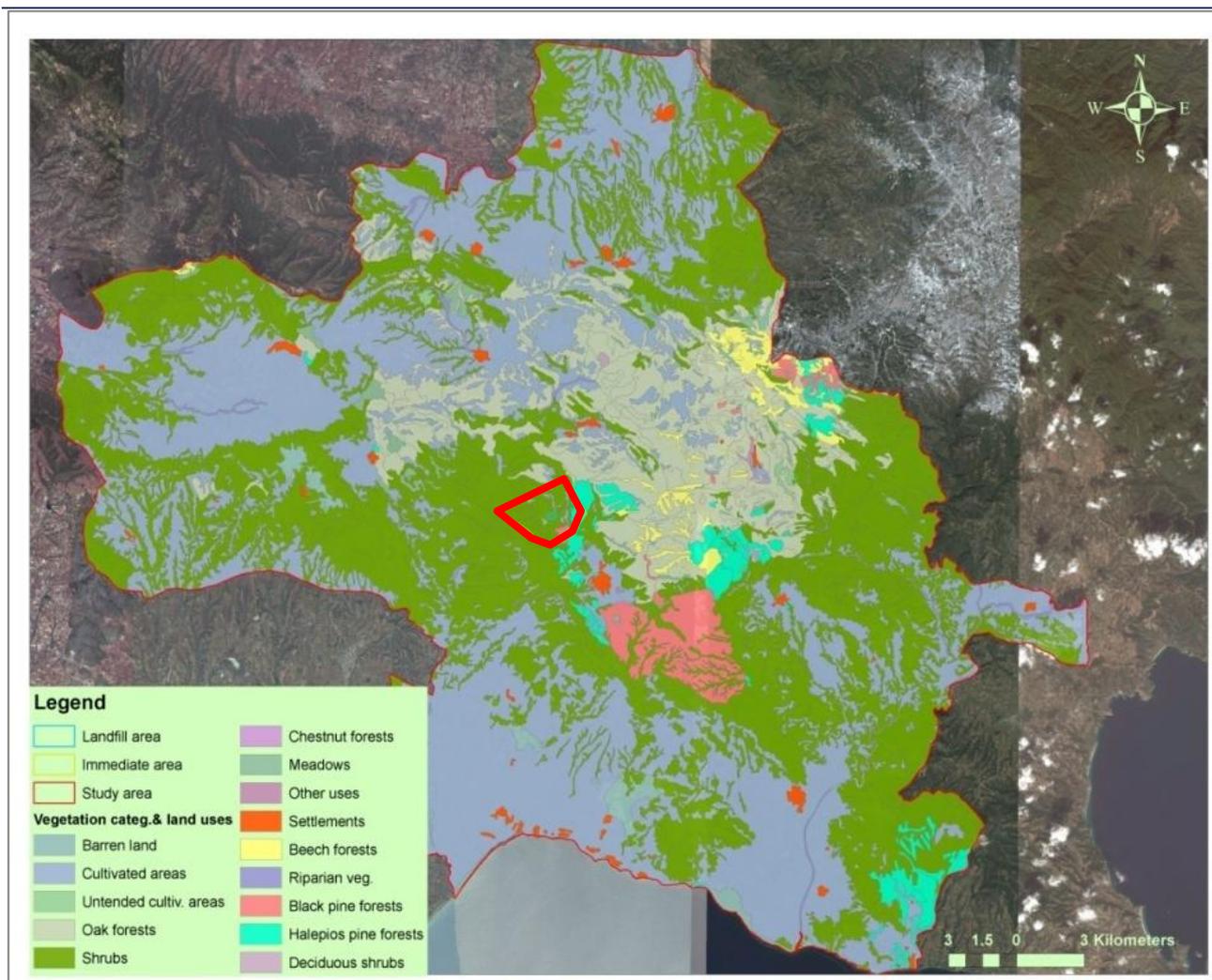


Figure 4.2-2: Vegetation categories and other land uses within the study area (red polygon: Polygyros Landfill)

As mentioned in the previous chapter within the vicinity of the immediate study area is located the Natura 2000 area 'GR 1270001 – Mount Cholomontas'. The present habitat types on the site and assessment for them according to the Standard Data Form, are presented below.

Table 4.2-2: Habitat types and the assessment for them

Code	Habitat type	Representativity	Relative surface	Conservation
9260	<i>Castanea sativa</i> woods	C	C	B
9280	<i>Quercus frainetto</i> woods	B	B	B
5210	Arborescent matorral with <i>Juniperus</i> spp	D		
92C0	<i>Platanus orientalis</i> and <i>Liquidambar orientalis</i> woods (<i>Plantanion orientalis</i>)	C	C	C
9340	<i>Quercus ilex</i> and <i>Quercus rotundifolia</i> forests	C	C	B

Habitat description according to the Interpretation manual of European Union habitats (2007) is presented below:

9260 Castanea sativa woods. Supra-Mediterranean and sub-Mediterranean *Castanea sativa*-dominated forests and old established plantations with semi-natural undergrowth.

9280 Quercus frainetto woods. *Fagus sylvatica* or *Fagus moesiaca* forests, more thermophile occurring in the transition zone between the supra-Mediterranean and montane levels, characterized by the presence of numerous species of the Quercion frainetto.

5210 Arborescent matorral with Juniperus spp. Mediterranean and sub-Mediterranean evergreen sclerophyllous scrub organized around arborescent junipers. Plants: *Juniperus oxycedrus*, *J. phoenicea*, *J. foetidissima*, *J. excelsa*, *J. communis*, *J. drupacea*, *J. thurifera*.

92C0 Platanus orientalis and Liquidambar orientalis woods. (Plantanion orientalis Forests and woods, for the most part riparian, dominated by *Platanus orientalis* (oriental plane) or *Liquidambar orientalis* (sweet gum), belonging to the Plantanion orientalis alliance.

9340 Quercus ilex and Quercus rotundifolia forests. Forests dominated by *Quercus ilex* or *Q. rotundifolia*, often, but not necessarily, calcicolous.

The study area is mostly covered with shrubs, cultivations and oak forests. The immediate area is mostly covered with shrubs. This shrubs, are mainly represented by *Quercus coccifera*, *Juniperus oxycedrus*, *Arbutus unedo*, *Erica manipuliflora*.



Figure 4.2-3: Extended shrubs in the vicinity of landfill area



Figure 4.2-4 Dense shrubs of *Juniperus oxycedrys*, *Quercus coccifera*, *Arbutus unedo* in the immediate area



Figure 4.2-5 Oak and beech forest in the study area

Within the natura area GR 1270001 approximately 377 species of flora were recorded, according to BIOMAP project (species presented in Table 4.2-3).

As other important species of flora, in the Standard Data Forms for the areas GR1270012 'Mount Cholomontas'(SPA) and GR1270001 'Mount Cholomontas (SAC) are mentioned the following species: *Abies borisii-regis*, *Achillea chrysocoma*, *Amelanchier cretica*, *Arabis bryoides*, *Cephalanthera longifolia*, *Corydalis integra*, *Crocus veluchensis*, *Epipactis helleborine*, *Epipactis microphylla*, *Himantoglossum hircinum*, *Lilium martagon*, *Limodorum abortivum*, *Listera ovata*, *Neottia nidus-avis*, *Ophrys scolopax ssp. cornuta*, *Orchis laxiflora ssp. palustris*, *Orchis mascula*, *Orchis papilionacea*, *Orchis quadripunctata*, *Platanthera bifolia*, *Platanthera chlorantha*, *Rosa arvensis*.

Concerning the wild growing plants the quality of the site is indicated by the occurrence of the important taxa. Among them, one taxon is Greek endemic, 8 taxa are protected by the EC Environment Legislation (1992), 2 taxa (*Corydalis integra*, *Rosa arvensis*) are included in the WCMC and/or European Red Data list, 10 taxa (*Dactylorhiza saccifera*, *Himantoglossum hircinum*, *Lilium martagon*, *Neottia nidus-avis*, *Ophrys scolopax ssp. cornuta*, *Orchis laxiflora ssp. palustris*, *Orchis mascula*, *Platanthera bifolia*, *Platanthera chlorantha*, *Viola tricolor ssp. macedonica*) are protected by the Greek Presidential Decree (67/1981), 10 taxa (*Abies borisii-regis*, *Achillea chrysocoma*, *Amelanchier cretica*, *Arabis bryoides*, *Crocus veluchensis*, *Dianthus cruentus*, *Helleborus cyclophyllus*, *Lamium bifidum ssp. balcanicum*, *Saxifraga chrysosplenifolia*, *Trifolium pignanti*) are Balkan endemics and 2 taxa (*Geranium macrostylum*, *Stachys cretica ssp. cassia*) find their main distribution area in the Balkan Peninsula extending also to Turkey.

The species *Epipactis helleborine* is mentioned as Vulnerable (VU) according to the Red Data Book of Rare and Threatened Plants of Greece (2009).

Table 4.2-3: Flora species of the area GR1270001 'Mount Cholomontas' (SAC) according to the Project BIOMAP

Flora species		
<i>Acer campestre</i>	<i>Festuca valesiaca</i>	<i>Potentilla argentea</i>
<i>Acer hyrcanum</i>	<i>Ficus carica</i>	<i>Potentilla micrantha</i>
<i>Achillea grandifolia</i>	<i>Fragaria vesca</i>	<i>Potentilla recta</i>
<i>Achillea millefolium</i>	<i>Fraxinus ornus</i>	<i>Potentilla reptans</i>
<i>Acinos graveolens</i>	<i>Fritillaria pontica</i>	<i>Primula acaulis</i>
<i>Aegilops neglecta</i>	<i>Fumaria officinalis</i> ssp. <i>officinalis</i>	<i>Primula veris</i> ssp. <i>suaveolens</i>
<i>Aegopodium podagraria</i>	<i>Galium aparine</i>	<i>Prunella vulgaris</i>
<i>Agrimonia eupatoria</i>	<i>Galium divaricatum</i>	<i>Prunus avium</i>
<i>Aira elegantissima</i>	<i>Galium intricatum</i>	<i>Prunus divaricata</i>
<i>Ajuga genevensis</i>	<i>Galium mollugo</i> agg.	<i>Prunus domestica</i> ssp. <i>insititia</i>
<i>Ajuga laxmannii</i>	<i>Galium verum</i>	<i>Prunus spinosa</i>
<i>Alliaria petiolata</i>	<i>Genista carinalis</i>	<i>Pteridium aquilinum</i>
<i>Allium paniculatum</i> ssp. <i>paniculatum</i>	<i>Geocaryum capillifolium</i>	<i>Pyrus pyraeaster</i>
<i>Allium sphaerocephalon</i> ssp. <i>sphaerocephalon</i>	<i>Geranium asphodeloides</i>	<i>Pyrus spinosa</i>
<i>Alyssum alyssoides</i>	<i>Geranium columbinum</i>	<i>Quercus coccifera</i>
<i>Anagallis arvensis</i>	<i>Geranium lucidum</i>	<i>Quercus frainetto</i>
<i>Anemone blanda</i>	<i>Geranium molle</i>	<i>Quercus ilex</i>
<i>Anemone pavonina</i>	<i>Geranium robertianum</i>	<i>Quercus petraea</i> ssp. <i>medwediewii</i>
<i>Anthemis tinctoria</i> ssp. <i>parnassica</i>	<i>Geranium rotundifolium</i>	<i>Quercus pubescens</i>
<i>Anthoxanthum odoratum</i>	<i>Geranium sanguineum</i>	<i>Ranunculus bulbosus</i> ssp. <i>aleae</i>
<i>Anthyllis hermanniae</i>	<i>Geum urbanum</i>	<i>Ranunculus ficaria</i>
<i>Arabidopsis thaliana</i>	<i>Hedera helix</i>	<i>Ranunculus illyricus</i>
<i>Arabis sagittata</i>	<i>Helianthemum salicifolium</i>	<i>Ranunculus millefoliatus</i>
<i>Arabis turrita</i>	<i>Helleborus cyclophyllus</i>	<i>Ranunculus rumelicus</i>
<i>Arbutus andrachne</i>	<i>Heracleum sphondylium</i> ssp. <i>ternatum</i>	<i>Rhagadiolus stellatus</i>
<i>Arbutus unedo</i>	<i>Hieracium cymosum</i> ssp. <i>heldreichianum</i>	<i>Romulea bulbocodium</i>
<i>Arctium lappa</i>	<i>Hieracium hoppeanum</i> ssp. <i>troicum</i>	<i>Romulea ramiflora</i>
<i>Aremonia agrimonoides</i> ssp. <i>agrimonoides</i>	<i>Hieracium bauhini</i>	<i>Rorippa thracica</i>
<i>Arenaria serpyllifolia</i>	<i>Hieracium bracteolatum</i>	<i>Rosa arvensis</i>
<i>Aristolochia pallida</i>	<i>Hieracium hoppeanum</i> s.	<i>Rosa canina</i>
<i>Armeria canescens</i>	<i>Hieracium murorum</i>	<i>Rostraria cristata</i>
<i>Arrhenatherum elatius</i>	<i>Hieracium piloselloide</i>	<i>Rubia peregrina</i>
<i>Arum italicum</i> ssp. <i>italicum</i>	<i>Hippocrepis emerus</i> ssp. <i>emeroides</i>	<i>Rubus canescens</i>
<i>Arum maculatum</i>	<i>Hippocrepis ciliata</i>	<i>Rubus hirtus</i>

Flora species		
<i>Asparagus acutifolius</i>	<i>Holcus lanatus</i>	<i>Rubus ulmifolius</i>
<i>Asperula purpurea</i> ssp. <i>apiculata</i>	<i>Hordeum murinum</i>	<i>Rumex acetosella</i>
<i>Asphodeline liburnica</i>	<i>Hypericum montbretii</i>	<i>Rumex conglomeratus</i>
<i>Asphodelus ramosus</i>	<i>Hypericum perforatum</i>	<i>Ruscus aculeatus</i>
<i>Asplenium adiantum-nigrum</i>	<i>Hypochaeris glabra</i>	<i>Sambucus nigra</i>
<i>Asplenium ceterach</i>	<i>Ilex aquifolium</i>	<i>Sanguisorba minor</i> ssp. <i>muricata</i>
<i>Asplenium onopteris</i>	<i>Juglans regia</i>	<i>Sanicula europaea</i>
<i>Asplenium trichomanes</i>	<i>Juncus inflexus</i>	<i>Saxifraga bulbifera</i>
<i>Astragalus glycyphyllos</i>	<i>Juniperus oxycedrus</i>	<i>Saxifraga rotundifolia</i>
<i>Astragalus monspessula</i>	<i>Jurinea mollis</i>	<i>Scabiosa triniifolia</i>
<i>Avena sativa</i>	<i>Knautia ambigua</i>	<i>Scorzonera mollis</i>
<i>Brachypodium sylvaticum</i> ssp. <i>sylvaticum</i>	<i>Koeleria cristata</i>	<i>Scutellaria albida</i>
<i>Brachypodium pinnatum</i>	<i>Koeleria lobata</i>	<i>Securigera varia</i>
<i>Brassica nigra</i>	<i>Lactuca viminea</i>	<i>Sedum amplexicaule</i> ssp. <i>tenuifolium</i>
<i>Briza maxima</i>	<i>Lamium amplexicaule</i>	<i>Sedum cepaea</i>
<i>Briza media</i> ssp. <i>elatior</i>	<i>Lamium maculatum</i>	<i>Sedum hispanicum</i>
<i>Bromus benekenii</i>	<i>Lapsana communis</i>	<i>Sherardia arvensis</i>
<i>Bromus hordeaceus</i>	<i>Laser trilobum</i>	<i>Sideritis montana</i> ssp. <i>remota</i>
<i>Bromus squarrosus</i>	<i>Lathyrus aphaca</i>	<i>Silene atropurpurea</i>
<i>Bromus sterilis</i>	<i>Lathyrus laxiflorus</i>	<i>Silene conica</i>
<i>Bupleurum gerardi</i>	<i>Lathyrus niger</i>	<i>Silene coronaria</i>
<i>Campanula trachelium</i> ssp. <i>athoa</i>	<i>Lathyrus nissolia</i>	<i>Silene italica</i> ssp. <i>italica</i>
<i>Campanula lingulata</i>	<i>Lathyrus sphaericus</i>	<i>Silene latifolia</i>
<i>Campanula persicifolia</i>	<i>Lathyrus venetus</i>	<i>Silene vulgaris</i>
<i>Cardamine bulbifera</i>	<i>Leontodon crispus</i> ssp. <i>crispus</i>	<i>Sonchus asper</i>
<i>Cardamine graeca</i>	<i>Leontodon cichoriaceus</i>	<i>Sorbus domestica</i>
<i>Cardamine hirsuta</i>	<i>Lilium martagon</i>	<i>Sorbus torminalis</i>
<i>Carex caryophyllea</i>	<i>Linum elegans</i>	<i>Stellaria media</i>
<i>Carex depauperata</i>	<i>Linum strictum</i>	<i>Stipa bromoides</i>
<i>Carex distachya</i>	<i>Lithospermu purpureocae</i>	<i>Symphytum bulbosum</i>
<i>Carex divulsa</i> ssp. <i>leersii</i>	<i>Lonicera caprifolium</i>	<i>Symphytum ottomanum</i>
<i>Carex flacca</i>	<i>Lonicera etrusca</i>	<i>Tamus communis</i>
<i>Carex flacca</i> ssp. <i>serrulata</i>	<i>Loranthus europaeus</i>	<i>Taxus baccata</i>
<i>Carex nigra</i>	<i>Lotus corniculatus</i>	<i>Teucrium chamaedrys</i> ssp. <i>chamaedrys</i>
<i>Carex pendula</i>	<i>Luzula forsteri</i>	<i>Thalictrum aquilegifolium</i>
<i>Catapodium rigidum</i> ssp. <i>rigidum</i>	<i>Luzula multiflora</i>	<i>Thesium divaricatum</i>
<i>Carpinus orientalis</i>	<i>Lysimachia nummularia</i>	<i>Thesium humile</i>
<i>Castanea sativa</i>	<i>Lysimachia punctata</i>	<i>Thlaspi praecox</i>
<i>Catapodium rigidum</i> ssp. <i>rigidum</i>	<i>Malus sylvestris</i>	<i>Thymus sibthorpii</i>
<i>Centaurea cuneifolia</i> ssp. <i>cuneifolia</i>	<i>Medicago lupulina</i>	<i>Torilis arvensis</i> ssp. <i>purpurea</i>
<i>Centaurea triumfettii</i>	<i>Medicago minima</i>	<i>Torilis arvensis</i>

