URBAN COASTAL SETTLEMENTS: IMPLEMENTATION OF A COASTAL AREA ASSESSMENT MODEL IN ISKENDERUN CASE

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ABSTRACT

URBAN COASTAL SETTLEMENTS: IMPLEMENTATION OF A
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Coastal urban settlements require a special planning approach since they bring the concepts of "*urban*" and "*coastal*" together. In relation to the specific contents of these concepts, there are also different models of management plans. "*Urban Disaster Risk Management*" and "*Integrated Coastal Zone Management*" are two of them. Urban Disaster Risk Management model deals with the planning and management problems of urban settlements in the case of disaster risk conditions. Likewise, Integrated Coastal Zone Management model focuses on the whole coastal area and deals with the sustainable use and protection of all types of coastal resources. However, in case of urban coastal settlements, these models of management plans can be valid together, can overlap, and they can even conflict with each other.

In this thesis study, these two models of management plan and their coexistence are considered. A Coastal Area Assessment Model is set up and applied for Iskenderun case. This model provides a detailed spatial analysis opportunity in planning and management of coastal urban settlement. Therefore the model offers a significant input for the planning process through determining urban and coastal risks at the same time. Coastal Area Assessment Model is a tool which takes both Urban Disaster Risk Management and

Integrated Coastal Zone Management models' concerns into account and evaluates the coastal settlement in terms of urban risk sectors and coastal management issues.

This study also introduces an approach on classification of the coastal areas and coastal urban settlements while setting up the Coastal Area Assessment Model.

Coastal Area Assessment Model becomes an advantageous tool since it has significant contributions to the planning process by making a simple risk analysis and guiding the proper utilization and protection of the population, built environment, and resources of the coastal areas. Risk sectors, coastal management issues, critical and prior intervention areas of a coastal urban settlement are easily determined, and preparation of development plans of a coastal settlement is guided by the implementation of Coastal Area Assessment Model. In addition to these, general principles on planning and management of coastal settlements are determined by the implementation of the model for the implementation conditions of Urban Disaster Risk Management model, Integrated Coastal Zone Management model, and the Coastal Area Assessment Model in Turkey are also discussed and presented.

Key Words: Coastal Uses, Coastal Classification, Urban Disaster Risk Management, Integrated Coastal Zone Management, Coastal Area Assessment Model, Urban Land-Use Planning, Coastal Development, Iskenderun.

ÖZ

KENTSEL KIYI YERLEŞMELERİ: BİR KIYI ALANI DEĞERLENDİRME MODELİNİN İSKENDERUN ÖRNEĞİNDE UYGULANMASI

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Kentsel kıyı yerleşmeleri, “*kentsellik*” ve “*kıyı*” kavramlarını biraraya getirmesi bakımından özellikli bir planlama yaklaşımını gerektiren alanlardır. Her iki kavramın kendine özgü içerikleri nedeni ile ortaya çıkmış çeşitli yönetim planı modelleri de bulunmaktadır. “*Kentsel Afet Riskleri Yönetimi*” ve “*Bütünleşik Kıyı Alanları Yönetimi*” modelleri bunlardan ikisidir. Kentsel Afet Riskleri Yönetimi, afet riskleri koşullarına karşı kentsel yerleşmenin planlanması ve yönetimi sorunları ile ilgilenir. Benzer şekilde, Bütünleşik Kıyı Alanları Yönetimi de kıyı alanının tümüne odaklanır ve her türlü kıyı kaynağının sürdürülebilir kullanımı ve korunması ile ilgilenir. Ancak kentsel kıyı yerleşmelerinde bu iki modelinin aynı alanda geçerli olması, çakışması ve hatta çatışması durumları ortaya çıkmaktadır.

Bu tez çalışmasında kentsel kıyı yerleşmeleri için söz konusu olan bu iki yönetim planı modelinden ve bunların birlikteliğinden yola çıkılarak, kentsel kıyı yerleşmelerinin planlanması ve yönetiminde detaylı bir mekansal analiz olanağı sunan, planlama sürecine önemli girdi sağlayan, kentsel ve kıyısal risklerin belirlenmesine olanak sunan, ayrıca da söz konusu iki yönetim planı modelinin birlikte uygulanabilirliğini sağlayan bir araç olarak Kıyı Alanı Değerlendirme Modeli süreci geliştirmiş ve bu süreç İskenderun kenti için uygulamıştır. Kıyı Alanı Değerlendirme Modeli, hem Kentsel Afet Riskleri Yönetimi hem de Bütünleşik Kıyı Alanları Yönetimi modellerinin kaygılarını hesaba katmakta ve kıyı

yerleşmesini kentsel risk sektörleri ve kıyı yönetimi konuları bakımından değerlendirmektedir.

Bu çalışmada, Kıyı Alanı Değerlendirme Modeli'nin geliştirilmesi sürecinde kıyı alanlarının ve kıyı yerleşmelerinin sınıflandırılmasına yönelik de bir yaklaşım sunulmaktadır. Bu sınıflama yaklaşımı ile, Kentsel Afet Riskleri Yönetimi ve Bütünleşik Kıyı Alanları Yönetimi modellerinin temel kaygıları Kıyı Alanı Değerlendirme Modeli'nin ana hatları oluşturmaktadır.

Uygulama sonucunun değerlendirilmesi ile, geliştirilen Kıyı Alanı Değerlendirme Modeli'nin planlama sürecine ciddi katkı koyarak basit bir risk analizi yapması, kıyı alanlarındaki nüfusun, kaynakların ve yapılı çevrenin hem korunması hem de doğru kullanılmasını yönlendiren bir araç olması avantajları ortaya koyulmuştur. Kıyı Alanı Değerlendirme Modeli'nin uygulanması ile; risk sektörleri, kıyı yönetimi konuları, kentsel kıyı yerleşmesinin ciddi ve öncelikli müdahale gerektiren parçaları kolaylıkla belirlenmekte ve kıyı yerleşmesinin imar planlarının hazırlanması yönlendirilmektedir. Ayrıca İskenderun örneğindeki özel uygulamadan yola çıkarak kentsel kıyı yerleşimlerinin planlanması ve yönetimine ilişkin genel ilkeler çıkarılmış, oluşturulan model ve Kentsel Afet Riskleri Yönetimi ile Bütünleşik Kıyı Alanları Yönetimi plan modellerinin Türkiye'deki işlerlik koşulları ve gereklilikleri tartışılarak ortaya koyulmuştur.

Anahtar Kelimeler: Kıyı Kullanımları, Kıyı Sınıflama, Kentsel Afet Riski Yönetimi, Bütünleşik Kıyı Alanları Yönetimi, Kıyı Alanı Değerlendirme Modeli, Kentsel Arazi Kullanım Planlaması, Kıyı Gelişimi, İskenderun.

To my beloved parents;

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ABPRS	: Address Based Population Record System
ALARP	: As Low As Reasonably Practicable
CAAM	: Coastal Area Assessment Model
CBD	: Central Business District
CRS - ERT	: Catholic Relief Services - Emergency Response Team
CVI	: Coastal Vulnerability Index
CSoVI	: Coastal Social Vulnerability Index
CZM	: Coastal Zone Management
DEWA	: Division of Early Warning Assessment
EEZ	: Exclusive Economic Zone
EIA	: Environmental Impact Assessment
FEMA	: Federal Emergency Management Agency
GEF	: Global Environmental Facility
GIS	: Geographical Information Systems
GPA	: Global Programme for Action
ICR	: Iskenderun Coastal Region
ICZM	: Integrated Coastal Zone Management
IDNDR	: International Decade for Natural Disaster Risk Reduction
IPCC	: Intergovernmental Panel on Climate Change
ISDEMIR	: Iskenderun Iron-Steel Cooperation (*İskenderun Demir – Çelik Fabrikası*)
ITU	: Istanbul Technical University
IUCN	: International Union for Conservation of Nature
LNG	: Liquid Natural Gas
MAP	: Mediterranean Action Plan
MP	: Master Plan
n.m.	: Nautical Miles
NOAA	: National Oceanic and Atmospheric Administration
OECD	: Organization for Economic Co-operation and Development
OIE	: Organized Industrial Estate

PAP	: Priority Action Programme
PVI	: Place Vulnerability Index
RAC	: Regional Activity Center
RADIUS	: Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters
SAP	: Southeastern Anatolian Project (*Güneydoğu Anadolu Projesi*)
SEPA	: Special Environmental Protection Area
SLR	: Sea Level Rise
SPO	: State Planning Organization (*Devlet Planlama Teşkilatı*)
SWOT	: Strengths – Weaknesses – Opportunities – Threats
TEM	: Trans European Motorway
TPAO	: Turkish Petroleum Corporation (*Türkiye Petrolleri Anonim Ortaklığı*)
TURKSTAT	: Turkish Statistical Institute (*Türkiye İstatistik Kurumu*)
UDRM	: Urban Disaster Risk Management
UN	: United Nations
UNDP	: United Nations Development Programme
UNEP	: United Nations Environmental Programme
UNISDR	: United Nations International Strategy for Disaster Reduction
UNCLOS	: United Nations Conference on the Law of the Sea
US	: United States
USGS	: United States Geological Survey
WB	: World Bank
WHO	: World Health Organization
WRI	: World Resource Institute
WWF	: World Wildlife Foundation (World Wide Fund for Nature)

CHAPTER 1

INTRODUCTION

Coastal urban settlements are distinctive areas of planning due to their special condition of complexity caused by intersection of two different worlds; land and sea. General planning approaches for any type of urban settlement, or usual and required management issues for any coastal area may probably not be applicable or adequate for coastal urban settlements. That means any type of urban-specific management plan or any type of coast-specific management plan is not efficient and operative for coastal urban settlements. These areas require either an integrated formulation of existing management plans, or a new type of comprehensive approach includes both urban-specific and coast-specific issues. Therefore, in this study the focus is on the problem of managing urban risks and coastal areas in a coastal urban settlement concurrently.

Almost every place on Earth has encountered one or more natural hazard. A vast number of people live in the areas subject to devastation by the Earth's natural processes. Every year floods, hurricanes, earthquakes, and other types of hazards affect communities by destroying homes and normal lives of people, and also by causing great physical damage. Most of the time, different kinds of hazards result in *disasters* which have been affecting rural and urban areas, coastal or non-coastal places. Natural disasters have significant effects especially in urban areas because of great population and built environment density.

Considering both observable physical damages and other effects (on social and economic structure, and in terms of aesthetic concerns) caused by disasters, governments have to do something in terms of making both communities and built environment more resilient and strengthening the resistance capacity of settlements by developing and implementing prevention and mitigation related policies and strategies. This situation requires *risk management* efforts. Taking action against disasters (before, during and after disasters) is a social responsibility of communities and governments since they are responsible for the losses in possible future disasters. People (managers, administrators, government authorities, bureaucrats, etc.) make the decisions on what to put on the way of disasters. Accordingly, risk management is basically a problem of *decision making*. Making decisions and implementing policies attain a multidimensional character especially in urban areas. *Urban disaster risk management* becomes an essential task of urban planning and management at this point.

Fortunately, the significant facts about natural hazards and disasters and their effects have created consciousness and awareness among managers, administrators, and intellectuals from different fields over the important role of disaster mitigation and risk management in both urban planning and reduction of disaster losses. Comprehensive master plans on risk management or strategic action plans have been prepared for many cities around the world, and also for some metropolitan areas in Turkey. Progressively, city administrations around the world have been emphasizing risk management issue. Today, as a way of making urban areas safer, Urban Disaster Risk Management (UDRM) is on the agenda of governments at all levels, administrative units, national and international institutions, and international politics. UDRM is a comprehensive process which mainly includes risk assessment, risk mitigation, and risk sharing components.

On the other hand, the location of an urban area, whether it is a coastal urban settlement or a non-coastal one, introduces new dimensions to UDRM. Disasters caused by natural and human-made hazards have been threatening coastal areas as well. Earthquakes, floods, tsunamis, storms, and hurricanes are affecting many coastal settlements negatively. Demographical studies explain that a great portion of the world's population lives on coastal areas, especially in coastal cities. According to World Resources Institute – WRI (2000), "in 1995, over 2.2 billion people (39 % of the world's population) lived within 100 km - 62 miles of a coast. In 2001 over half of the world's population lived within 200 km of a coastline." At the same time, United Nations Environmental Programme – UNEP (2010) highlights that, eight of the top ten largest and crowded cities in the world (Tokyo – Japan, Mumbai – India, New York City – USA, Shanghai – China, Lagos – Nigeria, Los Angeles – USA, Calcutta – India, and Buenos Aires – Argentina) are located by the coast. These statements reveal the huge population density of coastal areas. Likewise, coastal settlements are more crowded and popular than inner settlements also in Turkey. Coastal cities have the highest rates of growth than other areas. This situation is engendering dense and compact urban activities and infrastructure locating on coastal areas. The coastal zone has significant value because of providing easy living conditions, ecological or biological diversification, various natural resources, and national and international economical inputs. Due to such benefits, cities have mostly been located on coastlines historically. Global Programme for Action – GAP division of UNEP (2006) underlines that products and raw materials, and hence, money traditionally flow into countries through their ports. This has set precedence for populations to migrate towards coastal areas inherently. Besides, this also has caused that coastal areas are the most preferred investment areas. According to the data get from the General Directorate of Environmental Impact Assessment and Planning of the Ministry of Environment and Forestry of Turkey (2010), 193 of the 1968 projects that appealed for the Environmental Impact Assessment – EIA report between 1993 and 2010 are in the category of transportation and coast investments. However; more than 500 of 1968 projects (nearly 25 % of the all projects) are also located on the coast in all investment categories. This situation is an indicator of the demand on coastal areas in Turkey.

