

V.2.1.2. Flora

The project area is a transition zone between Iranian-Turanian and European-Siberian floristic regions. The flora and vegetation of the study area are evaluated separately in this section and the taxonomic list of floristic species identified in the area is presented in Annex 5, Table A5.1, together with the family distribution of the species.

As a result of the field studies conducted in the area and the laboratory analysis, 542 plant species belonging to 90 families have been identified from the samples collected. The distribution of these species according to their phytogeographic region is presented in Table V.7 below.

Table V.7. Phytogeographic Distribution of Floristic Species in the Study Area

Phytogeographic region	Number of species	Percent (%)
Iranian-Turanian	57	10.5
Mediterranean	64	11.8
European-Siberian	48	8.8
Euxine	17	3.1
Other (Wide or unknown)	356	65.7
Total	542	100.0

Among these 542 species, 28 (5.1 %) are endemic to Turkey. The study carried out by Ekim et al. (1988) aimed to determine the endemic species in Turkey and their status. According to this study, species are classified as "vulnerable", "rare", "indeterminate", "out of danger" and "not threatened." The species that are classified as "not threatened," are spread all over Turkey and correspond to species that are found in sufficient quantities. The species that are classified as "out of danger," are the ones whose generation is guaranteed by the precautions that are put into force by relevant regulations.

Of the 28 endemic species, 27 (96.4 %) are wide spread in Turkey and are categorized as "not threatened" (nt). Only one of the endemic species, namely the Mouse-ear, is in the **R** (rare) category. The elevational distribution of Mouse-ear is between 300 to 900 m, so after impounding this species will survive above 350 m elevation.

The land to be flooded by the reservoir consists mostly of agricultural land (about 40%) and rocky terrain, together with degraded forest. There are some reforestation efforts in the vicinity of the project area, which are located outside the impact zone of the project.

Among the flora species identified in the study area, plants such as mothers' heart and madwort are annual or biannual and complete their life cycle in a season. Of the annuals, poppy and camomille complete their life span in the rainy period.

The major xerophytic plants of the steppe are thistle and vetch. The dominant pastoral plants in the meadows within the reservoir area are lucerne and clover. Tamarisk and willow were observed along the banks of the Kizilirmak.

The project site has a microclimate due to the fact that it is surrounded by the range of Kunduz, Cal and Ada Mountains from the south, and Akbelen and Duragan Mountains from the north. Under this microclimatic condition, the geophytes, such as grape hyacinth and star of bethlehem occur.

Rice fields cover the valley bed near the river. In addition to these, the basal flora consists of tamarisk, plane tree and willows. Reddish pine is dominant on the slopes up to an elevation of about 500 m. The floristic composition of the forests on valley shoulders and hills consists of juniper and some broad-leaved species, such as common hornbeam, oak, elm, walnut, rowan and mulberry, in addition to reddish pine.

Within the mixed forest zone in the reservoir area, oak, dogwood, plum, apple, pear, hawthorn, rose and berry, thorn, and bower are frequently encountered. From place to place, the under layer of the forest is occupied by tamarisk, dogwood, and rose.

In the stream valleys and irrigated areas poplar trees and some orchards, such as apple, pear and plum, are widespread. The plants between 200 to 500 m altitudes are arboreous and shrubby species. There are reforestation efforts by Sinop Regional Directorate of Forestry in places above the maximum water level (330 m) of the future Boyabat Reservoir.

Field studies to identify the flora and vegetation in the project area were carried out at 10 sampling stations selected in the area, with additional intermittent sampling between stations in the project area. The locations of the selected sampling stations are given in Figure V.2.

The first station was near Erduasi village. The elevation of this station is around 200 m. At this station, the area is covered by natural forest and the major plant communities are reddish pine and juniper; reddish pine the dominant species and the degree of diversity, not very high. These forests are owned by the government and mainly composed of about six to ten meters high reddish pine trees with trunk diameters of 20-60 cm and crown diameters of 4-5 m. The General Directorate of Forestry, an affiliation of the Ministry of Forestry, is the responsible agency for all of the forests in the project area. These forests are managed by the regional directorates and, from time to time, these directorates identify the trees to be cut down to be used as logs. Although these forests form a habitat for various fauna species, they are generally destroyed by the villagers for obtaining land or to be used as fuel. The forests observed at this site are even aged and 40 to 50 years old. The understory of the forest consists of dogwood.

The second station was very close to the dam axis and within the dam site, the construction area and vicinity, at about 200 m. The area is covered by steep rocks and scattered trees. The major species are reddish pine, oak, dogwood, and

hawthorn, with reddish pine the dominant species. The height of the trees varies from four to ten meters, where thickets are moderately low (reaching about half a meter). These plants are the ones that could resist natural degradation, by wind, rain, etc., resulting in the steep rocky terrain at the dam site. The area forms a good habitat for some bird species.

Station three was located between Fakili and Yukaridaricay villages at an elevation of about 210 m. Orchards form the main vegetation in this section. The major plant species in this area are apple, pear, plum, berry, mulberry and bower. These are generally planted by the villagers, but there are natural plant communities of some of the same species as well. They are mainly used for subsistence of the households. In addition, some bird species feed on the fruits of these plant species.

Station four covered the area close to Hacıcayi village. The elevation is about 250 m at this station and the dominant vegetation is reddish pine. In addition to reddish pine, juniper, hornbeam, elm and mulberry form the major plant communities. The reddish pines reach a height of about eight to ten meters, with trunk diameters about 30-60 cm and crown diameters about five meters. Tamarisk, rose and dogwood mainly form the undergrowth of the forest area. These natural forests are good quality habitat for many terrestrial fauna species. The forest area close to the village has been disturbed by the villagers.

Station five was located between Karacaoglan and Yukarizeytin villages. Its elevation is about 220 m. Vegetation in this area is composed of thickets; chaste tree, hawthorn, berry, clover and willow being the major plant communities. Poplar trees may also be seen along the Kizilirmak. While these provide habitat for various fauna species, some of them, such as poplar and willow, are also utilized by the villagers for subsistence and commercial purposes. These plant communities are generally natural, but some of them are also planted by the locals in the area.

The sixth station was located in the vicinity of Asikbuku village. The elevation at this station is around 250 m. Severe erosion can be seen in this section of the study area. The valley bed is covered by rice fields. Rice is the major cultivated and commercial crop in the project area. Some shrubby vegetation is also present in this section, as well as some poplar trees, apple, pear, plum and berries. Dominant vegetation is formed by the rice fields in the valley bed.

Station seven was between Koprubasi and Maksutlu villages, at an elevation around 300 m. Juniper communities form the dominant vegetation in this area. Other major plant communities are shrubs and forbs, such as thistle, vetch, lucerne, and clover. There is not much undergrowth below juniper communities. These species are naturally grown and form a transition zone from the Black Sea region to Central Anatolia steppes.

Station eight was located near Maksutlu village, at an elevation of about 300 m. The dominant vegetation in this area consists of orchards and thickets. Major plant species are pear, plum, berry, rose, camomile, cherry, almond, thistle and lucerne.

Orchards are used by the villagers for subsistence and some terrestrial fauna species use the thickets as habitat.

Station nine was selected to be close to Karapurcek village. The elevation at this station is about 350 m and the dominant vegetation types are orchards and thickets similar to those at station eight. Orchards are again mainly cultivated, but there is a portion which grows naturally as well. Major plant species are apricot, peach, quince, cherry, mulberry, and potato. Tamarisk, thistle and vetch are other major species identified in this section.

The last station (station ten) was placed in the vicinity of Karaboya village, at an elevation of 330 m. Juniper communities and thickets such as lucerne, chaste tree, willow, and tamarisk are the dominant species forming the vegetation in this area. Severe erosion can be observed on the hills. Scattered juniper communities are present, without much undergrowth. Only shrubs occupy the under layer from place to place in a limited area. The height of junipers is around two to four meters, while the trunk and crown diameters are about 20-40 cm and two to four meters, respectively. This vegetation is being used as a habitat by various species and it has a limited use by the villagers as well.

V.2.1.3. Vegetation Communities

Three different topographic characteristics are observed in the study area:

- Valley bed
- Valley slopes
- Steep rocky areas and the hills

Due to these topographic properties, the existing vegetation between valley bed (elevation 185 m ASL) and the hills (elevation 500 m ASL) was studied to find out the vegetation structure in the project area. Average plant dominance and major communities were examined for different aspects of community structure. Figure V.21 shows the vegetation map of the Boyabat Project Area. The altitudinal distribution of the plant species is also given in Table A5.1 in Annex 5.

Basically, vegetation communities of Boyabat Project area consist of species found in the Mediterranean and Iranian-Turanian communities. Based on the field studies, plant communities identified in the study area were grouped as plant communities in the valley bed, on valley slopes, and on steep rocky areas (valley shoulders) and the hills.

In the project area, the valley bed starts at an elevation of about 185 m and runs up to an elevation of 335 m, which is the crest elevation of Boyabat Dam. Rice fields are located in flat areas close to the river, covering the valley bed. Vegetation cover of the valley bed can be seen in Photograph V.1. Rice is the main commercial crop in the area and most of the villagers earn their living by rice cultivation. Nearly, 40 % of the land to be inundated by the Boyabat Reservoir is agricultural land and rice

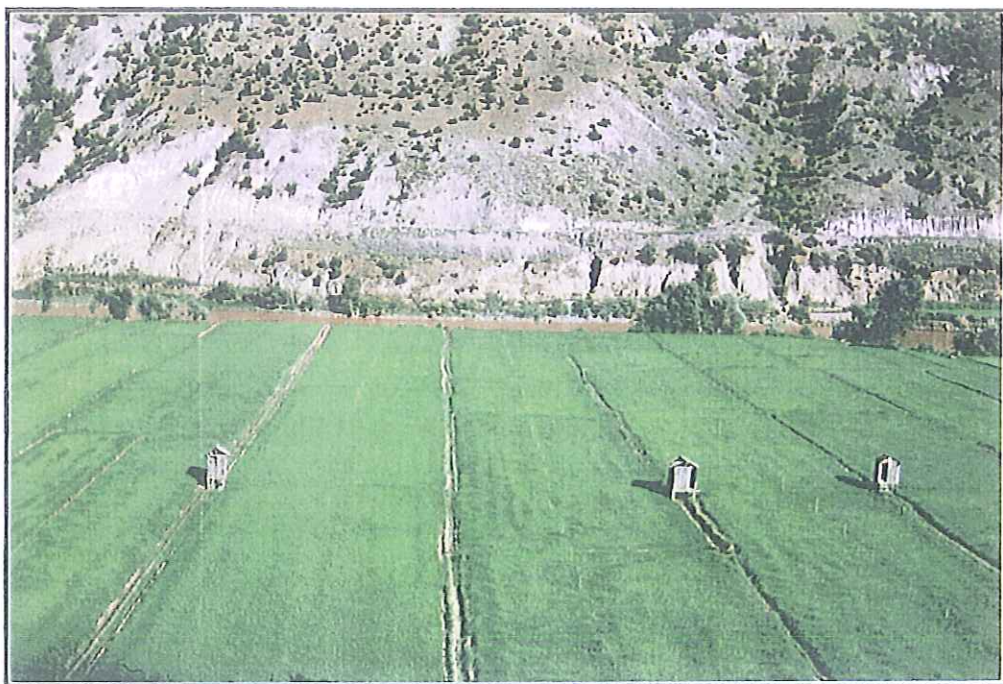
fields are the major portion of the agricultural land to be flooded. In addition, plane tree and tamarisk are the major species along the river bed, where willow can also be observed.

In the vicinity of settlements, orchards are present in areas far from the river, where the water table is close to the surface. Some of the commonly cultivated species are grape, plum, cherry, sour cherry, apricot, peach, almond, medlar, quince, apple, pear, pomegranate, white mulberry, black mulberry and walnut. These are mostly used for subsistence by the villagers. They are also used for nesting and feeding by some of the fauna species, especially birds.

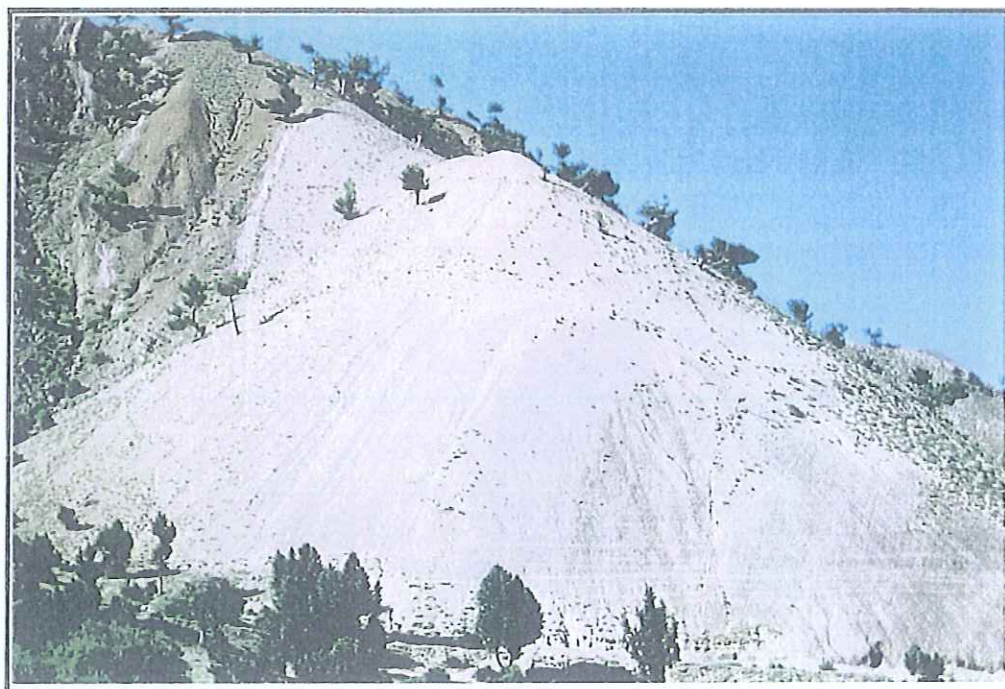
Thickets, such as chaste tree, are present in areas far from the settlements and the river, but at places where the water table is close to the surface. Thickets are also observed in dry and flat areas. These shrubs can be observed in the valley bed and on the valley slopes, as well, and form 50 % of the vegetation in the project area. Therefore, they provide important habitat for fauna and some of these thicket species are utilized by the villagers for subsistence.

The zones between 350 and 500 meters are occupied by shrubs, reddish pine forests and juniper communities. The slopes are covered with two major vegetation types depending on the topography, namely reddish pine forests and juniper communities. In addition to these, shrubby forms of tamarisk, berry, olive, rose, and dogwood were also recorded in this zone. Occasionally, hornbeam, oak, elm, walnut, rowan, and mulberry are observed. In some sections of the study area severe erosion is observed on the slopes, especially between Saraycik and Koprubasi villages, where the Central Anatolian influence on the vegetation starts (Photograph V.2).

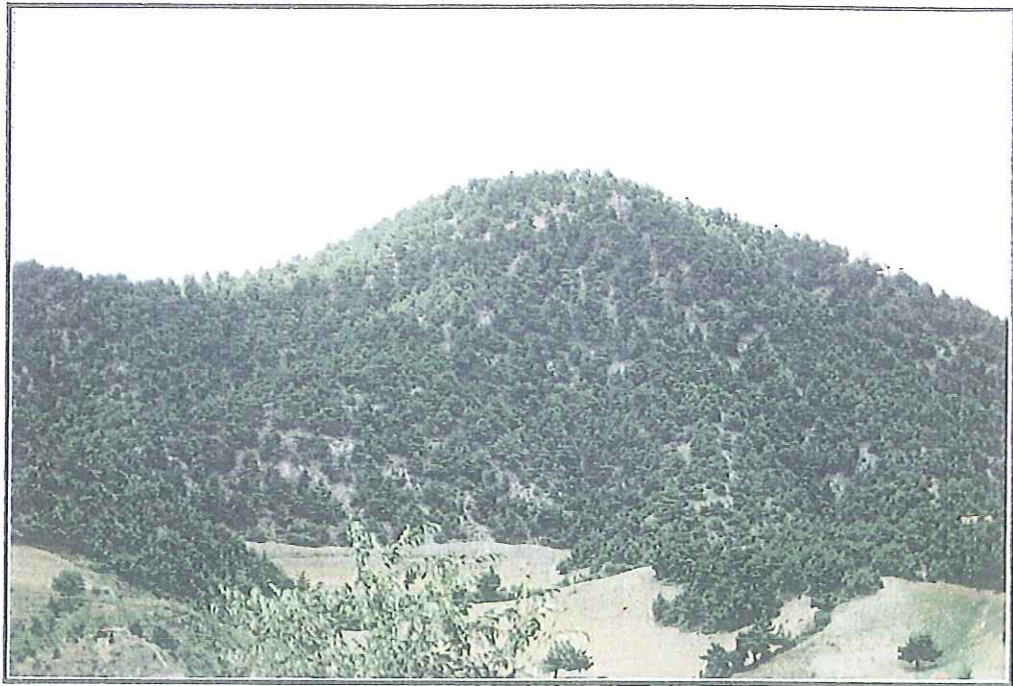
Reddish pine forests at elevations 220-500 m, between Erduasi and Yalmansaray villages (in the Province of Sinop), cover 70 % of the valley slopes in this area (Photograph V.3). These are natural forests, though there is an afforestation effort by the Sinop Regional Directorate of Forestry. These form an almost homogeneous forest with respect to the age of the trees. Reddish pine trees in this area reach about 6-10 m with trunk diameters about 20-60 cm and crown diameter about 4-5 m. Although the dominant species are reddish pines, there are also oak, hornbeam and elm trees. The underlayer of this forest is generally occupied by dogwood and tamarisk. These forests are good habitats for various mammals, reptiles and birds identified in the area. However, at some sections they are degraded as a result of human activity. Degraded forests on the valley slopes, in the vicinity of Karaboya village, can be seen in Photograph V.4. These forests are managed by the Regional Directorate of Forestry, but they can not prevent the damage created by the locals.



Photograph V.1. Vegetation Cover of the Valley Bed



Photograph V.2. Effect of Erosion on Vegetation in the Project Area



Photograph V.3. Reddish Pine Forests on the Valley Slopes



Photograph V.4. Degraded Forests on the Valley Slopes

Juniper communities at elevations 220-500 m, between Sinanozu and Karaboya villages (in the Province of Corum) covers 60 % of the valley slopes in this section. Juniper communities in this area are mostly natural, consisting of *Juniperus oxycedrus* and *Juniperus excelsa*. The individuals of *Juniperus oxycedrus* have a height around 2-4 m with trunk diameters of 20-40 cm and crown diameters of 2-4 m. The individuals of *Juniperus excelsa* are generally higher, with a height of 4-8 m and trunk and crown diameters of 10-20 cm and 3-5 m, respectively. They are degraded by natural factors, such as erosion, and by the locals where they are located close to the settlements. Juniper communities do not display uniformity with respect to age. These are generally monospecific, but in some parts of this region species such as rowan, walnut and mulberry can also be observed. There is limited undergrowth in juniper communities, formed by shrubs, such as lucerne, thistle and clover. This undergrowth was observed in a limited area between Sinanozu and Karaboya. Ecologically, these form a suitable habitat for some birds, reptiles and mammals. On the other hand, they are also used by the villagers for various purposes such as fuel and construction material. In some places they have been cut down to obtain land for agriculture.

Approximately 10 % of the study area (7.0 km) consists of steep rocky areas, including the dam site (Photograph V.5). These rocky areas are generally barren, except for occasional pine trees. Except in these rocky areas, reddish pine is the major plant species on the hills. In Photograph V.6, a general view of the vegetation cover on the hills in the project area can be seen.

V.2.2. Terrestrial Fauna

The geographical coverage of the study area was determined according to field observations and the video of the reservoir area. Approximately a 70-km long area was studied in 5×5 km grids, including the 60-km long reservoir area and 5 km upstream and downstream of the reservoir area. The highest elevation studied was limited to about 500 m since the maximum water level in the reservoir will be 350 m.

For fauna studies, continuous field observations were carried out while traveling through the study area. In addition, representative sampling sites were set (locations of sampling sites are shown Figure V.2). The area surveyed covers approximately 40-50% of the total area.

Three methods were used for the preparation of the fauna inventory.

1. The pertinent literature (books, articles, etc.) (Başoğlu and Baran, 1977a; Başoğlu and Baran, 1977b; Başoğlu and Özeti, 1973; Demirsoy, 1988 and 1992; Giles, 1978; Heinzl, 1992)
2. Communication with the inhabitants
3. Field observations, direct or with guides (Heinzl, 1992)



Photograph V.5. Steep Rocky Areas in the Project Area



Photograph V.6. Vegetation Cover on the Hills in the Project Area

Starting in April 1997, the field studies were conducted for 6 months to identify the terrestrial fauna species (mammals, birds, reptiles, amphibians) found in the area that will be affected by the construction of the Boyabat Dam and HEPP. Daily field observations began at dawn and lasted till dark for about 12 hours per day for a total of 14 days.

In the field studies, a grid mapping system is used for data recording to avoid repetitions and to allow fast and accurate evaluation of the records. For this purpose the study area was divided into a total of 100 grids of 500 × 500 m, each grid was numbered systematically and the observed species were recorded according to these numbers. Same gridding system was used by both the botanical and the terrestrial field teams.