Flora species		
<i>Cephalanthera longifolia</i>	<i>Melica uniflora</i>	<i>Torilis humilis</i>
<i>Cephalaria leucantha</i>	<i>Melilotus neapolitanus</i>	<i>Torilis ucranica</i>
<i>Cerastium brachypetalum</i> ssp. <i>roeseri</i>	<i>Melilotus officinalis</i>	<i>Tragopogon dubius</i>
<i>Chamaecytisus hirsutus</i>	<i>Melissa officinalis</i>	<i>Trifolium repens</i> ssp. <i>repens</i>
<i>Cistus creticus</i> ssp. <i>creticus</i>	<i>Mentha longifolia</i>	<i>Trifolium alpestre</i>
<i>Cistus salviifolius</i>	<i>Micromeria juliana</i>	<i>Trifolium angustifolium</i>
<i>Clematis flammula</i>	<i>Minuartia hirsuta</i> ssp. <i>falcata</i>	<i>Trifolium arvense</i>
<i>Clematis vitalba</i>	<i>Moehringia trinervia</i>	<i>Trifolium campestre</i>
<i>Clinopodium vulgare</i>	<i>Moenchia mantica</i>	<i>Trifolium glomeratum</i>
<i>Colchicum autumnale</i>	<i>Monotropa hypopitys</i>	<i>Trifolium heldreichian</i>
<i>Convolvulus elegantissimus</i>	<i>Muscari comosum</i>	<i>Trifolium hirtum</i>
<i>Cornus mas</i>	<i>Muscari neglectum</i>	<i>Trifolium incarnatum</i>
<i>Cornus sanguinea</i>	<i>Mycelis muralis</i>	<i>Trifolium medium</i>
<i>Coronilla scorpioides</i>	<i>Myosotis ramosissima</i> ssp. <i>ramosissima</i>	<i>Trifolium nigrescens</i>
<i>Corydalis solida</i> ssp. <i>solida</i>	<i>Myosotis sylvatica</i> ssp. <i>cyanea</i>	<i>Trifolium ochroleucon</i>
<i>Corylus avellana</i>	<i>Myrrhoides nodosa</i>	<i>Trifolium pignantii</i>
<i>Crataegus monogyna</i> var. <i>monogyna</i>	<i>Neottia nidus-avis</i>	<i>Trifolium stellatum</i>
<i>Crocus pulchellus</i>	<i>Oenanthe pimpinelloide</i>	<i>Trifolium subterraneum</i>
<i>Crucianella angustifol</i>	<i>Ononis pusilla</i>	<i>Trifolium tenuifolium</i>
<i>Crucianella latifolia</i>	<i>Ononis spinosa</i>	<i>Trifolium trichopterum</i>
<i>Cruciata laevipes</i>	<i>Orchis laxiflora</i> x <i>palustris</i>	<i>Triticum aestivum</i>
<i>Cruciata pedemontana</i>	<i>Orchis mascula</i>	<i>Urtica dioica</i>
<i>Cyclamen hederifolium</i>	<i>Origanum vulgare</i>	<i>Urtica urens</i>
<i>Cynosurus cristatus</i>	<i>Orlaya daucoides</i>	<i>Valerianella locusta</i>
<i>Cynosurus echinatus</i>	<i>Ornithogalum sphaerocarpaceum</i>	<i>Valerianella muricata</i>
<i>Dactylis glomerata</i>	<i>Ornithopus compressus</i>	<i>Verbascum nigrum</i>
<i>Dactylorhiza romana</i>	<i>Ostrya carpinifolia</i>	<i>Verbascum phoeniceum</i>
<i>Dactylorhiza saccifera</i>	<i>Osyris alba</i>	<i>Veronica chamaedrys</i> ssp. <i>chamaedrys</i>
<i>Dianthus cruentus</i> ssp. <i>turcicus</i>	<i>Paliurus spina-christi</i>	<i>Veronica arvensis</i>
<i>Digitalis lanata</i>	<i>Persicaria maculosa</i>	<i>Veronica austriaca</i>
<i>Digitalis viridiflora</i>	<i>Petrorhagia dubia</i>	<i>Veronica cymbalaria</i>
<i>Doronicum orientale</i>	<i>Phillyrea latifolia</i>	<i>Veronica hederifolia</i>
<i>Dorycnium pentaphyllum</i> ssp. <i>herbaceum</i>	<i>Phleum phleoides</i>	<i>Veronica officinalis</i>
<i>Dorycnium hirsutum</i>	<i>Phlomis samia</i>	<i>Veronica serpyllifolia</i>
<i>Draba muralis</i>	<i>Physospermu cornubiens</i>	<i>Vicia cracca</i> ssp. <i>gerardii</i>
<i>Epilobium lanceolatum</i>	<i>Pinus nigra</i>	<i>Vicia grandiflora</i>
<i>Epilobium montanum</i>	<i>Pistacia terebinthus</i>	<i>Vicia hirsuta</i>
<i>Epipactis helleborine</i>	<i>Plantago lanceolata</i>	<i>Vicia sativa</i> ssp. <i>incisa</i>
<i>Equisetum arvense</i>	<i>Plantago major</i>	<i>Vicia sativa</i> ssp. <i>nigra</i>
<i>Erica arborea</i>	<i>Platanthera chlorantha</i>	<i>Vicia tenuifolia</i> ssp. <i>dalmatica</i>
<i>Eryngium campestre</i>	<i>Platanus orientalis</i>	<i>Vicia tenuifolia</i> ssp. <i>tenuifolia</i>

Flora species		
<i>Erysimum diffusum</i>	<i>Poa bulbosa</i>	<i>Vicia tetrasperma</i>
<i>Euonymus europaeus</i>	<i>Poa compressa</i>	<i>Vicia villosa ssp. villosa</i>
<i>Euphorbia helioscopia</i>	<i>Poa nemoralis</i>	<i>Viola alba ssp. dehnhardtii</i>
<i>Euphorbia stricta</i>	<i>Poa pratensis</i>	<i>Viola kitaibeliana</i>
<i>Euphorbia taurinensis</i>	<i>Poa trivialis ssp. sylvicola</i>	<i>Viola reichenbachiana</i>
<i>Fagus sylvatica</i>	<i>Polygonatum odoratum</i>	<i>Viola riviniana</i>
<i>Ferulago sylvatica</i>	<i>Polygonum aviculare</i>	<i>Viola sieheana</i>
<i>Festuca heterophylla</i>	<i>Polypodium vulgare</i>	<i>Viola tricolor</i>
<i>Festuca rubra</i>	<i>Polystichum setiferum</i>	<i>Vitis vinifera ssp. sylvestris</i>
	<i>Populus tremula</i>	<i>Vulpia ciliata</i>

5.3. Fauna species

5.3.1. Species of Birds

Many feeding, nesting, breeding, wintering and refuge habitats for bird species are located in the wider area, thus the surrounding hilly and mountainous area supports a large number of bird species.

According to the Standard Data Form for the Special Protection Area (SPA) GR1270012 'Mount Cholomontas' which is located, in the east part of the wider area, and in the vicinity of the studied area, there are about 88 important species of birds referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC (Tab. 4). There are also other common species in the wider area.

Considering the presence status of the above mentioned birds, 6 species are wintering, 10 species are permanent in the wider area, 35 are concentrated in the area and 37 species reproduce in the wider area. So far, bird species of interest include birds of prey (Black Kite, Short-toed Eagle, Honey Buzzard, Booted Eagle, Lesser Spotted Eagle and Peregrine Falcon), and the Black Stork. Furthermore, there is a number of forest species (woodpecker such as the White-backed Woodpecker, Medium Spotted Woodpecker, Grey Woodpecker) that nest in the area. Many of these species (mainly wintering, permanent and concentrated were also observed in the wider area, during field visits).

Table 4.3-1: Bird species of the areas GR1270012 'Mount Cholomontas' (SPA) and GR1270001 'Mount Cholomontas (SAC), referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and their conservation statuses

Code	Scientific name	Common name	SDT GR1270012	SDT GR1270001	IUCN	Red Data Book	Annexes Bird Directive	EU25 Threat Status	2004 Pan-European Conservation Status
A402	<i>Accipiter brevipes</i>	Levant Sparrowhawk	X		LC	NE	I	Rare	Unfavourable
A085	<i>Accipiter gentilis</i>	Northern Goshawk	X	X	LC	NE	I	Secure	Favourable
A086	<i>Accipiter nisus</i>	Eurasian Sparrowhawk	X	X	LC	NE	I	Secure	Favourable
A247	<i>Alauda arvensis</i>	Eurasian Skylark	X		LC	NT	II/2	Declining	Unfavourable
A465	<i>Alectoris graeca</i>	Rock Partridge	X		LC	VU	I,II/1	Depleted	Unfavourable
A255	<i>Anthus campestris</i>	Tawny Pipit	X	X	LC	LC	I	Depleted	Unfavourable
A226	<i>Apus apus</i>	Common Swift	X	X	LC	NE	-	Secure	Favourable
A228	<i>Apus melba</i>	Alpine Swift	X		LC	NE	-	Secure	Favourable
A091	<i>Aquila chrysaetos</i>	Golden Eagle	X	X	LC	EN	I	Rare	Unfavourable
A089	<i>Aquila pomarina</i>	Lesser Spotted Eagle	X		LC	EN	I	Declining	Unfavourable
A028	<i>Ardea cinerea</i>	Grey Heron	X		LC	NE	-	Secure	Favourable
A215	<i>Bubo bubo</i>	Eurasian Eagle-owl	X	X	LC	LC	I	Secure	Unfavourable
A087	<i>Buteo buteo</i>	Common Buzzard	X	X	LC	NE	-	Secure	Favourable
A224	<i>Caprimulgus europaeus</i>	Eurasian Nightjar	X	X	LC	LC	I	Depleted	Unfavourable
A365	<i>Carduelis spinus</i>	Eurasian Siskin	X	X	LC	NE	-	Secure	Favourable
A031	<i>Ciconia ciconia</i>	White Stork	X		LC	VU	I	Depleted	Unfavourable
A030	<i>Ciconia nigra</i>	Black Stork	X	X	LC	EN	I	Rare	Unfavourable
A080	<i>Circaetus gallicus</i>	Short-toed Snake-eagle	X	X	LC	NT	I	Secure	Unfavourable
A081	<i>Circus aeruginosus</i>	Western Marsh-harrier	X		LC	VU	I	Secure	Favourable
A084	<i>Circus pygargus</i>	Montagu's Harrier	X		LC	CR	I	Secure	Favourable
A373	<i>Coccothraustes coccothraustes</i>	Hawfinch	X	X	LC	NE	-	Secure	Favourable
A207	<i>Columba oenas</i>	Stock Pigeon	X	X	LC	NT	II/2	Secure	Favourable
A208	<i>Columba palumbus</i>	Common Wood-pigeon	X		LC	NE	I,II/1,I II/1	Secure	Favourable
A231	<i>Coracias garrulus</i>	European Roller	X	X	NT	VU	I	Vulnerable	Unfavourable
A113	<i>Coturnix coturnix</i>	Common Quail	X		LC	NE	II/2	Secure	Unfavourable
A212	<i>Cuculus canorus</i>	Common Cuckoo	X	X	LC	NE	-	Declining	Favourable
A253	<i>Delichon urbica</i>	Northern House Martin	X	X	LC	NE	-	Declining	Unfavourable
A239	<i>Dendrocopos leucotos</i>	White-backed Woodpecker	X		LC	NT	I	Secure	Favourable

Code	Scientific name	Common name	SDT GR1270012	SDT GR1270001	IUCN	Red Data Book	Annexes Bird Directive	EU25 Threat Status	2004 Pan-European Conservation Status
A238	<i>Dendrocopos medius</i>	Middle Spotted Woodpecker	X	X	LC	LC	I	Secure	Favourable
A429	<i>Dendrocopos syriacus</i>	Syrian Woodpecker	X	X	LC	NE	I	Secure	Favourable
A027	<i>Egretta alba</i>	Great Egret	X		LC	VU	I	Secure	Favourable
A026	<i>Egretta garzetta</i>	Little Egret	X		LC	LC	I	Secure	Favourable
A379	<i>Emberiza hortulana</i>	Ortolan Bunting	X	X	LC	LC	I	Declining	Unfavourable
A382	<i>Emberiza melanocephala</i>	Black-headed Bunting	X		LC	NE	-	Declining	Unfavourable
A269	<i>Erithacus rubecula</i>	European Robin	X	X	LC	NE	-	Secure	Favourable
A098	<i>Falco columbarius</i>	Merlin	X	X	LC	NE	I	Depleted	Favourable
A100	<i>Falco eleonora</i>	Eleonora's Falcon	X		LC	LC	I	Declining	Unfavourable
A103	<i>Falco peregrinus</i>	Peregrine Falcon	X	X	LC	LC	I	Secure	Favourable
A099	<i>Falco subbuteo</i>	Eurasian Hobby	X	X	LC	NE	-	Secure	Favourable
A097	<i>Falco vespertinus</i>	Red-footed Falcon	X	X	NT	DD	I	Endangered	Unfavourable
A321	<i>Ficedula albicollis</i>	Collared Flycatcher	X	X	LC	NE	I	Secure	Favourable
A320	<i>Ficedula parva</i>	Red-breasted Flycatcher	X	X	LC	DD	I	Secure	Favourable
A442	<i>Ficedula semitorquata</i>	Semicollared Flycatcher	X		NT	DD	I	Vulnerable	Unfavourable
A359	<i>Fringilla coelebs</i>	Chaffinch	X	X	LC	NE	I	Secure	Favourable
A078	<i>Gyps fulvus</i>	Eurasian Griffon	X		LC	VU / CR	I	Secure	Favourable
A092	<i>Hieraetus pennatus</i>	Booted Eagle	X	X	LC	EN	I	Rare	Unfavourable
A438	<i>Hippolais pallida</i>	Olivaceous Warbler	X		LC	NE	-	Declining	Unfavourable
A252	<i>Hirundo daurica</i>	Red-rumped Swallow	X	X	LC	NE	-	Secure	Favourable
A251	<i>Hirundo rustica</i>	Barn Swallow	X	X	LC	NE	-	Declining	Unfavourable
A233	<i>Jynx torquilla</i>	Eurasian Wryneck	X	X	LC	NE	-	Declining	Unfavourable
A338	<i>Lanius collurio</i>	Red-backed Shrike	X	X	LC	NE	I	Depleted	Unfavourable
A339	<i>Lanius minor</i>	Lesser Grey Shrike	X	X	LC	NT	I	Vulnerable	Unfavourable
A341	<i>Lanius senator</i>	Woodchat Shrike	X	X	LC	NE	-	Declining	Unfavourable
A179	<i>Larus ridibundus</i>	Common Black-headed Gull	X		-	-	II/2	Secure	Favourable
A246	<i>Lullula arborea</i>	Wood Lark	X	X	LC	LC	I	Depleted	Unfavourable