Meanwhile, significant value of coastal zone has been devaluated for years because of facing some critical problems created in both natural (natural hazards for instance) and unnatural or external (human-made threats; pollution, overuse, etc.) ways. Most of the time, urban uses multiply the influence of disasters on coastal areas. In other words, coastal areas have been affected negatively by both landward and seaward activities, internally and externally. These direct and indirect relations on the coastal area and their significant situation require and even force human beings to manage these areas consistently. These management efforts are also essential for the safety of coastal settlements and communities.

Coastal zone management (CZM), which has reformed as integrated coastal zone management (ICZM), emerged in the late 1960s due to the deteriorated conditions of coastal areas. In general, ICZM refers to a set of policies, rules, and implementation tools and institutions, and focuses mostly on unnatural or human-made effects on coastal areas. Natural hazards and disasters, and their significant negative impacts on societies are the most discussed issues of the world’s scientific community for years. Almost all states are coping with at least one or more natural hazards. The coast is also subject to natural effects such as effects of extreme hydro-meteorological events, effects of natural hazards and disasters. Especially with the impacts of global warming and climate change, problems of coastal nations are expected getting bigger. Those nations have to both prepare their settlements for unexpected events such as natural disasters and manage their coastal areas conscientiously and persistently. However ICZM includes limited actions against these effects, and most of the time those actions are limited with engineering solutions. Additionally, when “urban” and “coastal” come together, more complex problems and management issues arise. Distinct from any urban area, a kind of risk management approach which also takes ICZM requirements into consideration should be identified for coastal urban areas. Moreover, general rules and requirements of ICZM, and also general rules and requirements of UDRM may not be applicable for all coastal urban areas because of the different spatial, social, and historical characteristics of the area. Hence, local characteristics of the area have a significant role in UDRM and ICZM.

Considering these points, the focus of this study is coastal settlements and their current planning and management problems in the case of natural disasters. In the study coastal urban settlements are evaluated as specific risk areas because of their rapid and easily changing character. These areas are easily changing areas because of the persistency of natural and human-made impacts. Effects of wave and wind process comprise some of the natural impacts. Meanwhile, urbanization and varying types of resource requirements for urban and industrial uses comprise some of the human-made impacts. All of those impacts compose a kind of pressure on coastal areas, and this situation makes a way for a rapid and easy change on both spatial and social character of coastal areas. Uncontrolled change and development create the origin of pressure on coastal areas and other interrelated problems.

Change on the coast happens in two ways; by natural impacts and by human-made impacts. Human impact is in fact the most influential one by building up settlement areas or other structures on coastal areas. Moreover, change by human undergoes much more rapidly than natural ways do. Rapidly happening changes are usually intolerable and result with the loss of resistance of that coastal region to sudden phenomena. Change in coastal areas should be carried on slowly and controlled by planning. If building some structures on a coast is necessary and unavoidable, and this change is in the scope of plan, this intervention should definitely take its place in both ICZM and UDRM plans and programs of that coastal settlement. These plans and programs should offer precaution ways and emergency opportunities. This approach entails making another assessment on the subject. Rapid changes may not be tolerable and may result with the destruction of that area; however the area may tolerate the results of usual natural processes and recover itself when it remains as natural as possible. In other words, if there is no settlement or built area on the coast, natural impacts and hazards do not turn into a kind of disaster. With its natural and unintervened conditions, coasts may tolerate the negative impacts of natural forces. Usual processes may turn into a kind of disaster when the coasts are changed, and most particularly transformed rapidly to a built environment with high population. Depending on these explanations it is certain that maximum change means maximum risk.

Reviewing these facts, coastal development has a critical and significant position due to the intrinsic characteristics of *coast* and *development*. Besides, coastal development draws attention and mainly represents itself by coastal settlements, especially with urban ones. Accordingly, all considerations about the **coastal area** and **urban settlement** are noteworthily the subject of planning and management of **coastal urban settlements**. This point of view introduces the necessity for associating **ICZM**, which is theorized and applied for coastal areas, and **UDRM**, which is theorized and applied for urban areas, for coastal urban settlements.

1.1. Statement of the Problem and Hypothesis

Recently arising management plan types like ICZM for coastal areas and UDRM for urban areas show specific deficiencies and inefficiencies. This situation is not specific only for Turkey but also for many countries. Because of many reasons, neither ICZM nor UDRM have significant or successful practices in Turkey. Besides, as there are also coastal-urban areas, there is a need for a kind of association between ICZM and UDRM for coastal urban settlements.

Aforesaid problems mainly arise due to the lack of complete implementations of ICZM as a result of the administrative, institutional, legal, educational, and also social inadequacies in the structures of the states and governments. This is a general problem almost for all countries with coastal settlements. Additionally, the problem of Turkey as being one with coastal settlements is that the idea of ICZM is a very new concept; its hints are undetermined and accordingly the number of the professionals on the subject is so limited. Today in Turkey, ICZM's not only spatial and social dimensions but also legal and political dimensions are unclear.

Another general deficiency of ICZM is the lack of emphasis on disaster cases. Especially, when considered in urban coastal areas and for disaster risk cases, ICZM has almost no effect and power. In addition to these specific deficiencies of ICZM, UDRM has also no emphasis on coast-related disaster risks. Accordingly, disaster risk cases should be considered in the context of ICZM, and coastal disaster risks should be considered in the context of UDRM for coastal urban areas. Bu underlining these deficiencies, this study critically evaluates the separate management approaches to the coast by its own associated approach. From this point of view, it is obvious that there is a need for a kind of association between ICZM and UDRM for coastal urban areas.

According to this general frame the basic research question is formulated as "*how are prior intervention areas determined and how are development plans coordinated in a coastal urban settlement when managing coastal areas and urban disaster risks are considered at the same time*?"

This study claims that;

- ICZM in urban areas and UDRM in coastal areas should not be taken into account independently, and they have to be considered and implemented together in coastal urban settlements. Existing ICZM and UDRM understandings, and main contents and scopes of these two concepts should be reformulated according to a new type of associated management plan for coastal urban settlements.
- Since disasters interrupt the proper operation of ICZM plans, ICZM plans should give a place to these unusual and extraordinary situations. Accordingly, an ICZM

plan should have a flexible structure including action plans which are organized considering disaster cases. Besides, UDRM programs also should include coast-related disaster risks by taking the problems of coastal urban settlements into consideration.

- These two models of management plans have restricted frameworks and narrow rationalities for coastal urban settlements, in terms of policy planning and spatial planning parts a comprehensive management approach.

According to these claims the basic question is clarified as "*how a management framework could be integrated to planning and policy framework for coastal urban settlements?*"

Coastal Area Assessment Model (CAAM) have been set up in the context of this study and proposed as a tool which provides a way of associating ICZM and UDRM in coastal urban settlements. This model, which in fact involves a process, makes a classification of coastal areas. This classification helps to coordinate the management program of any kind of coastal area by taking risk conditions of that area into consideration. Besides providing a kind of spatial classification of coastal areas by gathering institutional and spatial inputs; CAAM also gives the opportunity to define the areas which have intervention priorities by revealing primary and secondary risk factors of the area. These inputs and related outputs composed by the model can definitely be used for the preparation of development plans at any scale. CAAM is also beneficial for the preparation of integrated risk maps, to be prepared whenever needed for the coastal settlements.

Therefore the hypothesis of this study is:

"*There is a need to associate ICZM and UDRM. Developing <u>coastal urban typology</u> and <u>disaster risk</u> based CAAM is the way of associating ICZM and UDRM, for better and more effective planning and management of coastal urban areas; especially in terms of implementing disaster risk mitigation strategies and determining prior intervention areas in those settlements*."

1.2. Objectives of the Study

In the light of the explanations above, the aim of the study may be generalized as “to enhance the quality of planning and management in coastal urban areas by proposing a type of coastal code which especially considers the associated use of two models of management plans, UDRM and ICZM, for Turkish coastal settlements.” CAAM is developed by the study as the tool of making a classification of coastal areas and introducing coastal typologies of Turkey. CAAM is developed also as the tool of determining the areas which have intervention priorities, and clarifying the procedures of both improvement ways of ICZM and operation principles of UDRM in coastal areas.

Since local characteristics of any area have a significant role in UDRM and ICZM, the CAAM should be based on a coastal urban typology and classification. In this sense, clarifying spatial inputs and outputs of the CAAM for Turkey by developing coastal typologies and coastal classifications is essential. As a solution, the study aims to *develop CAAM (as the way of associating ICZM and UDRM, and defining the prior intervention areas when managing coastal areas and urban disaster risks are the issue) and its implementation conditions for Turkish coastal settlements*.

In relation to this purpose, the study also aims to:

- Introduce coastal urban typologies for Turkish coastal settlements.
- Create a coastal classification map based on typologies and risk conditions.
- Evaluate the operation principles and requirements of ICZM and UDRM by examining the world experiences and theoretical approaches.
- Explain the contents and full implementation conditions of ICZM and UDRM in Turkish experience.
- Identify the contributions of these management plan types to Turkish urban planning experience.
- Emphasize the spatial and physical inputs and outputs of CAAM to the associated implementation of ICZM and UDRM in coastal urban areas.
- Develop more efficient and appropriate implementation ways of ICZM and UDRM, and

- Introduce a kind of coastal code by using CAAM for Turkish coastal settlements.

Accordingly, *developing spatial inputs and outputs of CAAM in order to orientate the associated preparation and use of ICZM and UDRM in coastal urban settlements* is the main objective of the study.

1.3. Significance of the Study

ICZM and UDRM are the models of *management plans* and both of them are relatively new concepts for Turkey. First of all, this study explains the actual and original contents of both ICZM and UDRM in Turkish experience with reference to the world experiences. Additionally, in this study there is a significant contribution in terms of understanding full implementation requirements of both ICZM and UDRM in Turkey. Since there is a need for an association between ICZM and UDRM, the way of associating ICZM and UDRM for coastal settlements is also explained. While doing this, the contributions of these models of management plans to Turkish urban planning experience and planning system is evaluated. Additionally, a classification of coastal areas in Turkey depending on coastal urban typology of CAAM, which also provides making a general type of multi-risk assessment is made. Finally, the hints of enhancing quality of planning and management in coastal urban settlements by showing the ways of associated use of ICZM and UDRM oriented by the results of CAAM is given. CAAM also forms a basis for the preparation of coastal urban integrated risk maps. Putting forth a coastal classification and a typology, developing a coastal area assessment matrix which especially highlights spatial features, and proposing a kind of "coastal code" for Turkish coastal settlements are the unique contributions of the study to Turkish planning experience.

1.4. Method of the Study

The study basically adopts a deductive approach in its methodology. In its deduction, the study starts with abstractions and ends with the transfer of these abstractions to a concrete testing material in the case of Iskenderun. Abstraction part includes the review of the theoretical bases and assumptions of two models of management plans; ICZM and UDRM.

Additionally, developing a theory-based new assessment tool, CAAM, is the final section of abstraction. The concrete testing part includes an inventory of coastal settlements of Turkey, review of their current conditions, case selection process, and implementation of the theory-based assessment model in the case area, Iskenderun, in order to judge its operational results.

Depending on the mentioned method, scientific and practical discussions on the significant positions of coastal areas and natural disasters in the starting point of this study. This initial step carries the discussions to understand the need for, theoretical bases, contents, operation principles, world experiences, interactions and comparisons in between, and compatible and incompatible parts of ICZM and UDRM. Thus models of ICZM and UDRM plans and the related terminology, also coastal settlements in Turkey are critically evaluated. In this sense, models of ICZM and UDRM plans have been discussed in the world context, and the Turkish case has been introduced as a point of view, in terms of growth tendencies, sectoral variation and domination, land-use characteristics, disaster risks, urban problems, and coastal problems. A comparative evaluation of ICZM and UDRM has also been summarized.

Clarification of ICZM and UDRM was followed by the exposition of the coastal areas in Turkey and Turkish coastal settlements. An inventory has been performed for this purpose. This inventory includes the size of population, annual growth rate of population, population density, sectoral diversity and dominance, and basic sectors of all kind of coastal settlements in Turkey. Analysis of data collected in this study has helped to determine the settlements which have more urbanization pressure and change. This inventory has also taken its place in the processes of developing a coastal (urban) typology, a classification, and selecting the case study area. Since all types of coastal areas should not be treated by the same approach, classification of coastal areas and coastal settlements has a significant part in this study. Thus coastal settlement types, their sizes, their basic economic sectors, their relationships with basic coastal uses, basic disaster risk factors of coastal urban settlements are all defined by using this inventory. Apart from the settlements, this inventory also includes the characteristics of non-urban coastal areas. A significant part of this group gives a place to protected coastal areas. Special Environmental Protected Areas

(SEPA), national parks, natural – archeological – urban – historical sites, nature parks, nature reserves, and some tourism areas which have located on coastal areas are also listed and presented spatially in the extension of the inventory study. The results of this part of the inventory study provide us to construct the typology of coastal areas. Meanwhile, the other approaches to the issue of coastal classification in the literature are also examined critically.