Field studies were extended over a period starting from early spring (April) till fall (September) in order to observe especially the birds that visit the area for short times during the migration in spring or fall, as well as the local birds and the birds spending a longer time in the area.

V.2.2.1. Mammals

In this study, mammals in the area were identified by means of field observations and interviewing local people. The species that were identified through communication with the local people were carefully analyzed and this information was checked with several other references and the species classified according to the Bern Convention and the ERL. The list of these species is provided in Annex 4.

The number of mammals believed found in the area is 17. Three of these species, namely, golden jackal, grey wolf and badger, were not observed in the area, but determined according to the interviews with the local people. The others were identified in the area either by direct observation or from various signs. Of the 17 species found in the study area, seven are listed as "protected fauna species" in Annex 3 of the Bern Convention and two others are listed in Annex 2, as "strictly protected fauna species." Only the grey wolf is classified in the ERL and its status is vulnerable.

Wild boar is one of the faunal species widely observed in the area. It generally lives in forest areas. In the project area it mostly uses corn fields and rice paddies for feeding and for this reason, it is hunted by the villagers. In addition, the golden jackal inhabits dense forests, oak woods and shrubs. Shrubs and forests with underbrush are suitable habitats for red fox. Northern water vole lives near water in dense forests and prefers meadows as habitat. House mouse and black rat are also present in the project area and they prefer houses for living.

Western hedgehog is generally observed in woods, gardens and humid areas. The pygmy shrew prefers forests, meadows, and shrubs as habitats and also live near lakes. The grey wolf, on the other hand, prefers tundra, open areas and mountainous areas. Open areas, fields, cavities and holes in buildings are suitable habitats for the weasel. The squirrel prefers to live in trees in forest areas and woodlands.

V.2.2.2. Birds

A total of 86 bird species have been identified in the study area, which corresponds to 20 % of the 426 birds species identified to date in Turkey. Fifty-three (62 %) of the birds identified in the study area are listed as strictly protected fauna species in Annex 2 of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) of 1994. Twenty-six (30 %) species are included in the list of protected fauna species, Annex 3 of the Bern Convention, which covers the species not included in Annex 2, with a few exceptions.

Although a high majority of the bird species observed in the study area are listed as protected species in the appendices of the Bern Convention, none of these species is listed on the IUCN Red List of Threatened Animals (World Conservation Center, 1998), which is same as the European Red List. Annex 5, Table A5.2 lists the observed bird species, indicating their abundance in the study area, status (as resident or migratory species), Red List standings, and conservation status according to Bern Convention.

Man-made structures, such as dams, affect the habitats of bird species to varying degrees. For instance, species like kestrel have been adversely affected from the structural change, due to technological advances. However, species such as yellow wagtail and finches have benefited from the situation and have obtained advantageous conditions for survival.

Similarly, many water birds, such as waders and waterfowl, while facing the danger of losing their natural habitats, such as marshes and ponds, make use of artificial reservoirs and ponds for breeding, resting and migration. Sometimes this brings such positive results that some species start to prefer artificial structures as habitat. For example, duck species that face hunting pressure, make up large colonies in reservoirs that are better protected.

The degree of impacts created by impoundment will differ for each bird species, depending on their habitat requirements for nesting, feeding and resting. A few species identified in the study area, such as the white stork and house sparrow will be mostly affected, as they depend on rice fields and orchards for nesting and feeding. On the other hand, water birds like herons, egrets, etc. that prefer lakes and marshy areas will benefit from this change.

Birds that will be Adversely Affected

The white stork is the most abundant large bird in the area. It nests on chimneys and roofs in villages, with an occasional nest on a telephone pole. Being non-territorial, storks are able to utilize the abundant urban nest sites effectively. Kargi and Yaylacili are notable for supporting numerous nests, sometimes two on a single roof. The birds appear to feed mostly in the rice fields along the river but no doubt, as elsewhere in the region, they also hunt for rodents, reptiles, and amphibians in

pasture and other open land. Dependent on prey that are largely absent in winter, storks migrate out of the region, spending the winter in the tropics.

The bee-eater inhabits orchards, woods, steppes and even semi-desert areas and nests in the deep holes it digs in the soil on the steep slopes along rivers. It feeds on the insects, especially bees, flying in the open areas near water. Although the bee-eater is presently feeding at habitats below 330 m in the study area, the shoreline of the reservoir will continue to supply food for this species. However, they will have to move their nests to other areas.

The Syrian woodpecker inhabits forests, orchards, parks, gardens, plains and mountainous areas. It makes its nest in old trees by carving them and feeds on the insects and larvae under the bark. When it can not find these foods, it eats small fruits as well. This species which is frequently observed in the valley bed might be expected to leave the study area since its feeding areas will be flooded and it does not prefer to live at high altitudes.

The lesser short-toed lark inhabits steppes and flat arid areas, the crested lark inhabits cultivated areas and pastures near settlements and the woodlark inhabits in sparse woods, near forests and winters in fields. They nest in holes in the soil and feed on seeds, grains, beetles and other insects. Their habitats will be flooded upon impoundment and therefore these species will also leave the study area for similar habitats in the vicinity.

The sand martin inhabits open areas near rivers and lakes and feeds on flies, water insects and small butterflies it catches while flying. They nest in colonies in 50-60 cm deep holes they dig in sandy soils. Although the reservoir will continue to supply their food, their nests in the study area will be flooded.

The wren inhabits sparse woods, sparse shrubs and hedges in parks and orchards; nests on hedges and in hollow trees; and feeds on insects, flies and to a smaller extent on grapelike fruits. The rufous bush robin inhabits orchards; sparse shrubs, arid areas and near cactuses; nests on the ground near shrubs and cactuses; and feeds on insects, flies, worms and caterpillars. The robin inhabits deciduous forests, parks, gardens, shrubs and near settlements; nests in small holes in soil and in cavities and feeds on insects, larvae, worms, small snails, leaves, algae and fruits. The nightingale inhabits deciduous forests, parks, orchards and shrubs; nests in soil among berries and thorny shrubs and feeds on insects, larvae, worms, caterpillars, and grapelike fruits. The blue throat inhabits woods near swamp areas and rivers, willows and damp meadows; nests in small holes near swamps and rivers and feeds on insects, larvae, caterpillars, and grapelike fruits.

White throat, garden warbler and blackcap inhabit low trees, shrubs, orchards, near meadows and dense forests. They make their nests among shrubs close to the ground and feed on insects, caterpillars, flies and grapelike fruits. These species are generally summer visitors and their nesting areas will be flooded.

Habitats of red-backed shrike and lesser grey shrike are open areas with shrubs and sparse trees, orchards, and parks and they are also seen near forests. They nest among shrubs or on low trees. Their diet consist of insects, grasshoppers and butterflies. Red-backed shrike also feeds on young birds and lesser grey shrike on mice, frogs and small birds.

Agricultural fields with trees, orchards, parks, areas near forests, swamp areas, and mountainous areas are the habitats where hooded crow, a local bird to Turkey, can be observed. It nests on top of high trees and feed on insects, carrion, fruits, seeds, grains and garbage.

House sparrow lives in and near settlements, and nests under roof tiles, in attics, cavities and on dense leaved trees beneath the stork nests. Spanish sparrow prefers wood and shrub type habitats along rivers, fields, near forests. It nests beneath the nests of large birds like eagles, herons, etc, also empty nests of martins.

Tree sparrow is observed near forests, orchards, parks and willow trees. Hollow trees, willow trees, and empty houses in the orchards are its nesting areas. Their food are seeds, grains, fruits, garbage and insects. Only house sparrows nesting together with the white storks in the settlements that would be flooded will be adversely affected from the Project.

Birds that will Face Partial Loss of Habitat

The black stork which typically inhabits forests is also represented by only one individual in the study area. It probably nests on the mixed trees in the nearby quiet areas and can be observed in the study area only when it visits the still shorelines of Kızılırmak for feeding. The rice fields that will be flooded are also important feeding areas. Although the black stork had become a rare species due to the destruction of its habitats in Europe, its population has started to increase.

Seven species of birds of prey (sparrowhawk, buzzard, long-legged buzzard, Egyptian vulture, golden eagle, kestrel, red-footed falcon) were identified in the study area. Many of these species feed on various mouse species, reptiles, worms and insects, and occasionally on other smaller bird species. Species like sparrowhawk and falcon nest on trees while other raptors like eagles and vultures make their nests at high rocky places.

The chukar generally inhabits slopes, valleys and hills covered with shrubs and stony and rocky areas near cultivated areas and orchards. It makes a simple nest on the ground among shrubs and under rocks and feeds on grains, seeds, buds and insects. No signs of nesting was observed for the chuckar although it is a local bird. This species is observed as groups of 9-10 individuals and prefers the habitats at the downstream of the dam axis that will not be flooded.

The rock dove inhabits open areas, fields and rocky areas; nests in the cavities of rocks and feeds on grains, insects, larva and small snails. The collared dove

generally lives near settlements and nests on trees, electricity or telephone posts, roofs and balconies. It feeds on grains, seeds, garbage, grapelike fruits and insects.

The turtle dove is a summer visitor that inhabits open fields, orchards and near forests. It feeds on grains, seeds, buds, grapelike fruits and mushrooms and nests on trees and dense shrubs. The wood pidgeon inhabits deciduous and evergreen forests and mountainous areas. It nests in cavities in trees and feeds on grains, seeds, buds, weeds and various insects. It's diet is primarily composed of cereals and acorns.

The little owl is generally found near settlements, orchards, woods, parks and near forest areas rather than in dense forests. It nests in cavities of trees, attics and empty chimneys and feeds on mice, insects and small reptiles.

The roller inhabits sparse woods, near old forests and open areas. It nests in holes in trees and cavities in rocks and slopes. The forests areas remaining after the filling of the reservoir will continue to supply its diet composed primarily of insects, worms, small reptiles and mice.

The hoopoe inhabits open areas with trees, sparse forests, orchards and parks. It preys on insects, worms and larvae generally in open areas and nests in holes in old trees, cavities in rocks and in soil.

The swallow inhabits areas near settlements, in open fields, meadows, near lakes and lagoons while the house martin inhabits settlements. They make their nests under roof tiles, in windows, and under balconies, and feed on the flies and insects they catch in flight.

The dipper prefers the banks of fast flowing rivers at high elevations and can be observed up to 2,000 m. It nests on steep slopes, under bridge footings and weirs of water mills and catches water insects, water snails and fish larvae for feeding.

The chiffchaff and wood warbler prefer deciduous and evergreen forests as habitats. The chiffchaff is also seen in parks and gardens. They nest close to ground among shrubs and feed on spiders, insects, flies and their eggs and larvae. Their population in Turkey is rather dense.

The blue tit and great tit lives in forests, parks, gardens, on trees and shrubs along the fields. They nest in hollow trees, cavities, all kinds of holes, and also in nest boxes. Their food is generally composed of insects and larvae in trees and seeds in winter.

Jay and magpie prefer forests, sparse woods, orchards, parks, fields with trees as habitats and nest on trees. Jay feed on seeds, grains, fruits, insects, snails, mice, bird eggs and youngs, where magpie also eats frogs, worms, carrion and garbage. Jackdaw is observed near settlements, parks, gardens, fields, rocky areas and ruins. It nests in hollow trees, cavities and in ruins. Its food consists of seeds, grains, fruits,

insects, snails, bird eggs and youngs, worms and garbage. Raven lives in high plateaus, rocky shores and forests, shrubs, mountainous areas. It nests on old large trees and sometimes rocky areas and feeds on carrion, wounded or ill game animals, small mammals, reptiles, snails, bird eggs and youngs, fish, mussels, insects, worms, and seeds. These birds are all local species, but no nests were observed during the field studies.

Habitats of goldfinch are orchards, fields, parks, open fields with thorny shrubs, woods, near forests and settlements. It nests on forked branches and feeds on seeds of trees, shrubs, grass and insects in summer. This is a local bird in the area and it has a relatively large population.

Open areas, plains, fields, meadows, shrubs are suitable habitats for yellowhammer, black-headed bunting, curl bunting, and corn bunting. Rock bunting is observed in orchards and shrubs in rocky areas. They nest in holes in the ground, on or close to the ground among shrubs and feed on seeds, grains, and insects in summer. Rock bunting and corn bunting are local species where the others are either summer or winter visitor, or transit.

Birds that will not be Adversely Affected

The grey heron was represented by only one individual in the study area. It makes its nests on high, deciduous or evergreen trees generally in colonies and feeds by fishing in the still parts of the river.

The common sandpiper was observed with its youngs in only one nest at the shore in the study area. It feeds on insects, larvae, worms, frogs and spiders. The common sandpiper generally nests along river banks.

A few herring gulls were observed on one occasion in the study area. Since the herring gull generally inhabits swamp areas near seas and the downstream sections of rivers close to the sea, it is highly probable that they come to the study area from the surrounding areas for a short time for feeding.

It is expected that the cuckoo will continue to survive in the study area in any case due to their characteristics. It is a nest parasite that lays its eggs to the nests of other species, one egg each nest. The cuckoo inhabits forests, woods, orchards, even marshes and areas with plenty of vegetation. It feeds on caterpillars, grasshoppers and other such insects.

The swift spends most its time flying and feeding while in the air. It feeds on all kinds of flying insects and nests in and near settlements, in rocky areas, in old hollow trees and in cavities of buildings.

The kingfisher inhabits areas rivers, lakes, seas and along canals and irrigation trenches. It nests in deep holes that it digs in banks near rivers and lakes and feeds on fish, tadpoles, water insects, leeches, water snails and small worms.

The crag martin inhabits cliffs in high valleys, near lakes and seas and nests in the cavities in rocks. It feeds on small insects and flies.

The tawny pipit inhabits arid areas, sandy areas covered with shrubs and can be observed up to an elevation 2,000 m. It makes its nest in a hole in the soil near shrubs and feeds on insects, spiders, worms, caterpillars and small snails. This species was seen only once in the study area and no nests were observed.

The white wagtail inhabits orchards, meadows, open areas and fields and generally prefers areas near water. It nests in hollow trees and cavities and beneath bridge footings and feeds on flies, insects, spiders, worms, caterpillars and small snails.

The black redstart and redstart inhabit forests, orchards, near old houses and ruins; the black redstart was also observed in rocky areas. They make their nests in the cavities of rocks and ruins, while the redstart also nests in hollow trees and nest boxes. They feed on the small insects, worms, larvae and butterflies they catch by darting out from perches. The whinchat inhabits swamps, meadows, flat open areas with shrubs and few trees. It nests beneath shrubs and among grass and feeds on insects, larvae, spiders and small snails. The wheatear and black-eared wheatear inhabit barren rocky areas, plateaus, tundras and dry open areas with few trees. The wheatear occurs up to an elevation of 2,500 m. They make their nests in cavities and among stones and feed on insects, grasshoppers, flies, butterflies and spiders.

The blue rock thrush inhabits cliffs at all elevations ranging from sea level to high mountains. It nests in cavities and feeds on insects, spiders, worms and fruits.

The blackbird inhabits orchards, vineyards, parks, gardens, shrubs and forests at all altitudes and the mistle thrush prefers forests at high elevations, as well as woods near fields. The blackbird nests among shrubs, on trees, and cavities, where mistle thrush nests on tree forks without leaves. They feed on insects, snails, worms under the soil, and small fruits.

Spotted flycatcher and collared flycatcher inhabit forests, parks, gardens and shrubs. Spotted flycatcher nests on tree forks and collared one in hollow trees as well nest boxes. They catch insects and flies flying nearby them while they rest on tree tops, roofs, and poles. Also they feed on forest fruits. Their population is relatively small in the area and there is no evidence that they breed in the project area.

The Long-tailed tit inhabits forests, willow trees, parks and gardens in winter and nest on forks of branches. It feeds on small insects. Sombre tit prefers woods and shrubs in valleys as habitats and nests in hollow trees and cavities. It feeds with insects and larvae in trees and seeds in winter. These species were observed only once in the study area and probably they came into the vicinity for feeding.

The Rock nuthatch inhabits cliffs and rocky areas and nests in cavities among rocks. Its diet includes insects, larvae, worms, grass, seeds, fruits and grains. A couple of nests were observed on high rocky areas.

Deciduous forests, dense woods along rivers, orchards and vineyards are suitable habitats for the golden oriole. It makes hanging nests on branches close to tree tops and feeds with insects, larvae, caterpillars on leaves, insects on the ground and fruits. Only one individual was observed in the area, so it can be considered as a casual visitor.

The Great grey shrike is a winter visitor in Turkey and only a couple of individuals were observed in the area. It generally prefers to live near forests, orchards, vineyards, open areas with shrubs and trees. It nests among thorny shrubs or on high and dense branches of trees and feeds on mice, small reptiles and big insects, also on other birds as big as larks.

The Starling lives in forests, parks, gardens, near settlements, open fields and nests in hollow trees, cavities and under roof tiles. Insects, worms, caterpillars, fruits, and grains and seeds in winter form their diet. They are observed in large colonies where they find plenty of food and they feed in habitats above 330 m elevation in the project area.

Rose-colored starling prefers open areas, fields and steppes habitat. It nests in ruins, under boulders and in cavities in rocky areas near water. It feeds on grasshoppers and their larvae, and small fruits like mulberry, cherry, and grape. This species is a summer visitor in Turkey and it was observed only once during the field studies. It can be considered as a casual visit to the area for feeding.

Brambling, serin, greenfinch and chaffinch inhabit forests, woods, fields with trees, and shrubs. Brambling nests in trees and feeds on oily seeds, and insects in summer. Chaffinch nests on forked branches near treetops and prefers seeds, grains, insects and spiders in summer as food. On the other hand, greenfinch nests among dense shrubs and feeds with large seeds, grains and insects in summer. Serin prefers fruit trees, vines and dense shrubs for nesting and seeds, buds and green plants for feeding. Brambling has a winter visitor status in Turkey and was observed only a few times in the study area. Although serin is a local species a few individuals were seen in the study area and they are not expected to breed in the area. Greenfinch was observed downstream of the dam axis.

Birds that will Benefit from the Project

A few waterbird species like herons, egrets, etc. have been identified in the study area. Most of the waterbirds identified in the area were represented by either few individuals or one individual only. One reason for this situation is the fact that suitable marshes or shrubs for the nesting of waterbirds are scarce in the study area. In addition, the river (Kızılırmak) flows rather fast and does not allow the formation of water pools and ponds along the shoreline, which in turn restricts the feeding of waterbirds. The delta of Kızılırmak is inhabited by over 300 waterbird species, about 120 km from the dam axis as well as other alternative habitats such as reservoirs and small lakes in the vicinity of the project area is another reason that water birds do not prefer the study area.

The purple heron and great white egret were represented by only one individual each in the study area. They generally select dense marshes for nesting. At present, the marshy areas found in the study area are insufficient in quantity and not suitable for hiding or nesting.

V.2.2.3. Reptiles

Reptiles identified in the study area generally prefer stony areas and shrubs as habitats. Also, some of them live in gardens and fields as well as in meadows close to water. Six reptile species were observed. Among these four are listed in Annex 2 of the Bern Convention and two are listed in Annex 2. Only the spur-thighed tortoise is classified as vulnerable by the ERL, while the other reptile species are not included in any category of the ERL.

V.2.2.4. Amphibians

Two amphibian species occur in the project area: green toad and marsh frog. Green toad is listed in Annex 2 of the Bern Convention and marsh frog is listed in Annex 3. Stony areas in gardens and open fields are suitable habitats for green toad. Marsh frog prefers deciduous forests and damp meadows as habitats. The amphibian species identified in the area are observed in large numbers.

V.2.3. Aquatic Biota

V.2.3.1. Aquatic Flora Communities

Extensive sampling of the Kizilirmak River aquatic flora was carried out in 1993 by researchers (A. Hasbenli and K. Yildiz) from Istanbul University. The objective of this effort was to describe the algae in the river. The samples were examined microscopically and the relative abundance of each species estimated using the scale defined below:

- A = Very scarce
- B = Scarce
- C = Moderately abundant
- D = Abundant
- E = Very abundant

Some of the sampling stations in that study were located in the reservoir area of the Boyabat Project. The following algae were found in the samples from that area: Chlorophyta (green algae), 19 species; Cyanophyta (blue-green algae), 14 species; Euglenophyta (euglenoids), four species; and Chrysophyta (golden and yellow-green algae), one species. The various species of algae found in the portion of the Kizilirmak that will become the Boyabat Project Reservoir are listed (with their respective relative abundance) in Table A5.6 of Annex 5.

Species belonging to *Chlorophyta* constituted 50% of the aquatic flora. These species mostly exhibited an increase in number in the summer months, when turbidity is low and water temperature and light transmittance is high. Although there were more species of green algae, the blue-green (*Cyanophyta*) species were more abundant. Among the most abundant blue-green algae were three species of the genus *Oscillatoria*, which are known to produce organic compounds causing earthy and musty flavors and odors in water.

V.2.3.1.1. Diatom Species

Although research concerning the diatoms in Turkish rivers has been neglected for a very long time, some published information is available. Diatoms mostly serve as the initial part of the food chain and can provide important indications concerning water quality and pollution levels. For example, a high diversity of diatom species in a water body indicates a fairly high water quality. The data presented below reveal a high diversity of diatom species in the Kizilirmak, indicating that the river is not significantly polluted.