Code	Scientific name	Common name	SDT GR1270012	SDT GR1270001	IUCN	Red Data Book	Annexes Bird Directive	EU25 Threat Status	2004 Pan-European Conservation Status
A271	<i>Luscinia megarhynchos</i>	Common Nightingale	X	X	LC	NE	-	Secure	Favourable
A230	<i>Merops apiaster</i>	European Bee-eater	X		LC	NE	-	Depleted	Unfavourable
A073	<i>Milvus migrans</i>	Black Kite	X		LC	CR	I	Secure	Unfavourable
A260	<i>Motacilla flava</i>	Yellow Wagtail	X	X	LC	NE	-	Declining	Favourable
A319	<i>Muscicapa striata</i>	Spotted Flycatcher	X		LC	NE	-	Declining	Unfavourable
A278	<i>Oenanthe hispanica</i>	Black-eared Wheatear	X		LC	NE	-	Declining	Unfavourable
A277	<i>Oenanthe oenanthe</i>	Northern Wheatear	X	X	LC	NE	-	Declining	Unfavourable
A337	<i>Oriolus oriolus</i>	Eurasian Golden-oriole	X	X	LC	NE	-	Declining	Favourable
A214	<i>Otus scops</i>	Common Scops-owl	X		LC	NE	-	Depleted	Unfavourable
A323	<i>Panurus biarmicus</i>	Bearded Parrotbill	X	X	LC	NE	-	Secure	Favourable
A072	<i>Pernis apivorus</i>	European Honey-buzzard	X	X	LC	LC	I	Secure	Favourable
A274	<i>Phoenicurus phoenicurus</i>	Common Redstart	X		LC	NE	-	Depleted	Unfavourable
A313	<i>Phylloscopus bonelli</i>	Bonelli's Warbler	X	X	-	-	-	Declining	Unfavourable
A315	<i>Phylloscopus collybita</i>	Common Chiffchaff	X	X	LC	NE	-	Secure	Favourable
A314	<i>Phylloscopus sibilatrix</i>	Wood Warbler	X	X	LC	NE	-	Declining	Unfavourable
A234	<i>Picus canus</i>	Grey-faced Woodpecker	X	X	LC	NT	I	Depleted	Unfavourable
A155	<i>Scolopax rusticola</i>	Eurasian Woodcock	X		LC	NE	II/1, III/2	Depleted	Unfavourable
A210	<i>Streptopelia turtur</i>	European Turtle-dove	X	X	LC	NE	II/2	Vulnerable	Unfavourable
A311	<i>Sylvia atricapilla</i>	Blackcap	X	X	LC	NE	-	Secure	Favourable
A310	<i>Sylvia borin</i>	Garden Warbler	X	X	LC	NE	-	Secure	Favourable
A304	<i>Sylvia cantillans</i>	Subalpine Warbler	X	X	LC	NE	-	Secure	Favourable
A309	<i>Sylvia communis</i>	Common Whitethroat	X	X	LC	NE	-	Secure	Favourable
A308	<i>Sylvia curruca</i>	Lesser Whitethroat	X	X	LC	NE	-	Secure	Favourable
A285	<i>Turdus philomelos</i>	Song Thrush	X	X	LC	NE	II/2	Secure	Favourable
A232	<i>Upupa epops</i>	Eurasian Hoopoe	X	X	LC	NE	-	Declining	Unfavourable

Legend

SDF GR1270012	Standard Data Form for the area GR1270012 'Mount Cholomontas' (SPA)
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SDF GR1270001	Standard Data Form for the area GR1270001 'Mount Cholomontas (SAC)
IUCN	Least Concern (LC), Near Threatened (NT)
Red List of Threatened species of Greece (Red Data Book)	CR: Critically Endangered EN : Endangered VU: Vulnerable NT: Near Threatened LC: Least Concern DD: Data Deficient NE: Not Evaluated
DIRECTIVE 2009/147/EC on the conservation of wild birds	Annexes I, II, III
Bird Life International (BirdLife International 2004a; IUCN 2004).	EU25 Threat Status, 2004 Pan-European Conservation Status

5.3.2. Other fauna species

Taking in account the diversity of the habitats in the wider area, it is expected a large number of fauna species. Apart from the important species, which are given below according to the Standard Data Form for the SPA - GR1270012 'Mount Cholomontas' and SAC - GR1270001 'Mount Cholomontas (Tab.6), there are many other common species of invertebrates, amphibians, reptiles and mammals in the wider area. Many of the expected species were observed during field visits.

Concerning fauna, the quality of the site GR1270012 'Mount Cholomontas' is indicated by the occurrence of the invertebrate *Syrichthus tessellum* which is contained to the Presidential Decree 67/1981, the invertebrate *Eppalage fatima* which is referred to Heath J. 1981. Threatened Rhopalocera(butterflies) of Europe. Council of Europe, the invertebrate *Maculinea alcon* which is referred to IUCN Conservation Monitoring Centre 1988. 1988 IUCN Red List of Threatened Animals, the invertebrates *Platycnemis pennipes*, *Pyrrhosoma nymphula*, *Gomphus vulgatissimus*, which are referred to van Tol. J., Verdonk M.J. 1988. The protection of dragonflies (Odonata) and their biotopes. Council of Europe and the invertebrate *Brenthis hecate*, which is referred to Koomen P. van Helsdingen P.J. 1993. Listing of biotopes in Europe according to their significance for invertebrates. Council of Europe. The reference on *Platycnemis pennipes* is about the subspecies *Platycnemis pennipes pennipes*. The reference on *Pyrrhosoma nymphula* is about the subspecies *Pyrrhosoma nymphula nymphula*.

Details on the habitat preferences and conservation status of the important species mentioned in Table 4.3-2, are given in the following paragraphs.

Table 4.3-2: Fauna species (except birds) of the areas GR1270012 'Mount Cholomontas' (SPA) and GR1270001 'Mount Cholomontas (SAC), referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and their conservation status

Code	Scientific name	Common name	SDF GR1270012	SDF GR1270001	IUCN	RED DATA BOOK	EU Habitats Directive	Presid. Decree 67/1981	Bern Convention
-	<i>Elaphe quatuorlineata</i>	Four lined snake	X	X	NT	LC	II/IV	*	II
1217	<i>Eurotestudo hermanni</i> (<i>Testudo hermanni</i>)	Hermann's tortoise	X	X	NT	VU	II/IV	*	II
1293	<i>Zamenis situlus</i> (<i>Elaphe situla</i>)	Leopard snake	X	X	LC	LC	II	-	II
1219	<i>Testudo graeca</i>	Mediterranean spur-thighed tortoise	X	X	NT	LC	II/IV	*	II
1193	<i>Bombina variegata</i>	Yellow bellied toad	X	X	LC	LC	II/IV	-	II
1306	<i>Rhinolophus blasii</i>	Blasius's Horseshoe Bat	X	X	LC	NT	II	-	II
-	<i>Lindenia tetraphylla</i>	Bladetail	X	-	-	-	II	-	-

Legend

SDF GR1270012	Standard Data Form for the area GR1270012 'Mount Cholomontas' (SPA)
SDF GR1270001	Standard Data Form for the area GR1270001 'Mount Cholomontas (SAC)
Red List of Threatened species of Greece (Red Data Book)/IUCN	CR: Critically Endangered EN : Endangered VU: Vulnerable NT: Near Threatened LC: Least Concern DD: Data Deficient NE: Not Evaluated
EU Habitats Directive 93/43/EOK	II : Annex II (Animal and Plant species of community interest whose conservation requires the designation of special areas of conservation) IV: Annex IV (Animal and Plant species of community interest in need of strict protection) V: Annex V (Animal and Plant species of community interest whose taking in the wild and exploitation may be subject to management measures)
Bern Convention	II : Appendix II (Strictly protected fauna species) III : Appendix III (Protected fauna species)

Bombina variegata

Lives mainly in the foothills and mountains over 600m.elevation. Its habitat includes coniferous, deciduous and mixed forests, bushes, and meadows, floodplains, grasslands, etc. At low elevations it lives in deciduous forests whereas in the highlands it inhabits coniferous forests, highland glades and the upper forest margins. It frequents various types of water bodies, including lakes, ponds, swamps, rivers and stream pools, springs, etc.

Eurotestudo hermanni

Similar to *Testudo graeca* but may be found in areas with denser vegetation. In southern Greece the species is almost totally restricted to cultivated areas. During summer it may also enter water. It is found as 1.500 elevation.

Testudo graeca

This species can be observed in a variety of habitats including open woodland and light forests, meadows, cultivated fields, shrub land, stabilized sand dunes and dry coastal heaths.

The species is regarded as the most threatened tortoise species in Greece, mainly because of its preference for the coastal zone and dry heaths that are more susceptible to tourism developments and urbanization. The species is threatened by forest fires and the burning down of cultivated fields after harvest. Illegal collection for the pet trade is another increasing threat.

Zamenis situlus

This species is often found in the Mediterranean maquis and in cultivated areas like vineyards and olive groves. It is found in dry stone walls, in gardens and in buildings. In Greece it occurs from sea level up to 1.600m elevation.

Elaphe quatorlineata

The four-lined snake maybe found in all types of Mediterranean habitats up to 1.400m, including suburban areas and wetlands. It prefers warm, humid, areas which offer vegetation cover.

Rhinolophus blasii

Blasius's Horseshoe Bat is restricted to south – western Romania and the Balkans. Concerning the population status, Blasius's Horseshoe Bat is probably the rarest European horseshoe bat. It is found on Mediterranean and sub-Mediterranean woodlands. Roosting sites in Europe and Asia in natural or man – made caves.

Lindenia tetraphylla

L. tetraphylla inhabits lakes with extensive reed belts in its western range, while it is found on nearly all types of waterbodies in its eastern range (with a preference for flood plains of larger rivers). The migratory capacity of adults and tolerance of larvae to increased salinity and high temperature are regarded as adaptations to unstable environmental conditions (e.g. in temporary waters of arid zones).

Because of its ecological requirements, *L. tetraphylla* is one of the endangered dragonfly species of the western Palearctic. Major threats include tourism (Balkan region), irrigation (Middle East), and oil/gas exploitation (Caspian region).

Other important species of fauna According to the SDF of the Natura 2000 network, SAC – GR1270001 'Mount Cholomoantas' and SPA – GR1270012 'Mount Cholomontas', are listed in Table 4.3-3.

Table 4.3-3 Other important species of fauna

Group	Code	Scientific name	Common name	GR1270012	GR1270001	IUCN	Red Data Book	EU Habitats Directive	Presid. Decree 67/1981	Bern Convention
I	-	<i>Brenthis hecate</i>		x	x	-	-	-	-	-
I	-	<i>Gomphus vulgatissimus</i>		x	x	-	-	-	-	-
I	1058	<i>Maculinea arion</i>		x	x	-	-	IV	-	-
I	-	<i>Platycnemis pennipes</i>		x	x	-	-	-	-	-
I	-	<i>Pyrrhosoma nymphula</i>		x	x	-	-	-	-	-
I	-	<i>Syrichthus tessellum</i>		x	x	-	-		+	-
A	1209	<i>Rana dalmatina</i>		x	x	LC	NE	IV	+	II
R	1269	<i>Pseudopus apodus</i> (<i>Ophisaurus apodus</i>)		x	-	LC	LC	IV	-	II
R	1263	<i>Lacerta viridis</i>	Green lizard	x	x	LC	LC	IV	+	II
M	1352	<i>Canis lupus</i>	Wolf	x	-	LC	VU	II/IV/V	-	II
M	-	<i>Capreolus capreolus</i>	Roe Deer	x	x	LC	VU	-	-	II
M	1363	<i>Felis silvestris</i>	Wildcat	x	--	LC	NE	IV	-	III
M	-	<i>Martes foina</i>	Beech marten	x	x	LC	NE	-	-	III
M	-	<i>Meles meles</i>	European badger	x	x	LC	NE	-	-	III
M	-	<i>Mustela nivalis</i>	Least Weasel	x	x	LC	NE	-	+	III
M	1328	<i>Nyctalus lasiopterus</i>	Giant Noctule	x	x	NT	VU	IV	+	II
M	1317	<i>Pipistrellus nathusii</i>	Nathusius' pipistrelle	x	x	LC	DD	IV	+	II
M	-	<i>Sus scrofa</i>	Wild boar	x	x	LC	NE	-	-	III

See previous legend.

Details on the habitat preferences and conservation status of the important species mentioned in the previous table are given in the following paragraphs.

Canis lupus

The Wolf in Greece is still considered as a vulnerable species. Approximately 600 wolves inhabit a variety of habitats in semi-mountainous and mountainous areas. Distribution exceeds 45,000 km². Livestock still encompass the major food source for the species due to low wild ungulate abundance. Major threats include human caused mortality combined with continuous reduction of food availability (free ranging livestock) and ongoing habitat fragmentation due to the construction of closed highways.

Nyctalus lasiopterus

The Giant Noctule has been located in few areas of Mt. Pindos, Chalkidiki and Thrace. In Greece it is classified as Vulnerable, as the species depends largely on mature woodland, its populations are few and isolated and its known range does not exceed 20,000 km². The status of its populations in Greece is completely "unknown". Although the species is protected by national laws and there are international legal obligations for its protection through the Bonn and Bern Conventions, so far no protection measures have been implemented. As in the rest of Europe, little is known about potential threats, but loss of mature woodland and loss of/or disturbance to roost sites (in old trees and buildings) may have a negative impact on the species. Further research efforts are needed in order to locate its populations and study its roosting habits.

Capreolus capreolus

The Roe Deer is distributed in isolated areas of central and northern Greece. The mountains Oiti, Vardousia, Giona and Parnassos are at the southern edge of its distribution. In the past it was more abundant but now it has been restricted to remote forested areas. Due to fragmentation of its habitat and distribution there are possible subpopulations with restricted connection. It disappeared from the Peloponnese, where recently it has been reintroduced in Kalavryta Sanctuary, as well as in N. Euboea. Roe Deer densities have been estimated for Epirus Region, W. Greece, at 0.14-4.82 animals per km². Its hunting is prohibited but poaching is the main threat for the species. The species is considered Vulnerable.



CHAPTER 6. MANMADE ENVIRONMENT

6.1. Land Use

The broader study area (Municipality of Polygyros) has a total surface of 951.97 km². The Municipality District of Polygyros alone covers about 470.90 km², the Municipal District of Anthemountas 254.16 km², the Municipal District of Ormylia 88.00 km² and the Municipal District of Zervochoria 138.91 km².

The sources of information for the land uses and cover are the following:

- The Hellenic Statistical Authority (ELSTAT)
- The CORINE LandCover program
- Town-planning of the municipalities of the wider area

Based on ELSTAT, the categories of land use in the study area are given in **Table 5.1-1**. From these data, the following observation prevail:

1. The nature of land use in the area of Chalkidiki is very close to the one of the whole of Greece. Small deviations are observed in category "Forests - Semi-natural areas", where Chalkidiki has highest percentage (54 % versus 47 %) and the "areas covered by water" (smaller 0.3 % vs. 1.4 %).
2. The land uses of the Municipalities of the wider study area is significantly different from that of the country. Forest - Semi-natural areas occupy high percentage (over 90 %) of all of the municipal districts of the study area, as the farmlands occupy very large areas of the study region (from 48 to 63%) along with the forest areas.
3. The characteristics of the four aforementioned municipal districts of the study area are similar and distinctive for their great participation in agricultural and forest areas, and to almost zero percentage of the aquatic element, with the exception of the district of Ormylia (2.5%).

Regarding the main land cover classification in CORINE (2001) and their distribution for the study area this is presented in **Tables 5.1-2** and **5.1-3**, as well as in Map 6 of Appendix 1, which leads to the following conclusions:

- i. 51.4% of broader and 100% of immediate study area is covered by land of forest character. These values are consistent with those of ELSTAT and declare that these areas have not had any strong intervention by humans.
- ii. In the study area, the two most prevalent categories of coverage are the sclerophyllous vegetation and non-irrigated arable land (35.7% and about 19.2% respectively). In the immediate study area (the Polygyros landfill) the only category of cover is the prevailing forest (sclerophyllous vegetation).
- iii. The areas of agricultural character are particularly great in comparison with other regions of Greece, but these are non-existent in the immediate study area.

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- iv. The urban character areas are significantly enhanced, reaching the same percentage as the average of the country (2.0%), mainly because of the extent of the built environment in the town of Polygyros, which is the capital of Chalkidiki, and the extent of the mining sites over the whole study area.

Regarding statutory land use (Map 7 of the Appendix 1), the region includes:

1. Settlements with Statutory limits:

- At the Municipality District of Polygyros: Town of Polygyros, Agios Prodomos, Vrastama, Gerakini, Paralia Gerakinis, Diastavrosi Palaiokastrou, Palaiokastros, Kalyves, Keli, Olynthos, Plana, Sana, Taxiarches,
- At the Municipality District of Ormylia: Town of Ormylia, Vatopedi, Metamorphosi, Psakoudia
- At the Municipality District of Zervochoria: Palaiochora, Riza, Geroplatanos, Krimni, Marathousa, Platanochori
- At the Municipality District of Anthemountas: Galatista, Galarinos, Vavdos, Doumbia

2. No Industrial Area (VIPE) has been established in the study area.

3. Declared and confirmed or under declaration archaeological sites (in detail at **chapter 5.4**)

4. For the study area, two General Urban Plans have been approved, one for the Municipality District of Polygyros (Official Gazette 243/VNEUS/21-06-2013) and another for the district of Ormylia (Official Gazette 260/VNEUS/27-06-2008).

5. The district of Zervochoria has an approved Spatial Plan of Urban Organization for the Open City (Official Gazette 286/VNEUS/21-07-2010). However, there is no official approval of any urban plans for the region of Anthemountas.

Mining areas of exclusive and mixed² use are also included in the General Urban Plans of Polygyros and Ormylia. Some of these areas are under definitive concessions for mining use. These are areas of mining or mineral interest, identified by earlier decrees of the relevant bodies and in accordance with the 210/1973 Mining Code and in application of its Articles 3, 38 and 128, the mineral exploration and utilization into these areas is allowed after special environmental studies, according to N.1650/1986. These areas do not conflict with existing farming and woodland or coastal tourist and residential uses.