Disaster Risk Potentials of Turkey and its Coasts are assessed by the study. This part starts with listing disastrous events chronologically according to the results and effects, and goes on determining the main natural disaster risk types, and ends up by presenting the spatial distribution of those risk potentials on Turkish coasts. However, this part is clarified by sorting those disastrous events within a coastal area problematic in coastal settlements. Past experiences have been evaluated and the most risky coastal areas have been defined in this part.

A synthesis chart, which shows the most problematic coastal areas, is prepared by using the result of the data assessed at the previous stages of the study. This chart summarizes risk creating factors and significant features of the most problematic coastal settlements in Turkey. Evaluation of this chart (by emphasizing sectoral and phenomenal variety) leads the case selection process also.

Since CAAM also introduces a comprehensive assessment of coasts in terms of different risk factors, whether there is any technique or tool used for assessing coastal risks have been explored. Even though not performing a complete multi-risk assessment but only making a kind of vulnerability calculation for one-type risk factor, Coastal Vulnerability Index - CVI is also questioned within this study, and a comparison among CAAM and CVI is presented.

Development of a CAAM is performed by using previously formulated coastal classifications. Coastal urban typlogy matrix is a part of CAAM. This matrix uses spatial features such as natural thresholds, land-use types, ownership pattern, asset density, and administrative structure. Coastal urban typology matrix is also the first part of CAAM. Assessment of this part of CAAM gives the information about the intervention possibilities in different parts of urban area by giving the information about present conditions of urban physical elements with respect to coast type.

The second part of the CAAM is Risk Matrices. Rationality of preparing risk matrices is depends on "As Low as Reasonably Practicable – ALARP" principle[1]. One risk matrix is prepared as a composition of Consequence Matrix and Frequency Matrix, and those risk matrices are prepared for each type of disaster risk. Assessment of this part of CAAM points out the event that creates the highest disaster risk for the settlement.

The third part of CAAM is ICZM-UDRM Comparative Check Matrix. Assessment of this part gives information about the existence of any ICZM plan or UDRM plan or both. Togetherness of all three parts composes the CAAM implementation process. "Which disaster type has the highest risk for the settlement?" "Which part of the settlement has the intervention priority?" "Is there any ICZM or UDRM plan prepared for the settlement?" questions are answered by using the results of these three matrices. Answers of these questions guide the process of preparation of associated ICZM-UDRM plan, or revision of formerly prepared plans in an association. All of these three questions are answered by the implementation of those three matrices in Iskenderun Coastal Region, and applicability of CAAM in terms of orientating ICZM and UDRM plans in an association is discussed as a conclusion. Figure 1.1 summarizes design of the research and flow of the study.

[1] ALARP principle was generally used for assessing risks in technology-based or hazardous material-based industries. This type of risk assessment which uses risk matrices is highly required for these kinds of industry investments especially in Great Britain. Evaluation of the matrices is made according to the pre-defined criteria.

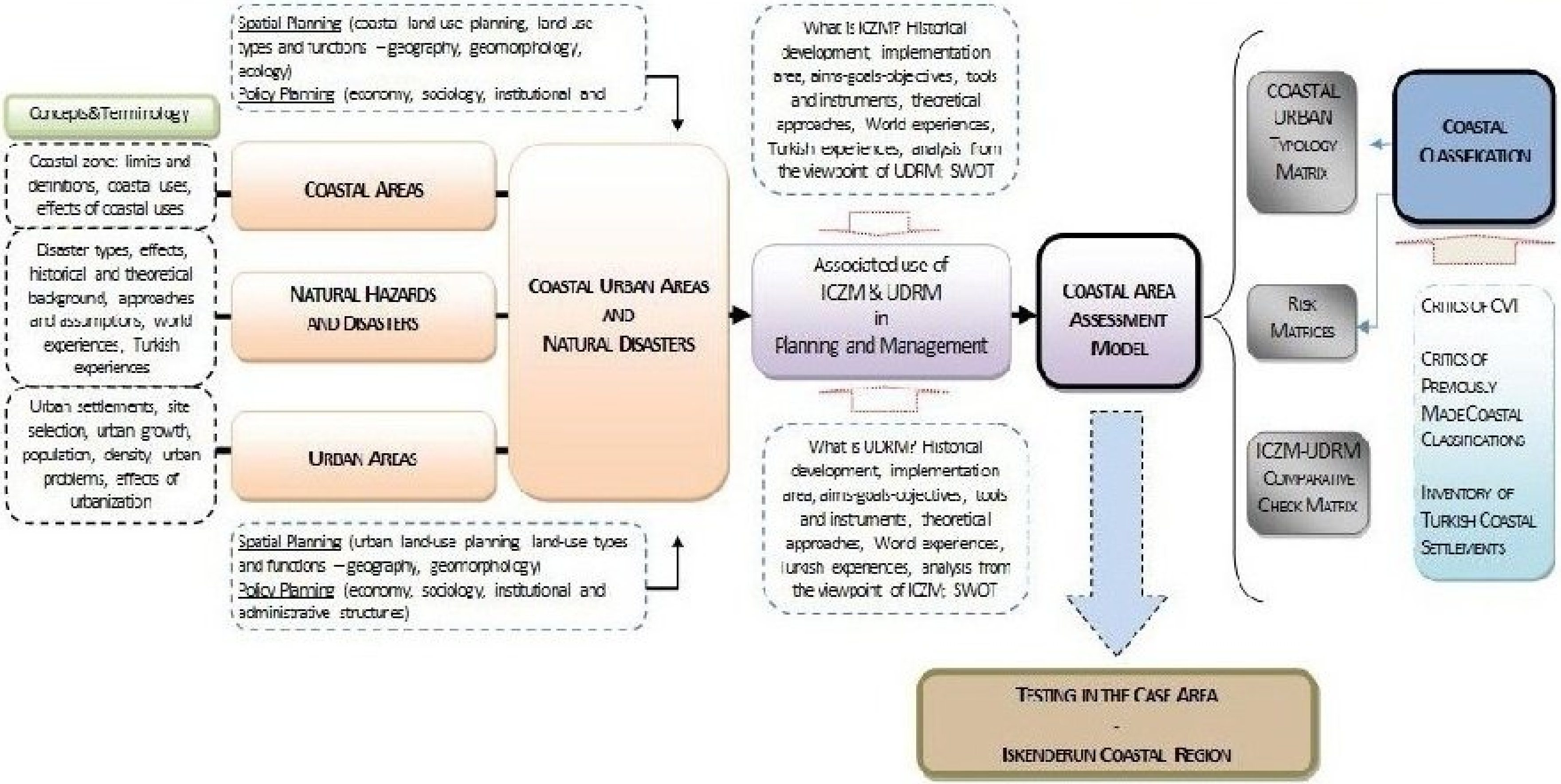

Figure 1.1: Design of the Research and Flow of the Study

1.5. Outline of the Study

This study has been held in order to develop spatial inputs and outputs of CAAM process. This process shows the way for the associated preparation and use of ICZM and UDRM and enhances the quality of planning and management in coastal urban settlements. The whole process of the study which intends to achieve the objectives explained above is explained in the following chapters.

Assuming that risk management component of ICZM should be improved, and this component should be considered with UDRM approaches, the evaluation of the main arguments and implementation conditions of those two management programs is the starting point. Evaluation of those management programs, first of all, requires understanding the basic concepts and definitions of those programs. Those basic concepts and are discussed in *Chapter 2*. This chapter also gives detailed information about historical development of coastal areas and their disastrous conditions.

Chapter 3 mainly evaluates the ICZM and UDRM approaches; their emergence, evolution, basic assumptions and contents, implementation conditions, and situations in other countries. This chapter also reveals the basic deficiencies and inefficiencies of the two approaches in implementation. The situation in Turkey in terms of implementation efforts and technical, procedural, institutional, legal, and administrative bases of both ICZM and UDRM are explained critically. At the end of this chapter, a comparison between ICZM and UDRM is made, the results of using those management plans independently from each other is discussed, the need for associated use is highlighted, and the possibilities of their associated use is questioned.

Chapter 4 starts with seeking out other risk assessment tools and techniques used in coastal areas; and the relevancy of Coastal Vulnerability Index (CVI) for this purpose is discussed. Following this, the study starts to develop and introduce its own approach for the association. Classification of coastal areas is the starting point of the study's own approach. Before introducing its own classification approach, the study gives place for previously made coastal classification studies, their approaches and critiques in this chapter. This chapter ends by defending the need for Coastal Area Assessment Matrix and its own coastal classification.

Chapter 5 starts with a commentary and evaluationary part mentioning the development of Turkish coastal settlements and their current situation extensively. Depending on this part, this study’s coastal classification types are introduced. After classifying the coastal areas and coastal settlements from different aspects, this chapter goes on with the explanations on the development principles and development levels of Coastal Area Assessment Matrices. According to the coastal typology used for the development of CAAM, a list of possible cases and their significant features are introduced in order to discuss the possibilities of those cases to be case study area for this research. Evaluation of prominent settlements and explanations on the reasons why Iskenderun was selected as the case study area are given at the end of this chapter.

Chapter 6 starts with explaining the boundaries of the case study area, its main characteristics, planning experiences, and evaluation of the plans in different scales, in terms of their approaches to the coast and different risk factors. This chapter ends by the implementation of CAAM and discussions on its results for Iskenderun Coastal Region.

Chapter 7 makes a conclusion of the study in general and introduces specific suggestions for the development of a kind of coastal code for the coastal urban settlements in Turkey. This chapter makes an evaluation on the use of CAAM in terms of its contributions to Turkish planning experience, and generalizes coastal urban area planning principles in terms of enhancing quality of space and its planning. Additionally, new directions in terms of ICZM and UDRM implementations, implementation conditions of CAAM in Turkey, and commentary explanations in Turkish experience and decision making system are offered as the conclusion and the contributions of the study.

CHAPTER 2

DISASTERS AND COASTS

This chapter contains starting point of the study; basic concepts and definitions. There is also a critical review of the basic information on the subject that have guided and shaped the following stages of the study. Contents of this chapter mostly focus on risk and disaster concepts, natural disasters, coastal areas, and coast related urban problems. Definitions on the subject should be made in order to prevent conceptual confusions and in order to make the subject understood better. Accordingly, this section reveals the problem area and the coverage of the study, beside conceptual explanations.

2.1. Starting Point

As discussed in the previous chapter, disasters are happening everywhere and mostly affect urban areas. Meanwhile, coastal areas are the most significant places that experiences urban development pressures, besides environmental disruption threat. Taking these into consideration, the intersection point of *coastal areas, urban areas,* and *natural hazards and disasters* has created the starting point of this study. This intersection area can be summarized as coastal settlements and natural disasters as shown in Figure 2.1. In fact, this intersection is the origin of a huge set of problems, which mainly requires and focuses on planning and management issues.

With reference to this simple scheme, research steps of the study starts with the explanations of a series of concepts and definitions in order to understand and clarify the real context and relations of these three intersecting areas, and therefore the model set up in this study.

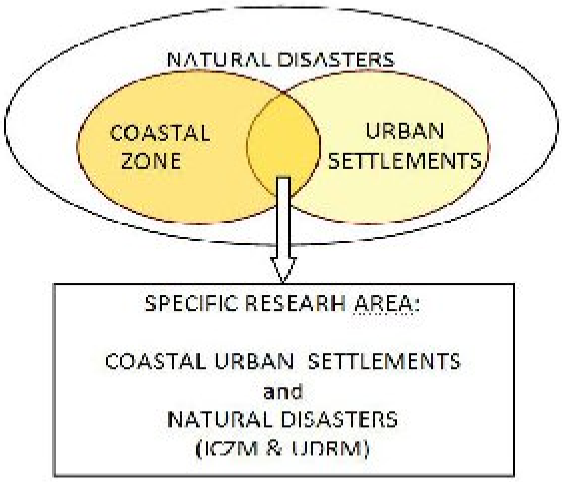

Figure 2.1: Starting Point of the Study

2.2. Disaster Related Terminology and Current Situation

Almost all of the concepts and definitions explained here are related to disaster risk management. This section also clarifies the confusing use of related terminology since many of them are used in our daily life in different meanings without a reference to their original meanings. UDRM is a whole which includes mitigation, preparedness, prevention, emergency response, and recovery actions. Expressing the original definitions of risk, hazard, vulnerability, and disaster is essential to understand what the UDRM focuses on.

As defined in Collins Cobuild Essential English Dictionary (1998: 884), in our daily life, the term ***risk*** is used to describe "a source of danger; a possibility of incurring loss or misfortune, a venture undertaken without regard to possible loss or injury". In this context, the term of risk must not be confused with the term hazard. As stated by the North Carolina Division of Emergency Management (2002), risk is the predicted or actual frequency of occurrence of an adverse effect of a hazard. In other words, risk is the potential future harm that may arise from some present action and mostly caused by a hazard. It is often combined or confused with the probability of an event that is seen as undesirable. However, especially in UDRM, risk is measured according to a scenario. Therefore, predictability and having information about hazards are the essential parts of risk measurement, risk assessment, risk definition, and risk management.