A total of 117 diatom species have been identified in the river. A list of diatom species reported in the reservoir area can be found in Annex 5 (Table A5.7). The most numerous species were in the genera *Navicula* (20 species), *Nitzschia* (18 species), *Surirella* (seven species), and *Gomphonema* and *Pinnularia* (six species each). These genera constituted 48% of the total number of species found in the Kizilirmak. *Cyclotella ocellata* and *C. meneghiniana*, which are central diatoms, were quite common. Additionally, *Fragilaria vaucheriae*, *Navicula tripunctata*, *Cymbella ventricosa*, *Gomphonema olivaceum* and *Gomphonema parvulum* have been found to be abundant and widespread on the river's sediments.

Other species, such as *Cymbella microcephala*, *Nitzschia palea*, *N. subcopitellata* and *Surirella ovata* are also common, although not as abundant as the previously mentioned species. Although *Amphora ovalis* is very widespread, it is not abundant. The species *Diatoma vulgare*, *Synedra ulna*, *Cymbella ventricosa*, *C. amphicephala*, *Gomphonema olivaceum* are widely distributed on various plants and stones. Except *Diatoma vulgare*, these species are also abundant and widespread in the river.

Gomphonema parvulum and *Synedra ulna*, which are very sensitive to pollution, have been found to be both abundant and widespread. In addition, the studies have shown that *Nitzschia palea*, which is also very sensitive to pollution, is common in the river, but is not as abundant as *G. parvulum*. In conclusion, the high species diversity of diatoms and the abundance and distribution of the pollution sensitive species, indicate that the Kizilirmak waters in the area of the project reservoir are of good quality.

V.2.3.1.2. Phyto and Zooplankton Species in Altinkaya Reservoir

Altinkaya Reservoir is just downstream of the Boyabat Project and will be affected by changes in the Kizilirmak River due to the development of that project. Hence, the baseline conditions in Altinkaya are considered here. The planktonic community of the reservoir differs from that of the Kizilirmak River.

The various phyto and zooplankton species in Altinkaya Reservoir (which can also be considered as a model for future Boyabat Reservoir) are listed in Table A5.8 in Annex 5. Because relatively stable water conditions exist in a reservoir (compared to the river) the formation of planktonic communities is favored. Consequently, the abundance and diversity of such communities (especially zooplankton) will be greater in a reservoir than in a river. Additionally, the dominant species of phytoplankton can be expected to be different in reservoirs as the community changes from riverine to lacustrine.

V.2.3.2. Aquatic Fauna

The aquatic species (macrobenthos and fish) of the Kizilirmak River were periodically sampled throughout the project area during 1997. Biologically important water quality parameters were measured at the sampling locations in conjunction with these studies. The aquatic studies began in April and extended through September, and were conducted in parallel with the studies of terrestrial fauna and flora. The map provided in Figure V.2 shows the locations of the aquatic sampling stations. Field observations were conducted for about 12 hours per day for a total of 14 days.

A YSI SCT-meter Model 33 equipped with a YSI-3300 model SCT probe was used to measure the temperature (in °C), electrical conductivity (in $\mu\text{mhos/cm}$) and salinity (in ppt) of water at the selected stations. A YSI DO-meter Model 5514 equipped with a Model 5521 DO probe was used to measure the dissolved oxygen (in ppm) at these stations. Depth and secchi depth, both in cm, were measured using a sounding-lead and a secchi disc, respectively. The pH was measured using a Type 400 Chemitrx pH-meter. Current and wave conditions were determined by observation on-site and the bottom conditions were determined using a bottom skimmer (dip net).

Fish samples were collected using a 7.5 m diameter cast net, having a 15.0 mm stretch mesh. In accordance with Mahon (1980), approximately the same fishing effort was expended at each of the sampling stations, which were chosen to represent different habitats. The samples were identified using dichotomous keys and literature information (Kuru, 1975; Erk'akan and Akgul, 1985). Macrobenthos samples were collected using a 0.2 m diameter dip net having 1.0 mm square mesh, and preserved in 70% alcohol (Resch and Unzicher, 1975). Identification of macrobenthos samples was performed in the laboratory using dichotomous keys published by International Organization for Standardization (1985). Water quality measurements were performed as described in the Hydrology section of this report.

V.2.3.2.1. Fishes

The fish species identified in the project area, their distribution with respect to sampling stations and the physical characteristics of the sampling stations are presented in the relevant tables in Annex 5. Eight species of freshwater fish were found in the study area (Table A5.9, Annex 5). The most abundant species was the barb, *Barbus plebejus esherichi* (196 specimens); followed by siraz, *Capoeta capoeta sieboldi* (16 specimens); and wels, *Silurus glanis* (nine specimens).

Barb was found at all sampling stations throughout the project area and accounted for about 83% of the total number of fish captured (Table A5.10, Annex 5). Most fish (approximately 30% of the total catch) were captured at the sampling station (Station 5) located about 26 km upstream of the Boyabat Dam site. The morphometric measurements of the species captured at each station are given in Table A5.11, in Annex 5.

The fish species found in the study area are common in Turkey and can be observed in most of the catchment areas, rivers and lakes throughout the country (Annex 5, Table A5.12). Suitable habitats for these species exist over a wide geographical area in Turkey. The biological properties of the fishes identified in the study area and their habitat requirements are summarized in the following paragraphs.

Barb (*Barbus plebejus esherichi*):

This species lives in the upper reaches of rivers in rapidly flowing water. While the adults are often solitary, the young live in small schools. The species prefers areas with instream structure, inhabiting portions of the stream with rocky substrates and with brushy cover on the banks. Young individuals feed on insect larvae and small crustaceans, while the adults are carnivorous. Their spawning habitats are generally the stony and sandy shores of the river and 12-18°C are suitable temperatures for spawning.

Carp (*Cyprinus carpio*):

The carp, which inhabits lakes and slowly flowing rivers, is one of the most frequently caught species in Turkey. (In contrast, however, only 1.3 % of the fish captured during the 1997 field studies were carp.) The species is omnivorous, feeding on aquatic insect larvae, zooplankton, worms, fish larvae, plant seeds and algae.

Carp prefer shallow and warm waters, and are highly tolerant of poor water quality conditions. Spawning areas generally are located along the banks of the river or lake where the vegetation is abundant. Reproduction occurs at water temperatures of 17-20 °C, at a depth of 30-40 cm. Fertilized eggs reach 1.6 mm diameter and adhere to the surrounding plant material. Adults may reach a size of 60 cm. Generally, carp are adversely affected by changes in water level that result in drying of this vegetation.

Siraz (*Capoeta capoeta*):

This species lives in lakes and rivers. It can be mostly found in the pools sections of the river. The size of adults changes between 15 to 30 cm and it is fairly tolerant of poor water quality conditions. It mostly feeds on vegetal material and detritus. The females become sexually mature at three years of age, and the males at two years. Egg productivity varies between 2,911 and 8,900 (Erk'akan and Akgul, 1985). Their reproduction period is from July to October and suitable spawning temperatures are 15-22°C. They lay their eggs on sandy and stony areas close to the riverbanks.

Siraz (*Capoeta tinca*):

This species lives in rivers and lakes, and may reach a length of 42.5 cm. It is very tolerant of adverse water quality conditions and can survive in highly polluted and saline waters. Although it is a very bony fish, it is considered economically important in Turkey because of its good flavor. Run and pool sections of the river are the habitats where it can be found frequently. It feeds mainly on vegetal material and detritus. Its reproduction period is from July to October. For spawning, it prefers sandy and stony grounds that are close to the banks of the river and suitable spawning temperatures are between 15 and 22°C. The females become sexually mature at three years of age, and males at two years. It is reported that egg productivity varies between 1,932 and 16,840 (Erk'akan and Akgul, 1985).

Chub mackerel (*Chalcalburnus chalcoides*):

Although information about this species is sparse, it is known that the chub mackerel is a pelagic schooling fish that lives in lakes and rivers. It is reported from most river basins flowing into the Black Sea, and also occurs in the Black Sea, but migrates into freshwater to spawn (Maitland, 1977). The chub mackerel inhabiting lakes also migrate into rivers that enter the lake to spawn. Reproduction occurs May - July, with spawning taking place over gravel and stony areas in shallow water throughout the river. The size of the adults is usually 15 - 30 cm, but may reach 40 cm. The species feeds on invertebrates, including worms, molluscs, crustaceans and aquatic insect larvae. Although this species has some commercial value in the Caspian area, it is not a commercially preferred fish in Turkey due to its size and relatively poor taste.

Chup (*Leuciscus cephalus*):

This species is known as a typical river fish, but it is also well adapted to lakes and slowly flowing waters. It is also known from brackish water. Adults are usually 30 - 50 cm, but may reach 80 cm. While the young individuals live in schools and close to the surface of the water, adults live solitarily. The diet of this species varies with age; young individuals feed on some plant material, insect larvae and other aquatic invertebrates, while adults feed on fish, crabs and even frogs.

In Turkey, the reproduction period for chup starts in May and ends in September, with a peak in May and June. Spawning occurs among stones and plants in slowly flowing water near shore. The eggs hatch in 8-10 days. Adults are sexually mature in three to four years. The amounts of fish caught in Turkish river waters are monitored regularly by the Ministry of Agriculture and Village Affairs, the General Directorate of Agricultural Production and Development, Directorate of Water Resources, throughout the year. According to the records, among the species identified in the study area chup is one of the species that provide economic yield for the fishermen in this region. In 1995, approximately 80 tons of chup had been caught in this area.

Wels (*Silurus glanis*):

Wels, which is one of the larger freshwater fish species in Turkey, is a typical bottom-dwelling catfish. This species lives in lakes and parts of rivers with slow current. It is tolerant of eutrophic waters and is reported in brackish waters of the Black Sea (Maitland, 1977). A predatory fish that rests in cavities in the daytime, the wels feeds on invertebrates when young and, when mature, preys on other fish, frogs (and even waterfowl) at night. They spend the winter resting inactively at the bottom. Reproduction takes place in May and June, when the water temperature is over 20 °C. Shallow, flooded areas with abundant vegetation near shore are preferred for spawning. Wels form a simple nest using plants and the eggs adhere to this nest. Similar to chup, wels also provides economic yield for the fisherman and around 22 tons of wels had been caught in this region in 1995.

Zander (*Stizostedion lucioperca*):

The zander is widely distributed throughout Europe, where it is prized as a sport species as well as for its commercial value. However, in Turkey it has limited economic yield and the amount of zander caught was not found in the records of the Ministry of Agriculture and Village Affairs. It is found in lakes and slow rivers, and can live in waters with low salinity. Adults are usually 30 - 70 cm, but can reach 130 cm. Spawning occurs at and above 12°C in Turkish waters, and generally occurs over gravel and stones. For spawning, it generally prefers 1-3 m deep sections close to the shore and moves towards the upstream of the river. The young feed on aquatic invertebrates, but adults feed almost entirely on fish.

V.2.3.2.2. Benthic Species

During the 1997 field studies, benthic macroinvertebrate species were also sampled at each station. Dominance and diversity of benthic species provide an indication of the quality of river water and the ecological health of the aquatic community. The dominant macroinvertebrate species and diversity indices for the benthic communities found in the study area are given by season in Tables A5.13 and A5.14, respectively, in Annex 5.

In Table A5.13, the dominant species listed represent the species having the highest number of individuals observed at a station. For some seasons, more than one species is listed because the number of individuals of those species were very similar. Nonetheless, it can be seen that the benthic community was dominated by gammarids (which are relatively tolerant of poor water quality) at most stations throughout the study area. Shannon-Weaver diversity index is used to obtain the diversity values provided in Table A5.14, Annex 5, and this index indicates the degree of diversity of the benthic species observed at each station on the corresponding season. As can be seen, the diversity values are relatively low.

V.2.3.2.3. Sampling Station Habitat Characteristics

Field conditions during the fish sampling efforts of the 1997 studies are given in Table A5.15 in Annex 5. The water quality and physical characteristics of the aquatic habitat at each sampling station on each date of sampling are given in Table A4.10 (Annex 4) and Table A5.16 (Annex 5), respectively.

The water quality characteristics at the stations show that salinity and electrical conductivity (EC) of the river was high. EC values were between 1,350-2,150 μ mhos at the surface and bottom at all stations. The levels of other parameters were all suitable for aquatic life (Train, 1979).

V.2.4. Species of International Concern

The international community, especially the European community, has historically shown an interest in protecting native plants, wildlife, and fisheries. For half a century, the International Union for the Conservation of Nature and Natural Resources (IUCN) has identified species in need of protection, placing such species on the "European Red List." More recently, in 1979, the Council of Europe enacted the Convention of Bern, signed by 26 member countries of the Council (including Turkey), to protect species of international concern.

The Convention of Bern is intended to provide broad protection to nature in Europe, in order to preserve and enhance biodiversity, promote national policies for the conservation of wild flora, wild fauna, and natural habitats, conserve wild flora and fauna in planning and development and in measures against pollution, promote conservation education, and encourage and coordinate research related to these objectives (Council of Europe 1979). All of the signatory nations also have signed the Convention on Biodiversity, pledging to take all possible steps, consistent with their national development, to protect fragile habitats and threatened species (Council of Europe 1994).

All plant species protected under the Convention of Bern are listed in Annex 1, "Strictly Protected Flora Species." No Bern-listed plants were found among the 542 species identified during the 1997 field studies.

In providing broad protection, the Convention of Bern divides the faunal species of concern into three categories. Annex 2 lists species that are to be "strictly protected." Signatory nations agree to prohibit all forms of capture, keeping, and deliberate killing, destruction to breeding or resting areas, disturbance during breeding, rearing, or hibernation, destruction or taking of eggs, and international trade in live or dead animals or their parts (Council of Europe 1979). Annex 2 species may or may not be threatened or endangered in the designation of the IUCN (Council of Europe 1996).

The second category of Bern species is Annex 3, "protected." These species are to be provided legislative and administrative protection to ensure that their populations are maintained. Protection and management of habitat is indicated. Measures specified include closed hunting seasons and/or local prohibition on hunting, regulation of the sale of live or dead wild animals, and regulation of indiscriminate hunting or capture that might affect species in Annex 3 (Council of Europe 1979).

The third category of species under the Bern Convention are those not afforded specific protection. Although the individual species are not listed, the Convention protects these species, nevertheless, through the habitat protection aspects of the agreement.

The European Red List, on the other hand, is intended to draw attention to species whose populations actually are at risk or in peril. The IUCN places a species on the Red List only after a study of its populations and the reasons for its decline. Some countries pay greater attention to IUCN-listed species than to Bern-listed species, since the Red List relies on more research. The categories of the IUCN European Red List (ERL) are:

- EX: Extinct
- E: Endangered
- V: Vulnerable
- R: Rare
- I: Indeterminate
- K: Insufficiently Known

The plant, wildlife and fish species found in the project area during the 1997 field studies are listed in Annex 4 of this report. Species listed by the IUCN or the Convention of Bern are so designated in the respective tables in that annex. Although none of the species found in the project area are listed by the IUCN as endangered, many are listed by the Convention of Bern as "protected" (Annex 3) or as "strictly protected" (Annex 2). Thus, attention will need to be given to project impacts on the habitats of these species (especially those used for breeding), so that the local populations do not become extirpated.

The extent to which the various groups of plants and animals in the Boyabat project area are protected under the Bern Convention or cited on the Red List varies from one group to another. No plants found in the field surveys of the project area are listed by the IUCN or the Convention of Bern. However, one, the mouse-ear (not to

be confused with mouse-ear chickweed, which is not listed), is classified as "rare" according to the "List of Rare and Endemic Plants in Turkey." It is found in the project area from 300 to 900 m elevation.

A few of the mammals observed or reported in the project area are listed in Annex 2 (the early flying bat, and the gray wolf), or Annex 3 (the hedgehog, pygmy shrew, weasel, badger, squirrel, and vole). Although local people have reported seeing gray wolf and badger in the project area, the presence of these species was not confirmed.

Turkish hunting regulations currently in force date from 1937 and do not reflect prevailing wildlife management views toward predators and other unpopular animals. Nor do they meet the requirements imposed by the Bern Convention. They allow hunting of several mammals and birds covered under Annex 2, year-round in the case of wolf, leopard, and tiger, and restricted to August through March in the case of cranes, bustards, swans, and many wetland birds. Snakes and tortoises, some of which are Annex 2 species, may be hunted at any time. The General Directorate of Forestry is responsible for designating species for protection and for enforcing hunting regulations.

Virtually all the birds of the region are protected under Annex 2 or Annex 3, the exceptions being eight species that are considered to be crop pests or commensals with human habitation. Thus, it is inevitable that nearly all the species of birds in the project area are listed by the Convention of Bern. No IUCN-listed birds are known breed in the project area, but some could visit it on migration or in winter.

Annex 2 lists 84 species of reptiles, while all other reptiles in the region are afforded protection under Annex 3. Of the Annex 2 species, three were seen in the project area during the 1997 field studies: The Mediterranean spur-thighed tortoise, the Balkan green lizard, and the tessellated water snake. The tortoise is considered "vulnerable" by the IUCN, due to its heavy exploitation by the international pet trade. Although probably kept as a pet by some project area families, it does not appear to be subject to commercial exploitation.

Annex 2 includes 46 species of amphibians, only one of which, the green toad, was seen during the 1997 field program. All amphibians in the region not covered under Annex 2 are listed in Annex 3, so the marsh frog enjoys "protected" status. Neither of these species, the only amphibians found during the 1997 field studies, is on the European Red List.

Of the eight fish species collected in the project study area, three are listed in Annex 3 by the Convention of Bern: the barb, the chub mackerel and the wels. These species undoubtedly spawn in the portion of the Kizilirmak within the project boundaries. All other species are unlisted, and no fish species found during the 1997 field studies are on the European Red List. The Government of Turkey has enacted fishing regulations establishing minimum sizes and maximum numbers that may be caught and possessed per day for the barb and the wels, as well as for other species found in the 1997 field studies.

Finally, the Government of Turkey also enacted legislation that addresses the habitat protection concerns of the Convention of Bern, designating areas having special environmental protection. These areas are protected by various regulations to preserve their natural, cultural, or historical values. The Boyabat project area is not classified as such an area.

V.3. Socio-Economic Environment

V.3.1. Introduction

Expropriation and resettlement studies were started by DSI in 1985. The area to be flooded and the land to be expropriated was estimated by DSI. In 1987, the number of villages which would be directly and indirectly affected from the project was first estimated as 25. Another study was conducted by DSI in late 1992 and, because of the changes in the region since 1987, it was found that some properties and districts of three other villages would also be affected by the project. These villages are located in Kargi and Osmançik districts of Corum Province; Vezirköprü district of Samsun Province, and Boyabat district of Sinop Province. The locations of these villages are shown in Figure V.2.

Seven of these villages and a part of another village will be directly affected from the project through flooding by the future reservoir. These villages are Fakili, Yaylacili, Asagidaricay, Yukaridaricay, Susuz, Yalak section of Alankoy, Asagi Zeytin and Asikbuku. The remaining 20 villages will be indirectly affected by the project. Only some of their fields and buildings, which are below the maximum water level of the proposed reservoir, will be partially affected. In Table V.8 these villages are presented together with the number of houses and occupied houses, and the total populations according to the 1990 census. In the 1985 census, total population of these villages was 18,000, whereas by the time of the 1990 census this population had decreased to 16,593. About 12,000 people living in these villages will be affected by the project.

The cadastral surveys for most of the villages to be expropriated were completed by DSI. Here it should be noted that although DSI conducted the studies mentioned above, MENR is responsible for expropriation. As DSI is an affiliate of MENR, it will carry out the expropriation if it is assigned by MENR. The surveys to find out the resettlement preferences of the villagers were completed in many of the villages, and are still being conducted in some of them by the General Directorate for Rural Affairs (KHGM). Table V.9 shows the resettlement preferences of the families affected by the project, according to the completed surveys.

Table V.8. Villages that will be Directly and Indirectly Affected by the Boyabat Project, and Total Number of Houses and Population

Province	Town	Village	Number of Houses	Number of Occupied Houses	Total Population (1990 census)
Sinop	Sarayduzu	Fakili Akbelen Hacicayi Yaylacili Yalmansaray	466	336	2,027
Samsun	Vezirkopru	Susuz Yukaridaricay Asagidaricay Kizilkise Alanköy (Yalak Dis.)	574	469	3,600
Corum	Osmancik	Aydin Asagizeytin Yukarizeytin Pelitcik Asikbuku Kamil Avlagi	873	478	5,090
	Kargi	Avsar Bagozu Orencik Saraycik Sinanozu Karaboya Maksutlu Koprubasi Demiroren (Egzen) Karapurcek Gokcedogan (Tekkesin) Karacaoglan	1,232	1,045	5,876
		TOTAL	3,145	2,328	16,593

Table V.9. Type of Resettlement Preferences of Villagers

Province	Town	Families Preferring Resettlement	Rural Resettlement		Urban Resettlement	
		Number	Number of Families	(%)	Number of Families	(%)
Sinop	Sarayduzu	240	238	99	2	1
Corum	Kargi	379	306	81	73	19
Corum	Osmancik	421	365	87	56	13
Samsun	Vezirkopru	432	383	89	49	11
Total		1,472	1,292	88	180	12

In these surveys the KHGM staff interviewed the villagers to ascertain whether or not they would like to be resettled. First of all, the KHGM staff explained what benefits were provided under their resettlement program, and if the person makes a positive choice, he or she is required to deposit the cash compensation received in a special account. After KHGM had ascertained a particular household's intention to be resettled, the staff carried out a simple socio-economic survey of the household, its property, and its income earning activities.