Moreover, within the region of Zervochoria, an Mild Industrial Park has been officially planned within a surface of 106,26 acres for proposed mild activities in accordance with the provisions of Article 2 of Law 2545/97 (Official Gazette 254/A/97). The location of the industrial zone in the area creates the favorable conditions for the development of manufacturing activities and the retention of the declining youth population of the region.

Finally, in the study area several natural protected regions exist, such as three Natura 2000 sites and the National Park of the lakes Koroni and Volvi. These have all been analysed previously in **section 4.1** of this study.

² "Mixed" in this context means combined with other (related or not) industrial uses

Table 5.1-1: Distribution of the Country's area into generalized land cover/use categories (source: ELSTAT)

Region – Municipality District	Total area (km ²)	Area under cultivation and fallow land (km ²)		Pastures (km ²)		Forests (km ²)		Area under water (km ²)		Areas occupied by the locality (buildings, roads, etc) (km ²)		Other areas (km ²)	
GREECE	131,982.2	50,684.6	38.4%	14,451.6	11.0%	57,968.9	43.9%	1,790.1	1.4%	2,307.5	1.8%	4,779.6	3.6%
CENTRAL MACEDONIA	19,170.0	9,334.1	48.7%	1,437.8	7.5%	7,314.2	38.2%	388.1	2.0%	408.4	2.1%	287.4	1.5%
CHALKIDIKI	3,260.6	1,399.7	42.9%	53.3	1.6%	1,720.3	52.7%	9.0	0.3%	20.7	0.6%	57.6	1.8%
Study Area	949.2	510.9	53.8%	22.0	2.3%	397.7	41.9%	2.6	0.3%	4.3	0.5%	11.7	1.2%
POLYGYROS	472.0	226.8	48.1%	6.4	1.4%	229.5	48.6%	0.4	0.1%	1.7	0.4%	7.2	1.5%
ANTHEMOUNTAS	250.6	149.7	59.7%	7.9	3.2%	88.2	35.2%	0.0	0.0%	0.8	0.3%	4.0	1.6%
ZERVOCHORIA	139.0	88.3	63.5%	6.6	4.8%	42.6	30.7%	0.0	0.0%	1.0	0.7%	0.5	0.4%
ORMYLIA	87.6	46.1	52.6%	1.1	1.3%	37.4	42.7%	2.2	2.5%	0.8	0.9%	0.0	0.0%

Table 5.1-2. Categories of CORINE land cover in the intervention and wider study area

Category	Description	Surface(km ²)	Percentage
STUDY AREA			
112	Discontinuous urban fabric	7.74	0.8%
121	Industrial or commercial units	2.50	0.3%
131	Mineral extraction sites	8.25	0.9%
133	Construction sites	0.36	0.0%
211	Non-irrigated arable land	182.12	19.2%
221	Vineyards	11.52	1.2%
223	Olive groves	92.54	9.8%
231	Pastures	1.46	0.2%
242	Complex cultivation patterns	56.42	6.0%
243	Land principally occupied by agriculture, with significant areas of natural vegetation	96.06	10.1%
311	Broad-leaved forest	76.34	8.1%
312	Coniferous forest	14.87	1.6%
313	Mixed forest	24.05	2.5%
321	Natural grasslands	9.94	1.1%
323	Sclerophyllous vegetation	337.94	35.7%
324	Transitional woodland shrub	22.64	2.4%
331	Beaches, dunes, sands	0.88	0.1%
334	Burnt areas	0.35	0.0%
421	Salt marshes	0.55	0.1%
TOTAL		946.53	100.0%
Category	Description	Surface(km ²)	Percentage
INTERVENTION AREA			
323	Sclerophyllous vegetation	0.09	100%
TOTAL		0.09	100.0%

Table 5.1-3. Grouping of the categories of CORINE land cover in the study area

Category	Description	Surface(km ²)	Percentage
STUDY AREA			
1	Artificial surfaces	18.85	2.0%
2	Agricultural Areas	440.12	46.5%
3	Forest and seminatural areas	486.13	51.4%
4	Coastal/riparian areas	0.88	0.1%
5	Marshlands	0.55	0.1%
TOTAL		946.53	100.0%
Category	Description	Surface(km ²)	Percentage
INTERVENTION AREA			
1	(Sclerophyllous vegetation)	0.09	100%
TOTAL		0.09	100.0%

6.2. Town Planning - Urban Environment

The methodology used to assess the current state of the built environment involves the following steps:

1. Data about buildings with exclusive or mixed use of residential housing for 2000 were obtained from ELSTAT
2. Data about new buildings for housing were obtained for the years 2001, 2002, 2003, 2004, 2005, 2006, 2007 and 2008.
3. Time series were created with the number of buildings for the whole country, the Chalkidiki area and the Municipality Districts of the wider study area
4. We assessed the change rates from year to year for each area, as well as the ratio compared to the greater area of Chalkidiki and Greece.

The relevant results are given in the **Tables 5.2-1, 5.2-2 and 5.2-3**.

Based on the data obtained, the following can be assumed:

1. Chalkidiki constantly concentrates the 1.9 - 2.8% of the total construction activity of Greece after 2000. The growth rate of construction in the area is consistently greater than in the country by 0.1 to 0.6 percentage points.
2. The Municipality District of Polygyros is where the town of Polygyros (the capital of Chalkidiki) is located. The area in 2000 held the 6.3% of the housing construction total of Chalkidiki, and the next years, the new construction activity starts from 10.2% and reaches to 16.5%, after falling to 8.6%. Polygyros has an impressive building growth rate activity, significantly bigger than that of Chalkidiki, but also the whole of Greece.
3. The district of Anthemountas is taking up the 2.6% of the residency buildings of Chalkidiki at the year 2000, and for the following years, this percentage remains steady, presenting a growth rate somewhat bigger and analogous to that of the country.
4. The relatively smaller district of Ormylia constitutes the 2.7% of the total of housing buildings of Chalkidiki. Its growth rate has been consistently relevant to that of the whole of Greece, except for the year 2008 (1,6% relevant to 0,8%).
5. Finally, the Zervochoria region has the smallest percentage of housing (1.4% of total Chalkidiki) compared to the other ones. However it has experienced an increase to its growing rate from 0.4% (2001) to 1.3% (2008).

In conclusion, it was revealed that the study area is growing at rates above the ones of the whole of Chalkidiki region, as well as the country of Greece in total. The fastest growing region is estimated to be Polygyros, followed by Anthemountas, while Zervochoria and Ormylia are considered less developed. The trending growth of the whole area is also evident by the aforementioned urban development plans, the reforms of which were recently approved by local and regional authorities.

Table 5.2-1. Existing buildings in 2000 in the study area, based on data from ELSTAT

Area	Buildings of exclusive use (Total), 2000	Buildings of exclusive use for housing, 2000	Buildings of combined use (Total), 2000	Buildings of combined use mainly for housing, 2000	Buildings with housing use (Total), 2000
Greece (Total)	3577355	2755570	413615	316380	3990970
Urban Areas	1693665	1422792	256395	205481	1950060
Rural Areas	1883690	1332778	157220	110899	2040910
Northern Greece	1197142	855932	142642	115145	1339784
% of Greece (Total)	33.5%	31.1%	34.5%	36.4%	33.6%
Urban Areas	502633	400276	85407	72530	588040
Rural Areas	694509	455656	57235	42615	751744
Chalkidiki	68308	56522	6436	4475	74744
% of Greece (Total)	1.9%	2.1%	1.6%	1.4%	1.9%
Urban Areas	30316	25322	3074	2245	33390
Rural Areas	37992	312	3362	223	41354
POLYGYROS	5196	4230	494	414	4702
% of Chalkidiki	7.6%	7.5%	7.7%	9.3%	6.3%
ANTHEMOUNTAS	2305	1861	116	94	1975
% of Chalkidiki	3.4%	3.3%	1.8%	2.1%	2.6%
ORMYLIA	2232	1605	442	407	2045
% of Chalkidiki	3.3%	2.8%	6.9%	9.1%	2.7%
ZERVOCHORIA	1331	934	141	131	1075
% of Chalkidiki	1.9%	1.7%	2.2%	2.9%	1.4%

Table 5.2-2: Total buildings of 2000 census and development of new buildings from 2001 to 2005 (source: data of ELSTAT)

Area	Buildings with housing use (Total), 2000	New Buildings of 2001		New Buildings of 2002		New Buildings of 2003		New Buildings of 2004	
	Number	Number	Yearly change						
Greece (Total)	3990970	40446	1.0%	45195	1.1%	45249	1.1%	43446	1.1%
Chalkidiki	74744	1003	1.3%	1276	1.7%	1270	1.6%	1103	1.4%
% of Greece	1.9%	2.5%		2.8%		2.8%		2.5%	
POLYGYROS	4702	102	2.2%	116	2.4%	109	2,2%	100	2,0%
% of Chalkidiki	6.3%	10.2%		9.1%		8,6%		9,1%	
ANTHEMOUNTAS	1975	28	1.4%	33	1.6%	31	1,5%	20	1,0%
% of Chalkidiki	2.6%	2.8%		2.6%		2,4%		1,8%	
ORMYLIA	2045	17	0.8%	18	0.9%	37	1,8%	20	0,9%
% of Chalkidiki	2.7%	1.7%		1.4%		2,9%		1,8%	
ZERVOCHORIA	1075	4	0.4%	8	0.7%	7	0,6%	5	0,5%
% of Chalkidiki	1.4%	0.4%		0.6%		0,6%		0,5%	

Table 5.2-3: Total buildings of 2000 census and development of new buildings from 2005 to 2008 (source: data of ELSTAT)

Area	Buildings with housing use (Total), 2000	New Buildings of 2005		New Buildings of 2006		New Buildings of 2007		New Buildings of 2008	
	Number	Number	Yearly change						
Greece (Total)	3990970	56342	1,4%	45406	1,1%	41790	1,0%	34021	0,8%
Chalkidiki	74744	1439	1,8%	984	1,2%	1024	1,3%	898	1,1%
% of Greece	1.9%	2,6%		2,2%		2,5%		2,6%	
POLYGYROS	4702	143	2,8%	120	2,3%	121	2,2%	148	2,7%
% of Chalkidiki	6.3%	9,9%		12,2%		11,8%		16,5%	
ANTHEMOUNTAS	1975	60	2,9%	34	1,6%	27	1,2%	42	1,9%
% of Chalkidiki	2.6%	4,2%		3,5%		2,6%		4,7%	
ORMYLIA	2045	33	1,5%	20	0,9%	21	1,0%	35	1,6%
% of Chalkidiki	2.7%	2,3%		2,0%		2,1%		3,9%	
ZERVOCHORIA	1075	22	2,0%	12	1,1%	21	1,9%	15	1,3%
% of Chalkidiki	1.4%	1,5%		1,2%		2,1%		1,7%	

6.3. History and Culture

In the Municipality of Polygyros, or in the area of the modern settlement according to other sources exists the ancient Apollonia, which was one of the 32 cities of the Chalkidian League. Founded in 432 BC, the Chalkidian League, with its capital city of Olynthus was subjugated in 379 BC by the Spartans. Some decades later, in 348 BC, Philip II of Macedon subdued the area of Chalkidiki and annexed it in the Macedonian kingdom. In 168 BC, Chalkidiki was conquered by the Romans as the rest of Greece.

The town of Polygyros is first mentioned in writing in a medieval imperial document, chryssovoulon (with golden stamp), of Emperor Nikephoros III Botaneiates, addressed the monastic community of Mount Athos at about 1080 CE.

In 1430, the town was conquered by the Ottoman Turks, and annexed to the region ("Sanjak") of Thessaloniki. The inhabitants of Polygyros participated in the great revolutionary movement of 1821 and on 17 May of that year they temporarily expedite the local Turkish garrison. Papageorgakis Mavroudis and John Stastaris from Hasikohoria of Polygyros and the chieftain John P. Styloudis excelled in these actions and went on to support the revolution in South Greece. Important personalities of the revolution of Polygyros were also Georgios Cressidis, the petty officers Chris Mavroudis and Georgios Pantoudis and surgeon Christos Nikolaidis. Similar activity was displayed by the townsfolk of Polygyros during the revolution of 1854 led by Tsamis Karatasos. Finally, after 482 years of Ottoman occupation, Polygyros was liberated on November 2, 1912 by the Greek army and was directly incorporated Greek state.

Today, some of the history of Polygyros can be examined in the Archaeological Museum of the town, which contains exhibits from the entire peninsula of Chalkidiki, including the prehistoric times, the Geometrical, the Archaic, the Classical, the Hellenistic and the Roman period. It also has an exhibition with the finds from the excavations at ancient Olynthus. There is also a Folklore Museum, housed in the Karagani residence. Its exhibits include traditional costumes, agricultural tools and a representation of an urban house of the early twentieth century (on the first floor of the museum).

6.4. Archaeological Sites and Monuments

The archaeological site of Olynthus (declared by the 1194/B/5-10-1973 and 980/V/17-9-1998 Official Gazettes) is located within the study area, 12km south of the Polygyros landfill. It is probably the most important archaeological site in the region. Built ontop a double hill, in the southern part of which remains of the Late Neolithic era were identified (3000 - 2500 BC), as well as the planning scheme of an archaic town of the 7th century BC., where an administrative center is identified (market and prytaneum), shops and small houses, all of which were destroyed by the Persians in 479 BC. Olynthus' prime was during the classical times, when a city was built on the plateau and the east side of the north hill, covering a surface of 64 blocks, separated horizontally and vertically by streets. There are many two storey houses but also villas with mosaic floors, a few public spaces, a gallery and a public fountain.

Other listed monuments, officially declared or undergoing zoning as Archaeological Sites in the Study area are the following:

1. **Byzantine tower and two water mills in the community of Galatista of Chalkidiki**, Anthemountas (Official Gazette 51/B/28-1-1981).
2. **Archaeological Site at the “Agios Georgios” location**, Galatista, Anthemountas (Official Gazette 1478/B/20-7-1999).
3. **Archaeological Site at Agia Paraskevi of Galatista (ancient town of Anthemous)**, Anthemountas (Official Gazettes 280/B/9-6-1987 and 1478/B/20-7-1999)
4. **Archaeological Site at the Agioi Apostoloi Doumbion location**, Anthemountas (Official Gazette 438/B/26-4-1999)
5. **Archaeological Site at the Mikri or Kommeni Tumba (Karakoli)**, Anthemountas, (Official Gazette 1478/B/20-7-1999)
6. **Holy Monastery of Saint Anastasia Farmakolytria with burial church and chapel of Saint Kyrikos and Saint Ioulitis at Galatista**, Anthemountas, (Official Gazette 65/B/30-1-1981)
7. **Archaeological Site of early Christian ruins, in the yard of the chapel of Saints Anargyri**, Anthemountas, (Official Gazette 470/B/25-7-1985)
8. **Tomb in Galatista**, Anthemountas (Official Gazette 1194/B/5-10-1973)
9. **Archaeological Site at the Tumba Panikova location**, Anthemountas (Official Gazette 1478/B/20-7-1999)
10. **Building at Vavdos, property of A. Dimitriadis and D. Vogiatzis. Declassification**, Vavdos, Anthemountas (Official Gazettes 674/B/20-9-1984 and 76/B/1-2-2000)
11. **Archaeological Site of Galarinos at the "Kastelli" location**, Galarinos, Anthemountas (Official Gazette 438/B/26-4-1999)
12. **Building at Galatista, property of D. Tsifoutis**, Galatista, Anthemountas (Official Gazette 218/B/29-4-1987)
13. **The school building “Anthemountos” at Galatista, property of Ephoria of School 1st Elementary School**, Galatista, Anthemountas, (Official Gazette 629/B/22-8-1994)
14. **Building at Galatista, alleged property of Diamanto Deligianni**, Galatista, Anthemountas, (Official Gazettes 780/Δ/16-11-2000 and 1368/B/18-10-2001)
15. **The building complex with its surroundings, property of the heirs Chatzoglou**, at the Municipality District of Galatista of Anthemountas, Chalkidiki (Official Gazette 554/B/25-4-2005)
16. **Church of Saint Paraskevi** at Galatista, Anthemountas, (Official Gazette 65/B/30-1-1981)
17. **Building complex at Krimni, property of Athanasia Tzirini and heirs of Antonios Tzirinis**, Krimni, Zervochoria (Official Gazette 352/B/13-5-1994)
18. **Archaeological Site at Saint Georgios location** at Ormylia, (Official Gazettes 1194/B/5-10-1973 and 207/B/5-3-1998)
19. **Archaeological Site at Platia Tumba (Ancient Sermyli)**, Ormylia (Official Gazette 661/B/4-8-1997)
20. **Archaeological Site at a hill, with a chapel of Prophet Elias** at Ormylia (Official Gazettes 1194/B/5-10-1973 and 207/B/5-3-1998)
21. **The central building of the old metochion complex of the Holy Monastery of Vatopedi** at Ormylia, Chalkidiki, (Official Gazette 226/B/21-2-2005)
22. **Windmill at Ormylia**, (Official Gazette 128/B/23-3-1983)
23. **Five (5) buildings at Ormylia, property of Georgios Michaloudis and Triantafyllos Mpougias**, (Official Gazette 674/B/20-9-1984)
24. **The parish church of Saint Georgios and its bell tower** at Ormylia (Official Gazette 735/B/2-10-1989)
25. **Old school building** at Ormylia, (Official Gazette 887/B/30-10-1991)