On the other hand, Collins Cobuild Essential English Dictionary (1998: 468) defines ***hazard*** in our daily use meaning as “something which could be dangerous to you.” Some key points can be understood from this definition. That means, hazard may be dangerous, and also may not be dangerous. When considered in the context of disaster risk management, hazard represents an extreme natural event that adversely affects human life, property or activity and to the extent of causing disaster with a certain degree of probability and severity (Zhang, Okada, and Tatano, 2005). Generally, the higher probability and higher severity of an extreme, the higher the damage degree caused by it and the higher the natural disaster risk (Zhang, et.al, 2005).

Smith (2004) describes the threat of hazards as totally global and classifies hazards as natural hazards, technological hazards, and new-concern threats. However, this study classifies the hazards basically in two categories; natural and human-made as summarized in Table 2.1 and basically focuses on natural hazards. Considering the definitions about the term and Smith’s classification, it is clear that hazards may create or may result with a kind of disaster.

While risk is defined as the probability of an event occurring, ***vulnerability*** is defined as those factors that magnify or attenuate the effects of an extreme natural, technological, or human induced event and those factors that decrease a community or individual’s ability to rebound after the event has occurred (Boruff, Emrich, and Cutter, 2005) In other words, vulnerability is the extent to which a community or a socio-economic structure is likely to be affected by a hazard (related to their capacity to anticipate, cope with, resist, and recover from its impact); strength of physical structures in standing up to a hazard. In this sense, the probability or frequency of an event occurrence can be calculated from past events, but determining vulnerability is more complicated. This requires examination of the interacting physical attributes and the socioeconomic characteristics of a locale. Combining physical and socioeconomic characteristics provides a measure of the overall vulnerability of the community and is termed place vulnerability. (Boruff et. al., 2005)

Table 2.1: Major Categories of Hazard (Modified from Smith, 2004)

1. Natural Hazards (extreme geophysical and biological events)	Geologic – earthquakes, volcanic eruptions, landslides, avalanches
	Atmospheric – tropical cyclones, tornadoes, hail, ice and snow
	Hydrologic – river floods, coastal floods, drought
	Biologic – epidemic diseases, wildfires
	Super hazards-catastrophic earth changes, impact from near-Erath objects
2. Human-made hazards (major accidents and environmental degradation)	Transport accidents – air accidents, train crashes, ship wrecks
	Industrial failures-explosions and fires, release of toxic or radioactive materials
	Unsafe public buildings and facilities-structural collapse, fire
	Hazardous materials-storage, transport, misuse of materials
	International air pollution-climate change, sea-level rise
	Environmental degradation-deforestation, desertification, loss of natural resources
	Land pressure- intensive urbanization, concentration of basic facilities

Vulnerability of a society depends on some sources. Clark, Moser, Ratick, Dow, Meyer, Emani, Jin, Kasperson, J., Kasperson, R. E., and Schwarz (1998) underline these sources of vulnerability themes as; age, disabilities, family structure and social networks, housing and the built environment, income and material resources, lifelines, occupation, race and ethnicity. For instance, when socio-cultural vulnerability of a community is considered, variables of socio-cultural structure such as population, cultural heritage, transportation lines, land-use, and conservation status, etc. should be taken into consideration. In general expression, vulnerability is mostly related to how hazardous event and human population interact with all its special features.

Besides, in the context of social-ecological systems, resilience refers to the magnitude of disturbance that can be absorbed before a system changes to a radically different state as well as the capacity to self-organize and the capacity for adaptation to emerging circumstances. When considered with resilience; vulnerability, by contrast, is degree to which a system is susceptible to and is unable to cope with adverse effects (Adger, 2006).

Depending on these explanations, a comparative table between vulnerability and resilience in terms of what they actually refer can be summarized as in table 2.2.

According to the definition made by United Nations Environmental Programme Division of Early Warning and Assessment – UNEP-DEWA (2006), ***disaster*** means; "an unforeseen and often sudden event that causes great damage, destruction, loss of human life, deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community". In other words, UNEP-DEWA (2006) explains disaster as a serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources. Though often caused by natural hazards, disasters can have human origins. Wars and civil disturbances that destroy homelands and displace people are included among the causes of disasters. Other causes can be: building collapse, blizzard, drought, epidemic, earthquake, explosion, fire, flood, hazardous material or transportation incident, hurricane, nuclear incident, tornado, or volcano. According to North Carolina Division of Emergency Management (2002), natural disasters result when hazardous natural phenomena (floods, landslide, earthquakes, etc.) occur in areas where society and infrastructure are highly vulnerable.

Table 2.2: Comparative Explanation of the Features of Vulnerability and Resilience

(*Source:* Manyena, 2006)

VULNERABILITY	RESILIENCE
Resistance	Recovery
Force bound	Time bound
Safety	Bounce back
Mitigation	Adaptation
Institutional	Community-based
System	Network
Engineering	Culture
Risk assessment	Vulnerability and capacity analysis
Outcome	Process
Standards	Institution

According to these explanations the terms hazard, disaster, and risk may be summarized as shown in Figure 2.2.

The concepts of *mitigation, preparedness,* and *prevention* are also highly related to disaster risk management process. As defined in the following sections, disaster risk management is a detailed group of actions with its pre-disaster, during disaster, and post-disaster actions, and these concepts mainly refer to pre-disaster actions.

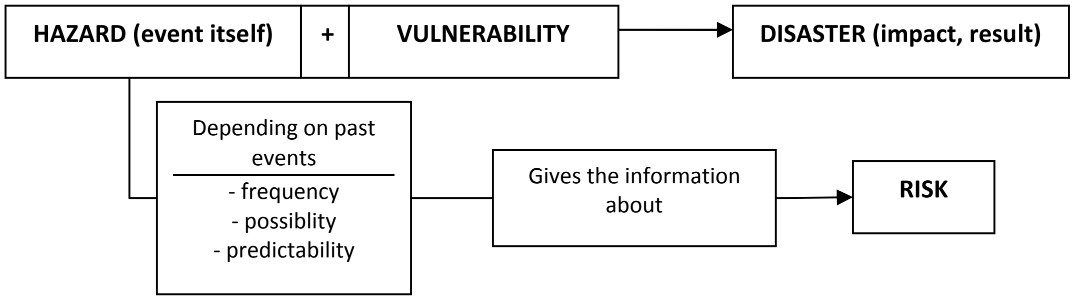

Figure 2.2: Explanation of the Relations among Hazard, Vulnerability, Disaster, and Risk

As defined by United Nations Inter-Agency Secretariat of the International Strategy for Disaster Reduction – UNISDR (2004) and United Nations Development Programme – UNDP (2004), ***mitigation*** means "the process of preventing disasters or reducing related hazards". Methods of limiting damage can be as simple as placing a fuse box higher on a wall in a flood-prone area, or as costly as strengthening a building's structure to withstand an earthquake. Mitigation efforts may include risk management plans, local planning programs, brochures and training videos, local presentations to raise awareness of mitigation, and serving on committees and task forces that coordinate mitigation programs.

Again, UNISDR (2004) and UNDP (2004) define ***preparedness*** as, "the state of having been made ready or prepared for any use or any action". This also means, being ready in order to experience a natural hazard or disaster. For example, Federal Emergency Management Agency (FEMA) plans preparedness and mitigation and response activities in United States.

Collins Cobuild Essential English Dictionary (1998: 801) defines ***prevention*** as, "to take action to stop something before it happens". UNDP (2004), for instance, defines all disaster reduction and mitigation actions as prevention actions; although they sometimes just decrease the effect, not strictly prevent the event.

In addition to these explanations there are also emergency response and recovery activities in the process of disaster risk management. These concepts refer to during and after disaster activities. Emergency response can be defined as a situation where people's normal means of support for life with dignity have failed as a result of natural or human-made hazard and recovery actions mostly focuses on structural renewal and restoration actions which aims to return to the original state (Catholic Relief Services-Emergency Response Team – CRS-ERT, 2002).

In the light of these explanations, it is possible to make a simple division about disaster and its related terminology. When disaster is divided into three basic phases like pre-disaster phase (before), impact phase (during), and post-disaster phase (after);

- mitigation, preparedness and prevention activities focus on pre-disaster phase,
- emergency response activities mostly focus on impact phase, and
- recovery actions focus on post-disaster phase.

The next step following these terminological relations is explanation of “natural disaster” concept. Zhang et.al. (2005) define ***natural disaster*** as “natural variation exceeds a certain level, and results in some damage to human and social - economic development. Accordingly, ***natural disaster risk*** is defined as both the possibility of natural disaster’s occurrence and the degree of damage caused by it during the following several years (Zhang et.al, 2005). Hereby, four factors are determined in the formation of natural disaster risk by Zhang et.al. (2005). These are hazard, exposure, vulnerability, and emergency response and recovery capability. However, Zobin and Ventura-Ramírez (2004) adds one more factor to these factors depending on the methodology of RADIUS - Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters, which is developed under the umbrella of UN General Assembly.[2] This factor is “external context” factor such as political issues and situations. Therefore, natural disaster risk is the function of hazard, exposure, vulnerability, emergency response and recovery capability, and external factors; and can be formulized as below. Zhang et.al. (2005) explains exposure as the number of people, and the value of property, structures and activities that will experience hazard and may be adversely impacted by them.

[2] The United Nations General Assembly designated the 1990s the "International Decade for Natural Disaster Reduction (IDNDR)" to reduce loss of life, property damage, and social and economic disruption caused by natural disasters. In 1996, international institutes founded RADIUS initiative under the IDNDR secretariat of UN (GeoHazards International, 2010).

NATURAL DISASTER RISK = HAZARD X EXPOSURE X VULNERABILITY X EMERGENCY RESPONSE AND RECOVERY CAPABILITY X EXTERNAL FACTORS

Figure 2.3: Formulation of the Natural Disaster Risk

(*Source:* Zhang, et.al. 2005 and Zobin and Ventura-Ramírez, 2004)

As stated at the beginning of this section, disaster risk management is a whole which includes mitigation, preparedness, prevention, emergency response, and recovery actions. In other words, disaster risk management is a complex approach which necessarily creates linkages between disaster prevention, disaster mitigation, disaster preparedness, emergency response, and development. It is essential to explain and understand these concepts in order to understand the working process and procedures of UDRM. Detailed explanations on disaster risk management and UDRM are given in the following chapter.

2.2.1. Types and Classification of Natural Disasters

As stated previously, varying types of natural or human-made hazard may cause a disaster related to the vulnerability of the system (social, cultural, economic, or ecological). Accordingly, disasters may be classified as natural disasters and human-made disasters. These two broad categories can be sub-divided into several categories based on the causing event's (hazard's) speed, scale and duration of the event(s). Another simple classification can be made according to causing event's origins; such as they are meteorological originated or geomorphologic originated. Also another classification could be made including the occurrence place of a disaster, predictability of disaster, beginning type of a causing event, duration of the event, or frequency of occurrence of disasters. Classifying disasters according to such characteristics will definitely help with preparing risk management plans and programs, and taking actions against disasters. Table 2.3 shows the classification of disasters made by Altıntaş (1998) according to varying characteristics.

Table 2.3: Classification of the Characteristics of Disasters

Characteristic			Example
Source	Natural hazard	Geophysics	Earthquake, volcano
		Atmospheric	Storm - hurricane, tornado, flood
	Human-made hazard		Accidents, building collapse, war, hazardous material incidents, fire.
Place	One Place	One Event	Plane accident
		Plenty of Events	Earthquake and small shocks
	Many Places	One Event	Tornado
		Plenty of Events	Terrorism
Predictability	Predictable		Flood
	Non-Predictable		Earthquake
Beginning	Step by Step		Storm–hurricane
	Sudden		Gas Explosion (*Grizu*)
Duration	Short		Building collapse
	Long		Hazardous Material Incidents
Frequency	Frequent		Tornado (in season)
	Infrequent		100 years floods

2.2.2. Disasters around the World

In recent days, world population is especially faced by earthquake, flood, hurricane, landslide, tsunami, fire, and volcano. These disasters are seen very frequently, and almost every day a crucial event is announced in the news from televisions, newspapers, and internet. However, there are some other events also experienced in some parts of the world. These others are drought, erosion, tornado, and winter storm. These may be less remarkable due to their frequencies or impacts. Besides, Altıntaş (1998) points out that, flood is faced widespreadly around the world. According to the statistical data of UNEP-DEWA (2006), each week, at least one significant disaster, which requires aid of international society, happens. For example, in 1999, earthquakes caused more than 22,000 deaths worldwide. On the other hand, WWF has announced the year 2007 as the year of disasters (NTVMSNBC, 2007).

The year 2004 ended with one of the biggest disasters in recent times; the tsunami in the Indian Ocean. The reported death toll of this disaster is more than 280.000, while about ten times that number were injured, homeless or otherwise affected, and massive damage was incurred by infrastructure, housing and ecosystems. In total, 300.000 people were reportedly killed in 2004 due to natural disasters (UNEP – DEWA, 2006).

Several major disasters, including the earthquake in Pakistan and many related to typhoons (in Asia) and hurricanes (in the Caribbean and North America) were seen in the year 2005. 2007 was mostly the year of floods and hurricanes. Earthquakes hit different parts of the world in between the years 2008 – 2010. Chile Earthquake (happened on the 27th February, 2010), Mexico and California Earthquake (happened on the 4th April, 2010), and China Earthquake (happened on the 14th April, 2010) are the some largest ones. An environmental disaster has just happened with the collapse of an oil drilling rig in the Gulf of Mexico. Only 11 people killed as the result of this event; however the world will experience the other and the worst impacts of this event for the forthcoming years. United States' scientists estimate that 5 million barrels crude oil has leaked into the Gulf of Mexico and it is the largest oil spill in the world's history. And finally, after two weeks of catastrophic flooding in the country of Pakistan (started on the 30th July, 2010), United Nations has estimated that at least 1600 people have been killed and 14 million people have displaced from their homes. News agencies[3] have reported that 20 % of the land area of the country has flooded. Also damage to infrastructure has left many survivors of the floods and many villages and towns inaccessible to government aid. Table 2.5 shows the examples of recent significant disasters of the world.