Scientific studies about the region and statistical and documentary information are supplementary sources used in the preparation of the Socio-Economic Environment part of this Report. The main source of data, however, was a detailed field study conducted in 14 of the villages that will be affected by the Boyabat Project. Five villages from Kargi, five from Osmançik, two from Vezirköprü, and two from Saraydüzü Districts were selected to represent the villages that will be affected by the project. Photograph V.7 shows a typical village from the project area.

The field work was carried out by an experienced team of 11 researchers and interviewers. Each village was visited by a male and a female investigator. In each locality three village interviews and one village history interview were conducted to collect firsthand general data about the past and present situation in the village. In addition to these, two focus group studies were done with men and women.

With the help of the headman, the villagers were all informed about the study and invited to attend the meetings. The persons contacted, the place, date and duration of the meetings in each village, are summarized in Annex 6 (Session 21).

During the interviews and meetings, after general information about the Project was provided, the opinions of villagers about their environmental concerns were solicited, in addition to their socio-economic concerns. The environmental concerns of the villagers were found to relate only to the loss of their farmlands. Villagers working in their fields can be seen in Photograph V.8. Their concerns were mainly on resettlement and expropriation issues.

The field data were transferred to a computer database and then analyzed. Focus group studies were decoded from tape recorders and field reports were prepared for each discussion. With the data, the research coordinators and all members of the field-work participated in one-day workshop to discuss the research issue in detail. The validity and the reliability of the collected information were examined in detail and the opinions and observations of field-workers were taken into consideration in an open discussion.



Photograph V.7. A Typical Village from the Project Area



Photograph V.8. Villagers Working in Their Fields

V.3.2. Demography

V.3.2.1. Population Structure

V.3.2.1.1. Distribution of Population

According to the data collected in the field survey, the total population of these 14 villages is 8,180 persons. The population of the individual villages ranges from 200 to 1,200 persons. There are six villages of less than 500 persons, five with between 500 and 1,000 persons, and three with 1,000 or more.

Age Structure of the Population

Almost half (48 %) of the total population of villages consists of persons in the under 14 and over 50 age groups. Approximately one-fourth (23 %) of the total population of villages consists of young villagers, aged less than 14. In several villages there are few youngsters in this age group from both sexes.

The total number of young males (under 14) is 957, corresponding to 12% of the total population. The number of people in this age category in a village ranges from 15 to 200 in all villages. Only four villages have 100 or more youngsters in this age group.

In the same age group there are 928 young women, constituting 11% of the total population of all villages. The number of females in this age category ranges from 20 to 150 in a given village. Five villages have 100 or more youngsters in this age group.

It is indicated that in about half of the villages (8) no preference is shown toward the gender of children. The primary reason given for the desire to have male child is continuation of the descent line and name (11 villages). In only two villages, family support was given as the reason for the preference of male child.

The male and female population above 50 years of age shows a distribution similar to that of the less than 14 age group. Of the total population of villages, 25% is above the age of 50.

There are 975 men above the age of 50 in these villages, or 12% of all villagers. The number of people in this age category in the individual village ranges from 20 to 250. Only three villages have 100 or more men in this age group.

In the same age group there are 1,020 women, or 13% of total population. The number in this age in a village category ranges from 20 to 300. Only three villages have 100 or more women in this age category.

Almost half of the total population of all villages is within the age groups of less than 14 and more than 50 years of age.

V.3.2.1.2. Household Structure

It was determined that there are 1,728 households in the 14 villages surveyed. The number of households in a village is between 40 and 350. There are seven villages of up to 100 households, five with between 100-200; and two with more than 200. Household size ranges between four and nine persons. Half of the households have four or five members. In five villages, households are larger, averaging between seven and nine people.

Forty-four per cent of all households (755 households) in these villages consist of nuclear families. The number of nuclear families ranges from 15 to 150 in all villages. Seven villages have up to 30 nuclear families; five have 30-60 nuclear families; and only three have between 100-150 nuclear families. The nuclear family sizes varies between three to six members. In nine villages the nuclear family size is between three and six and in two villages it is six persons.

Reasons of Decreasing Household/Family Size

In the villages surveyed it was found that the household size has constantly declined in the last 20 years. Income difficulties (10 villages), family planning (8 villages), and emigration (7 villages) are given as the main reasons for this tendency. Small land ownership (one village) and the increased age of marriage (one village) are not considered primary reasons.

The Reasons for Married Sons Forming Separate Households

Emigration due to unemployment (9 villages), population pressure (9 villages), and the conflicts in families (8 villages) are the prominent reasons of early or late split of married sons from the households of their fathers. In only three villages, split after the death of the father seems to be a dominant tendency.

V.3.2.2. Population Dynamics

V.3.2.2.1. Origins of Population

The origins of these villages extend back to 300 years and all have native populations. These villages have not experienced resettlement; but they have rebuilt or renovated their houses due to natural disasters (seven villages) and fire (two villages).

V.3.2.2.2. Internal Emigration

All villages have experienced internal emigration (ie, within Turkey). A total of 1,455 households have emigrated from these 14 villages in the recent past. In these villages, the number of emigrated households ranges from 15 to 250. In seven villages 100 or more households and in three villages 250 households have emigrated.

Reasons of Internal Emigration

Personal reasons and unemployment (13 villages) are indicated as the primary reasons of internal emigration. There are families in five villages who emigrated due to the the Boyabat Project. It is interesting to note that land and population pressures (three villages) are not given as the primary reasons for emigration.

The Use of Land of the Village Migrants

The land of migrants is generally cultivated by relatives remaining in the village. In three villages these lands are used through sharecropping and in two they are rented.

The Employment of Village Migrants

Most of the migrants are employed as wage workers (11 villages) or unskilled construction workers (6 villages). In addition, gatekeeping (5 villages), self-employment (5 villages) and working in state offices (5 villages) seems to be relatively common occupations in cities.

Returnees to the Village

In seven villages, no one has returned of those who emigrated. Among the 1,455 emigrated households, only 26 households (2% of the total) returned to their villages. They usually returned a year or two after emigration (4 villages), or after retirement (4 villages). The returnees are now engaged in agriculture (4 villages), do forestry wage-work (1 village), or do not work (2 villages).

V.3.2.2.3. External Emigration

External emigration (outside of the country) is not common among the villages surveyed; no emigration occurred in 11 villages; and only 1 household in two villages and 4 households in one village emigrated abroad and none of them returned permanently back.

V.3.2.2.4. Conditions of Birth and Mother/Child Mortality

Village women give birth to their children in hospital conditions (11 villages) and by the help of elderly women from villages (8 villages). Midwives (5 villages) and health centers (1 village) are not common in these villages. Because of the impending project, medical personnel have not been appointed to the villages for a long time.

The infant/child mortality rates had been reduced in the villages surveyed, compared with the previous decade. The use of hospital conditions (9 villages), the extension of the transportation (7 villages) and technical provisions (6 villages) are stressed as basic factors that contributed for the reduction of mortality of mothers. Similar tendencies of development are also valid for the reduction of the infant/child mortality:

immunization (11 villages), doctors (8 villages) and transportation (7 villages). An interesting finding is that family planning is not expressed among the causes.

V.3.2.2.5. Marriage

The characteristics related to marriage age by sex, number of bachelors, external marriage and polygamy are taken into consideration as important variables for the analysis of demographic dynamics.

Age of Marriage

The marriage age for girls is between 16 and 18 years. The marriage age for boys varies between 18 and 21.

Bachelors

In the villages surveyed there are 202 young men and 118 young women of marriageable age. The discrepancy between the number of male and female bachelors is partially explained in terms of the late marriage of young men, but is mainly due to compulsory military service. Another factor is the seasonal employment of a considerable number of young men outside of their villages.

External Marriage

It is not too common for young women and men to marry outside of their villages. However, there is an increasing tendency for young girls to marry young men from their own villages who work in big cities. Although it is very rare, due to seasonal employment, young men occasionally marry outside of their villages.

V.3.3. Socio-Economic Infrastructure and Institutional Links

V.3.3.1. Level of Education

There are 655 primary school students in the villages surveyed. Since primary school education is compulsory in Turkey, every village has had at least one primary school for a long time. Very few primary school graduates can continue their education in secondary schools, mainly due to the lack of these schools in the villages and their distance from the villages.

The level of education of men is mostly limited to the primary school level. The majority of men (11 villages) are literate, but there are a few secondary school, high school and university graduates. The education level of women is relatively lower than men. The majority of women in five villages and more than half in 12 villages are literate. There are few secondary and high school graduates from both sexes in few of the villages. In half of the villages no one regularly reads the newspaper.

V.3.3.2. Institutional Skill Attainment

In one village it is reported that no "course" had ever been organized up to the time of the survey. In the remaining 13 villages total number of 47 courses had been organized. In 13 villages reading-writing courses had been taught; in 12 tailoring; in 7 religious education (Koran); in 5 carpet weaving; in 4 mother-child health; in 3 family planning; in 2 beekeeping; and in 1 carpentry. It is recognized that few of these courses are directed towards gaining vocational training, but most are related more to general education and health.

V.3.3.3. Basic Infrastructural Factors

V.3.3.3.1. Electricity and Water

The earliest installment of electricity was made in one village in 1978. For the remaining villages electricity was connected between 1982 and 1986. In all villages all households use electricity. It is mostly used within the houses for domestic needs; and in a few villages for the operation of water pumps.

In only six villages is there running water in houses; in the rest of the villages, the water is provided at the village fountains.

V.3.3.3.2. Communication and Sources of News

All villages and 51% of all households have telephones. The connection of telephones was made between 1987 and 1996. In half of the villages there is a post-office (an agent). The other half, which do not have a postal agent in their villages, collect their mail from the nearest post-office in the district.

In addition to telephone and postal services, the visits to town centers provide an important source of communication and news. Since regular newspaper reading is not common (Section V.3.3.1), the major sources of news for the villages are radio and especially television. Listening to the radio and watching television are particularly widespread among children and women.

V.3.3.3.3. Housing and Heating

In the 14 villages 75% of all houses are made from wood and the remaining 25% are concrete. The villagers, especially after they were informed that the dam was going to be constructed, decided not to invest in new house construction, or even to repair or expand their houses. All villages use basically wood for heating and in three villages coal is partially used.

V.3.3.3.4. Ownership of Second House

In four villages no one owns a second house; however, in the remaining 10 villages, 116 households (7% of all households) own a second house. While in eight villages 36

households own a second house, the number of households having a second house is 80 in two villages.

V.3.3.3.5. Health

In only four of the 14 villages surveyed are there medical centers or midwives. In general, majority of villagers apply to formal medical institutions in "emergency" situations. (Table V.10)

The villagers seem not to use amulets. However, in nine villages local/traditional bone-setters are used; midwives/nurses, dentists and doctors are consulted when there is a need for them, particularly in emergency situations.

Table V.10. Conditions of Using Health Provisions

Conditions of Use	Number of Villages			
	Not Use	In Emergency	In Need	Frequently
Doctor	-	3	9	2
Dentist	-	5	7	2
Midwife/nurse	1	3	10	-
Local Bone-setter	2	1	9	2
Healer with Amulets	10	-	3	1

The factors which prevent villagers from using and consulting medical institutions as frequently as needed seem to be related with being far away from the medical centers, insufficiency of health-service provisions, lack of a health-insurance system, low levels of income, and the prevalence of the negative health habits.

The most common diseases encountered in these villages are goiter and intestinal cancer. Due to rice cultivation in irrigated fields, rheumatismal and gynecological diseases are very common.

V.3.3.3.6. Agricultural Services

The use of agricultural technicians and veterinarians is limited among the formal agricultural services. The villagers use veterinarians only when they "need" them (9 villages) and the agricultural technicians under 'emergency situations' (6 villages) and 'when needed' (5 villages).

V.3.3.4. The Use of Organizational Services

The service areas in these villages are presented in Table V.11. In terms of provision of services within villages (Table V.11.), it is observed that:

- All villages have a mosque and a school and two villages have two of each.
- Only two villages do not have fountains; in the remaining 12 villages there are 28 fountains.
- Excluding three villages, all villages have a village guest-house.
- In more than half of the villages (eight) there are cooperatives. However three cooperatives had been closed, and the activities of the remaining ones are limited.
- In half of the villages there is no coffee-house; however, in seven there are a total of 10.
- In five villages there is a merchant. These merchants are mainly engaged in rice purchasing and they buy rice either in cash or in installments.
- Five villages have a common laundry and 4 villages have a mill and a medical center/midwife.
- In three villages there are total number of 16 hand-loom.
- In two villages there are dairy and carpenter workshops. Only one village has a reading-room where daily newspapers and a couple of books can be found.
- Relatives and neighbors are the basic sources of indebtedness. In five villages bank loans and in one village merchant loans exist.

V.3.3.5. Vehicles

The villages have a relatively extended vehicle park (Table V.12.). The villagers own motorcycles, cars and minibuses for private and public transportation; trucks and lorries for transporting goods. Many villagers hold driving license.

In every village there are cars: among the 14 villages there are 74 cars. In only one village is there no motorcycle; among the remaining 13, there are 39 motorcycles. In only two villages there are no minibuses; but in the remaining 12 there are 27 minibuses. In one village there are six minibuses. In 11 villages there are a total of 49 trucks.

V.3.3.6. External Links of Villages

Trading, working, having education and having a house, involving in administrative and managerial bureaucratic tasks are the basic elements of the external links of the villages.

Table V.11. Service Areas

Service Areas	Number of Villages		Total Number of Service Areas
	Do Not Exist	Exist	
Mosque	-	14	16
School	-	14	16
Fountain	2	12	38
Grocery	2	12	28
Village Room	3	11	12
Cooperative	6	8	8
Coffee-House	7	7	10
Common Laundry	9	5	5
Village Merchant	9	5	5
Mill	10	4	4
Medical Center/Midwife	10	4	4
Hand Loom	11	3	16
Workshop	12	2	2
Dairy	12	2	2
Carpentry Workshop	12	2	2
Reading Room	13	1	1

Table V.12. Vehicles

Vehicles	Number of Villages	Total Number of Vehicles
	Exist	
Cars	14	74
Motorcycles	13	39
Minibuses	12	27
Trucks	11	49

V.3.3.6.1. Commuting to Nearest Districts and Provinces

Ten of the 14 villages surveyed belong to Kargi and Osmançik Districts of the Corum Province and the remaining four villages belong to Vezirköprü District of Samsun and Boyabat District of Sinop Provinces.

Among the 14 villages, one-third go to centers of Provinces: eight to Corum; two to Samsun and one each to Sinop, Kastamonu, Istanbul and Ankara Provinces. Two-thirds of the villages thus go to the nearest district center: 10 villages go to Kargi; 9 to Osmançik, 6 to Boyabat, 3 to Vezirköprü and 1 to Saraydüzü Districts. The distance to the district center ranges from 10 to 55 kilometers.

Most of the villagers (12 villages) go to the district center one to three times weekly. Only in two villages it is stated that they pay visits to the district daily. In seven villages it is observed that women seldom go to the district center. Health, household and personal needs are the reasons for women going to the district.

V.3.3.6.2. Commerce

The district centers that the villagers visit are also the centers of commercial transactions. Seven villages have established links with the Osmançik District, six with Kargı, three with Boyabat, and one with Vezirköprü.

The survey indicated that the commercial relations for nine villages have been growing since 1980. Four villages indicated that it has remained constant and three linked the development of trade to the growth of rice cultivation after 1960.

V.3.3.6.3. Employment

In all villages except one, most of the men are engaged in seasonal migratory work outside of the village. In these villages, 854 persons work outside for different periods. This number is unequally distributed among the villages. In four villages 55 people work outside of the village and in the remaining villages the number of seasonal workers ranges from 20 to 30.

Some villagers are engaged in seasonal work in factories (nine villages), construction work (eight villages), gatekeeping (five) or work as public officers (four), work in restaurants and similar places (three) and transportation work (two). Except for transportation, nearly all of these employment areas involve wage or salary earning occupations. Only transportation provides self-employed income.

V.3.3.6.4. Seasonal Work

One of the features of employment outside of the village is that it is limited to seasonal work periods. Almost half (49%) of those men employed outside of the village work in temporary status. Male villagers, beyond their compulsory tasks in agriculture, seek seasonal employment in the nearest town centers and cities. They are usually employed in non-agricultural jobs, mostly in construction work. The difficulties of maintaining a livelihood and possessing insufficient land are expressed as the main reasons for seasonal employment. Seasonal work has been carried out since the 1960's. In only three villages, women work as seasonal workers in rice cultivation.

V.3.3.6.5. Education Outside of the Village

A total of 224 villagers were found to be continuing their education outside of their villages.

V.3.3.6.6. House Ownership Outside of the Village

In three villages no one has a house outside of the village. In the remaining 11 villages, 455 villagers own a house outside of the villages. Since there are 1,728 households in these 14 villages, 26% of all households own a separate house outside. It is worth noticing that in one village there are 255 households that own a second house outside of their village.

V.3.4. Economic Situation

V.3.4.1. Land Possession

V.3.4.1.1. Distribution of Land Use

The total land of surveyed villages is, 8,255 ha. This land is privately owned by the villagers. There are significant differences among the villages in terms of the size of land possessed. The sizes of land possessed by nine villages varies between 50 and 300 ha. Two villages have between 500 and 600 ha of land and five villages possess more than 1,000 ha of land.

The villagers allocate the land that they possess for different usage. In some of the villages only some part (10-30 %) of the land could be cultivated. In four of the villages 50-60 % of the land has allocated for crop cultivation. In only eight villages 80-100 % of the land is used for this purpose.

In six of the villages there is no fallow land. In the other villages, five to thirty per cent of land possessed is fallow. The pasture land ranges from five to twenty percent of total village land. The irrigated land in these villages range from 8-300 ha. In five of the villages there is no poplar-wood/willow land. In some of the villages poplar land varies between one and two hectares. The land allocated for vegetable and fruit growing generally ranges between two and thirty hectares. However, in one village vegetable and fruit growing is done in 300 ha of land.

Six villages do not have any forest land; in the remaining, the forests range from 20 to 50 percent of total village land. There is no public land in seven villages. In three villages, state land ranges from 0.5 to 2.5 ha, and in four villages it ranges from 10 to 200 ha.

V.3.4.1.2. Distribution of Land

The land distribution analyzed in all villages shows that the small, private, land ownership seems to be the most prominent land tenure system (Table V.13). Seventy-one per cent of all households own up to 2.5 ha of land. Ninety-six households own land between 5.0-10.0 ha and only five households own more than 10.0 ha. The existence of only 17 landless households is an additional indicator of the prevalence of a strong small land ownership system in these villages.

V.3.4.1.3. Land Distribution and Land Titles

The villages have not experienced any kind of land distribution and almost all possess titles of their land.

Table V.13. Land Distribution

Hectares	Households	
	Number*	Percents
0-1.0	548	38.3
1.0-2.4	475	33.2
2.5-4.9	308	21.5
5.0-9.9	96	6.7
10.0-15.0	5	0.3

* In relation to sizes of land ownership the number of households given here is 1432 which is considerably less than the answer given before to the question of 'number of households in the village' which is 1728.

V.3.4.1.4. Number of Land Parcels

The number of parcels of the land owned in these villages ranges from 3-15 per owner. This number ranges from 3-6 in nine villages, seven to nine in three villages; and the up to 15 in two villages. The tendency of the continuation of land fragmentation in almost all villages (13) is a supporting finding for the high number of land parcels in these villages. In only one village was land consolidation is reported.

V.3.4.1.5. Productivity and Value of Land

It was found that the village lands are productive, considering variation in irrigation development. According to villagers' declarations, the value of the irrigated (rice) land varies between 500 and 2,000 million Turkish Lira per hectare, and the non-irrigated land between 500 and 750 million TL per hectare.

V.3.4.1.6. Land Market

It is stated that the purchase and sale of land is not widely practiced in the villages surveyed. The difficulties of livelihood, landlessness, village border neighborhood, kinship and emigration are factors in the commercialization of land in these villages. An increase in land commerce in two villages is expected, due to the realization of the Boyabat Project.

V.3.4.1.7. Land Inheritance

It is a common practice in these villages that the land is equally inherited and the titles are registered among the heirs immediately after the death of the patriarch, i.e. the father. In some villages land is inherited but titles are registered later. It is declared that women also receive equal shares as heirs.

V.3.4.1.8. Land Disputes

In half of the villages land disputes are nonexistent, while among those that have land disputes, the problems originate mainly from the border conflicts (six villages); and sometimes from issues related to forest land and inheritance.

V.3.4.1.9. Absentee Landowners

In 12 villages, 619 absentee families own land; in only two villages are there no absentee land owners. In 10 villages, the number of absentee land owners ranges from 10 to 40; however this number reaches 140-250 in two villages.

V.3.4.1.10. Land Possession Outside of the Village

Land ownership outside of the village is not found in half of the villages. In the remaining seven villages, 44 households own land outside of their villages. In five villages the number of such families ranges from one to five, and in two from 10 to 15.