26. **Church of Evangelismos (Annunciation)** at Ormylia (metochion of Vatopedi), (Official Gazette 827/B/12-8-1998)
27. **Archaeological Site at Kallipoli location** at Ormylia, (Official Gazettes 781/B/12-9-1995, 963/B/29-10-1997 and 207/B/5-3-1998)
28. **Elementary school at Municipality District of Vrastama**, Municipality of Polygyros, Chalkidiki, (Official Gazette 354/ΑΑΠ/11-8-2008)
29. **Windmill at "Molyvdopyrgos" location**, property of Municipality of Polygyros, (Official Gazette 85/B/12-2-1996)
30. **Ruins of early Christian building at Vatonia location**, Palaiokastro, Polygyros (Official Gazette 567/B/9-8-1988)
31. **Church Saint Theodoros at Taxiarchis**, Polygyros (Official Gazette 670/B/5-9-1994)
32. **Byzantine tower and tandem watermill** at the Mariana location of the Olynthos community, Polygyros (Official Gazette 65/B/30-1-1981)
33. **The early Christian church of Saint Nikolaos (ruins)** at the Mariana location of Olynthos, Polygyros (Official Gazette 65/B/30-1-1981)
34. **Two hills and the defined zone by the enclosure at Olynthos**, Polygyros (Official Gazette 1194/B/5-10-1973)
35. **The hill with the church of Vrasta village** (Vrastama), Polygyros, (Official Gazette 1194/B/5-10-1973)
36. **Archaeological Site of Kalyvia (Ancient town of Mikyverna)**. Defining of Protection Zones A and B, Polygyros (Official Gazettes 1194/B/5-10-1973, 120/B/4-3-1996 and 1219/B/4-10-2000)
37. **Ancient town at the "Amygdalies" location** of Kelli, Vrastama, Polygyros (Official Gazette 1194/B/5-10-1973)
38. **Residency of Georgios Lambrou** at Polygyros (Official Gazette 867/B/11-12-1986)
39. **The old School** at Polygyros, (Official Gazette 34/B/20-1-1989)
40. **Residency at Polygyros, property of the heirs of the painter G. Paralís**, Polygyros, (Official Gazette 819/B/25-10-1989)
41. **Historical center of Polygyros**, (Official Gazette 406/B/10-8-1987)
42. **Church of Saint Theodoros**, Taxiarchis, Polygyros (Official Gazette 727/B/11-10-1984)
43. **Building complex at Taxiarchis**, property of Community of Taxiarchis, Polygyros (Official Gazette 727/B/11-10-1984)
44. **Building at Taxiarchis, property of Chr. Papagiannis**, Taxiarchis, Polygyros (Official Gazette 154/B/31-3-1987)

The closest Archaeological sites and monuments to the intervention area (Polygyros landfill) are the ones in the town of Polygyros, as presented in detail in the relevant Map 7 of Appendix 1. Responsible for the aforementioned declared Archaeological Sites of the study area is the 16th Ephorate of Prehistoric and Classical Antiquities. None of these sites is directly affected by the activities in the landfill.

6.5. Financial and Social Environment

6.5.1. Demographics

Overall, Chalkidiki includes five (5) municipalities. In this study, we examined the social and economic characteristics of the Municipality of Polygyros (the study area), namely the Municipality District of:

- Polygyros: Includes 1 municipal community (Polygyros) and 6 local communities (Agios Prodromos, Vrastama, Olynthos, Palaiokastros, Sana, Taxiarchis)
- Ormylia: Includes 1 municipal community (Ormylia) and 1 local community (Metamorphosi).
- Anthemountas: Includes 1 municipal community (Galatista) and 3 local communities (Vavdos, Galarinos, Doumbia).
- Zervochoria: Includes 5 local communities (Geroplatanos, Krimni, Marathoussa, Palaiochora, Riza)

The overall population trend at Chalkidiki, and details for each district of the study area during the last decades is given in **Table 5.5-1**.

Table 5.5-1: Evolution of actual population of Chalkidiki and the study area

Region	Population (person)			Change (%)	
	1991	2001	2011	1991-2001	2001-2011
POLYGYROS	5.708	6.227	11.386	9.1	82.8
ORMYLIA	3.513	4.471	4.282	27.3	-4.2
ANTHEMOUNTAS	3.805	4.208	4.002	10.6	-4.9
ZERVOCHORIA	2.758	2.808	2.378	1.8	-15.3
Study Area total	9.988	10.444	22.048	4.6	111.1
Chalkidiki	92.054	104.894	105.908	13.9	0.9
Greece (total)	10.259.900	10.964.020	10.815.197	6.9	-1.36

From the population data of the last twenty years (3 census cycles), the following conclusions can be drawn:

1. During the years 1991-2001, the study area's population grew by 4.6% . The population growth is mainly located in the coastal region of Ormylia (+27,3%), in Anthemountas (+10,6%) and Polygyros (+9,1%), contrary to the small increase of the Zervochoria population (1,8%). The rate of change in the district of Chalkidiki and the whole country is, however, much greater than that of the study area.
2. During the decade 1991 - 2001, everything changed dramatically. The population of the whole study area increased enormously, more than doubled its original number (+111.1 %). Breaking this information down, this rapid change comes from the increase of the population of the Municipality District of Polygyros (+82,8%), which is the biggest urban

center of Chalkidiki. On the contrary, the Municipality Districts of Anthemountas, Zervochoria and Ormylia suffered a significant decrease in their populations (-4.2, -4.9, and -15.3 respectively). As the population of the main district of Chalkidiki remained practically unchanged (+0.9%), it is safe to assume that these growth indicators are associated with the movement of the rural population in large urban centers (town of Polygyros). At the same time, the total population of Greece actually decreased by 1.36%.

Generally, the proximity of Chalkidiki with the metropolitan center of Thessaloniki, its geomorphology, the absence of areas of economic growth, and the distance from the main economic axis Patra - Athens - Thessaloniki, led to the lack of a major urban center – (with the exception of the town of Polygyros), which due to size would cause diffusion of development to the surrounding region.

In summary, throughout the considered period, the population change for the examined study area is in line with the corresponding change recorded at Chalkidiki. The population decline is pronounced in mountainous districts, while in the urban center of Polygyros has increased its population.

Breakdown of Population by Age Groups

Based on the statistical data of ELSTAT (census of 2011) the following **Table 5.5-2** was established, showing the distribution of population by age groups in the four Municipality Districts of the study area, in Chalkidiki and in the whole of Greece.

Table 5.5-2: Distribution of population by age groups in the four Municipality Districts of the study area, at a Chalkidiki and country level.

AREA	Total (people)	Population classified according to age groups									
		0-14		15-24		25-39		40-64		>64	
		people	%	people	%	people	%	people	%	people	%
POLYGYROS	11386	2364	20.8	1135	10.0	1665	14.6	4482	39.4	1740	15.3
ANTHEMOUNTAS	4002	922	23.0	391	9.8	502	12.5	1525	38.1	662	16.5
ZERVOCHORIA	2378	406	17.1	258	10.8	254	10.7	970	40.8	490	20.6
ORMYLIA	4282	876	20.5	442	10.3	650	15.2	1679	39.2	635	14.8
Study Area	22048	4568	20.7	2226	10.1	3071	13.9	8656	39.3	3527	16.0
Chalkidiki	105908	21921	20.7	11272	10.64	15678	14.8	40960	38.68	16077	15.18
Greece (Total)	10816286	2122544	19.62	1350868	12.49	1635304	15.12	4106994	37.97	1600576	14.8

The percentages of each age group of the total population for the study area, the district of Chalkidiki and the whole country, are presented in **Figure 5.5-1**. As noted, the structure of the total population in the study area differs very little from that of Chalkidiki and the country. The percentages of the total population of the more productive ages (20-69) are smaller, while the rates for those younger than 19 and aged over 69 appear almost the same as Chalkidiki and larger than those of the whole of Greece.

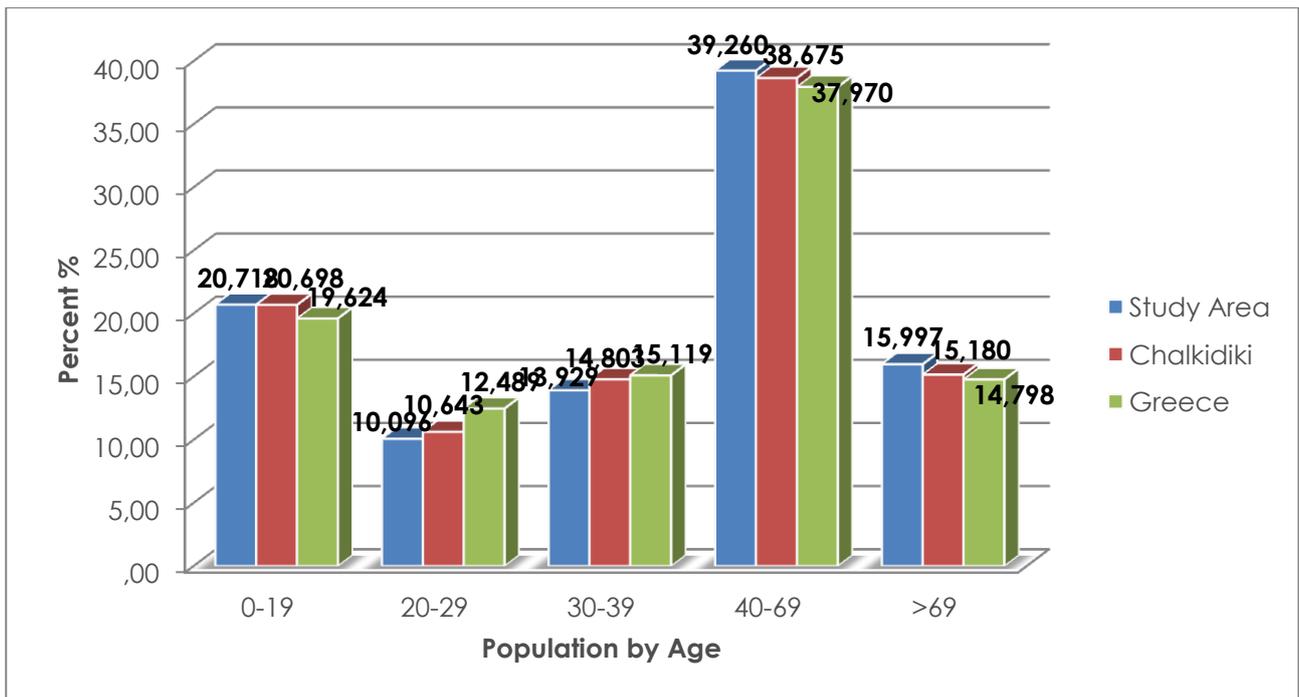


Figure 5.4-1: Percentage of population classified by age groups

6.5.2. Production Data

The economic profile of the study area arises from the analysis of the three productive sectors (primary, secondary, tertiary) and local production activities. In this context, primary production sector includes activities deriving goods directly from nature (e.g. raw materials and resources); secondary production sector includes activities that process or remanufacture goods of the primary sector into consumer products; tertiary production sector includes services and products transport and sales.

Primary Sector

The primary production sector accounts for 22.8 % of employment in the study area, relatively bigger when compared with the figure of the whole of Chalkidiki (16.7%) (ELSTAT, 2011), with the smallest participation recorded in the study area being the one from the Municipality Districts of Polygyros (18.8%). The data show a great development of the primary sector in the study area compared with the rest of the county (10.4%).

In particular, in the Municipality District of Polygyros, 1320 agricultural and livestock holdings have been recorded (ELSTAT, 2000), with a total percentage of cultivated/farmed lands of 23.1% over the total surface of the district. Agriculture dominates over livestock: Only 0.6% of the agricultural area is purely pastoral land, their respective holdings being 21.

In the Municipality District of Anthemountas 806 agricultural and livestock holdings have been recorded (ELSTAT, 2000), with taking up a 29.2% of the total surface of the district. Very similarly to Polygyros, agriculture dominates over livestock, with only 0.7% of the agricultural area being exclusively used for animal farming. The total livestock holdings are 34 over a 501,5 acres.

The Municipality District of Zervochoria relies at a large rate on agriculture. With 492 recorded agricultural and livestock holdings (ELSTAT, 2000), taking up a surface of 46939,3 acres (33,8% of the total surface of the district). Again, agriculture and mixed use areas are dominating over livestock, with only 0.25% of the agricultural area being exclusively used for animal farming.

The smaller district of Ormylia has a vast agricultural area, with 969 agricultural and livestock holdings (ELSTAT, 2000), which account for the 34,1% of the total area of the district. Taking into account that this is a small district, with also some touristic development, this is an impressive percentage. However, exclusive livestock is almost non-existent, with the number of animal count not exceeding 3000.

More recent statistical data about the agricultural and livestock holdings are not as detailed, and they are provided by ELSTAT for bigger geographic areas, but for comparison reasons the following **table 5.5-3** was prepared.

Table 5.5-3. Changes of agricultural and livestock holdings through the years in the broader study area (ELSTAT, 2000 and 2009)

AREAS	2000			2009		
	Agricultural Holdings	Livestock Holdings	% of the total area of the district	Agricultural Holdings	Livestock Holdings	% of the total area of the district
Chalkidiki	12.918	2.698	26.6%	17.674	2.127	27.2%
Central Macedonia	116.838	62.914	33.8%	154.784	39.820	34.1%
Greece (Total)	817.059	747.947	27.2%	1.207.466	466.407	26.4%

The forestry production in the study area is considered quite important. Also, the fishing activity that has developed in the region comes mainly from sea fishing, which is done either by coastal way (nets, lines, trawls) or middle fisheries (seiners and trawlers) while there are no fish cultures in the area.

Secondary Sector

In the study area, the secondary sector production accounts for 19.5 % of employment (ELSTAT, 2011), with its main branches being construction, mild industrial activities and mining. However, the mining activity has experienced glitching in the 1990s, which led to a reduction of the product of industry. The decline of the mining industry has emerged as the most important factor to the decline of the local economy. Furthermore, the impairment of Mines in recent years led to the crisis and a number of other businesses related to their operation. Also, manufacturing activity contributes little to the development of the region, while the lack of infrastructure for artisanal and small size enterprises in the market does not favor the establishment of new manufacturing units. In order to assist the industrial development of the region, the aforementioned Mild Industrial Zone was established in the area of Zervochoria as well as the areas of mining interest in Polygyros and Ormylia.

Tertiary Section

The tertiary sector production accounts for 51.2 % of employment in the study area (ELSTAT, 2011). Especially for the Municipality District of Polygyros, which has the biggest urban center of the area, the main economic activities are commerce and provision of services. Tourism is also another source of employment for the study area, and particularly on the coastline of Polygyros and Ormylia. There are several hotel units of small and medium capacity, however, the study area generally lacks the comparative advantage in forms of mass tourism.

The contribution of tourism in the region throughout Chalkidiki is very limited (0.8 %), while collecting only 2% of hotel beds in the area (Papavassiliou et al, 1996). Because of geographical and morphological features, it seems that it is not suitable for mass tourism development, but with the creation of appropriate infrastructure development, the area can follow mild climate that will attract alternative specific types of tourist audience (rural tourism, historical tourism, mining tourism etc).

Regarding trade, this activity is limited and unevenly distributed in Chalkidiki. The market influence of Thessaloniki and the uneven population distribution whose main effect to the commercial activities are mainly concentrated in the western and its southern part.

Also, a special mention should be given to the export trade relating to mining products and prospects of the study area, which depend critically on the prospects of the mining business

6.5.3. Employment Data

The area of interest is one of the most developed areas of Chalkidiki which is the result of being built around Polygyros, the biggest urban centre of the region. **Table 5.5-4** summarizes the employment data for the study area, according to the census of 2011.

From **Table 5.5-4**, it seems that the Municipality Districts of Polygyros, Anthemountas and Zervochoria have lower unemployment rates than that of Chalkidiki and Ormylia.

The breakdown of employment by production sector is presented in **Table 5.5-5**. From these figures, it is concluded that the employment of the study area in the primary sector is higher than in the entire county (22.8 % vs. 10.0 %), while the secondary sector is also higher with a smaller margin (19.5% versus 17.6%). The corresponding rates in the tertiary sector are a lot smaller (57.7% versus 72.5%). In Chalkidiki, employment in the tertiary sector is mainly related to tourism and trade. At the country level, the percentage attributed to the tertiary sector is larger, due to the concentration of services in bigger urban centers.

Table 5.5-4. Economically active and inactive population in the study area (ELSTAT, census of 2011)

AREAS	Economically active population					Economically inactive population
	TOTAL	Employed	Employed (% of the total)	Unemployed	Unemployed (% of the total)	
POLYGYROS	5412	4034	74.5%	689	12.7%	6663
ANTHEMOUNTAS	1730	1174	67.9%	278	16.1%	2550
ZERVOCHORIA	977	697	71.3%	140	14.3%	1541
ORMYLIA	2015	1489	73.9%	263	13.1%	2530
Study Area	10134	7394	73.0%	1.370	13.5%	13284
Chalkidiki	51191	34275	67.0%	8.458	16.5%	63175
Greece (Total)	5445639	3727633	68.5%	859.003	15.8%	6229650

Table 5.5-5. Breakdown of employment in the productive sector for the study area. % on total employment (ELSTAT, 2011).