Meanwhile, many coastal countries in the world have been coping with the hazards and disasters which come from the sea or ocean. Those disasters take their power from natural cyclical events such as hydrodynamics, stream dynamic and other natural phenomena. Thus, this study especially focuses on the disasters which are both occurring naturally and affecting coastal areas. Earthquake, sea-level rise, wildfire, landslide, tsunami, coastal flooding due to storm surge, coastal erosion, flood, and marine accidents, explosions and pollution have been experienced on coastal areas for years. These disasters are examined in the context of this study.

[3] These explanations are reviewed from the highlights announced on the official website of CNN (http://edition.cnn.com) between the dates 2nd and 30th of August, 2010.

Table 2.4: Last 50 Years' Worst Natural Disasters

(*Source:* USGS, WHO, Associated Press, disasterrelief.org, NOAA, Guinness World Records, and Oxfam, 2009 and 2010)

Year	Disaster	Place	Minimum Number of Dead
1962	Huascaran Volcano	Peru	3.000
1970	Bhola Cyclone Tidal Wave	Bangladesh and East Pakistan	500.000
1971	Heavy Rain Flooding	Hanoi - North Vietnam	100.000
1975	Yangtz River Flooding	China	85.000
1976	Pacific Tsunami	Moro Bay - Philippines	5.000
1976	Tang Shan Earthquake	Tang Shan - China	242.000
1985	Nevado del Ruiz Volcano Eruption	Near Armero - Colombia	25.000
1988	Armenian Earthquake	Armenia	30.000
1990	Iran Earthquake	Iran	50.000
1991	Bangladesh Hurricane	Bangladesh	100.000
1998	Hurricane Mitch	Honduras and Nicaragua	11.000
1999	Eastern Marmara Earthquake	Marmara Region - Turkey	25.000
2001	Gujarat Earthquake	Bhuj - India	19.000
2002	Earthquake	Northeast Afghanistan	1.000
2002	Monsoon Floods	China, India, Nepal, Bangladesh	2.000
2003	Earthquake	Algeria	2.266
2003	Bam Earthquake	Bam - Iran	40.000
2004	Torrential Rains, Floods, and Mudslide	Dominican Republic	3.000
2004	South Asia Monsoon Flooding	India, Nepal, Bangladesh	1.800
2004	Tropical Storm Jeanne	Gonaives - Haiti	2.500
2004	Typhoon Nanmadol	Eastern Coast of Philippines	1.800
2004	South Asian Earthquake and Tsunami	Sumatra - Indonesia	280.000
2005	Earthquake	Sumatra - Indonesia	1.313
2005	Heavy Rainfall	Mumbai - India	1.000
2005	Hurricane Katrina	Louisiana and Mississippi - USA	1.800
2005	Hurricane Stan	Central America	2.000
2005	Earthquake	Kashmir - Pakistan	80.361
2006	Mudslide	Guinsaugon - Philippines	1.000
2006	Java Earthquake	Java - Indonesia	5.700
2008	Cyclone Nargis	City of Yangon - Myanmar	78.000
2008	Western China Earthquake	China	87587
2009	Earthquake	Sumatra Island - Indonesia	1.000
2010	Earthquake	Port-au-Prince - Haiti	200.000
2010	Earthquake	Chile	750
2010	Collapse of the Deepwater Horizon Oil Rig	Gulf of Mexico – Lousiana	11
2010	Floods	Pakistan	1.600

2.2.3. Disaster History of Turkey

Turkey is affected by many natural and human-made hazards, especially by earthquakes, which have caused great losses for years. Earthquakes, floods, landslides, fire, erosion, and different types of transportation accidents (train, plane, ship crashes etc.) have been resulting with losses and damages in Turkey and these events are the most frequent ones.

As known for years that Turkey has active fault zones and unfortunately its significant settlement areas, industrial areas, transportation lines, and also significant natural and historical wealth are located on these active earthquake zones. Additionally, those settlement areas located on earthquake zones are generally the urban ones. This situation makes the result worse in terms of losing lives, crucial lifelines, and devastating living spaces. Turkey lost thousands of its people as the result of earthquakes. Accordingly earthquake is the first type of disaster that Turkey has been coping with for many years. Flood is in the second place. Floods have caused loss of lives especially for the last five years. Beside life loss, it has caused greater harms on settlements and assets recently than it did before. Floods and landslides are heavily interrelated events in Turkey, especially in Black Sea Region. That means landslides are also significant in Turkey. Erosion is a landslide-related event from this point of view, and it is a problem in some parts of Turkey. The fire occurring in forests especially in summer season is a triggering factor for landslides and erosion in fact. There is no mistake in saying that about all types of disasters seen in Turkey are linked to each other with a cause and effect relation.

2.3. Coastal Urban Areas and Natural Disasters

Coastal areas are one of the critical and strategically important areas of the Earth. The combination of two different “worlds” - land and sea - breeds unique ecological, geologic, geomorphologic, and biological characteristics. By having these unique characteristics, coastal areas provide various resources and great opportunities for any kind of living organism and non-living things. Therefore, many types of uses have existed on coastal areas since ancient ages. Urban areas and their varying types of uses are the most critical ones. However, this unique area is not unlimited and it has boundaries. Also it may easily lose its unique characteristics. Additionally, varying types of uses are located on this limited area. Likewise, identifying the limitations and contents of a coastal area is necessary in order to understand what coastal is, where the coast is, and how the coast should be used.

2.3.1. Coastal Zone: Limitations and Definitions

This section defines how the boundaries of coastal zone will be used in this study. As Özhan (2004) argues, coastal zone consists of two different areas: landward (shore lands) and seaward (coastal waters). Shore land and coastal waters are connected by water flow. Definition of the boundaries of these areas is essential in terms of determining the utilization principles, interactions, and impacts. Klee (1999) also points out that understanding the coastal environment and its subsystems has also significant value in this sense.

Özhan (2004) provides four options for locating the landward boundary of coastal zone. First option is, a fixed horizontal distance from the shoreline (e.g. 1 km). Second one is, a biological definition: including biological features, geological features, and physical features (drainage basins, flood plains, dune formations, ridges of coastal mountain ranges, etc.). Third one is, an administrative definition based on biophysical data: political boundaries (municipality, town), and cultural landmarks (road, highways, canals, etc.). The last one is using multiple boundaries: using all of the above where necessary. He argues that seaward area is composed of three parts including estuarine (tidal river, bay, embayment, lagoon.), near shore (its offshore boundary is equal to territorial sea limit: 6 – 12 miles according to the articles determined in UNCLOS – United Nations Convention on the Law of the Sea), and oceanic (it defines the seaward of the territorial sea, and other parts of this sea area - territorial seas, contiguous zone, exclusive economic zone, high seas- are also determined by the UNCLOS).

In Turkey, limitations and boundaries of the coastal zone is defined by 3621 Coded Coastal Law. There are some discussions about possible changes on some of the articles of the law in recent days, but still the rules of this law are in force. According to this law, the coastal landward boundary as an area at least 100 (shore strip) meters wide horizontally, starting from the shore edge line, which is defined as the natural limit of the sand beach, wetland, and similar areas created by seawater motion. Shore edge line is defined by a commission which is created by governors. UNCLOS definitions about seaward boundaries are also in force for Turkey, except some critical disputes about the seaward boundaries in Aegean Sea. Seaward boundaries have strategic importance in terms of national security and international agreements and relations. Detailed discussions about the rules and implementations on coastal zone in Turkey will be explained later on.

2.3.2. Coastal Urban Uses

Different uses are located in coastal areas, and these uses have direct or indirect impacts on coastal areas. Commercial fish stocks, sports fish stocks, oil and gas reserves, sand and gravel deposits, open space, space for development, fresh water aquifers, clean water, clean air, aesthetic quality, medium for dispersal of human wastes, heat sink for industrial cooling water, special geological formations, agricultural land, archaeological / cultural remains, marine mammals, marine habitats /communities /ecosystems, shipping lanes, natural sites, energy potential (wave, wind, etc.), and minerals are the some of the resources that coastal and ocean areas provide.

Additionally, there are many types of coastal and ocean uses and activities like commercial fishing, sports fishing, recreation, tourism, oil and gas development, shipping / marine transport, ports and harbors, oil / LNG (liquefied natural gas) transport and facilities, sand and gravel mining, deep seabed mining, salt production, fresh water production / desalinization, energy production / power plants, urban development, agriculture, waste disposal, defense against storm hazards, conservation / protection, marine sanctuaries, scientific research and education, ocean incineration, artificial islands and reefs, marine cables and pipelines, defense operations, dredging, industrial development, and mariculture or aquaculture. In this sense, the importance and value of coastal zone cannot be underestimated.

Additionally, Yalçıner (2004) lists marine structures as residential buildings, commercial centers, industrial plants, open areas, educational buildings, health services, socio cultural and public assembly, fire stations, office of security service, communication centers, infrastructures near shoreline (waste water discharge systems, fresh and waste water network), support units, tourism, transportation structures (piers, breakwaters, coastal protection structures, all types ports or harbors, marinas, fishery harbors, shelters for small crafts, airport, heliport etc.), agricultural uses, historical-cultural buildings / monuments, military areas, cemeteries, and areas for solid wastes.

Various uses and activities in the coastal zone compete for the same scarce resource and space. Most of the uses on the coast can be considered as urban, and many of them require urban infrastructure services. These discussions show that coastal zones are defined by their boundaries and provide limited space with limited resources. This section clearly shows that why coastal areas are vulnerable, especially because of the uses it has.

2.3.3. Historical Development of Coastal Areas and Problems on the Coast

This section focuses on the discussions on coastal area and historical development of these areas since creation of urban risks takes its origin mostly from the creation of settlements. Discussions of this section prepare an introduction to risk creating factors related with the development of urban settlements, and other problems on the coast.

Today, great portion of the cities in the world has completed their urbanization process. They have all experienced their own urbanization project, and still, many of them are experiencing; may be not the process itself, but the consequences. In general, settlements of the world have experienced great changes since 1940s (2nd World War), and the consequences have been discussed for a few decades. The discussions are definitely not limited only with consequences. Many discussions have been held, and as a result of them, actions have taken for better and sustainable living conditions in urban areas. However, the problem in fact, is an old one.

Starting from the ancient ages, people have always chosen their living places according to the location of water. Accessibility to the water has always been the most important factor for decisions on establishing settlements because of the almost endless opportunities that water (coast) provide. Water is the source of life. People always want to be in a direct interaction with water. However, living with water (or close to the coast) also means living with some problems which are caused by the natural conditions of that area; such as floods, storms, erosion problems, etc. People found solutions in order to cope with those problems, however, most of the time those solutions brought new problems together. In time, especially with technological improvements, people started to use technological treatments on coastal areas such as diggings and fillings. They filled in order to gain more coastal place and be closer to the water, and they dug in order to use the coastal soil (or the sand) in other areas. Sooner, people started to extend their living spaces on the filled area. Those treatments showed negative effects in the short or long run; the balance of nature started to be broken down. Rapid and unplanned urbanization and its triggered element technological improvements can be interpreted as the main reasons of using those treatments on coastal areas. Industrial Revolution can be perceived as the first starting point of technological improvements. In this sense, 2nd World War and today's global era (globalization) can be evaluated as other turning points on risk creation impacts.

In pre-industrial cities, life was mostly based on agriculture and trade of agricultural crop, however, this trade was mostly within the city limits. There were limited cultivation tools and limited transportation potential to encourage that trade activities. Industrial Revolution made great changes and brought starting points of new technologies in different areas. After 1850s, technological and economic progress gained momentum with the development of steam-powered ships and railways, and later in the nineteenth century with the internal combustion engine and electrical power generation. These inventions also started a shift from agriculture-based settlements to industry-based urban areas. Development of urban areas and technological improvements triggered the heavy consumption of natural resources as if they are endless. In this process, coastal areas also have played significant roles; in terms of providing factory locations, raw materials, easy and cheap transportation possibilities, new trade ways, and so on.

Second great stroke to the balance of nature has been made by 2nd World War. Characteristics of Industrial Revolution continued to be influential again after the 2nd World War. Not only natural and environmental balance but also social characteristics of nations of the world have changed. As a consequence of the 2nd World War, nations and settlements entered to a reconstruction process. This new era also changed many things like social / economical / cultural / national / international structures and relations; production types and life styles changed, and new culture was created: modern industrial society. This new society has always been defined by the distribution of goods. At this point, Beck (1992) defines new era of modernity as “the social production of risks” which is accompanied by the social production of wealth. According to Beck (1992), each component of modernization has become a risk creating factor. Also, Beck (1992) strongly argues that the main reason of risk society is industrial overproduction, not scarcity. Wealth production mission of industrial society creates a risk production society. New life forms and choices brought new inequalities, gender conflicts arose, uncertainties increased in this risk society. Individuals started to live without having any idea or prediction, and responsibility. This time, coastal areas have stayed under “overuse pressure” and continued to lose its natural values.