V.3.4.2. Potential and Quality of Labor

The factors influencing the quality and quantity of the labor potential of the peasants in the villages are determined by age, sex, family/household, marriage, health, emigration, education, agricultural mechanization, and seasonal wage-work.

V.3.4.2.1. Sex and Age

It should be assumed that, excluding the very old and very young, almost the whole village population has the potential to work and actually does. In general, although it changes according to the labor demand of the crops cultivated, the rural population actively participates in agricultural labor, except for the under 12 and over 60 age groups.

Since the dominant economic activities depend on small peasant production, there exists a strong subsistence economy in the villages surveyed. In this structure, in addition to the tasks performed at the field, peasants, especially women, work continuously for almost the whole year to look after animals, process animal products, prepare food for winter and satisfy domestic needs.

In these villages, women do not work in non-agricultural jobs and very few are engaged in seasonal agricultural work. The male rural population is primarily engaged in various agricultural activities at the field, organizes and manages production, carries out the organizational and administrative tasks outside of the village, and works in seasonal status in short and long periods in agricultural and non-agricultural sectors.

V.3.4.2.2. Education/Skill and Work Areas

In the villages surveyed, the level of education, although much lower for women, is limited to primary school. In spite of this, a significant number of students (224) continue their education outside of their villages.

The limited knowledge and skills attained by primary education usually do not negatively influence the potential of peasants for finding employment outside of their villages. Remembering that most of the courses opened in villages are not directed

towards production, it could be argued that the level of their skills, thus their potential to diversify the use of their labor, remains low. Hand weaving, which was an important potential skill in the past in this region, withered away and tailoring and carpet weaving have not remained prevalent in this area.

The knowledge and skill levels in production in these villages are limited to crop cultivation, animal husbandry, and processing animal products. In addition to this, many, especially adult males, work as seasonal workers in various branches of construction sector, forestry, and transportation. Although few in number, in various villages there are peasants who hold additional skills in the areas of carpentry, engine repair, electricity, and blacksmithing (Table V.14). The number of villages having such people is provided below:

Table V.14. Skilled Peasants

Skills	Number of Villages
Construction	12
Carpentry	9
Engine Repair	4
Electrician	3
Blacksmith	3
Car body work	1
Locksmith	1
Tailor	1

V.3.4.2.3. Female Labor

In 11 villages the work-load of women has not been decreased significantly, since mechanization is not widespread in the region. The development and improvement of the agricultural techniques and the ownership of electrical home appliances are considered important factors contributing to the decrease of the workload of women. Women weave carpets and textiles in only two villages.

V.3.4.3. Economic Inputs

V.3.4.3.1. Tractors

Depending on the labor demand of the crops cultivated, excluding the existence of water pumps in several villages, agricultural machinery is limited to tractors and their attachments. In 14 villages there are 284 tractors. Although the number of tractors in villages varies between 10 and 40, one village has 110 tractors.

The tractors were acquired into most of the villages (12) during 1970's. The other two villages have acquired their tractors in the last 15 years. Besides in agricultural production (12 villages), tractors are hired for transportation (six villages).

V.3.4.3.2. Artificial Fertilizer, Insecticides and Irrigation

In the villages surveyed, the villagers indicated that they have been using artificial fertilizers and insecticides for the last 10-15 years and irrigating their land mainly through small canals.

V.3.4.3.3. Livestock

Livestock of the villages is composed of cattle, sheep, goats and riding animals (horses, asses, mules). In these categories there are 15,472 animals in all 14 villages. Since the number of households is 1,728, the average number of animals is nine per household.

Animal husbandry is a basic element of the subsistence economy of these villages. Animal products contribute significantly to the subsistence food needs of the households in all villages. In nine villages respondents indicated that they sell animals when they need cash.

Among the 14 villages, 60 households secure their living through animal husbandry. In four villages animal husbandry is not practiced. In eight villages the number of such households ranges between one and five and in each of two villages 20 families are engaged in animal husbandry.

There are 3,540 cattle in all villages varying from 50 to 1,000 per village. Eleven villages possess between 150-450 cattle, two have 500-600, and one village has 1,000.

In one village there are no sheep or goats. In the remaining villages 4,860 sheep are owned. The number of sheep per village varies from 80 to 1,000. Eight villages possess between 80-300; three between 350 and 500, and in two there are 800-1,000.

In 13 villages there are 6,730 goats, the number of these animals ranging between 30 and 2,000. Six villages have 30-200 goats each, five have 300-700, and two have between 1,500-2,000 goats.

The number of riding animals in a village varies between 2 and 60. Seven villages have 2-20 riding animals, six have 25-30; and two have 50-60.

V.3.4.3.4. Access to Agricultural Technicians

The primary reasons of not using agricultural technicians sufficiently are the remoteness of the centers of agricultural directorates (eight villages) and the low level of awareness of the benefits of technical help (four villages).

V.3.4.4. Agricultural Production

In the surveyed villages it was observed that the basic crops cultivated are rice, wheat, vegetables, fruits and maize (Table V.15). Rice and vegetables seem to be the basic crops sold at the market, followed by wheat and fruit. Among the marketable crops, again rice, vegetables and wheat are indicated as the most profitable agricultural products.

Besides barley and rye, all crops products are marketed. However, a common characteristic of all products is their contribution to the subsistence needs of the household. The bulk of barley and rye is used for subsistence, for the remaining crops cultivated, part of it kept for the subsistence and the rest sold.

Table V.15. Basic Crops Cultivated

Basic Crops	Number of Villages		
	Production	Marketing	Most Profitable
Wheat	14	5	5
Rice	13	13	13
Barley	13	-	-
Vegetable	13	11	5
Fruit	9	4	-
Maize	7	2	-
Rye	3	-	-

The area of rice cultivation in five villages ranges between 20 and 45 ha; in three villages it is between 50-85 ha, and in five villages it is between 100 and 200 ha.

Three villages predominantly produce cereals for subsistence production; in the remaining 11 cereal cultivating villages the cereal cultivation ranges between 15 and 150 ha. In six villages cereal cultivation occupies 15-40 ha and in five others between 100 and 150 ha.

V.3.4.5. Land Tenure System

The dominant land tenure system that prevails in the villages is small production. The basic characteristics of small peasantry is that they carry out production with their family/household labor on land that they own. Most of these enterprises, due to insufficient land and/or labor, or the lack of economic assets essential for extending the area of cultivation, rent or sharecrop additional land or hire wage laborers to extend the scale of production. It is important to note that those the households that hire seasonal wage laborers, rent or sharecrop land are also small household enterprises. Small peasants do not secure their survival only with renting, sharecropping or hiring wage-laborers.

Sharecropping and renting relations are realized by either taking or giving land. Villagers say that taking or giving land for sharecropping can be profitable depending on the economic situation of the households, but rental arrangements seem to be more profitable for the renter than for the owner.

V.3.4.5.1. Sharecropping

Sharecropping is absent in three of the 14 villages surveyed. In the remaining 11, a total of 242 households (14% of all households) are engaged in sharecropping. The number of sharecropper families ranges between 4 and 40 in all villages. In four villages their number is 4-18 and in the remaining seven, 20-40.

In these villages sharecropping is mostly practiced within the village. In only three villages, land is taken for sharecropping outside of the village.

V.3.4.5.2. Renting

Renting is not common among most (10) of the villages, but only practiced in four villages. Some 35 households are engaged in renting. Five households in one village and 10 households in each of three villages practice renting. Only in one village is it indicated that land is rented from outside.

V.3.4.5.3. Seasonal Wage-Work

Sixteen per cent of all household enterprises (268) in 12 villages hire seasonal wage-labor, while two do not. The number of households that hire seasonal wage-labor ranges from 3 to 60 in the 12 villages; it is between 20-50 in three villages; and in one village 60 households hire seasonal workers.

The period of hiring seasonal workers is from one week to three months. In four of the villages such labor is hired for an average of one week, but in eight seasonal workers are hired for one to three months. In these villages, in addition to hiring seasonal wage laborers, the households practice labor exchange among themselves, not based on cash.

V.3.4.5.4. Marginal Land Possession

There are only 17 households that do not own land, but there are 78 households whose land ranges from 0.3 to 2.5 ha. These households primarily maintain their livelihood through seasonal work (10 villages), sharecropping (five villages) and animal husbandry (three villages).

V.3.4.6. Non-Agricultural Households

In only two villages are there non-agricultural households. In one village 15 households and in the other 20 households do not engage in agriculture. These

households secure their livelihood either by giving their land for sharecropping or working in non-agricultural jobs.

V.3.5. Conditions of Survival and Level of Welfare

V.3.5.1. Basic Source and Conditions of Survival

The basic sources of survival in agricultural related activities are cropping (13 villages), animal husbandry (eight) and fruit culture (one).

V.3.5.1.1. Difficulties of Survival for the Villagers

The main reasons of survival difficulties are stated to be insufficient land (13 villages), low productivity of land (5 villages) and excessive population (5 villages).

V.3.5.1.2. Size of Land Essential for Survival

The villagers stated that 1.5-5 ha of irrigated land is essential for survival. Some found 1.5-3.0 ha of land sufficient for survival (11 villages), whereas others declared that only 3.5-5.0 ha of land would be adequate (3 villages). On the other hand, in the case of non-irrigated land, the minimum land required was stated to be 2.5-3.0 ha (three villages). For others, this amount is not considered sufficient and the figure given was 8.0-15.0 ha (two villages) and 50 ha (one).

V.3.5.1.3. Number of Households Facing Difficulties of Survival

It was stated in two villages most of the villagers faced difficulties of survival. In the remaining villages, the ratio of those who faced difficulties of survival ranged between 10 and 60%. In nine of the 12 villages, 10-35% of the households face survival difficulties and this ratio increases to 50-60% in the remaining three villages.

V.3.5.1.4. Position of Households Facing Survival Difficulties

Villagers facing difficulties of survival usually emigrate to other towns or metropolitan areas (12 villages), take loans (three), and/or practice sharecropping (three), sell their livestock and cultivate extra land (two), and decrease their expenditures. If emigration is considered as an established and structural way out of this pressure, other means could be considered as the actual ways of hardship experienced by these families.

V.3.5.1.5. Wedding Expenditures

Evaluation of wedding expenditures is meaningful since it reflects the villagers' standard of living. Villagers reported that in general, 100-300 million Turkish Lira is needed for a wedding. However, it varies among the villages. In some, a wedding costs up to 100-150 million TL (five villages); while in others, it is 200-250 million TL (eight villages). In only one village does it reach 300 million TL.

V.3.5.2. Standard of Living

In the three of the 14 villages investigated, it was stated that the standard of living of villagers had not changed and the basic reason of this was given as the increase in the level of rice income parallel with the population increase in the households. The four villages that stated that their standard of living had decreased explained it in terms of increase in cost of living.

In seven villages it was stated that the standard of living has improved and explanations given in relation to the technological developments which increased agricultural productivity. Population decline due to emigration has also stimulated the increase in living standards.

V.3.5.2.1. Contentment With Agricultural Crop Prices

Only two villages are content with agricultural crop prices. Others complain that the increase in prices is insufficient (six villages). People in two villages are not pleased with the prices of the previous year and in six villages they are not pleased with any price.

V.3.5.2.2. Measures to Improve the Standard of Living

According to the villagers, measures that should be taken to improve their living standards are as follows (Table V.16):

Table V.16. Measures to Improve Living Standards

Factors	Number of Villages
Reducing Costs of Input	5
Diversification of Labor Use	5
Increase in Credit Facilities	5
Increase in Prices of Agricultural Produce	4
Extra Work	4
Cultivable Land	3
Easy Access to Transport	2
Factory Jobs	2
Improvement in Irrigation Means	2

V.3.5.3. State Services

V.3.5.3.1. State Provisions in the Last Ten Years

In the last ten years the state has supplied telephone (nine villages), road (eight villages), water (seven) and electricity (seven), but no service have been provided to four of the villages.

V.3.5.3.2. Services Expected from the State

The services that villagers demand from the state are especially drainage (six villages), water supply (six), road (five), loans without interest (four), and health center and midwifery (three).

V.3.5.4. Social Life

V.3.5.4.1. Benefits of Relatives

Kinship relations play an important role in maintaining livelihood. They are useful in providing moral support (13 villages), financial support (seven) and labor support (six).

V.3.5.4.2. Surviving and Lost Traditions

According to villagers, many traditions have disappeared, including most of the wedding ceremony (eight villages), wrestling (five), hand weaving (five), paying a bride price (two) and showing respect (one) are traditions which do not continue any more. On the other hand, some respondents said these traditions are still surviving, such as some parts of wedding ceremonies (five villages), paying a bride price (five) and marriage feasts (five).

V.3.6. Considerations Related to the Realization of the Project

V.3.6.1. General Considerations

In the villages surveyed it was declared that they all knew that the Project would be built. It had been 10-30 years or more since they had first heard about the Boyabat Project. Eleven villages had been informed about the Project for 10-30 years and 3 villages for 35-45 years. Majority of them (11 villages) reported that they would not abandon their villages if it was not essential; and were sure that they would face difficulties and hardship due to the involuntary resettlement. Their basic considerations are the place that they would live in the future and the means to secure their livelihood.

V.3.6.2. Considerations Related to Expropriation and Resettlement

Among the surveyed villages, six strongly prefer expropriation whereas nine villages prefer expropriation as much as resettlement. Regarding resettlement, urban resettlement (13 villages) is more preferred than rural resettlement (eight). One village has a rather different preference: house in the town and land in the rural area. Thus, they plan to live in the vicinity of a town and commute to their land for agricultural production.

In almost all villages (12 out of 14), those who want to be resettled prefer resettling collectively. As for the amount of land which will be given in case of resettlement, the villagers define sufficient amount of land either as "sufficient to maintain our livelihood" or "as much as we own".

As far as urban resettlement is concerned, resettlement within the region is more preferred (12 villages) than outside of the region. The same tendency is observed in the case of rural settlement, although less slightly: five villages want to be resettled within the region and three villages outside of the region. In sum, in both types of resettlement, within-region is more desired than outside-region. State support, directed to resettlement, is required particularly in starting up agricultural activities and husbandry in their new settlements (13 villages), in providing employment in towns and cities (10 villages), and in housing (6 villages).

V.3.6.3. General Problems

Villagers who will be affected by the realization of the Project are aware of the fact that they have two alternatives: They can either accept to take the compensation for expropriation or be resettled by the state. According to the villages the problems which would stem from this involuntary resettlement are as follows: likelihood of difficulty in maintaining their livelihood (13 villages); uncertainty regarding the place of resettlement (nine); anxiety in terms of the amount and duration of payment of the compensation for expropriation (six); fear of unemployment (four); fear of mis-investment (two) and emotional unrest due to the fact that their home-land would remain under the lake surface.

V.3.6.3.1. Problems Related to Expropriation

As for the compensation, the villagers have anxieties, such as that the amount of compensation would be insufficient (11 villages); and fear that the amount of compensation would not last for long enough (eight); and concern that it would not be paid all at once (three). The villagers have quite clear ideas about how they would use the compensation: trading and investment (12 villages), purchasing real estate (eight); doing livestock dealing (four); purchasing cars (two). In seven villages, villagers stated that they had not made up their mind yet.

V.3.6.3.2. Problems Related to Resettlement

These problems, as stated by the villagers are: uncertainty regarding the place of resettlement (10 villages); lack of information about the resettlement procedures; possibility of resettling in a poorly productive land (seven) and experiencing hardship in livelihood (four).

V.3.6.4. Responses Related to the Project

V.3.6.4.1. Present Responses of Villagers

Villagers declared that they had done nothing so far (12 villages); emigrated to other towns and cities (seven), stopped their investments within the villages (four); contented with the limited information given by officials (four); and demanded land in Osmançik and Kargi districts (three).

V.3.6.4.2. Possible Responses in the Future

When asked, if they could take action collectively, some villagers declared that they could not (8 villages), some that they could (seven); and others stated that they were not sure whether they could or not (five). When they were asked about what kind of action should be taken and by whom, in relation to the Project, some agreed that everybody must try to do their best (seven), some thought that the most prominent persons in the villages must be influential (seven); and others thought that state and politicians must take care of the issue (five).

V.3.6.4.3. Future Expectations of the Villagers

These expectations of the government are; that it give a decisive decision about the places of resettlement (12 villages); that it provide sufficient land (12); that it pay compensation all at once (10); that it to give them land equivalent to the land that they own (six); that it provide employment (five) and to give credit without interest (one).

V.3.6.5. Considerations Related to Post-Project Period

When villagers were asked to evaluate their future plans, the following occupational areas were stated; starting business (11 villages), engaging in agriculture (eight), engaging in livestock dealing (two) and engaging in forestry work (one).

Villagers were also asked whether they would like to use the new opportunities created in the region following the completion of the Project. The answers were; new opportunities could be used (8 villages); could not be used generally (seven); could not be used due to lack of information (six) and due to lack of education (three). In one village it was stated that new opportunities could be used by engaging in fishery.

The majority of villagers reported that they would return to the region if they could. In one village, the main tendency was not to return. In five villages, people stated that both decisions were plausible.

Nine villages complained about the uncertainty regarding the kind of opportunities that they would have after the resettlement. Eight villages expected that there could be better employment opportunities, others stated that they could have opportunities such as school (four), medical care (three), housing (three), cultivable land (two) and transportation facilities (two).

V.3.6.6. Advantages and Disadvantages of the Project

In some of the villages people were optimistic about the Boyabat Project, considering the possible employment chances that might be created during the construction period. In some of them, villagers are doubtful about the loss of land and the amount of compensation to be paid.

V.3.6.6.1. Those Who Would Suffer

According to the villagers, they would suffer due to the involuntary resettlement (all 14 villages), would have financial loss (all), would experience difficulty in obtaining a new settlement (13) and would become unemployed (13). Those who would experience such a hardship would be the poor people (14 villages); old and destitute people (all); those who have very little land (seven); those who do not have a marketable skill (three); those who have plenty of land (two) and women (two).

V.3.6.6.2. Those Who Would Benefit

According to the villagers, the groups who would take advantage of the realization of the Project are those who have ample land (one village), those who own lorries and engage in transportation (one); and the state (one).