AREAS	Primary Sector	Secondary Sector	Tertiary Sector
POLYGYROS	18,8%	17,9%	63,3%
ANTHEMOUNTAS	22,1%	26,3%	51,6%
ZERVOCHORIA	30,6%	19,8%	49,6%
ORMYLIA	30,3%	18,5%	51,2%

AREAS	Primary Sector	Secondary Sector	Tertiary Sector
Study Area	22,8%	19,5%	57,7%
Chalkidiki	16,7%	19,9%	63,4%
Greece (Total)	10,0%	17,6%	72,5%

According to the figures in these tables, at the same time, the following conclusions can be drawn:

- Of the professions related to secondary production (construction, manufacturing, mining), the construction activity is the one with the largest proportion of employment in the region (5,7%). Especially for the district of Anthemountas, in 2011 the percentage of employment in the secondary sector amounted to 26.3%.
- Employment in occupations directly related to the primary sector (agriculture, farmers, loggers, fishermen, etc.) is much greater, amounting to 22.8%, much bigger than that of Chalkidiki (16.7%) and the whole of Greece. Indeed, employment in these occupations is very big in the more rural areas such as Anthemountas, Ormylia and Zervochoria (22.1%, 30.6% and 30.3% respectively).
- Those employed in the tertiary sector (commerce, communications, transport, tourism, service provision) who are involved in the total employment of the study area, with slightly lower rates (57.7 %) compared with those of Chalkidiki (63.4 %).

6.5.4. National Regional Accounts

Table 5.5-6 presents the figures of the Gross Domestic Product of the Region of Central Macedonia, as well as the Chalkidiki area, in comparison to the National Gross Domestic Product (million € at current prices).

Table 5.5-6: Evolution of the GDP of Greece, of the Region of Central Macedonia and of the Chalkidiki area for the years 2000-2012 in million € at current prices (*provisional data – Source: ELSTAT)

Area \ Years	Years												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Chalkidiki	1,130	1,204	1,246	1,388	1,488	1,548	1,695	1,771	1,841	1,774	1,746	1,646	1,578
Central Macedonia	19,848	21,370	22,428	24,482	26,532	27,175	29,917	32,173	33,465	32,539	30,587	28,401	26,109
Greece	141,732	151,987	162,274	178,571	193,013	199,153	217,831	232,831	242,096	237,431	226,210	207,752	194,204

Also, **Table 5.5-7** shows the percentage participation of the Region of Central Macedonia and the area of Chalkidiki to the National Gross Domestic Product (million € at current prices).

Table 5.5-7: Percentage participation of the Region of Central Macedonia and of the Chalkidiki area to the National Gross Domestic Product for the years 2000-2012 in million € at current prices (*provisional data – Source: ELSTAT, after processing)

Years Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Chalkidiki	0.80%	0.79%	0.77%	0.78%	0.77%	0.78%	0.78%	0.76%	0.76%	0.75%	0.77%	0.79%	0.81%
Central Macedonia	14.00%	14.06%	13.82%	13.71%	13.75%	13.65%	13.73%	13.82%	13.82%	13.70%	13.52%	13.67%	13.44%

The participation of the Region of Central Macedonia to the National GDP remains relatively stable (though declining) during the years 2000-2012, as with most regions of the country (ELSTAT, 2014). **Tables 5.5-8 and 5.5-9** below provide information regarding the evolution of GDP per capita for the whole of Greece, for the Region of Central Macedonia and for the Chalkidiki area, as well as the comparison of these with the National GDP per capita of the entire country. The Region of the Central Macedonia has a middle level GDP per capita comparing to the other regions of Greece, although in the period 2005 - 2007 showed higher growth rates relative to the average change at national level.

Also, **Table 5.5-8** presents analytically the impact of the Greek Financial Crisis to the regional and national GDP per capita since its beginning in 2009. After almost a decade of continuous growth, the GDP has been decreasing dramatically, reaching in 2012 almost the same levels as in 2004.

Table 5.5-8: Evolution of the GDP per capita for the years 2000-2012 in € at current prices (*provisional data – Source: ELSTAT, after processing)

Years Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Chalkidiki	11,421	11,990	12,267	13,540	14,369	14,773	15,985	16,516	17,008	16,285	15,990	14,896	14,073
Central Macedonia	10,623	11,389	11,896	12,926	13,942	14,210	15,570	16,671	17,289	16,801	15,841	14,771	13,645
Greece	12,983	13,878	14,774	16,207	17,458	17,953	19,575	20,857	21,642	21,224	20,282	18,677	17,507

Table 5.5-9: Comparison of the regional GDP per capita to the National GDP, for the years 2000-2012
(*provisional data – Source: ELSTAT, after processing)

Area \ Years	Years												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Chalkidiki	88.0%	86.4%	83.0%	83.5%	82.3%	82.3%	81.7%	79.2%	78.6%	76.7%	78.8%	79.8%	80.4%
Central Macedonia	81.8%	82.1%	80.5%	79.8%	79.9%	79.1%	79.5%	79.9%	79.9%	79.2%	78.1%	79.1%	77.9%

Both Chalkidiki and the Region of Central Macedonia present a lower GDP per capita than the National GDP. In fact, this figure is expected to deteriorate further as the GDP per capita of Chalkidiki and the Region of Central Macedonia increase at a slower rate compared with the corresponding figures of the country, with the exception of the years 2002-2003 for Chalkidiki and 2005-2007 for Central Macedonia (**Table 5.5-10**). Furthermore, the decline of both the regional and the National GDP growth since 2009 is a result of the Greek Financial Crisis, with its biggest decrease being during 2010-2011.

Table 5.5-10: Growth Rates of the regional and the National GDP per capita, for the years 2000-2012
(*provisional data – Source: ELSTAT, after processing)

Area \ Years	Years											
	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05	'05-'06	'06-'07	'07-'08	'08-'09	'09-'10	'10-'11*	'11-'12*
Chalkidiki	4.98%	2.31%	10.38%	6.12%	2.81%	8.20%	3.32%	2.98%	-4.25%	-1.81%	-6.84%	-5.52%
Central Macedonia	7.21%	4.45%	8.66%	7.86%	1.92%	9.57%	7.07%	3.71%	-2.82%	-5.71%	-6.75%	-7.62%
Greece	6.89%	6.46%	9.70%	7.72%	2.84%	9.03%	6.55%	3.76%	-1.93%	-4.44%	-7.91%	-6.26%

Regarding the Gross Value Added (GVA), the figures for Chalkidiki, the Region of Central Macedonia and for Greece are presented in **Table 5.5-11**.

Table 5.5-11: Evolution of the GVA during the years 2000-2012 in million € at current prices (*provisional data – Source: ELSTAT, after processing)

Area \ Years	Years												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Chalkidiki	1,002	1,064	1,111	1,246	1,342	1,389	1,502	1,562	1,627	1,585	1,541	1,444	1,392
Central Macedonia	17,599	18,897	19,995	21,968	23,928	24,385	26,511	28,381	29,572	29,084	26,995	24,922	23,018
Greece	125,678	134,397	144,670	160,240	174,070	178,708	193,031	205,393	213,933	212,216	199,645	182,302	171,216

As shown in **Table 5.5-12**, the GVA per productive sector of both Chalkidiki and the Region of Central Macedonia shows differences compared with the corresponding structure at country level. In particular, the GVA of the Primary Sector at Chalkidiki (as a percentage of total GVA) is almost twice as the corresponding value of the country and The GVA in the secondary productive sector is more or less the same percentage in both Chalkidiki and the Region of Central Macedonia to that of the whole country. However, in the tertiary sector these percentage figures are significantly lower.

Table 5.5-12: Evolution of the GVA of the primary, secondary tertiary production sector during the years 2000-2012 (as a percentage of the total GVA) (*provisional data – Source: ELSTAT, after processing)

Years Area	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Primary Production Sector													
Chalkidiki	11.48%	9.89%	9.65%	10.93%	11.27%	9.82%	6.32%	6.20%	4.79%	5.59%	5.70%	5.90%	5.95%
Central Macedonia	8.84%	8.49%	8.10%	7.72%	7.17%	7.26%	5.06%	5.08%	4.62%	4.55%	4.60%	5.34%	5.41%
Greece	6.09%	5.87%	5.59%	5.60%	4.84%	4.81%	3.65%	3.45%	3.10%	3.13%	3.26%	3.49%	3.69%
Secondary Production Sector													
Chalkidiki	19.11%	20.47%	18.69%	20.22%	20.21%	17.08%	22.21%	18.15%	17.53%	15.79%	15.75%	12.72%	10.04%
Central Macedonia	22.80%	23.33%	21.87%	22.79%	22.78%	19.83%	24.03%	22.13%	20.80%	18.18%	16.97%	15.37%	15.36%
Greece	20.96%	21.70%	31.43%	22.08%	21.96%	19.25%	22.24%	19.93%	18.48%	16.94%	15.22%	14.31%	13.83%
Tertiary Production Sector													
Chalkidiki	69.40%	69.67%	71.64%	68.83%	68.53%	73.12%	71.45%	75.67%	77.66%	78.64%	78.57%	81.39%	83.98%
Central Macedonia	68.36%	68.17%	70.03%	69.49%	70.05%	72.91%	70.91%	72.78%	74.58%	77.27%	78.43%	79.29%	79.23%
Greece	72.95%	72.43%	73.26%	72.32%	73.21%	75.94%	74.12%	76.63%	78.42%	79.93%	81.53%	82.20%	82.48%

An interesting element resulting from the above tables, as to the areas of interest is the temporal evolution of the weight of each sector in the total GVA.

Both in Chalkidiki and the Region of Central Macedonia the focus on the primary sector appears to wane over time, although it remains a size larger than the GVA territory. The difference lies mainly in agricultural production, which is the main industry in terms of the primary sector. The same decline over time appears also at the secondary production sector. These data indicate a transformation of the region's economy to the service sector.

The focus of the three sectors is reflected also in gross fixed capital formation for the Region of Central Macedonia, shown in **Tables 5.5-13** and **5.5-14**.

Table 5.5-13: Gross fixed capital formation by industry for the Region of Central Macedonia million €. At current prices (*provisional data – Source: ELSTAT, after processing)

Area \ Years	Years												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Agriculture, forestry and fishing	322.45	355.9	299.94	330.70	358.32	380.71	372.10	501.96	623.26	463.46	366.40	331.65	280.76
Industry (including energy)	608.4	635.8	440.72	422.73	497.30	515.14	551.18	689.36	603.16	470.56	439.37	336.46	643.09
Construction	55.4	123.8	85.63	142.06	122.94	59.26	90.70	319.69	124.42	114.08	41.33	39.17	40.45
Wholesale and retail trade, repair of motor vehicles and motorcycles transportation and storage, accommodation and food service activities, Information and communication	756.36	924.79	1186.85	1221.60	1347.45	1016.65	1221.00	2195.49	859.13	1027.13	1019.91	841.56	472.64
Financial and insurance activities and real estate activities	2923.29	2795.12	2815.22	3408.39	4315.66	3625.53	4776.23	5631.18	4106.17	3006.13	2321.39	1712.24	1522.7
Other Services	1572.27	1507.55	1485.04	1765.33	1762.88	1447.26	1645.97	1656.01	1574.52	1328.50	1126.50	1096.63	1185.2
Total of Central Macedonia	6,238	6,343	6,313	7,291	8,405	7,045	8,657	10,994	7,891	6,410	5,315	4,358	4,145

Table 5.5-14: Gross fixed capital formation by industry in the Region of Central Macedonia, as a percentage of the total investment (*provisional data – Source: ELSTAT, after processing)

Area \ Years	Years												
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Primary	5.17%	5.61%	4.75%	4.54%	4.26%	5.40%	4.30%	4.57%	7.90%	7.23%	6.89%	7.61%	6.77%
Secondary	10.64%	11.98%	8.34%	7.75%	7.38%	8.15%	7.41%	9.18%	9.22%	9.12%	9.04%	8.62%	16.49%
Tertiary	84.19%	82.41%	86.92%	87.72%	88.35%	86.44%	88.29%	86.25%	82.88%	83.65%	84.06%	83.76%	76.73%

Regarding the absolute figures, an overall increase in total gross fixed capital investment is showing, up until the time of the Greek Financial Crisis, since when gross fixed capital investments dropped dramatically to their lowest levels since 2000.

Comparing the different productive sectors, the fixed capital investment in the primary sector is kept more or less stable. However, the secondary and tertiary sector suffered a lot of changes, which can also be due to the impact of the Greek Financial Crisis. The sudden increase of the secondary sector during the final years (2011-2012) is attributed to large industrial investments in the region.

Note that these data are not available at a smaller geographical level and have not been completed for subsequent years.

6.6. Technical Infrastructure

6.6.1. Road Network

Due to its central position, the Polygyros district is traversed by many roads of different levels, as it serves as a transportation hub. Polygyros is linked satisfactorily with the city of Thessaloniki, Mount Athos and the rest of the major residential centers of Chalkidiki (e.g. N. Moudania, Arnea, Ierissos, Ormylia) and the centers of tourist development (peninsulas of Cassandra and Sithonia).

The main road axis of the region serves the transportation needs at a local and regional level and connects the study area, the metropolitan center of Polygyros, to the surrounding rural areas and the city of Thessaloniki, through the the National Road Thessaloniki – Polygyros, with a length of 61 km. The road quality is generally found in tolerable condition, except for cases of local damage due to poor maintenance.

The existing road network, combined with the programmed projects for new road alignments (e.g. the Thermi-Galatista part of the N.R.16) and the bypasses of settlements (e.g. Polygyros, Kalyves, Plana), is satisfying the needs of the district of Polygyros (connection between the settlements and the surrounding area).

The primary and secondary provincial network of the study area is in good condition with only a few wear in some places, making it relatively easy to access the Eastern Macedonia and any location within Chalkidiki. Some of the rural roads are either partially paved or unpaved. In general, only local interventions and improvement of the network is required, especially for the the highlands. Additionally, a network of dirt roads is serving some isolated regions in the study area such as mining facilities.

Finally, a special mention should be made about the extensive network of forest roads which gives access to most parts of the woodland area. Given the coverage of forests of the broader study area (51.4 % - see Chapter 5.1 - Land use) and widespread wood-cutting, the forest roads network operates continuously and is maintained in good condition, even though it might suffer significant damage during periods of intense rainfall. Also, these roads are maintained by the local authorities as a means of protection against forest fires.

6.6.2. Transportation

The public transportation service for all the areas of Chalkidiki is conducted by road from the Chalkidiki Bus Service. For the study area, the buses to Sithonia are servicing the following settlements, with 5 to 6 routes per day:

- Agios Prodomos, Gerakini, Kalyves, and the town of Polygyros, of the district of Polygyros
- Vatopedi, Metamorphosi, Ormylia and Psakoudia of the district of Ormylia
- Galatista and Agia Anastasia of the district of Anthemountas

The buses to Ouranoupoli are servicing the following settlements within the study area with 5 to 6 routes per day:

- Palaiochora, Riza and Geroplatanos of the district of Zervochoria

In addition, there is regular connection to neighbouring Municipality of Aristoteles.

In conclusion, the connection the study area settlements to Thessaloniki and the other central locations of Chalkidiki is satisfactory. However, there certainly is a need for better municipal transportation between the settlements, as well as connecting them to the town of Polygyros.

Railway transportation is not available, while passenger and cargo air transportation is served by the airport of Thessaloniki.

6.6.3. Energy - Telecommunications

Electricity in Halkidiki distributed through the facilities of the Public Power Company (PPC) and its transmission lines. Power plants do not exist in the region of Chalkidiki. There are five power substations, located in Nikiti, Moudania, Kassandreia, Stagira and Vavdos (Anthemountas), the latter of which is powering almost the entire study area.

The main power lines in Chalkidiki are two: from the substation of Vavdos to Stagira and from Stagira to Kavala, through the substation of Amphipolis. The construction of a new line from the substation of Nikiti (whose operation has not started) to Stagira, has almost been completed. Also, some network upgrades have taken place to the Stagira - Amphipolis line, with the installation of a dual transmission line. This will lead to the strengthening of the installed capacity of the substation of Stagira.

At the boundary of Chalkidiki region, a central line still operates from the substation of Filippi to Thessalonica, while the planned construction of a new 400 kV transmission line from the substation of Lagadas to the Substation of Filippi (total length 110 km) is expected to enhance the security of electricity supply in the region and to increase the capacity to support Renewable Energy Sources (RES) at Eastern Macedonia and Thrace.

In the study area, there is no planning for the development of natural gas infrastructure. On the other hand, the development of the infrastructure for the exploitation of Renewable Energy Sources (RES) is encouraged, in accordance with the current city planning and the relevant applicable legislation.

The level of telecommunications for the entire study area is considered satisfactory. The network of the Hellenic Telecommunications Organization (OTE) expands underground in the settlements and overground along the roads, and it is powered by the large telecommunications center of Polygyros. It has been considered important by public authorities and planners to extend the infrastructure for broadband development, using modern technologies in all settlements and the development of wireless (WI-FI spots) covering the villages of the study area.