After late 1970s, globalization has brought everything at international or supranational levels and has started the era of post-modernization. With the influence of globalization, borders have disappeared and those (may be locally created) risks have become internationally influential. However, globalization also made a shift which has occurred within late modernity and has led to the emergence of the reflexive citizen. Today, this citizen engages with his or her world in ways that are significantly different to the past. With the new citizen consciousness, more influential individual and political actions are ready to take place against risks. Besides, not only individuals but also many different types of organizations and institutions have changed their characteristics and contexts according to the new world order and have become influential at all levels.

As a result of those significant processes that our world experienced, rapid and unplanned urbanization has definitely an influence both on built and natural environment. Most of the time, unpredictable natural forces or hazards accompanied this urbanization process and the result is unexpected (like disasters). Adverse effects and irrecoverable consequences of that type of urbanization have showed themselves painfully. Definitely, as stated before, all of the negative results of natural hazards cannot be linked with rapid urbanization. Even if there is a planned city, still there could be losses and damages. However, this situation is also a planning problem. Emergency programs, policy plans, and action plans should be prepared as parts of urban disaster risk management. These plans and programs should consider the density of those areas since density is the reason of the increase of the damage that caused by the disaster.

2.3.4. Coastal Natural Disasters and the Situation in Turkey

In addition to the problems mentioned above, there are also natural forces and coastal processes such as wind, flood, erosion and sediment transportation, hurricanes and storm surge, sea level rise due to the global warming and climate change, seismic events and tsunamis. These natural forces and coastal processes (wave processes, coastal erosion processes, coastal deposition processes, sea level chances, etc.) may easily turn into a coastal disaster according to the coastal use type, population and building density due to the explained process' negative and destructive results. That means, in fact, the normal and natural functions of the coast create the disastrous impacts most of time. Taking the normal and natural functions of the coast into consideration, Bell and Gorman (2003) explain the production of coastal hazards by different sources and the relations among the causes and impacts as shown in the Figure 2.4.

In the absence of planning and wrong decision conditions, effects of these forces and processes are not only resulting with environmental degradation problems but also resulting with interruption of development objectives, sectoral intentions at both local and national levels. That means, living close to the coast also means living some problems which may result with some destructive effects, and those effects should be minimized by making appropriate and strategic decisions.

Turkey's coasts are richly endowed with natural beauty, cultural attractions, and bays, estuaries, and wetlands replete with resources. These resources have been degraded, polluted and threatened by a sharp increase in coastal population density and economic activities such as agriculture, industry, tourism, fishing, aquaculture and urban development. Similar to the world's experiences, starting from mid 1980s, there is a sharp shift of population towards the coast, particularly with the migration from central and eastern Anatolia in search of better living conditions. In addition, rapid growth of the tourism industry, which has gained momentum since 1980s, along the coastal areas has effectively increased the population pressure on the coastal zone, resulting in many environmental and socio-economic effects.

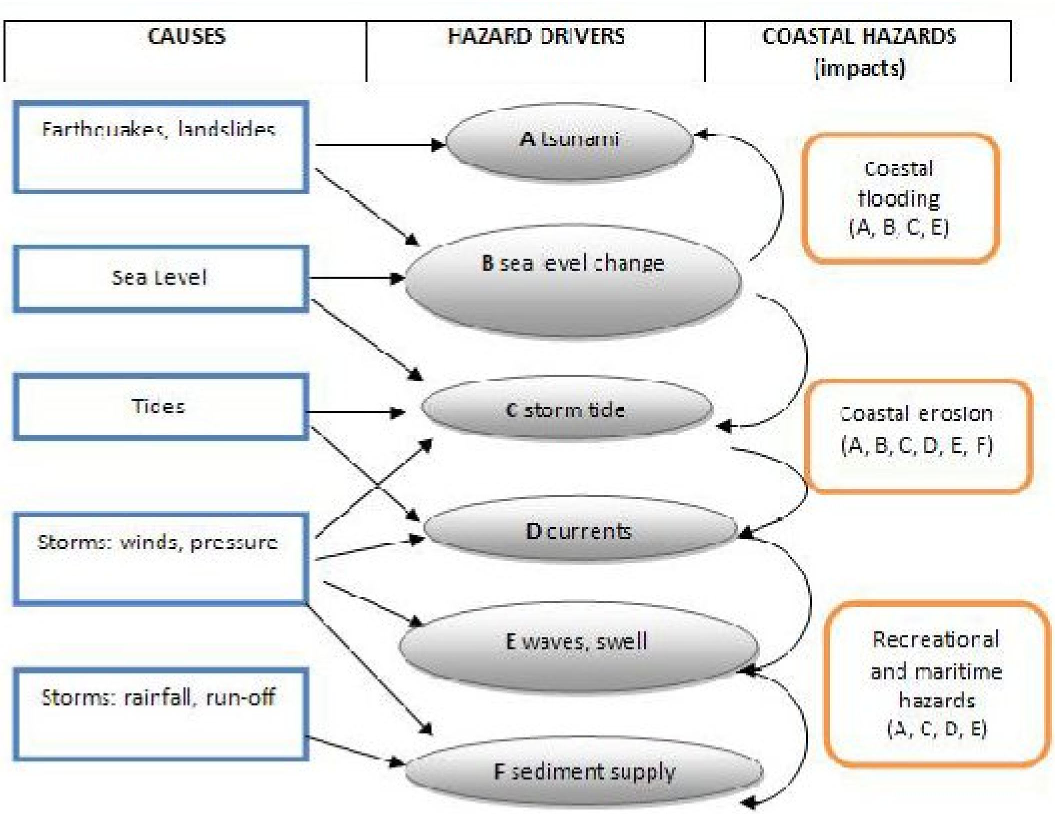

Figure 2.4: Production of Coastal Hazards by Different Sources

(*Source:* Bell and Gorman, 2003)

All of the events explained by the Figure 2.4 are also frequently experienced events in Turkey. Especially coastal flooding and coastal erosion events may sometimes turn into a disaster. Maritime traffic is also heavy around some larger ports, thus this situation increases accident risks and related environmental hazards. In this study all the possible types of coastal disasters are evaluated and covered while setting up the CAAM process. Basic criteria such as frequency, effect, action or impact area, and solution types are also taken into consideration. Erosion and sediment transportation problems require relatively more technical approaches, however; the others highly require systematic and strategic planning approaches.

In recent days hurricanes, storms, and sea level rise due to the global warming and climate change are significant concerns of the whole world. Impacts and results of sea-level rise are orientating the current discussions of scientific, epistemic, and bureaucratic communities, even of ordinary people. At this point, developing new planning strategies against the negative impacts of sea level rise, gain critical significance. On the contrary to sea-level rise, there are also some parts of the Earth which the level of sea has been decreasing. However there is no clear finding on the negative effects of this subject (NTVMSNBC, 2010). In the subject of sea-level rise, according to the researchers and scientists, sea level rise has a distinct character when considered on comparative conditions of sea level rise, storm surge, and tsunami. Researchers and scientists observe sea level rise as a preventable event, whereas storm surge and tsunami are not. On the other hand, sea level rise also has a significant impact on other types of coastal processes such as coastal erosion, storms surge, tides, and waves.

Another comparison issue among storm surge, sea level rise, and tsunami is their creation frequencies. Scientists assume sea level rise and tsunami as extreme events because of their creation frequencies. Repetition frequency for sea level rise is assumed as an hundred year, and for tsunami is assumed as a thousand year. However, repetition frequency for storm surge is assumed as a month. These issues are also taken into consideration in the setting up process of CAAM. Since CAAM takes its basics also from the models of UDRM and ICZM, basic contents and implementation areas of these models of management are discussed in the following chapter.

CHAPTER 3

URBAN DISASTER RISK MANAGEMENT AND INTEGRATED COASTAL ZONE MANAGEMENT

This part of the study generally explains the two models of management plan which compose the main argument of the study. First; contents, main concerns, and current implementations, and deficiencies of both UDRM and ICZM plan models are explained and second possibility of associated use of these two models of management plan are discussed in this chapter.

3.1. Mitigation Planning and Management: UDRM

Mitigation planning is generally used instead of risk management, especially in planning activities although it is the essential part of risk managements.

According to United Nations Development Programme - UNDP (2004), between 1994 and 2004, more than one billion people were affected by natural disasters and assets worth approximately US$730 billion were destroyed. Till 1990s, the two things that can be done against disasters were considered as emergency management and recovery actions. There were no serious risk management plans and programs. However, those great loses that disasters have caused, have created serious consciousness and awareness among managers, administrators, and educated people from different areas over the important role of disaster mitigation and risk management in reduction of disaster losses. For instance, UNDP has a disaster reduction unit and has been supporting many countries to strengthen disaster risk management capacities since beginning of the 1990s (UNDP, 2004).

As stated in previous chapter, disasters can be examined on three basic phases. Pre-disaster phase requires planning tasks. Disaster or impact phase may require some engineering tasks and emergency actions (a type of crisis management). Lastly, post-disaster phase requires financial tasks. Disaster risk management covers all these there phases, however, especially highlights pre-disaster phase. Easily understood from this classification, the main concern of the risk management includes the first phase of disaster and highly requires planning tasks.

In the past, general approach on disasters and their impacts were focusing on recovery and reconstruction in the post-disaster phase. Efforts of this approach have been usually at local level and required instant interventions. However, both occurrence and impacts of disasters cannot be evaluated locally anymore. Today, a new approach exists. This new approach necessitates several issues such as; research, development of new policies and leading instruments, knowledge exchanges; creation of communities of practice; and awareness rising for governments, civil society, and local communities. This new approach emphasizes risk management instead of disaster or crisis management. Disaster risk management requires and highly focuses on building a culture of prevention and mitigation.

This new approach has also been supported by different international organizations since mid 1980s. As Wisner (2000) discusses, recognizing the importance of disaster mitigation and risk management, United Nations gave much attention to public education, and in 1990s it developed a comprehensive project for urban earthquake risk reduction called Risk Assessment for Diagnosis of Urban Areas against Seismic Disasters (RADIUS). Nine pilot cities took part, with 84 associate cities. In cities such like Tijuana (in Mexico) and Izmir (in Turkey) this project was more successful since there was strong support from the local administration and many local universities and professional groups. The project developed a low-cost method of anticipating urban earthquake damage and loss, and a model for creating an action plan to mitigate those losses (UNDP, 2004).

Likewise, World Bank has changed its policies and shifted its traditional assistance focus from post-disaster reconstruction towards assistance for building capacity and culture of prevention. To support the global agenda of capacity building in the area of disaster risk management, the World Bank Institute’s Urban and City Management Program has developed a series of training programs on Natural Disaster Risk Management. The activities aim at awareness raising and advancing the participants’ analytical skills and professional knowledge in disaster risk management (UNDP, 2004). In sum, both World Bank's and United Nations' thematic focus is on awareness generation and education, training and capacity development for mitigation and better preparedness in terms of disaster risk management and recovery at community, district and state levels, and strengthening of disaster risk management information centers for accurate and timely dissemination (UNDP, 2002).

Risk management issue has taken its place on the agenda with supports of many events and institutions. Nevertheless, there is a need for an extended explanation on how risk management has gained its significance and how its "urban" and "coastal" dimensions have been considered. The following section includes a discussion on both theoretical and historical background of risk management and development of coastal urban areas as a risk creating factor.

As Eades (1998) states, in the late 1980s, there was increasing international concern about the growing vulnerability of people and property due to natural hazards. As a result of this concern, the United Nations General Assembly passed a resolution in 1989 designating the last decade of the twentieth century as the International Decade for Natural Disaster Reduction (IDNDR). By 1994, over 150 countries had established national IDNDR focal points or committees which included representatives of governments, disaster professionals and many non-government organizations. Much effort has been put into new scientific and engineering developments by many countries. Typical examples are the work on hazard-resistant structures (houses, factories, bridges, flyovers, etc.), and the development of electrical measuring techniques to predict earthquakes (Eades, 1998). Creating hazard resistant settlements are also one of the expectations of IDNDR designation. At this point, Urban Disaster Risk Management – UDRM, which especially focuses on planning activities, arises as the way of creating hazard-resistant settlements.

Disaster risk management in urban areas has some basic steps including risk assessment (or risk identification and analysis / avoiding from risks), risk mitigation, and risk transfer (or sharing risks).

Risk assessment step mainly focuses on vulnerability and involves information on the nature and extent of risk that characterizes a particular location. In this way informed decisions can be made on where to invest and how to design sustainable projects that will withstand the impacts of potential disasters.

Risk mitigation step requires that all stakeholders change their perceptions and behaviors to place a high priority on safety in planning and development, and involves taking some actions in hazard prone areas. Basically this component of the disaster risk management process includes mostly the disaster prevention and preparedness activities. Such activities include land use planning, structural design and construction practices, and disaster warning systems, etc. This step of risk management mostly requires planning and engineering tasks.

Risk transfer means protecting investments and sharing costs. The private insurance sector contributes important funding for reconstruction after a natural disaster in developing countries. Risk transfer or risk sharing component also includes (again, mostly based on financial activities) rehabilitation and reconstruction activities which are designed to help people rebuild their homes, build back their asset base and re-establish social networks. Risk transfer step of risk management mostly requires finance tasks.