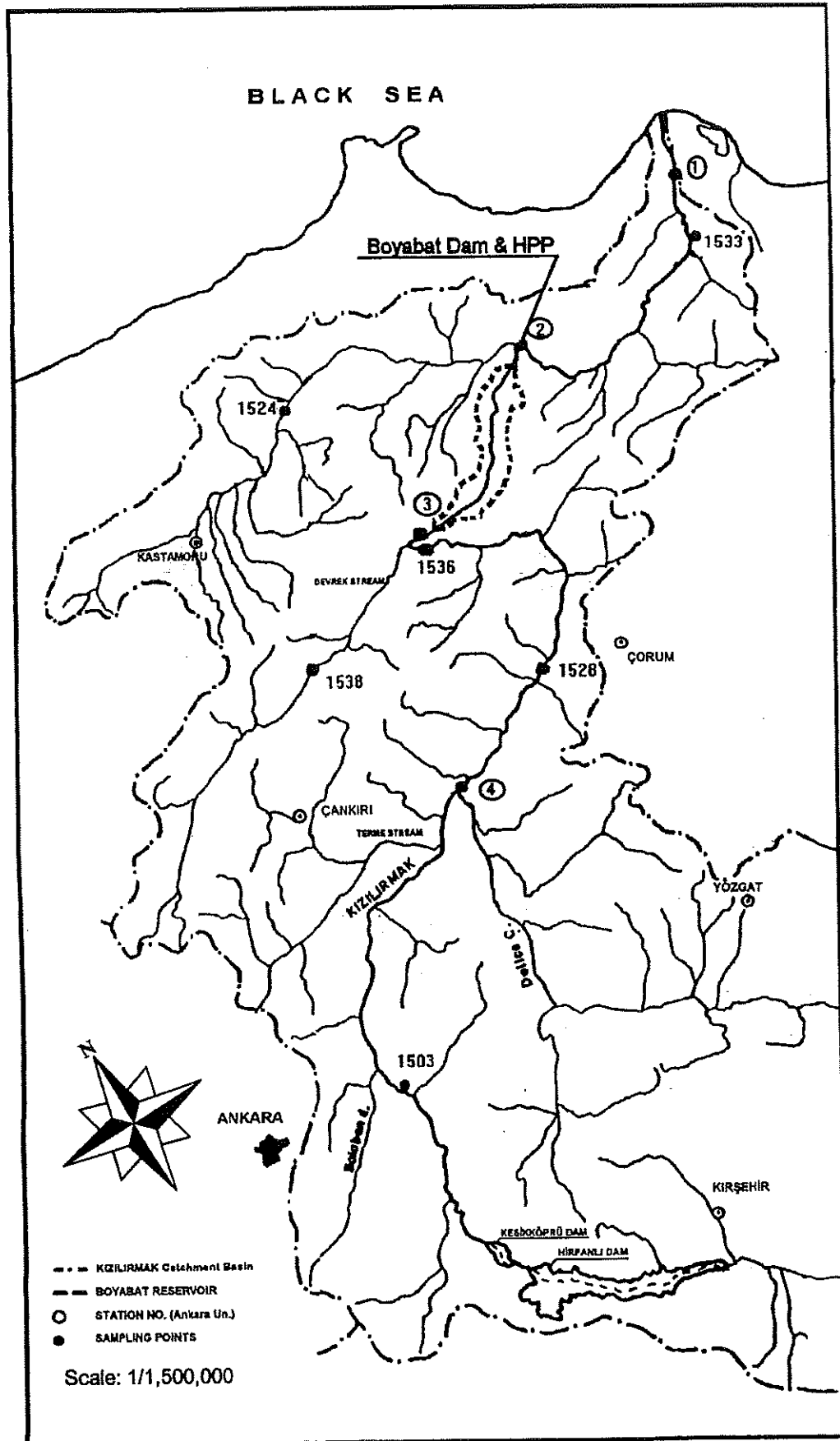


Figure V.1. Locations of the Water Quality Sampling Points for Boyabat Project on Kizilirmak River

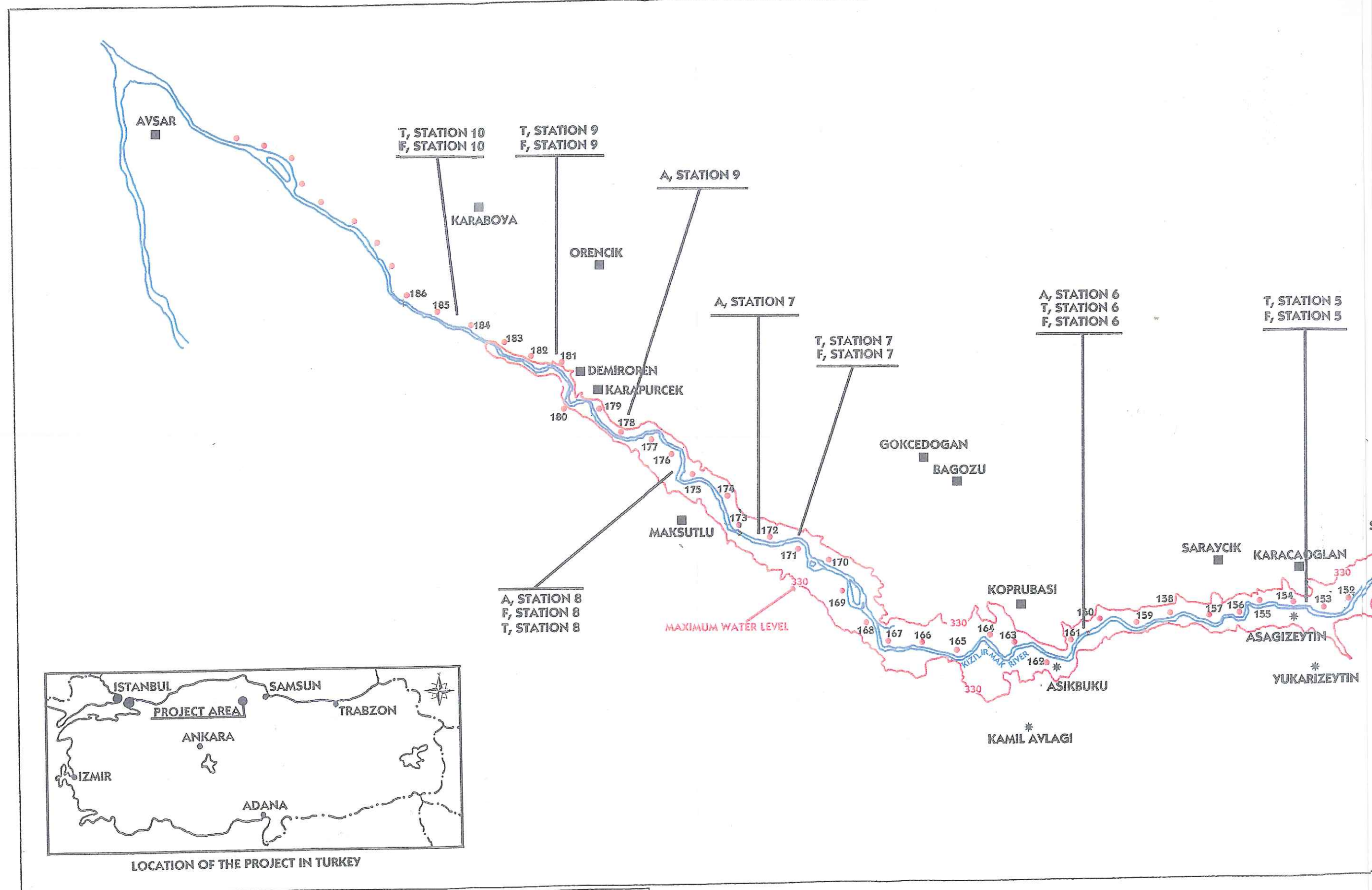
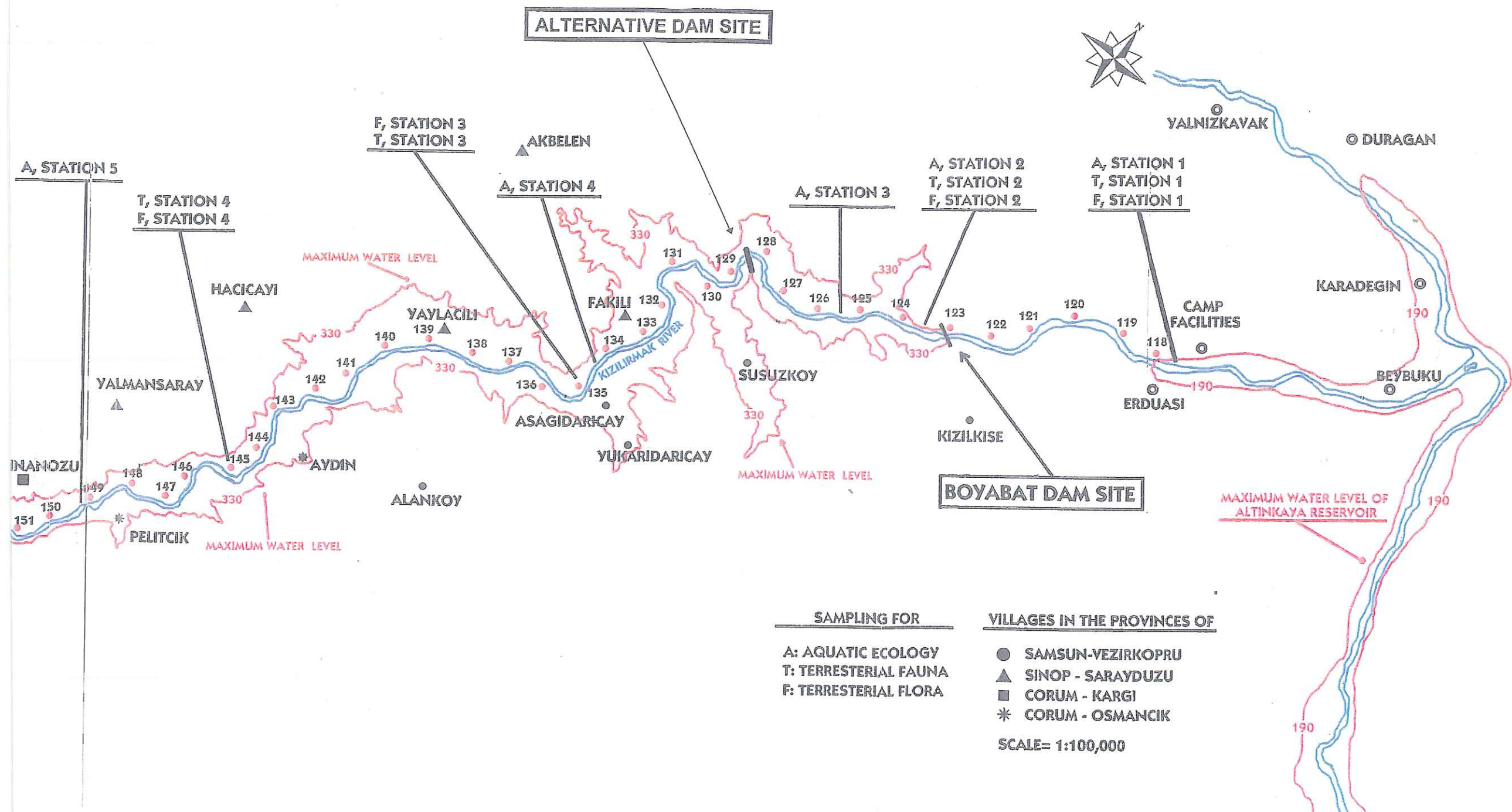