As far as mobile telephony is concerned, due to the geomorphology of the area, only a small fracture of the population in the area is not served by mobile networks. Nevertheless the coverage is sufficient in the immediate study area and most towns and villages.

6.6.4. Water Supply

Most of the water supply of settlements of the study area comes from wells and springs. For powering the networks, the settlements have tanks. The water supply networks in the study area have been rebuilt mostly during the 1990s and are serving almost the entire population (excluding the 5% of the population of Olynthos who are serviced by the public water fountains). Generally, the water supply is satisfactory in all over the study area, according to the official Urban Plans. To enhance the network's efficiency in the whole area, the following actions have been planned:

- Research drillings for the settlements Vrastama, Olynthos and Kalyves
- Construction of new reservoirs in the Kalyves and Palaiocastro
- Investigation boreholes for back up water supply.

Detailed information about the water networks (year of construction and reconstruction, percentage of network reconstructed, serviced people) for the settlement of Chalkidiki was gathered by the Ministry of Environment some years ago. The relevant information for the study area is presented in **Table 5.6-1**.

Table 5.6-1: Water supply networks in the study area (Ministry of Environment, 1999)

Settlements	Year of install	Year of re-furbish	% of network re-furbish	Year of 2 re-furbish	% of network 2 re-furbish	Year of 3 re-furbish	% of network 3 re-furbish	People serviced by the network (%)	People serviced by public fountains (%)	People not serviced by the network (%)
GALATISTA	1960	1998	50	1999	50			100	0	0
MARATHOUSA	1959							100	0	2
METAMORPHOSI	1955	1986	20					100	0	0

Settlements	Year of install	Year of re-furbish	% of network re-furbish	Year of 2 re-furbish	% of network 2 re-furbish	Year of 3 re-furbish	% of network 3 re-furbish	People serviced by the network (%)	People serviced by public fountains (%)	People not serviced by the network (%)
OLYNTHOS	1965	1988	15	1993	30	1997	40	95	5	0
ORMYLIA	1955	1988	10	1992	10	1994	10	100	0	0
PALAIOCHORA	1980	1990	40	1998	60			100	0	0
POLYGYROS	1960	1980	5	1990	5	1998	5	100	0	0
RIZES	1965	1965	60	1994	20	1997	20	100	0	0

Detailed information about water abstractions from natural resources for drinking water and irrigation are provided in the RBMP report of Central Macedonia, which was composed in accordance with the requirements of the Water Framework Directive 2000/60/EC (RBMP of Central Macedonia, 2014). In particular, for the River Basin District of the whole of Chalkidiki, surface water use is equally distributed between water supply (49.9%) and irrigation (49.9%, which refers to the lake Volvi), and has also a negligible percentage for industrial use. Regarding local aquifers exploitation, the water abstractions are being used mainly for Irrigation (83%), 11% for water supply and a smaller 6% for other uses, such as mining, manufacturing, etc.

The surface water abstractions for the River Basin District (RBD) of Chalkidiki are presented in the **table 5.6-2** bellow. The highlighted water bodies are found within the boundaries of the study area

Table 5.6-2: Surface water systems which are affected by abstractions, RBD of Chalkidiki (source: RBMP of Central Macedonia, 2014)

Classification of Water Body	Code	Name	Drinking Water	Irrigation Water	Other Uses
LAKE	GR1005L000000002H	Mavrouda Lake	X		
LAKE	GR1005L000000003N	Volvi Lake		X	
LAKE	GR1005L000000004N	Koroneia Lake	X		
RIVER	GR1005R000100021N	Mavros Lakkos	X		X
RIVER	GR1005R000201001N	Richios	X		
RIVER	GR1005R000206014N	Koutsikarli stream	X		X
RIVER	GR1005R000206115N	Varvara stream	X		X
RIVER	GR1005R000208017N	Megalo	X		X
RIVER	GR1005R000212019N	Chora	X		
RIVER	GR1005R000300022N	Basdeki	X		X
RIVER	GR1005R000500023N	Asprolakkas	X		X
RIVER	GR1005R000700024N	Petrenio	X		X

Classification of Water Body	Code	Name	Drinking Water	Irrigation Water	Other Uses
RIVER	GR1005R001700029H	Anthemous	X		X
RIVER	GR1005R002300033N	Xirolagkas	X		X
RIVER	GR1005R002500034N	Salidika Mandia stream	X		X
RIVER	GR1005R002704040N	Vatonias	X		X
RIVER	GR1005R003106051N	Xinoneri	X		X
RIVER	GR1005R003107045N	Havrias	X		X
RIVER	GR1005R003108052N	Havrias	X		X
RIVER	GR1005R003111047N	Havrias	X		X

Concerning the underground water systems of Chalkidiki, the BMP study mainly focuses on the resulting issues that are relevant to the abstraction of water from them. Its general conclusions are the following:

Within the study area:

- Level decrease and salination in the system of Epanomi - Moudania (GR1000060)
- Level decrease in the system of Mygdonia (GR1000070), particularly in Koroneia
- Level decrease of wells and partially pressurized aquifers, with declining and salination trend in the system of Anthemountas (GR1000080)
- Level decrease in the coastal part of the aquifer of the system of Ormilía (GR1000100)

Outside the study area:

- Decline in the supply of springs of the creviced system and reduced supply of water boreholes in the Sithonia system (GR1000180)
- Limited stress due to pumping is also located in the systems of Mavroudás (GR1000120) and Nea Roda (GR1000200)
- Important issues are detected in the subsystems of Skouries (GR1000191), creviced Olympiada (GR1000192) and Cholomontas - Oreokastro (GR1000190), caused by the mining activity in the area. Significant downgrading of the level of groundwater is induced, so that the mining of the ore can be carried out in dry conditions.

6.6.5. Sewerage

The settlements of the study area have varied characteristics regarding wastewater treatment. Some residencies and tourist lodgings are connected to compete sewerage systems and their

refuse is treated, while others have only septic tanks and are leading the untreated effluent into local water bodies. In particular, the following data are available for the main districts of the municipality:

Polygyros

- The sewerage system of Polygyros is one of the best in the area and it is covering 100% of the population of the town.
- The town of Polygyros does not have a Wastewater Treatment Plant (WWTP). The effluent is delivered to the facility of Galatista, at a distance of 28km.
- As for the rest of the settlements of the district, the approved Urban Planning for Polygyros (Official Gazette 243/VNEUS/21-06-2013) has announced the following actions:
 - o Sewerage network works and installation of a WWTP unit for Polygyros, Kalyves, and Gerakini - Paralia Gerakinis.
 - o Additional construction of relevant infrastructures to serve the rest of the Polygyros settlements (Agios Prodromos, Vrastama, Palaiokastro, Sana, Plana, Olynthos and Taxiarchis)
 - o Securing the sewerage infrastructure of Special Urban Regulated Areas (PERPO) and organized receptors of manufacturing and business activities.

Anthemountas

- The sewerage system of Galatista is covering 70% of the population.
- Anthemountas has its own WWTP, located in Galatista. This facility is servicing the 97% of the residents, but it does not accept any industrial wastewater. The effluent of the facility is led to the nearby stream (code: GR12700201320).

Ormylia

- Ormylia has its own WWTP, located just south of the town, servicing the settlements of Ormylia, Psakoudia and Vatopedi. The effluent of the facility is led to the nearby water body Zamouni (code: GR1005R002900041N), which flows into the sea.
- The sewerage network of Ormylia is in need of refurbishment, while the settlements Vatopedi, Psakoudia and Metamorphosi do not have any and are using individual cesspits and septic tanks.
- The issues of the sewerage of the area have been mentioned in the Urban Plan of Ormylia (Official Gazette 260/VNEUS/27-06-2008), where it is stated that the rapid actions should be taken. It is also suggested that another WWTP should be built in Metamorphosi.

Zervochoia

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- All the settlements of Zevochoria have sewerage networks, except for Marathoussa, where cesspits and septic tanks are being used. The wastewater is refused into local secondary streams or their branches, without any treatment.
 - This is creating some serious environmental issues to the surface and underground water bodies, which have lake Volvi as their final destination – a sensitive wetland ecosystem of great importance.
 - Addressing this problem, the official Spatial Plan of Urban Organization for the Open City (Official Gazette 286/VNEUS/21-07-2010) of Zevochoria suggests the building of a WWTP unit at the border of the settlements Riza and Palaiochora, which will service these two settlements at first, having the option to connect the Geroplatanos settlement later on.
 - Additionally, the Plan proposes the development of a sewerage network in Marathoussa, as well as alternative methods of wastewater management for the settlements and areas which will not be able to connect to the suggested WWTP.

6.6.6. Solid waste management

Management of municipal solid waste in the area of interest is realized according the Regional Planning for Solid Waste Management (known as PESDA). PESDA depicts the current situation in the waste sector and constitutes a framework of initiatives and interventions, setting targets and timetables for the installation and configuration of Organised Waste Management Facilities, all according to the general guidelines of the Greek National Solid Waste Management Plan (NAP). The PESDA should be evaluated every five (5) years to assess the potential need for its revision or modification.

The PESDA of Central Macedonia, harmonised with EU directives 94/62/EC and 99/31/EC and the Greek law, was approved with the protocol no. 639/02-12-2005 (Correction: 29-03-2006) by the General Secretary of the Region of Central Macedonia. With the implementation of Law 3852/2010 (Kallikratis Program) on 1/1/2011, the preparation and adoption of the PESDA was moved from the Decentralized Administration to the Regional District of Chalkidiki, within the relevant national planning framework.

On the 13/02/2012, Law 4042 was published (Official Gazette 24) which harmonised the 2008/99/EC Directive with the national legislation, removing the responsibility of PESDA from the Regions and entrusting it to the new regional FODSA (Solid Waste Management Bodies). The Law dictates that the competent authority - in this case the Department of Environment and Spatial Planning of Central Macedonia - will be responsible of proposing the PESDA and the Regional Council Decision be approving it. What is more, Law 4042 states that the approval and supervision of the implementation of the PESDA under the relevant NAP is the responsibility of the regions. Article 64 of this Law contains specific provisions concerning the renewal of the Board of the existing FODSAs, which should be formed within 30 days of the publication (18.02.2012).

The FODSA are the competent bodies of the local government, particularly responsible for issues and matters relating to the operation, activities and pricing, concerning the specification and

implementation of the objectives and actions of the PESDA on temporary storage, transportation, processing, re-use and final disposal of solid waste. According to Law 3852/2010, the establishment of a FODSA is within the administrative boundaries of each region of the country, to which all municipalities in the region are mandatory involved. Under this regulation, the five municipal FODSAs of Chalkidiki were merged into the United Association of Solid Waste Management Bodies, which is under the administration of the region of Central Macedonia. Among other responsibilities, the Association is supervising the management and operation of the Polygyros landfill, providing advisory services to the municipalities involved as well as a number of other actions including environmental studies, programs and initiatives.

For the entire Chalkidiki, it is calculated that the amounts of MSW in all municipalities is around 92.000tn, while the average daily per capita generation of MSW is around 0,7-1,2 kg / person / day. Overall, three sanitary landfills are in operation in Chalkidiki, presented in more detail in **table 5.6-3**, while 2 others are expected to be constructed later on. Also there are 2 operational Waste Transfer Stations, with other 3 being planned in the approved PESDA. As for open uncontrolled dumpsites, there used to be 76 in the total area of Chalkidiki, of which 61 has been rehabilitated and the rest be restored soon.

Table 5.6-3: Operational MSW landfills in the region of Chalkidiki (Ministry of Environment, 2012)

Serviced Area	Landfill Site Name	Location	Stage of Implementation /Operation	Name of Responsible Operations Body
Kassandra, Pallini	KASSANDRA	Palaiokastro, Kassandra, Chalkidiki	Operational	Inter-municipal Enterprise of waste Management (DEDAKAP), Kassandra, Pallini
Anthemountas, Kallikrateias, Moudania, Triglia	ANTHEMOUNTAS	Prinochori, Anthemountas, Chalkidiki	Operational	Body of Management of waste, 2 nd Management Unit of Chalkidiki (DEDA)
Polygyros, Zervochoria	POLYGYROS	Kastri, Polygyros, Chalkidiki	Operational	Common Body of Solid Waste Management (FoDSA), of Polygyros - Zervochoria

Moreover, since 2000, with the initiative of the Development Agency of Chalkidiki (AN.ET.CHA.) and with funding by the European Union «LIFE 99ENV/GR 000528: Green Drachma', started in Chalkidiki a pilot recycling program.

As assured by the Ministry of Environment (2014), there are no operating open dumpsites anymore within the area of Central Macedonia, as was Greece's target – according to the EU goals.

In particular, Polygyros Landfill is situated at the "Kastri" location, which belongs to the Municipality of Polygyros (in the Regional Unit Chalkidiki, in the Region of Central Macedonia).

The main characteristics of the landfill are the following:

- Total area of land-lot: 9028 ha
- Operational surface of the LF: 2.7 ha

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- Population equivalent: 13.867 cap
 - Overall capacity: 266,000 c.m.
 - Annual operational capacity: 8,000 t per annum.
 - Duration of operation: 21 years
 - Land ownership: public property

The landfill is developed in two phases (cells), i.e. A and B. It accepts municipal solid waste and its constructional characteristics include: geological barrier, synthetic membrane, leachate collection pipes, biogas collection wells, biological treatment plant for leachate and biogas active pumping.

In addition, Polygyros has applied packaging recycling under a contract with the Municipality of Thessaloniki who has provided recycling bins for paper and packaging. Also, the town has launched a recycling program for electrical and electronic devices. The old appliances are collected in a special container, which is located in the landfill of Polygyros.

6.6.7. Social Infrastructure

Health

The medical care in Chalkidiki is administered by the 4th Health District of Greece, the district of Macedonia –Thrace. This includes the Polygyros General Hospital, which has 146 beds and five Health Centers (H.C.) at the settlements of Agios Nikolas, Nea Kallikrateia, Nea Moudania, Palaiochori and Kassandra, with their regional clinics. Specifically, in the study area there are regional clinics in the following 5 settlements:

- Ormylia, which is managed by the H.C. of Agios Nikolaos,
- Olynthos, which is managed by the H.C. of Nea Moudania,
- Galatista, Rizes and Taxiarchis, managed by the H.C. of Palaiochori

Also, within the study area, a branch of the Social Insurance Institution (IKA) is operating, in the town of Polygyros (source: Ministry of Health, 2013).

Education – Sports

The existing sports infrastructure in Chalkidiki is rudimentary. In total, there are 6 national stages in the larger residential centers and 65 community courts, which operate with serious deficiencies. Regarding the study area, there are 28 sports facilities over all the Municipality of Polygyros.

Regarding the educational sector, the schools of Chalkidiki (47 in total) are administered by the Regional Directorate of Primary and Secondary Education of Central Macedonia. In the study area, there are no more than 12 schools, of which 8 (67 %) are in Polygyros, 2 (16 %) are in Ormylia and 1 (7 %) is in Galatista (Anthemountas district). **Table 5.6-4** summarizes the sports and school

facilities of the area, in comparison with the population of the Municipality District. The table shows the presence of more adequate social infrastructure in the Municipality District of Polygyros, which concentrates 51.6% of the residents of the study area, and its community infrastructure within its limits are is 42.9% (sports) and 66.7% (school) infrastructure in the region. The area of Anthemountas in contrast, has 8.3% of schools and 14.3% of sports infrastructure, garnering only 18.2 7% of the local population. Details on the education and sports facilities are presented in the **Table** below:

Table 5.6-4: Education and sport infrastructure in relation to the population of the municipalities of the study area

AREA	Population	Sports Infrastructure	School units	Population (% on the total of the study area)	Sports Infrastructure (% on the total of the study area)	School units (% on the total of the study area)
POLYGYROS	11.386	12	8	51,6%	42,9%	66,7%
ANTHEMOUNTAS	4.002	4	1	18,2%	14,3%	8,3%
ORMYLIA	4.282	2	2	19,4%	7,1%	16,7%
ZERVOCHORIA	2.378	10	0	10,8%	35,7%	0,0%
Study Area	22.048	28	12	100,0%	100,0%	100,0%

Culture

With regards to cultural infrastructure, the action of most of the Cultural Associations operating in Chalkidiki is limited. The small population of the house residencial problem base of residential centers of the county, and the proximity to Thessaloniki are two serious factors that led to the limited development of this sector. In recent years, considerable efforts have been carried out in establishing relevant Local Government Business for the cultural development of the region (Open Care Centers for the Elderly, Cultural Centres, Municipal Development Companies etc). Also, there are two public libraries operating within the study area in Polygyros and Ormylia. Finally, some cultural activities have been organised as of late by the Municipality of Polygyros, like the summer Music Festival, as well as many other seasonal events.

6.7. Air Quality

The main sources of air pollution from human activity are transport, industry and heating. Pollution is mainly produced from the combustion of liquid or solid fuels to meet energy needs. On the contrary, only in the case of certain industry, certain types and amounts of pollutants are emitted into the atmosphere, either during the process of production, or in the movement and storage of raw materials and products.