We can summarize these steps of UDRM and the requirements as following:

Assessment of Disaster Risks	requires	Planning Tasks
Mitigation of Disaster Risks	requires	Planning and Engineering Tasks
Share of Disaster Risks	requires	Financial Tasks

All of those three components also require processing the data of historical experiences effectively. Therefore, data management and creating comprehensive databases are the essential parts for all stages in Turkey.

3.2. UDRM in Turkey

Even though Izmir was one of the pilot cities that the comprehensive RADIUS project of the UN-IDNDR was implemented, Turkey's serious attempts in terms of UDRM have started especially after the 1999 Marmara Earthquake. Naturally, first attempts of UDRM have been held for Istanbul which is the most strategic city of Turkey and Marmara Region.

RADIUS project prepared for Izmir had strong support from the local administration and many local universities and professional groups. Izmir Metropolitan Municipality and Boğaziçi University prepared a comprehensive master plan called "Earthquake Scenario and Earthquake Master Plan for Izmir" in order to provide detailed information for the project. The project developed a low-cost method of anticipating urban earthquake damage and loss, and a model for creating an action plan to mitigate these losses (Izmir Metropolitan Municipality, 2008).

Earthquake Master Plan of Istanbul was more comprehensive and financial support for preparation of this plan was more when compared with Izmir case. Accordingly, the way of preparation of Earthquake Master Plan for Istanbul is examined in this section.

In the preparation of Contingency / Earthquake Master Plan of Istanbul; the research team (includes scientists and researchers from Middle East Technical University, Istanbul Technical University, Yıldız Technical University, and Boğaziçi University) has determined a group of risk sector which also indicates the analysis of urban vulnerabilities of Istanbul. These sectors have been accepted as the basic contents of a Metropolitan Area Risk Management.

As shown in Figure 3.1, summarizing the whole process of urban risk management and planning, preparation of the integrated hazard maps is the first step of risk management actions. Each type of possible disaster risk is considered in detailed dimensions and their affecting areas; and then, these maps should be combined in different scales.

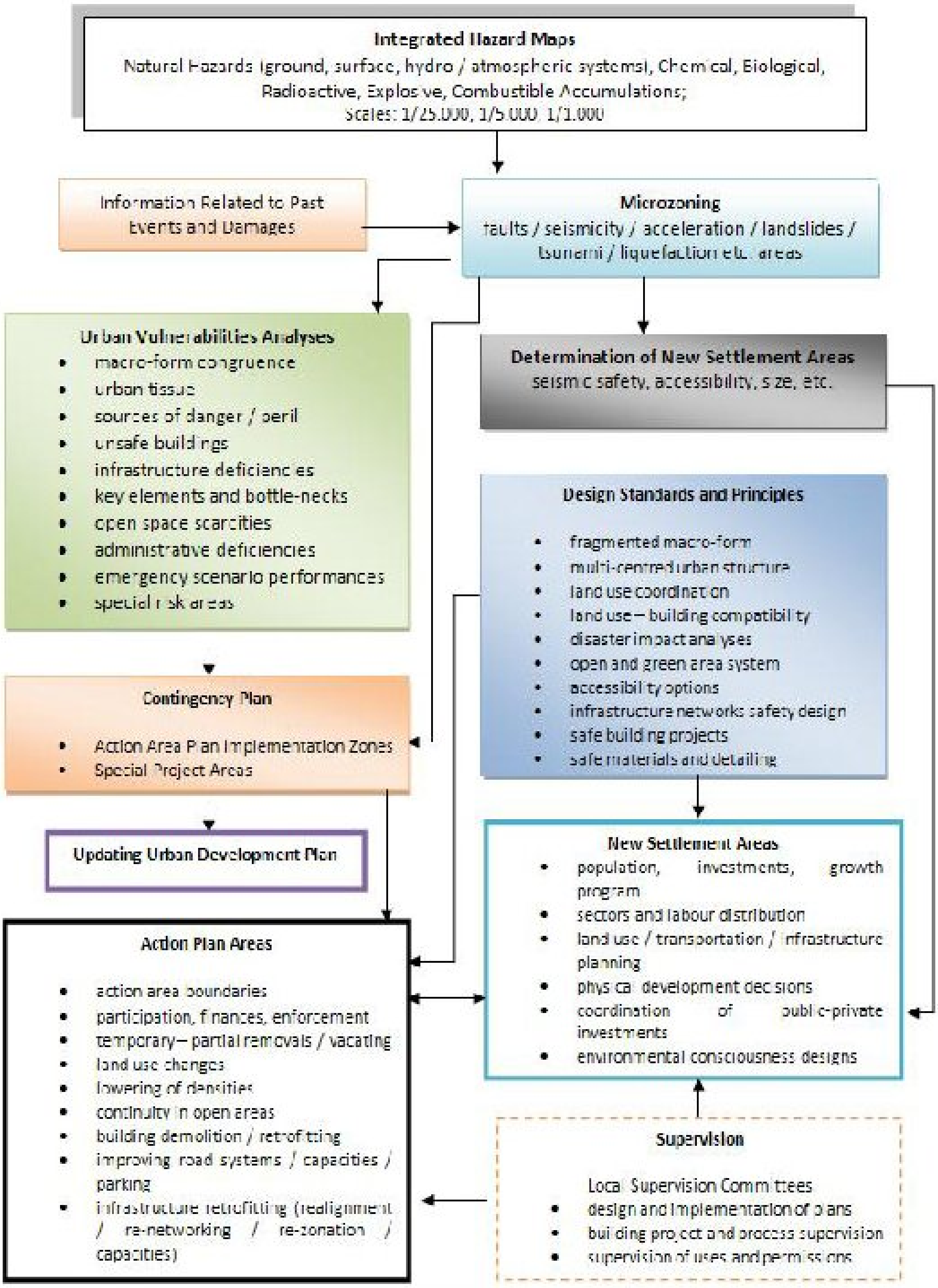

Figure 3.1: Risk Management and Planning in Settlements

(*Source:* Balamir, 2002. Research, planning and documentation studies of the METU City Planning Master Studio - 2002-2003 Academic Year)

The second step is micro-zoning according to these integrated maps and data on past events. Seismic micro-zoning is the first step of seismic risk analysis. Slob, Hack, Scarpas, Van Bemmelen and Duque (2002) explain that; earthquake hazard zoning for urban areas, mostly referred to as seismic micro-zoning, is the first and most important step towards a seismic risk analysis and mitigation strategy in densely populated regions. Micro-zoning is not a result of only seismic analysis but also analysis of other risk of the urban area.

Urban vulnerabilities analyses are made after micro-zoning. Micro-zoning data also gives an input for these analyses. At the same time, new settlement areas are also determined again by using micro-zoning data. As discussed by Balamir (2003), vulnerability (or urban deficiencies) analysis are held in following risk sectors:

- Macro-Form Analysis and Management,
- Urban Tissue Analysis and Formation,
- Land Use Conformity Analysis and Management,
- Loss of Urban Productivity,
- Hazardous Units / Uses and Reliability Supervision,
- Special Areas and Specific Provisions,
- Infrastructure System and Rehabilitation,
- Building Stock Assessment and Rehabilitation,
- Special Buildings / Urban Environments and Expert Management Assignments,
- Key Elements: Internal Safety and Inspection Routines,
- Key Elements: Spatial Distribution Evaluation and Coordination,
- Urban Management Deficiencies Appraisal and Training Programs,
- External Factors and Counter-Measures,
- Urban Growth / Change Diagnosis and Monitoring, and
- Open Space Availability and Provision

Balamir (2002) also summarizes the main activities of UDRM as shown in the Figure 3.2.

UDRM plans prepared for Izmir and Istanbul are the significant examples. However, these plans were prepared for earthquake disaster and related seismic disaster risks. Preparation and implementation of similar management plans should deal with other specific disaster types and consider each type of disaster risk for urban settlements separately.

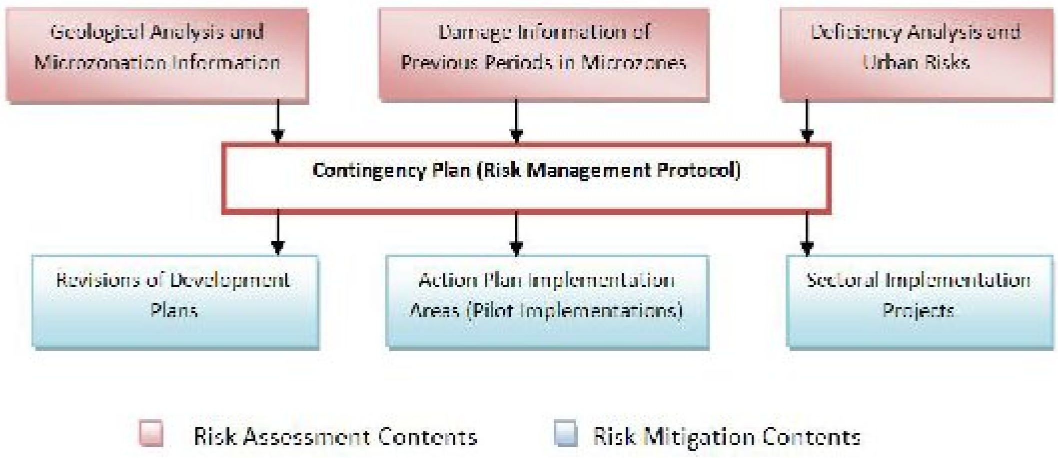

Figure 3.2: Main Activities in Urban Disaster Risk Management

(*Source:* Balamir, 2002)

A practical and significant problem on preparing and implementing an UDRM plan is its legal and institutional base. UDRM has no legal sub-structure in Turkey. There are several types of legal arrangements emphasizing "disaster". However these basically mention earthquake, and flood a little. On the other hand, there is no comprehensive law such as "UDRM Law". Today, a group of laws, by-laws, and decrees which mention disasters are in force, and this variety creates problems. (A summary of legal arrangements and related institutions on the subject of UDRM is given in Appendix H). Some of them define administrative levels, some of them explain the duties, some of them define more than one responsible body, some of them are in force or some of them are abolished due to the enaction of a new regulation, and most of them focus on "disaster" or "crisis management". Although UDRM plans are the subject of planning, these plans have no place in the context of "Development Law" or its by-laws. Accordingly, preparing master plans without an UDRM plan has no enforcement. This conflicting situation creates competencies among institutions, and sometimes puts decision makers, administrative units, and also judgement institutions in trouble.

3.3. Evaluation and the Content of ICZM

Another model of management like UDRM, ICZM and its contents could also be discussed for urban areas starting from its initial appearance.

As Özhan (2004) indicates, water quality management programs in estuaries and bays of the United States are the first attempts towards a kind of coastal zone management (CZM) in the 1960s. The need for CZM was announced first time in a report for the first time in 1969. This report about coastal zones of the United States, namely Stratton Report, was in fact a plan for national action in United States.

The threat to the environment by human activities made people more aware of the issue and this led the way to the first environment conference. UN Human Environment Conference, whose main target was to emphasize the interaction of human-beings and environment, was held in 1972 in Stockholm. In this conference, the Mediterranean was identified as among the particularly threatened bodies of water indirectly. Some recommendations were made in this conference; and "identification and control of pollutants of broad international significance" was one of the recommendations (Recommendation 86). Foundation of an "intergovernmental oceanographic commission" was also recommended (Recommendation 91) in this conference. Some basic legal regulations, which were related to environment, were declared by the members of the United Nations (UNEP, 2005).

In the light of the Stockholm Conference, the United Nations General Assembly decided to establish the United Nations Environment Programme (UNEP) to "serve as a focal point for environmental action and co-ordination within the United Nations system." Therefore, in 1973 UNEP was established as a result of both the decisions taken in 1972 Stockholm Conference and the legal setup of the conference (UNEP, 2005)

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans. Today, the Regional Seas Programme includes fourteen regions (Mediterranean, Red Sea and Gulf of Aden, ROMPE Sea Area (Kuwait region), Wider Caribbean, East Asian Seas, South East pacific, West and Central Africa, South Pacific, Eastern Africa, Black Sea, North-West Pacific, South Asian Seas, North-East Pacific, Upper South-West Atlantic) and has over one hundred twenty participant coastal states (UNEP, 2005).

Meanwhile, UNEP provided the preparation of the Mediterranean Action Plan (MAP) and put it into force in 1975. MAP was approved by sixteen Mediterranean states plus the European Community. Priority Action Programs (PAP) of MAP are the specific forms of CZM efforts and actions.

Another action, namely United Nations Convention on the Law of the Sea (UNCLOS), has nearly ten years preparation phase and twelve years putting into force phase. It aims to provide efficient and fair (equal) utilization of marine resources. Additionally, this convention also aims to make the legal arrangements on both protection / conservation of the marine environment and definition of the rights of the states in marine areas. In other words, this convention is a legal basis for seas and oceans - in terms of management and regime issues (or rules) of maritime zones. The convention refers to regional rules, regional programmes and regional co-operation, and underlines the issues of protection and preservation of the marine environment in part 12 (articles between 192 and 238). This part of the convention basically determines the measures to prevent, reduce and control pollution of the marine environment, and states the need for co-operation both in global and regional levels. Consequently, these definitions had already been effective in UNEP’s efforts (i.e. Regional Seas Programme or MAP).