Figure V.2. Future Boyabat Reservoir Area and 1997 Field Study Sampling Stations



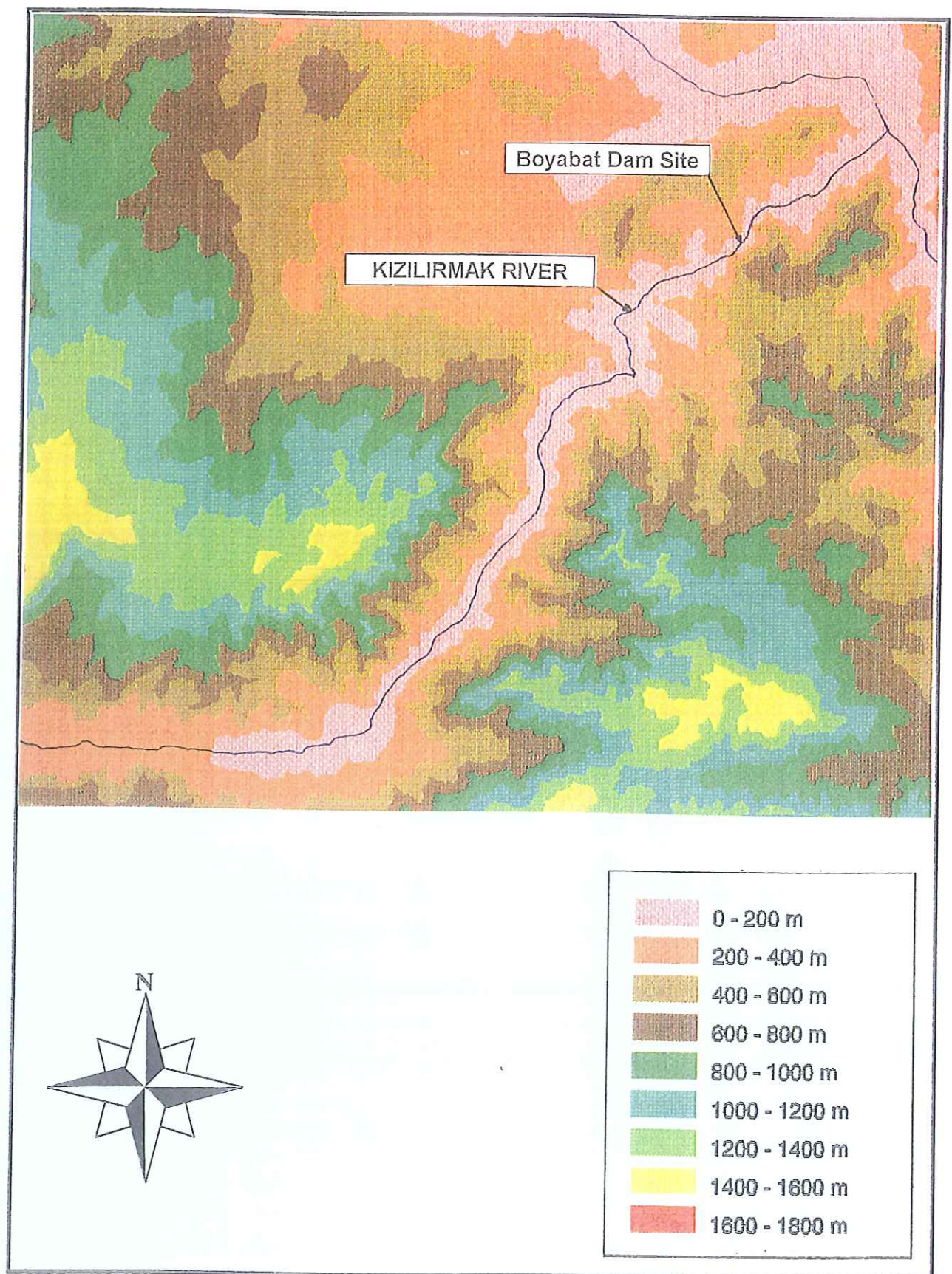


Figure V.3. Two Dimensional Elevation Map of the Project Area

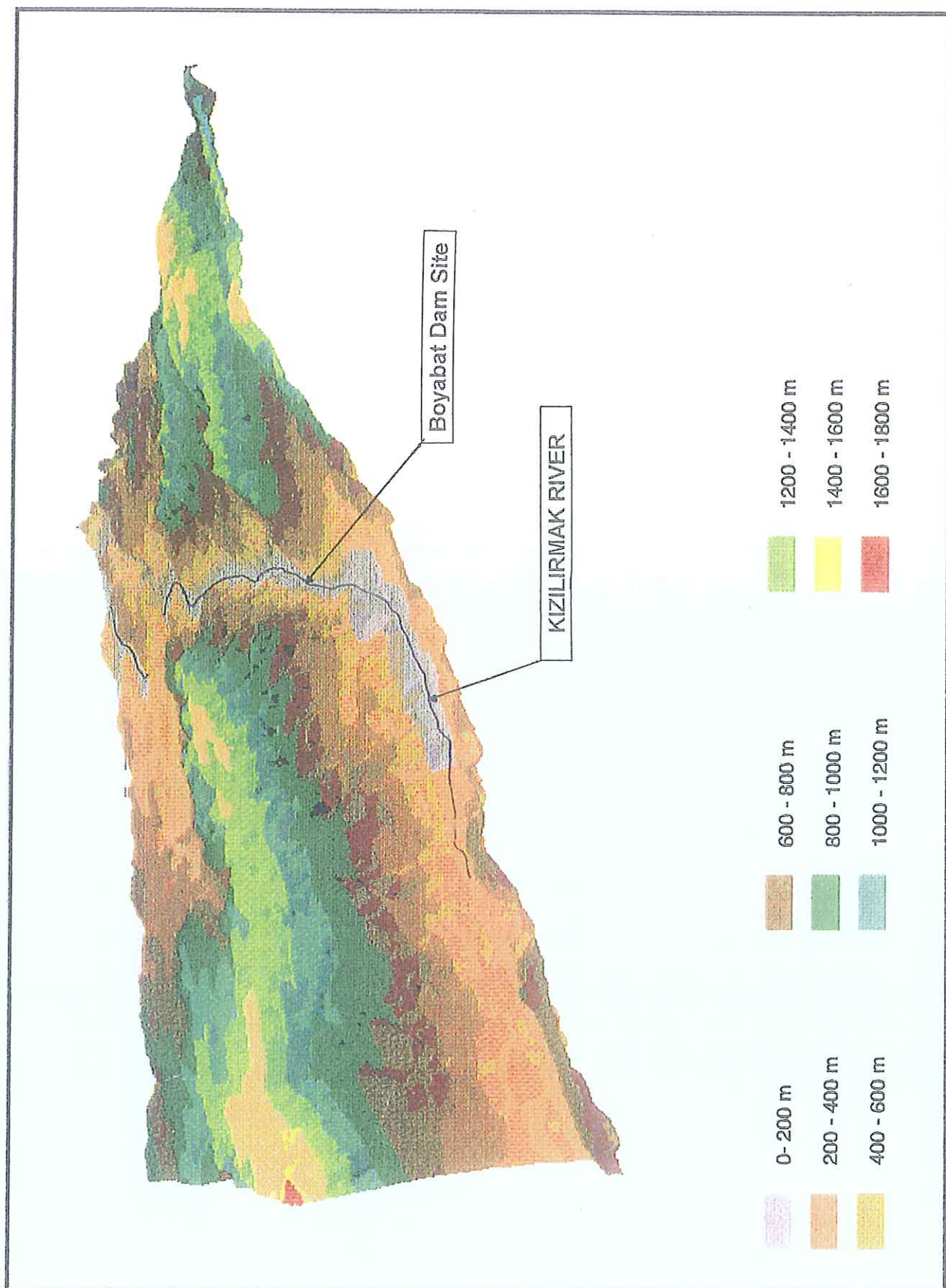


Figure V.4. Three Dimensional Elevation Map of the Project Area

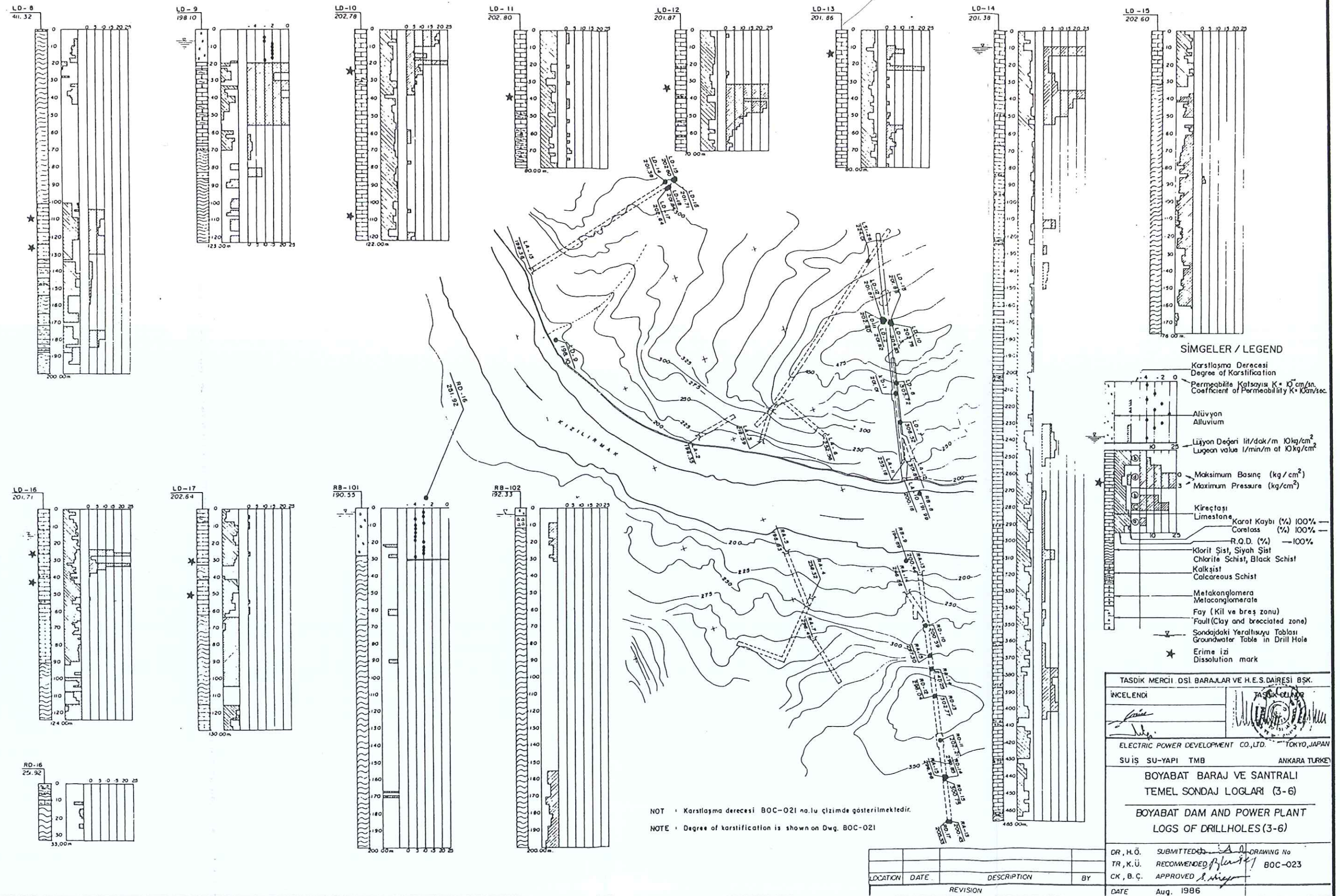


Figure V.5. Locations of Drill Holes of the Boyabat Dam Site

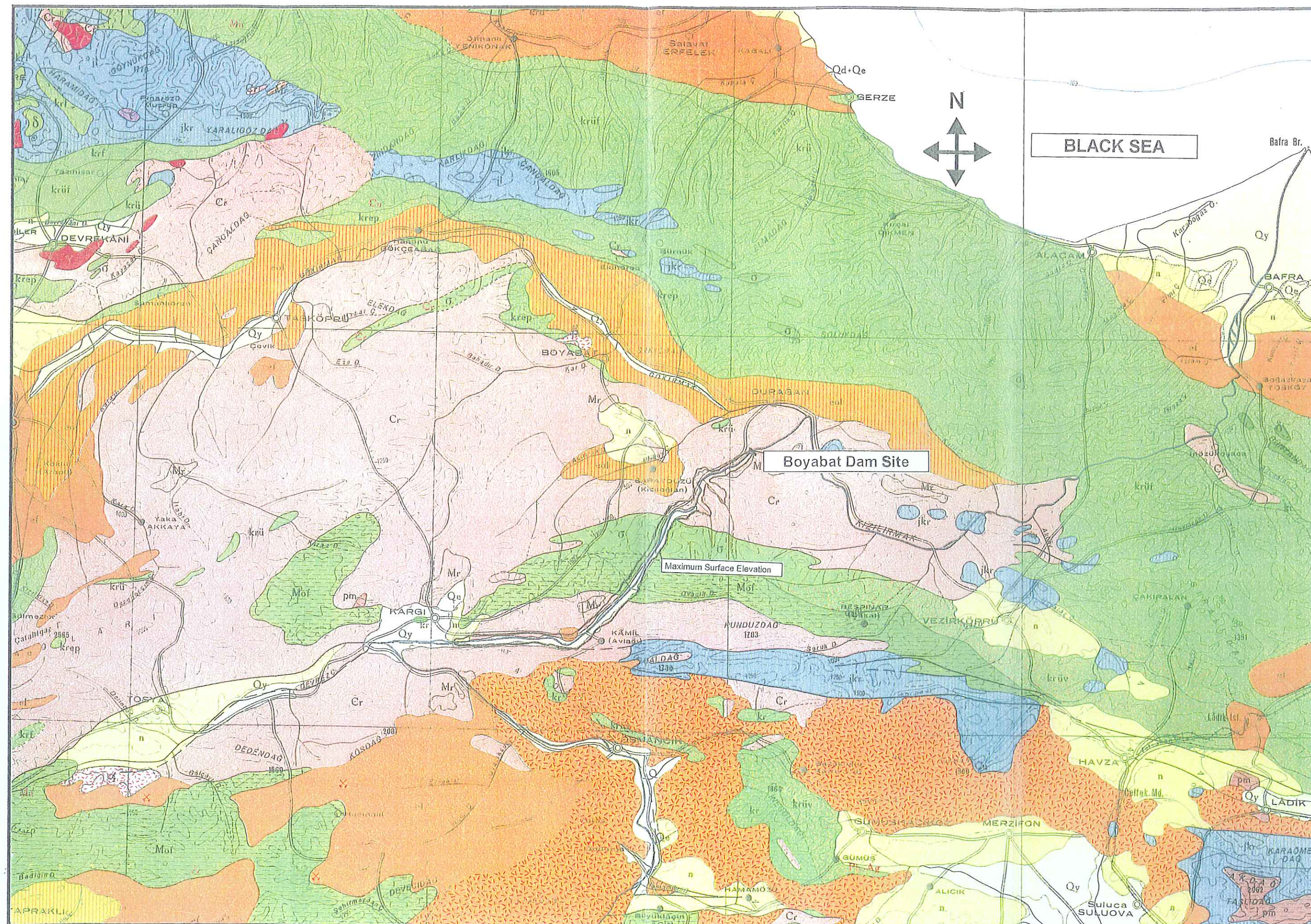


Figure V.6. Geological Map of the Region

	KUATERNER, KARASAL, AYRILMAMIŞ QUATERNARY, CONTINENTAL, UNDIFFERENTIATED		PERMİEN PERMIAN
	KUATERNER, DENİZEL, AYRILMAMIŞ QUATERNARY, MARINE, UNDIFFERENTIATED		KARBONİFER (KÖMÜRLÜ) CARBONIFEROUS (COAL - BEARING)
	HOLOSEN, YENİ ALÜVYON HOLOCENE, RECENT		METAMORFİK SERİ, AYRILMAMIŞ METAMORPHIC SERIES, UNDIFFERENTIATED
	PLEİSTOSEN, ESKİ ALÜVYON PLEISTOCENE		MERMER, KRİSTALİZE KALKER VE DOLOMIT MARBLE, CRYSTALLINE LIMESTONE AND DOLOMITE
	NEOJEN, KARASAL, AYRILMAMIŞ NEOGENE, CONTINENTAL, UNDIFFERENTIATED		KUARSİT QUARTZITE
	NEOJEN, JİPSLİ FASİES (TUZLU) NEOGENE, GYPSIFEROUS FACIES (SALT - BEARING)		GNAYS, MİKAŞİST, AMFİBOLİT GNEISS, MICASCHIST, AMPHIBOLITE
	PLİOSEN, KARASAL PLIOCENE, CONTINENTAL		
	OLİGO - MİOSEN, JİPSLİ FASİES OLIGO - MIOCENE, GYPSIFEROUS FACIES		GRANİT, GRANODİORİT, KUARSLI DİORİT GRANITE, GRANODIORITE, QUARTZ - DIORITE
	EOSEN - OLİGOSEN EOCENE - OLIGOCENE		DİORİT, GABRO, DİABAZ DIORITE, GABBRO, DIABASE
	EOSEN, AYRILMAMIŞ EOCENE, UNDIFFERENTIATED		SERPANTİN SERPENTINE
	EOSEN, VOLKANİK FASİES EOCENE, VOLCANIC FACIES		RİYOLİT, DASİT RHYOLITE, DACITE
	EOSEN, FLİŞ EOCENE, FLYSCH		ANDEZİT, SPİLİT, PORFİRİT ANDESITE, SPILITE, PORPHYRITE
	ORTA EOSEN, LÜTESİEN MIDDLE EOCENE, LUTETIAN		BAZALT, DOLERİT BASALT, DOLERITE
	ALT EOSEN, PALEOSEN LOWER EOCENE, PALEOCENE		
	ÜST KRETASE - PALEOSEN UPPER CRETACEOUS - PALEOCENE		FORMASYON SINIRI FORMATION BOUNDARY
	MESOZOİK (OFİOLİTLİ SERİ), EKSERİYA KRETASE MESOZOIC (OPHIOLITIC SERIES), MAINLY CRETACEOUS		MUHEMEL FORMASYON SINIRI ESTIMATED BOUNDARY
	MESOZOİK, AYRILMAMIŞ, EKSERİYA KALKER MESOZOIC, UNDIFFERENTIATED, MAINLY LIMESTONES		ŞARİYAJ, BİNDİRME, FAY OVERTHRUST, UPTHRUST, FAULT
	KRETASE, AYRILMAMIŞ CRETACEOUS, UNDIFFERENTIATED		MUHEMEL ŞARİYAJ, BİNDİRME, FAY PROBABLE OVERTHRUST, UPTHRUST, FAULT
			SICAK SU VE MADEN SUYU KAYNAĞI HOT WATER AND MINERAL WATER SPRINGS
			KROM CHROMITE
			MANGANEZ MANGANESE
			KURŞUN LEAD
			KAYA TUZU ROCK SALT
			LİNYİT ve TAŞKÖMÜR LIGNITE and COAL

Figure V.6. Geological Map of the Region, Legend

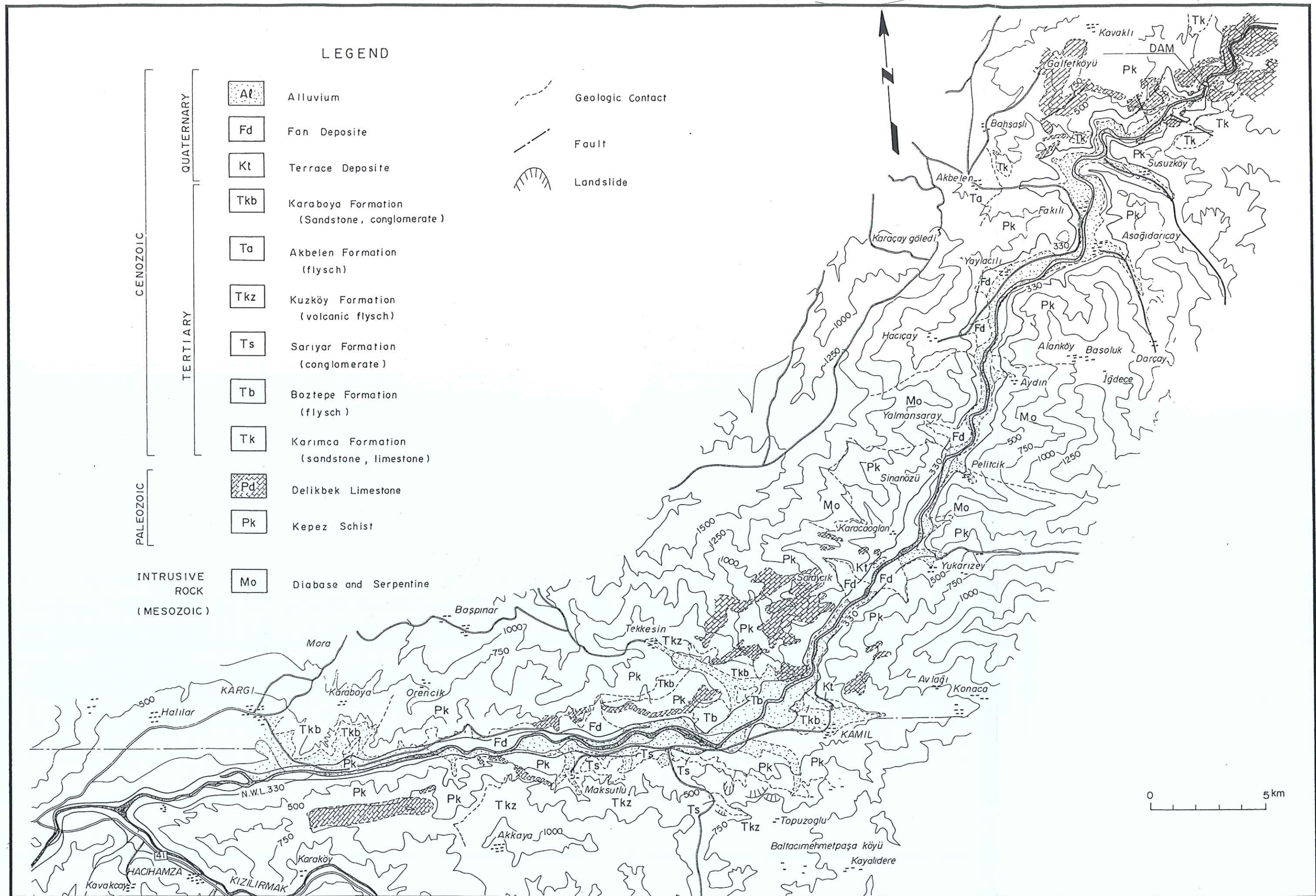


Figure V.7. Geological Plan of the Project Area

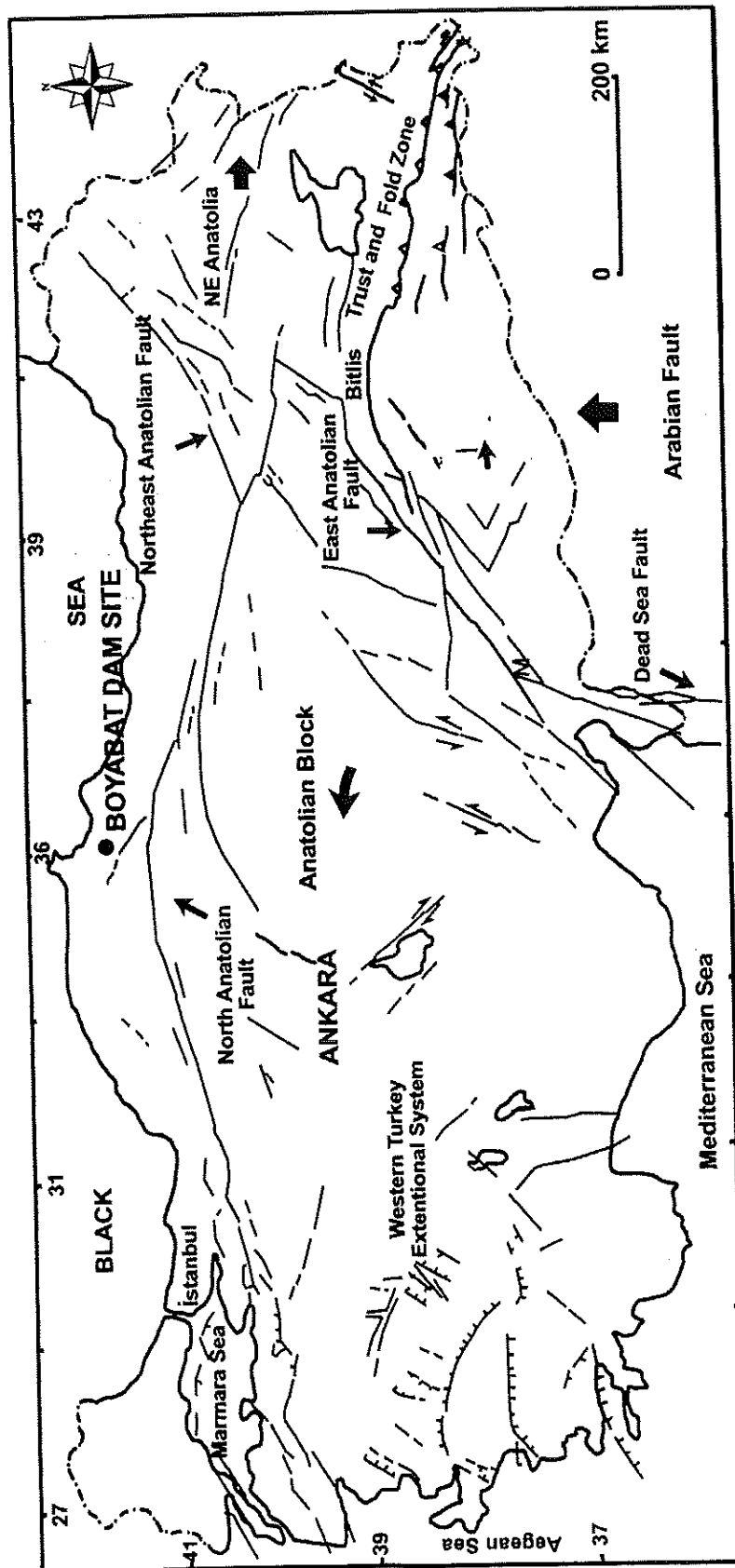
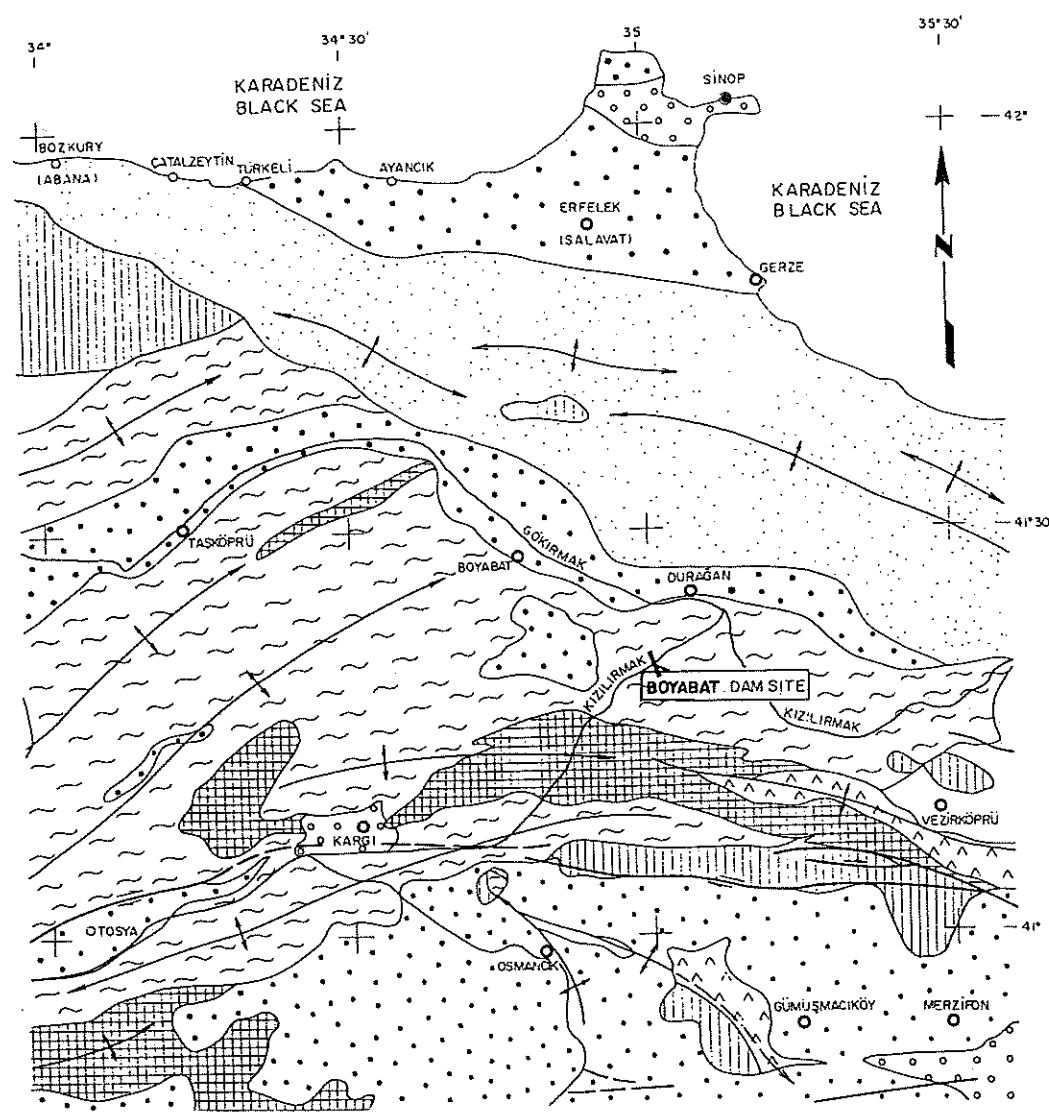


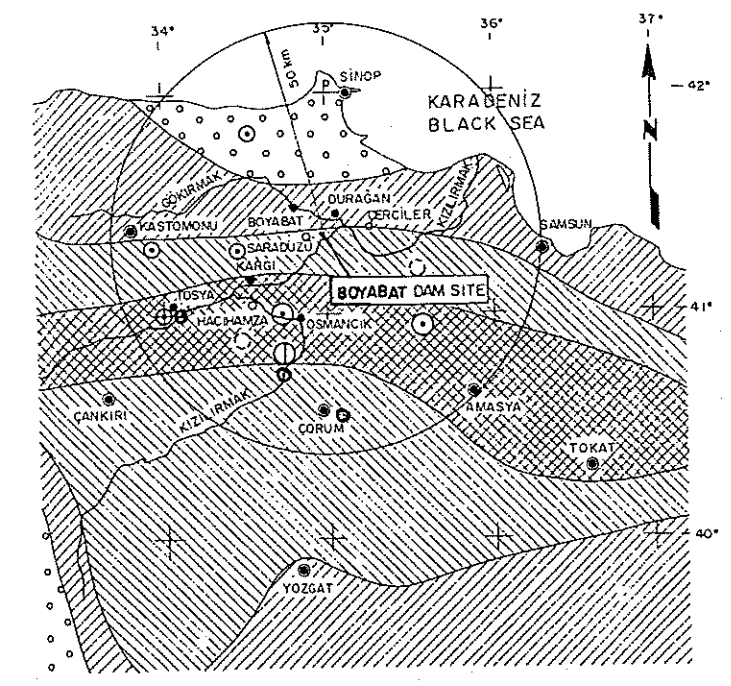
Figure V.8. Tectonic Map of Turkey



TECTONIC MAP

LEGEND

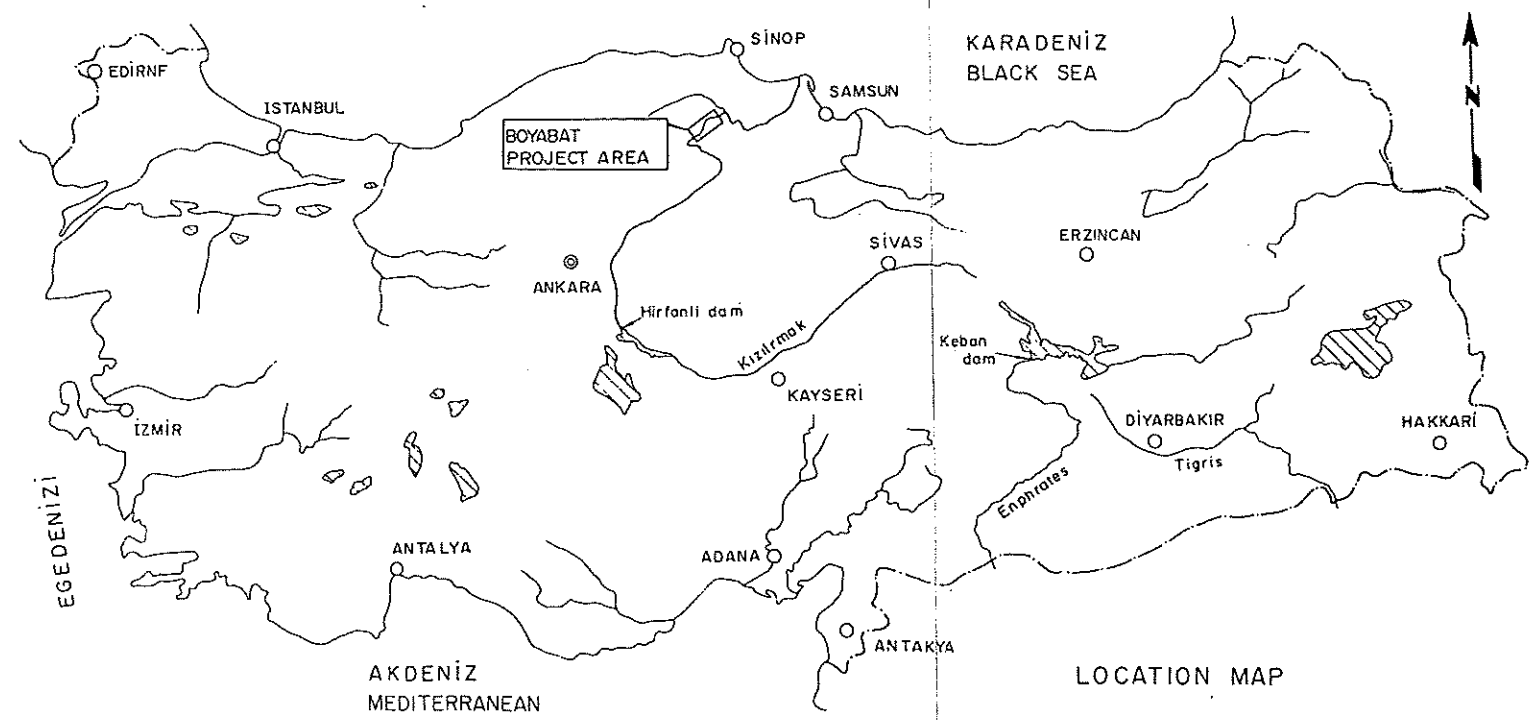
- Quaternary
- Tertiary
- Upper Cretaceous Flysch and Volcanics
- Mesozoic Ophiolitic Series
- Mesozoic Limestone
- Metamorphic Series
- Fold Axis
- Fault