As mentioned, the study area, with the exception of the Polygyros landfill itself, presents mainly agro-pastoral character combined with artisan activities attributes. Regarding air pollutants, they are categorized according to their physical state and the way they are produced. In particular, according to their physical state, air pollutants are categorized as follows:

- Gaseous pollutants, the most important of which is carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO₂), ozone (O₃) and hydrocarbons (HxC_x).
- Particles, which are grouped according to their size in dust, particulates, and in separate categories according to their chemical composition.

According to the way they are produced, they are classified as:

- Primary pollutants, which are emitted directly from the source to the atmosphere as carbon dioxide (CO₂), sulfur dioxide (SO₂), smoke, particles, etc.
- Secondary pollutants, which are formed in the atmosphere of pollutants after primary chemical reactions with natural constituents of the atmosphere and by catalytic action of radiation of humidity or temperature, such as ozone (O₃), the oxidizable hydrocarbons, etc.

The main sources of emissions of air pollutants in the landfill are:

- Movement of vehicles in the road network of the region, which mainly relates to the movement to and from the urban areas of the region
- Particulate emissions, in the form of dust, from agricultural activities in the region
- Particulate emissions due to wind, which takes place on deforested areas
- Emissions of soot, CO, NO_x, etc. resulting from heating equipment operating in the settlements of the region, who are within 2,5 km and longer.

From the aforementioned sources of pollution, it is estimated that particulate emissions are the main factor of degradation of the environment, while the remaining pollutants in conjunction with the prevailing climatic conditions and the morphological characteristics of the region do not cause any issues of air pollution.

Also, based on the monitoring program implemented by the Polygyros landfill, there is no detectable leakage of biogas to the environment.

6.8. Acoustic Environment

The current state of the acoustic environment of an area is related to the existing level of noise in the area. The effect of noise on the human environment has to do with one of the following:

- impact on the human hearing system (temporary or permanent)
- impact on health to other human biological systems (e.g. nervous system)
- impact to human activities (e.g. performance and overall attention for performing a task may be increased or decreased according to noise level)

Similar effects have been also observed over time in animals (domestic or wild). Most researchers agree that the noise affects the physiology and behavior of animals. If the exposure changed to chronic nuisance, noise can be detrimental to the energy, the reproductive effectiveness and longevity of animals.

The most important parameter to describe the noise (and sound in general) is sound pressure. The sound pressure which the human ear can capture is between the threshold of sound and it is limited to the sounds causing permanent damage to the ear. The ratio of these two pressures is 1 to 5,000,000 and to reflect this large range, a log scale can be used. Besides, the human ear responds to changes in sound pressure rather proportionally than directly. Thus, for the measurement of the sound (and therefore noise) the unit decibel dB has been established. The Sound Pressure Level (SPL) in dB is defined as ten times the decimal logarithm of the ratio of the intensity of the sound we are examining, at the intensity of a tone of reference.

Voice communications, listening to music, etc. are disrupted when the noise level exceeds 65 dB(A) and in these conversations special conditions are required by the participants, in terms of distance between them, etc. to be understood. At noise levels of above 75 dB(A) a normal conversation is impossible.

In the case of animals, there are no empirical data limits as mentioned above, and each species has different levels of annoyance and is affected differently. Nevertheless it is known that the animals (e.g. mammals) are also sensitive to vibrations even when they are at a lower level than those that can be perceived by human.

Noise is not a constant sound, but has an irregularly oscillating sound pressure level. For this reason, several indicators have been established to describe the noise levels that take account of this fact.

Environmental noise consists of sounds of different intensities and frequencies. However, the human ear has different sensitivities at different frequencies. Therefore, noises recorded by a microphone are filtered and adjusted in the same way that the human ear filters and adjusts the sounds received. There are several methods for simulating the human ear which are giving less emphasis to some frequencies and more to others. For environmental noise, scale A is being used that emphasizes the frequencies around 2000 Hz and then the noise recorded is expressed in dB(A). It must be said that the units of measurement for noise cannot be used like any other units of length. The simple addition of decibels is impossible because the scale dB(A) is logarithmic and not linear. That is why the sum of two of the same acoustic noise level L_0 in dB(A) will result, regardless of the

level, to an increase of 3dB(A), i.e. a total level $L_o + 3$ dB(A). So, the summation of 10 of the same L_o noise level will give a total noise $L_o + 10$ dB(A), while the difference of 3 dB(A) in the sum of two noises is very difficult to be perceived by the human ear. An increase of 10 dB(A) significantly increases the sonic impression or general acoustic disturbance. In the same way, a drop of 10 dB(A) improves this impression.

At the Polygyros landfill there are no monitoring data of the noise levels. Nevertheless taking into account the dynamics and operations of each area of the Municipality of Polygyros (study area), it is possible to draw the following conclusions:

- Disturbance from the noise by the movement of wheeled vehicles is confined within the residential area of cities and towns. However, this is not expected to be exceeding the statutory limits of noise and vibration.
- Noteworthy is also the disturbance from vehicular traffic in the immediate vicinity of the highway of Polygyros - Arnaia - Ierissos area, along which settlements are limited in number anyway.
- Industry is not highly developed and is mainly confined to statutory industrial areas on the outskirts of the urban - semi-urban centers. Some disturbance is expected there, but it is not appreciable in the residential areas.

In the immediate vicinity of the project area, there are no manmade facilities to burden the environment sound levels. The only potential sources of noise pollution are the movement of vehicles on the roads (highway and rural) and the occasional farm producing activities. While there are no measurement data for the sound levels of the road traffic, it is estimated that this is very low (even including the waste trucks of the landfill) and therefore this does not consist any substantial burden on the acoustic environment. Therefore, it is estimated that the acoustic environment of the study area is not burdened by disturbing human activities.

6.9. Anthropogenic pressure on the environment

The broader study area of the Polygyros has rapidly developed in recent years, causing an increase of stress on the environment, mainly due to man-related activities and interventions. Namely, the main categories of anthropogenic stress that are dominant in the area are the following:

- ✚ Extensive agriculture
- ✚ Urbanisation of Polygyros
- ✚ Landfills and old waste dumpsites (uncontrolled landfills) in the area
- ✚ Wastewater Treatment Facilities
- ✚ Mining and Quarrying activities

✚ Livestock farms

✚ Individual Industrial Units

As far as natural resources are concerned, the study area's habitats are mostly threatened by the rapid urbanization of the local settlements. Also, extensive agriculture and uncontrolled animal grazing can lead to very serious issues, such as eutrophication and deforestation, which are detected in the Municipality of Polygyros.

Detailed information about the environmental pressures on water resources in the study area are provided in the RBMP report of Central Macedonia. In particular, the anthropogenic stress on the water is classified according to its sources into two categories: point sources and diffuse sources. According to the Guidance Document No. 3 on the analysis of pressures, the activities and the related point source stress should be considered in relation to the urban development of the area, which includes wastewater treatment plants, waste disposal sites and treatment facilities.

Specifically, within the greater area of Chalkidiki, there are three (3) Sanitary landfills, located in Kassandra, Polygyros and Anthemountas, the latter two being in the study area. Within the area of Central Macedonia, open dumpsites are under rehabilitation, either through removal or, in most of the cases, through covering. This means that the water bodies may receive some pollutant loads of harmful chemical substances that either exist in the waste, or were generated indirectly, due to diverse conditions of excess oxygen or lack of it. This issue has not been investigated so far in the study area and therefore there are no available data.

The operation of WWTPs contributes significantly to reducing pollutant loads that result in natural recipients and to maintain the good environmental status of the water bodies. It is noted that most WWTPs have the ability to process the wastewater flow from isolated sewage systems to serve settlements that do not have sewerage system or partially served by it. The typical municipal wastewater production per capita/per day is the following:

- 60 gr BOD/capita/day
- 12 gr TKN/capita/day
- 2,5 gr TF/capita/day

Therefore, to calculate the stress in surface water systems from municipal wastewater, the official acceptable limits are given below:

- BOD: 25 mgr/L
- TP: 2 mgr/L
- TN: 15 mgr/L

The total environmental stress produced by the WWTPs in the whole area of Chalkidiki has been calculated and is presented in **table 5.9-1** below:

Table 5.9-1: Generated load of pollution by the WWTPs in Chalkidiki (source: RBMP of Central Macedonia, 2014)

	Generated load (tn/year)	Load refused to final natural recipients (tn/year)	Percentage of decrease (%) through pollution control
BOD₅	12.036,6	802,4	93,3
Total N	2.407,3	501,5	79,2
Total P	461,4	102,5	77,8

The main diffuse sources of surface water pollution, associated with human activities, are the following:

- Surface runoff from land-use (mainly from agriculture)
- Livestock waste

In particular, the diffuse source pollution is mainly due to nitrogen and phosphorus leaks which originate from crops and forests of the study area. Also, due to the high intensity of the cultivation of the area, the aquifers are suffering from nitrification issues. More detailed information about the state of the surface and underground water bodies of the study area are given in **chapter 3.4 - Aquatic Environment** of this study.

Regarding the stress on the coastal water systems of the study area, the main one encountered is the occasional point source pollution with municipal wastewater. This is coming from the nearby settlements where many households use septic tanks, due to lack of a complete sewerage network. This is also affected by the seasonal population fluctuation by tourists in the summer. Nevertheless, through the programme “Greek Bathing Water Profiles” of the Ministry of Environment, the seven swimming beaches along the coastline of the study area have been found to be one (1) in “good” and the rest six (6) in “high” environmental condition. Finally there are no Marinas or Ports, neither any aquacultures on the coastline of the study area.

CHAPTER 7. ENVIRONMENTAL TRENDS

The study area is characterized by a relatively high level of development in comparison to the country and the areas belonging to the same region. The performance of economic activities conducted in recent years show either stagnation or increased tendencies.

Regarding the existence of general development plans for the study area, two General Urban Plans have been composed and approved, one for the Municipality District of Polygyros (Official Gazette 243/VNEUS/21-06-2013) and another for the district of Ormylia (Official Gazette 260/VNEUS/27-06-2008). Also, the district of Zervochoria has an approved "Spatial Plan of Urban Organization for the Open City" (Official Gazette 286/VNEUS/21-07-2010). However, there is no official approval of any urban plans for the region of Anthemountas.

With regard to the ESPA 2007-2013, it is stated that for the broader region of Macedonia and Thrace, ten (10) Priority Axes have been adopted. These priorities, along with their expected impact on the socio-economic situation of the region, are being outlined below:

1. Accessibility infrastructure and services in the Region of Central Macedonia. Expected impacts: upgrading of the infrastructure (road and rail networks, port infrastructure), reducing travel time and enhancing openness of the Region as a result of improved connections with the national and European district.
2. Accessibility infrastructure and services in the Region of Western Macedonia. Expected impacts: Improvement of time for selected national road routes (h:min), increase of the flow of vehicles, increase in load flow.
3. Accessibility infrastructure and services in the Region of Eastern Macedonia and Thrace. Expected impacts: Increase of the flow of vehicles and cargo, improve of competitiveness and internationalization of economic interest sites and the established businesses - ensuring the sustainability of investment in areas of economic interest, improving competitiveness of border areas, strengthening the system of transportation for daily movements between major urban centers, strengthening system of daily movements between rural and urban areas, reduce road accidents
4. Digital convergence and entrepreneurship in the Region of Central Macedonia. Expected impacts: fostering entrepreneurship and internationalization of businesses, facilitating the access of businesses and citizens to information and communication technologies services (ICT), improvement and modernization of infrastructure and tourism services.
5. Digital convergence and entrepreneurship in the Region of Western Macedonia. Expected impacts: Increase of established businesses through business infrastructure, job creation for researchers and employees in Research and Technological Development, increased spending and funding for Research and Technological Development, increasing the proportion of modernized production facilities and infrastructure, increasing the percentage of RES in the energy balance, upgrading of the services provided by the public administration to citizens by increasing the integration of ICT use.

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6. Digital convergence and entrepreneurship in the Region of Eastern Macedonia and Thrace. Expected impacts: Improving competitiveness and internationalization of business, business expansion and sales of businesses, creating new businesses and jobs, economic integration of specific population groups, support economic transformation specific areas (e.g. rural, border areas), modernization of tourist infrastructure and services, protection and enhancement of the energy reserve of the Region.
 7. Sustainable development and quality of life in the Region of Central Macedonia. Expected impacts: the mitigation of intra-regional disparities, strengthening of economic prosperity of urban, rural and mountainous areas, the protection, promotion and rational management of natural and cultural resources of the region, enhancing of the access of the population to public transport, upgrading of health infrastructure and education and overall improved quality of life
 8. Sustainable development and quality of life in the Region of Western Macedonia. Expected impacts: Increase of the population served by sanitary landfills, increase of the population served by WWTPs, increase of the population served by sewerage system, increase of the population served by water supply, increase the proportion of recovered and/or reconstructed land to the total area in need of rehabilitation (%), increase of the total hospital beds, increase of the basic and supporting education infrastructure, increase of the population covered by 1st degree of health care from Health Centers, increase the capacity to welcome visitors to culture infrastructure, increase the annual number of visitors in protected archaeological sites and monuments, as well as areas of tourist interest, increase of the number of comprehensive plans for the organization of space, resources management and development of interregional and transnational cooperation.
 9. Sustainable development and quality of life in the Region of East Macedonia - Thrace. Expected impacts: Mitigation of intra-regional disparities and strengthening of social cohesion, improving the quality of life of the inhabitants of the region, reducing social exclusion
 10. Technical assistance for Region of Central Macedonia and Region of Western Macedonia
 11. Technical Assistance for Region of East Macedonia - Thrace

From the above axes, no. 1, 4, and 7 are of particular importance for the study area. As far as **no. 1** is concerned, the following actions are of importance:

- Strengthening of the ports network of the Region
- Security provisions across the transport network of the region, which relate to improving road sections which, because of technical or traffic characteristics present a low degree of road safety and the development and use/installation of technological media and applications that promote road safety.

Regarding no.4, the following actions appear to be more important:

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- Integrated and innovative interventions for modernization - rearranging of the tourism sector, relating to:
 - o Strengthening the investment plans of firms in tourism and services with emphasis on promoting innovative methods of production, diversification of products and all practices to improve their competitiveness.
 - o Encouraging entrepreneurship for the development of special types of tourism and improvement of the logistics of tourism promotion using new technologies.

Regarding no.7, the following areas of interest appear to be important:

- Environment
- Management of solid and hazardous waste
- Soil protection
- Management of water resources
- Air quality and acoustic environment
- Natural environment management

Also important to the developmental nature of the study area, which presents evidence of strong tourism development in its southern portions, is estimated to be the "Specific Framework of Spatial Planning and Sustainable Development for Tourism", which was approved (together with the relevant Strategic Environmental Impact Assessment) with the Decision 24208 (Official Gazette 138 B'/11-6-2009). This framework includes provisions for the following sectors:

Tourism

- Support of the infrastructure (development, upgrade) for the development of special and alternative forms of tourism.
- Creating alternative tourist products.
- Promotion of tourist products and services of the Region in both traditional and new premier markets and development of cooperation networks.

Sustainable urban development - Mountainous/Disadvantaged areas

- Development of local products from the mountain areas
- Development of mild and alternative forms of tourism
- Development of small- scale and mild productive activities
- Actions to protect the natural and human environment

It is estimated that the implementation of the actions of the ESPA and the realization of provisions of the Special Framework of spatial planning and sustainable development of tourism, will lead the study area to:

- Upgrading of port infrastructure
- Upgrading and modernization of road infrastructure
- Support alternative forms of tourism
- Development of mountainous areas
- Rational management of natural resources and the natural environment
- Improving the living environment for residents.

Therefore, the development trend of the region is estimated to be positive for the average income, but also for the general welfare of the residents. In any case, the prediction is based on statutory policies which are not known to what extent they will be adopted in practice.

CHAPTER 8. OVERALL CONCLUSION

Municipality of Polygyros is facing new developmental challenges, since:

1. There is great environmental wealth in the form of environmentally (ecologically) sensitive areas of high amenity and ecosystem value, such as Natura2000 areas and other forest biotopes.
2. There are many pending steps that should be taken in the immediate future which may improve the social and environmental status in the area (e.g. materialization of the regional waste management plan, construction of public facilities and infrastructure etc.)
3. Future spatial plans for the area will highlight the Town of Polygyros as a hub for the growth of activities and services, related especially to regular and ecological/rural tourism.

In parallel, there are specific environmental and social pressures that have already appeared, which relate to:

- a. Increasing population
- b. Increasing per capita production of waste
- c. Limited separation at source of municipal solid waste (MSW)
- d. Pressures from neighbouring municipalities (M.of Sithonia and M.of Aristoteles) for accepting MSW in Polygyros Landfill
- e. Increasing demand for water resources and land, owing to potential tourism growth.

The abovementioned conditions are favourable for developing and encouraging innovative actions, in the field of water resources management, waste management and land use management. The analysis presented in this report will enable the assessment of environmental and social impacts of such actions in the future.



ACTION A3

Baseline environmental and social conditions report

APPENDIX**Appendix 1: Maps & designs**

No.	Title	Scale
1	Orientation Map	1:50.000
2	Geological map	1:50.000
3	Soil map	1:50.000
4	Map of vegetation categories and protected/environmentally sensitive areas	1:50.000
5	Map of water bodies	1:100.000
6	Map of land cover categories	1:50.000
7	Map of statutory land uses	1:50.000