SEISMIC MAP

LEGEND

- Primary Degree Earthquake Region
- Secondary Degree Earthquake Region
- Third Degree Earthquake Region
- Fourth Degree Earthquake Region
- M.S. 11 - 1995 arası
- Shallow Earthquakes
- Earthquakes of Unknown Magnitude
- Macroseismic Epicenters:
 - Moderate 5.4 ≤ M ≤ 5.9
 - Severe Destructive 5.9 ≤ M ≤ 6.9
- Instrumental Epicenters



LOCATION MAP

References cited

- 1 Geological Map of Turkey, Scaled 1/500000 (M.T.A. Publication)
- 2 Earthquake Catalogue of Turkey & Surroundings (Ist. Tech. Uni. Pub.)
- 3 Map of Earthquake Regions of Turkey (Ministry of Reconstruction and Settlement)

Figure V.9. Seismic Map of the Region

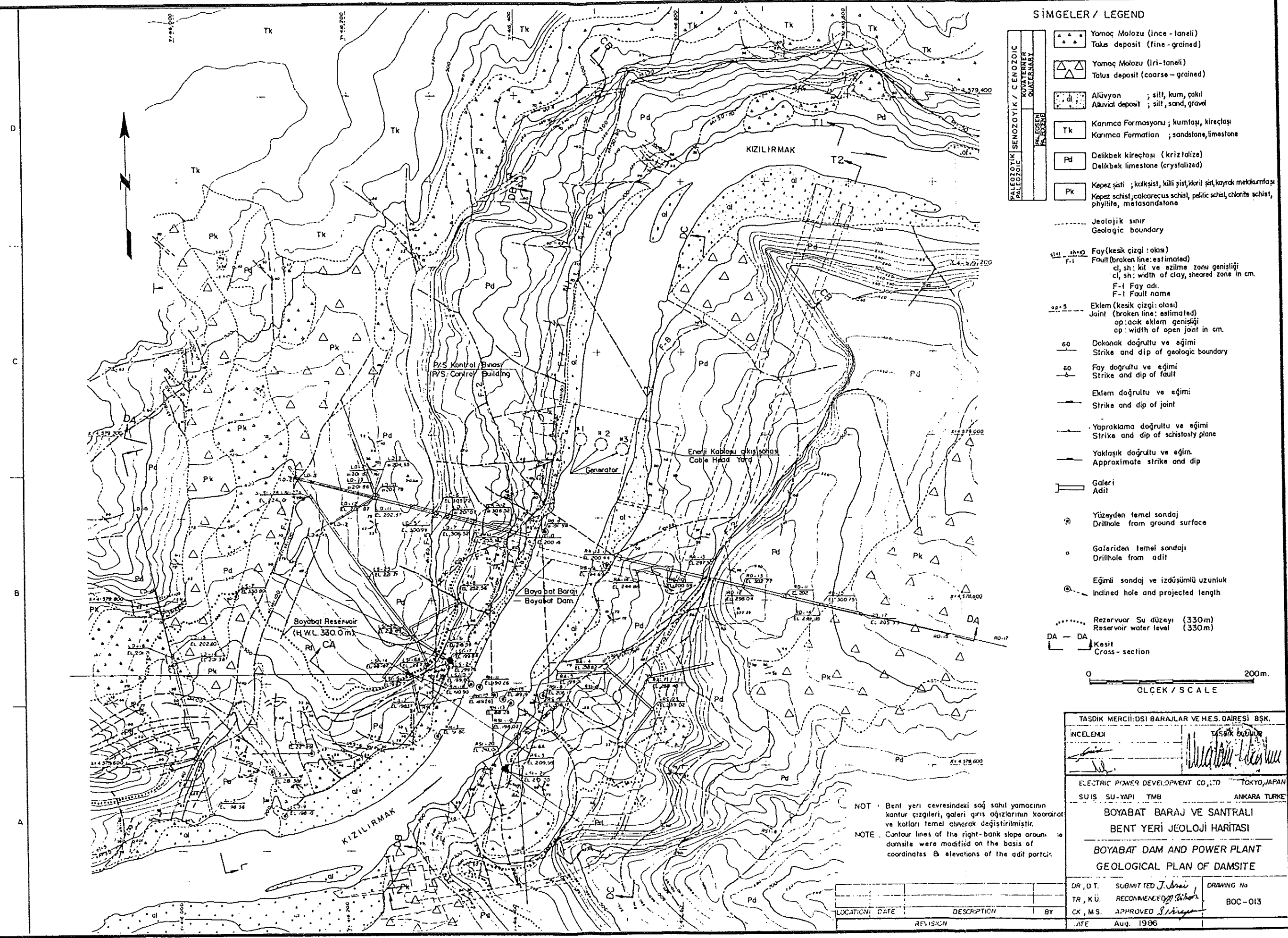
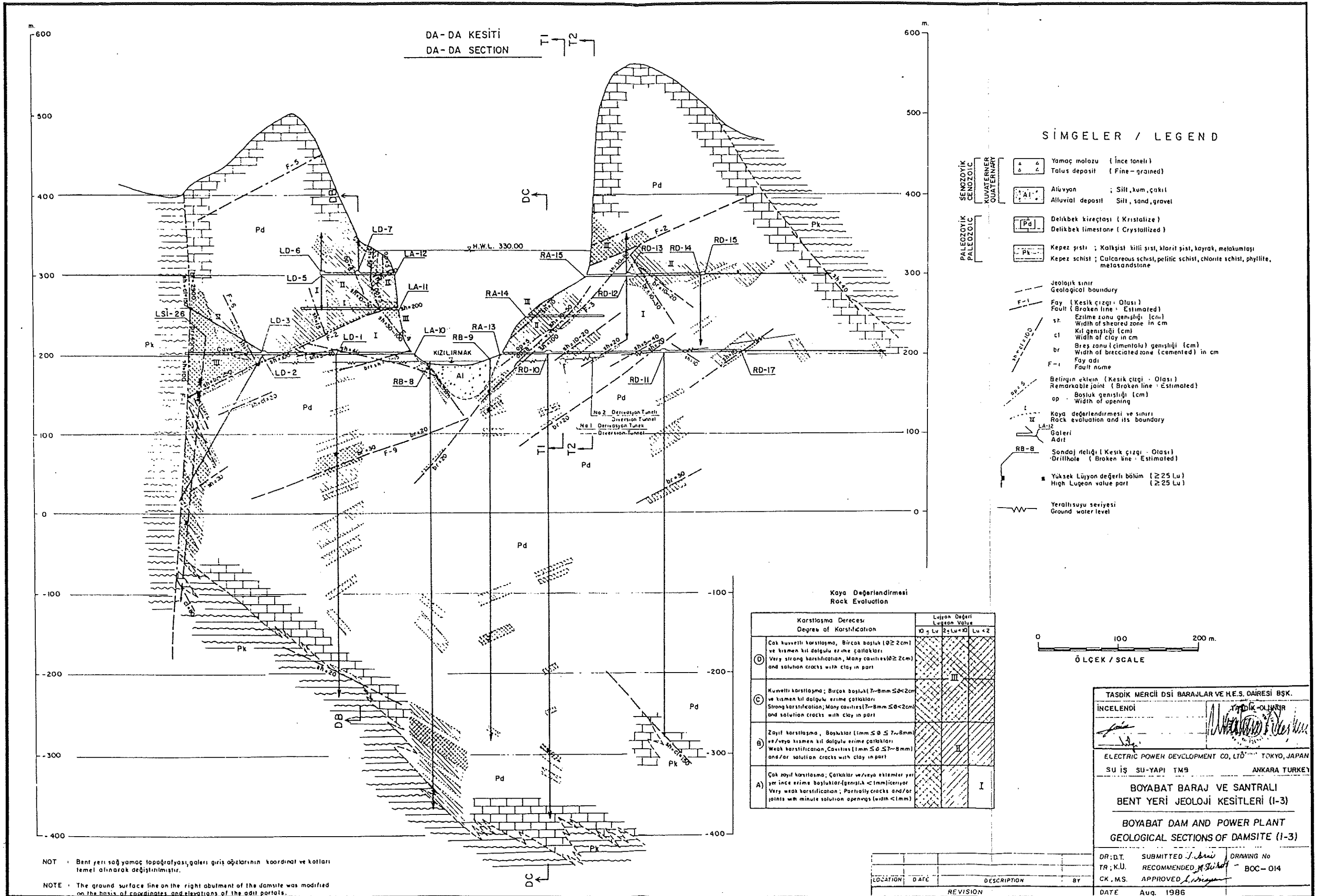


Figure V.10. Geological Plan of the Dam Site



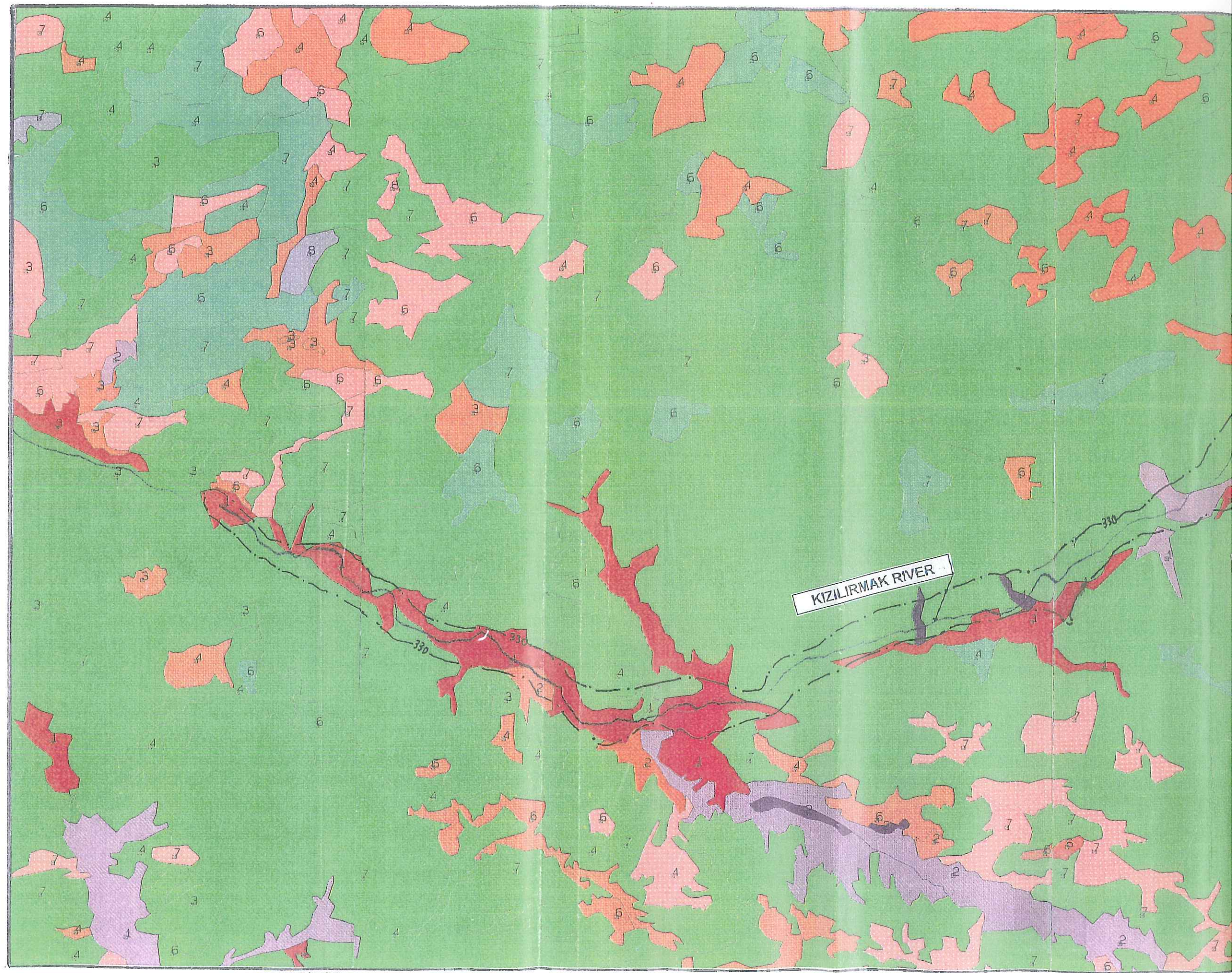
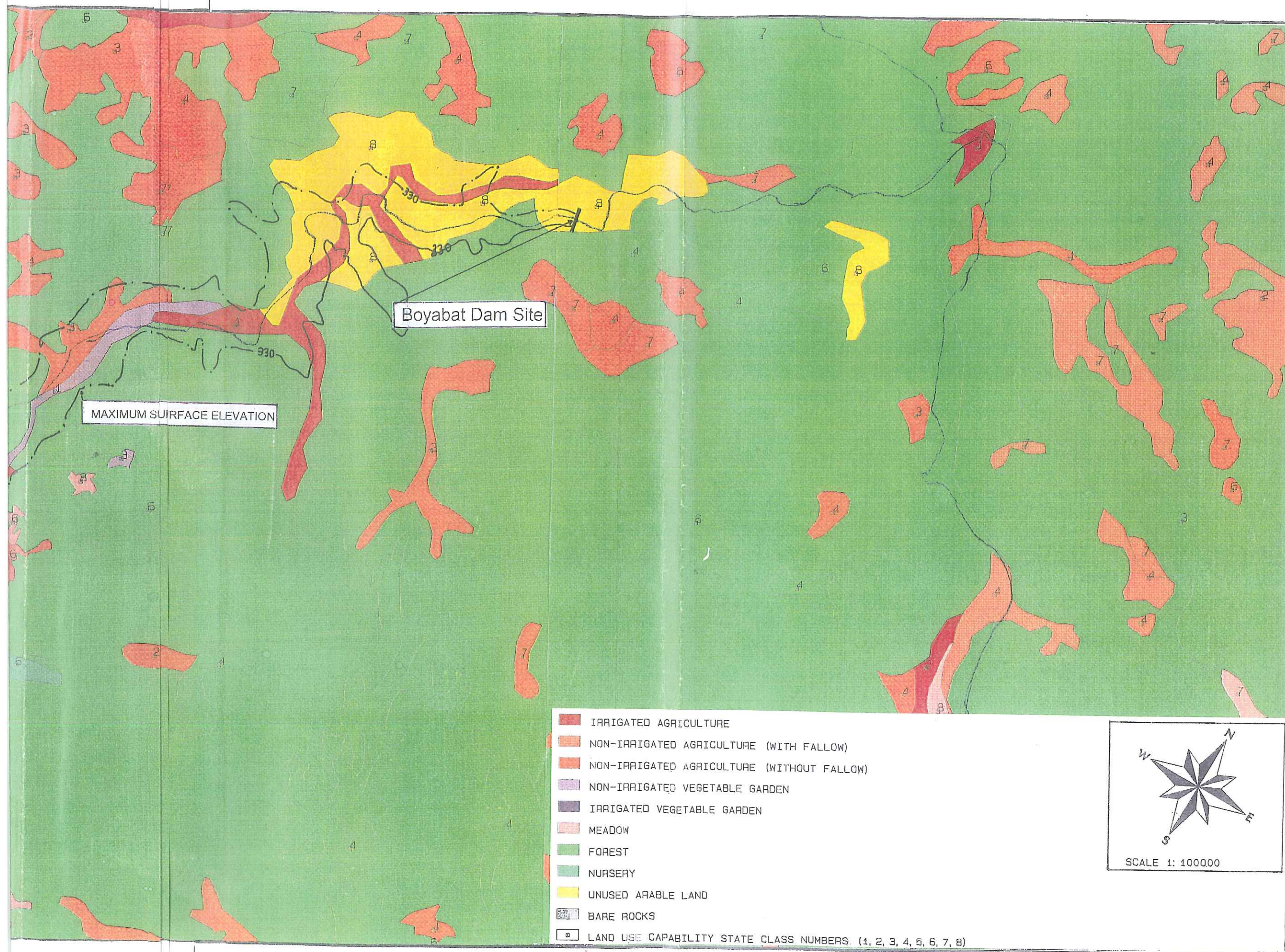


Figure V.12. Land Use Map of the Project Area



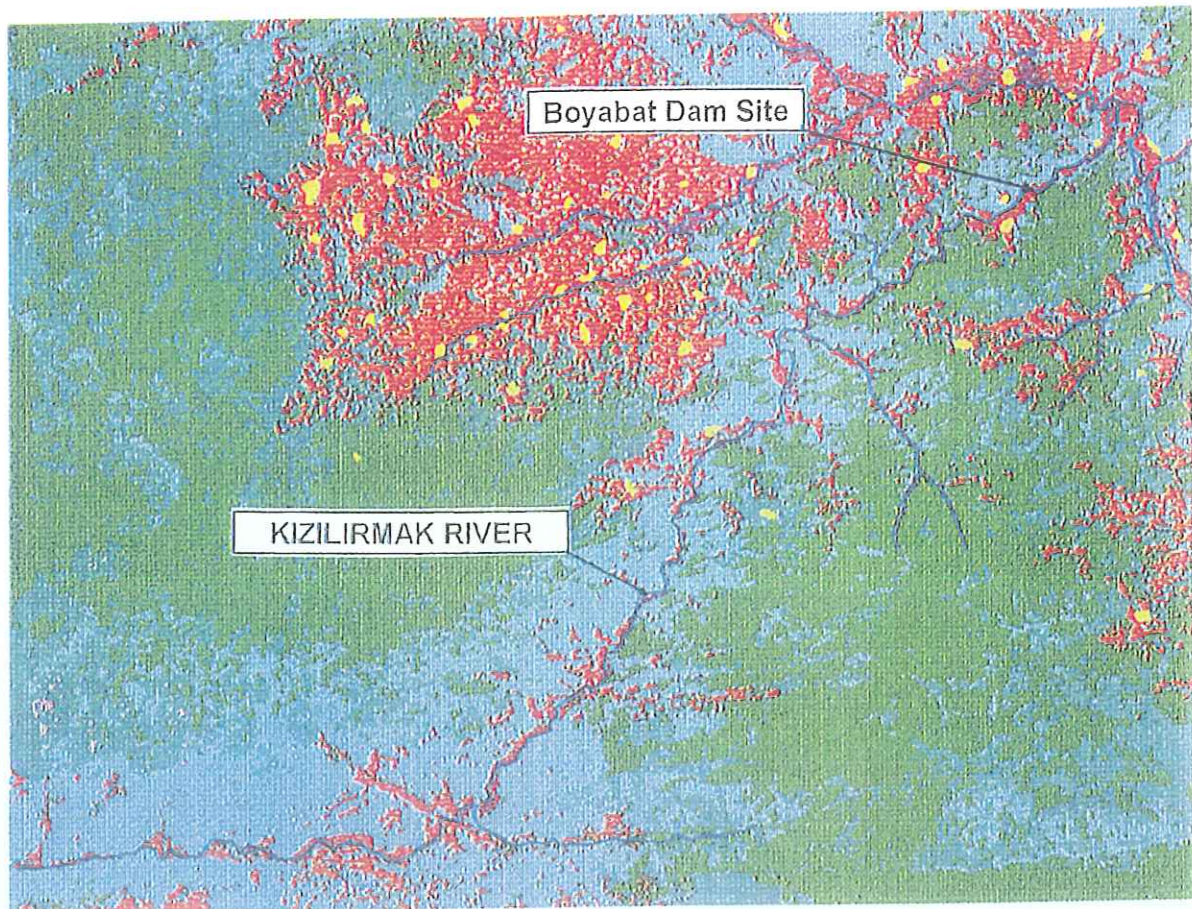


Figure V.13. Classified Image of the Region