On the other hand, in 1972, Coastal Zone Management Act was prepared in United States, and first CZM conference was organized in 1978. Following Brundtland Commission Report on “Our Common Future,” the importance of CZM increased especially with the arguments of sustainability / sustainable development. This landmark report triggered a wide range of actions, including the United Nations Conference on Environment and Development, the

Intergovernmental Panel on Climate Change (IPCC), and worldwide “Agenda 21” programmes.

The IPCC formed a subgroup on CZM to examine particularly the issue of sea-level rise and threat it may pose to low-lying coastal nations. Later on, the CZM subgroup issued a set of recommendations that endorsed integrated coastal management as the appropriate framework within which to develop and implement specific measures to reduce vulnerability to accelerated sea-level rise. Indeed, the recommendations made it clear that the effectiveness of such measures depended upon their being implemented within a broader CZM framework (IPCC, 1992).

Agenda 21 also triggered the creation of CZM. In its nature, Agenda 21 intended to serve as a kind of road map pointing the direction toward sustainable development. It is a forty-chapter action plan and represents an ambitious effort to provide recommendations across the entire spectrum of environment, development, and social issues confronting humankind today. In terms of social and economic issues, it addresses poverty, overconsumption and production, population, and human development problems.

According to Skjærseth’s (1996), argument Agenda 21 deals with the atmosphere, land resources, deforestation, desertification and drought, mountain ecosystems, agriculture and rural development, biological diversity, biotechnology, oceans and coastal areas, freshwater resources, toxic chemicals, hazardous wastes, solid wastes, and radioactive wastes. It has chapters devoted to the roles of major groups, including women, children and youth, indigenous peoples, nongovernmental organizations, local authorities, workers and trade unions, business and industry, the scientific and technological community and farmers. Finally, concerning means of implementation, it discusses financial resources, transfer of technology, the roles of science, education, public awareness and training, capacity building, institutional arrangements, legal institutions, and information for decision making. However, Agenda 21 is not a binding document. Yet by signing the document, governments indicated a willingness to be part of the international consensus seeking to move toward a more sustainable society along the lines set forth in Agenda 21.

In terms of CZM, the position of Agenda 21 reveals itself with Chapter 17. Güneş (2005) argues that, Chapter 17 of Agenda 21 titled *Protection of the Oceans, All Kinds of Seas, Including Enclosed and Semi-Enclosed Seas, and Coastal Areas and the Protection, Rational Use and Development of Their Living Resources* provides the major prescriptions for ocean and coastal management. Coastal nations commit themselves to "integrated management and sustainable development of coastal areas and the marine environment under their jurisdiction" (Cicin-Sain and Knecht, 1998, 87). The text stresses the need to reach integration (e.g., identify existing and projected uses and their interactions and promote compatibility and balance of uses); the application of preventive and precautionary approaches (including prior assessment and impact studies); and full public participation.

At the same time, as Cicin-Sain and Knecht (1998, 87) indicates, the text calls for integrated policy and decision making processes and institutions ("each coastal state should consider establishing, or where necessary strengthening, appropriate coordinating mechanisms; such as a high-level policy planning body, for integrated management and sustainable development of coastal and marine areas, at both the local and national levels"). Chapter 17 of Agenda 21 also provides a series of suggested actions such coordinating institutions should consider undertaking, such as preparation of coastal and marine use plans (including profiles of coastal ecosystems and of user groups), environmental impact assessment and monitoring, contingency planning for both human-induced and natural disasters, improvement of coastal human settlements (particularly in terms of drinking water and sewage disposal), conservation and restoration of critical habitats, and integration of sectoral programs (such as fishing and tourism) into an integrated framework. Chapter 17 of Agenda 21 also recommends cooperation among local or regional units in the preparation of national guidelines for coastal management, and the undertaking of measures to maintain biodiversity and productivity of marine species and habitats under national jurisdiction.

The need for information on coastal and marine physical systems and uses, information on both natural science and social science variables, education and training in integrated coastal and marine management, and capacity building, including building of human resource capacity, support of pilot demonstration programs and projects in integrated coastal and marine management, and establishment of centers of excellence in the area are indicated in the Chapter 17 of Agenda 21 according to Güneş's (2005) argument. As in other parts of Agenda 21, in this section there is a strong affirmation of the need to include traditional ecological knowledge of socio-cultural values as an input to management and of the importance of coastal areas for indigenous people. Emphasize of international cooperation on both a bilateral and multilateral basis to support national efforts by coastal states in the objectives and activities noted earlier are the other issues of Chapter 17.

Besides these evolution steps of CZM, Cicin-Sain and Knetch (1998) defend that coastal zone management traditionally began on the land side of the coastal zone, focusing on issues related to the special interface between the land and the sea, such as shoreline erosion measures, protection of wetlands, sitting of coastal development, and public access to the coast, because, these issues initially centered on control and regulation of coastal land. They summarize the evolution of the CZM as shown in the Table 3.1.

Table 3.1 shows that the actions concerning CZM were developed and reformed due to the inappropriate development and poor planning in time. At the beginning, most of the CZM programs had been dealing primarily with the management of shore land uses. However, progressively both the physical dimension and social – political dimensions of coastal area have extended. Accordingly, the contents of CZM programs have also extended. CZM programs have great variety of political, cultural, and physical settings today.

A terminological evolution of CZM is explained by Cicin-Sain and Knecht (1998). They state that the concept of coastal management has several names and corresponding acronyms over the three decades of its existence. The term *coastal zone management (CZM*) was the first name. However, early efforts in developing countries were given the name *integrated coastal area management (ICAM)* as they were usually limited to a specific coastal area rather than the entire coastal zone. As the concept of coastal management gained greater recognition internationally, the phrases *integrated coastal zone management (ICZM)* and *integrated coastal management (ICM)* came into use. More recently, in connection with the implementation of Convention on Biological Diversity, the term *integrated marine and* *coastal area management (IMCAM)* has been used as well. According to the Cicin-Sain and Knetch, these terms all refer to the same concept.ICZM is adopted in this study.

Table 3.1: Evolution of ICZM (Stage-Based Model)

(*Source:* Cicin-Sain and Knetch, 1998; 32)

Stage	Objective	Coastal Uses under Management	Geographical Coverage
1960s: rise	Use management addressing a single environmental issue socially perceived as important.	One or a few uses (e.g., seaports, recreational uses.	The shoreline
1970s: implementation	Use management and environmental protection.	Few uses (e.g., seaports, manufacturing plants, recreation, and fishing)	Various alternative extents: - the shoreline - a coastal zone delimited according to arbitrary criteria - a coastal zone delimited according to administrative criteria
1980s: maturity	Use management and environmental protection	Multiple use management	Various alternative extents characterized by the proclivity to move seaward to extend management to national jurisdictional zones
1990s: international primacy	Integrated Coastal Zone Management (ICZM)	Comprehensive use management, management of the coastal ecosystem	A zone extending - landward according to various criteria - seaward to the outer limit of the widest national jurisdictional zone

Since coastal resources and the coastal zone itself have been under pressure of various uses, a kind of management which regulates and organizes the actions that take place on coastal zone is needed. Ecological effects and multiple use conflicts are the main reasons of the need for management.

Coast – human relations and interactions have caused various environmental problems. As stated before, complex and conflicting uses in coastal areas have been causing interruptions on those uses and environmental degradation at the same time. Attractiveness of coastal areas has also caused conflicting interests and pressures on coastal areas. Therefore, primary goals of ICZM are; resolving conflicts among different uses and activities taking place in the coastal zone and decreasing the negative impacts on coastal environment and resources.

Basically, ICZM highlights the significance of coastal zone as a unique resource system and tries to organize all the activities on the coastal zone without allowing to one activity to interrupt another. In other words, ecological effect and multiple-use conflict are the main reasons that require management. Coastal area has a distinctive position that requires special management and planning approaches. In ICZM, it is essential that land and sea uses be planned and managed in common, and the sea shore is the focal point of coastal management programmes. However, understanding the coastal environment and its processes are essential for achieving an effective management; and natural disaster risk is one of the main elements of coastal environment.

Mainly ICZM defines a kind of special management area, determines management goals, and sets policies and programmes; however, coastal management boundaries should be issue-based and adaptive. That means ICZM programs can change and be redefined according to the peculiarities of different areas. The steps in the formulation of an ICZM program can be listed as follows:

- identification of initial problems, issues, and opportunities, setting priorities (development and analysis of coastal profiles: assessment of issues, programmatic scope: one issue or multiple issues, geographical scope: national approach or pilot project),
- formulation of goals, objectives, and strategies,
- establishment of the boundaries for the management area (landward boundary and seaward boundary),
- assessment of existing institutional and legal capacity for ICZM
- design of the intersectoral - intergovernmental coordinating mechanism and of the ICZM office (consideration of new management measures, and the resulting ICZM plan),

- formal approval of the ICZM plan by participating governments, and
- determination of management tools and techniques in operation phase (zoning, protected areas and special area planning, acquisition, easements, and development rights, and coastal permits etc.)

A major emphasis of ICZM is to conserve common property resources. Accordingly, prevention of damage from natural hazards and conservation of natural resources should be combined in ICZM programmes. Even though ICZM has been created to prevent the devaluation of coastal areas; the context, aims, basic contents and the comprehensiveness of ICZM are inadequate in terms of natural disasters. As well as this, the prevention measures of ICZM against natural disasters are mostly at structural and technological levels. ICZM assesses the effects on coastal areas from one side, and it considers mostly the human-made effects. There is a need for a kind of management which considers not only the protection and operation of coastal resources, but also coastal disasters and their effects on both urban settlements and natural resources. Disaster risk management emphasis of ICZM is relatively weak.

3.4. Turkish Coasts and ICZM in Turkey

Having 8.333 kilometers length, Turkey's coasts are richly endowed with natural beauty, cultural attractions, bays, estuaries and wetlands replete with resources. Additionally, Turkey has specific sea areas (territorial seas, exclusive economic zone, etc.) according to the definitions of United Nations Convention on the Law of the Sea (UNCLOS), although it is not a member of UNCLOS. 26 of the 81 provinces are located on coastal areas in Turkey. There are 15 province centers, 126 districts, 157 municipalities and 430 villages located by the coast. Additionally, according to the ABPRS results of 2009, more than 50 % of the approximately 75 million population lives in coastal areas, and 20 % of this total population lives at the sea side. Meanwhile, there are also different kinds of risk potentials on Turkish coasts. Starting with this brief information, this part will evaluate the main problems of Turkish coastal areas in terms of coastal disasters, evolution and progress of ICZM efforts and tools, and UDRM implementations.

Starting from mid 1980s, there is a sharp shift of population toward the coast, particularly with the migration from central and eastern Anatolia in search of better living conditions (Özhan, 2004). In addition, rapid growth of tourism industry, which has gained momentum since 1980s, along the coastal areas has doubled the population pressure on the coastal zone, resulting in many environmental and socio-economic effects.

Most of Turkey's industrialization has also taken place in the coastal provinces, including Istanbul, Izmir, Izmir, Adana, Mersin, Samsun, and Zonguldak. Although such industrial development is economically important, its rapid expansion along the coasts has caused serious coastal water pollution and deterioration. Besides industry, construction of tourist accommodations and summer houses along the coasts, especially the south-western coasts, has contributed significantly to sewage and solid waste problems and degradation of water quality. Increase of tourism activities on coastal zones also creates a competition among industry, agriculture, and tourism activities. Commercial fishing also has a significant portion in both coastal areas and economic income of the country. This activity also contributes to the coastal problems.

When disaster risks are added on these kinds of coastal problems, the situation of the coastal areas in Turkey becomes much more serious. At this point, definition of coastal risks becomes important. As predictability and having information about disasters are the essential parts of risk management, what the coastal risk is for Turkish coasts should be defined primarily. Mainly four types of disaster risks can be identified. First of all, there are geological and topographical disaster risks such as earthquakes and erosion. Second, there are meteorological disaster risks such as hurricanes and typhoons. Third, there are hydrological and marine disaster risks like tsunamis, storm surges, floods, and sea level rise. And finally, there are human – made or technological disaster risks like water pollution and nuclear – chemical accidents. All of these kinds of risks are possible for Turkish coasts.

Although there are several works on ICZM and its limited implications, it is not easy to say that complete ICZM shows itself in Turkish System. As being a republican parliamentary democratic country, national government of Turkey has a great deal of power. The national government's involvement in management of coastal resources and environment mandated numerous laws and regulations on a sector by sector basis; the laws were passed primarily during the period between 1980s and 1990s.

The current ICZM in Turkey basically includes spatial planning (including limited efforts in deciding land-use types and permissions on development type), environment, nature conservation, sectoral development, and generating a framework for development of ICZM. There are some instruments used for achieving ICZM in Turkey. These are mainly, nation-wide development plans, sectoral development plans, land use plans, specially managed areas (SEPA's, national parks, cultural sites etc.), coastal law, environmental impact assessment, critical area / endangered species protection, UNEP's regional seas program (Mediterranean since 1975, Black Sea since 1992), union of municipalities around important enclosed basins (the Sea of Marmara, Izmir Bay, etc.)

As Özhan (2004) mentions, major ICZM issues in Turkey are;

- urban sprawl, tourism development, illegal construction by the shore,
- coastal waters polluted by municipal, industrial, agricultural, and ship waste, and
- biodiversity protection required for extremely rich biodiversity and last natural habitat for monk seal, green turtles, and other rare species.

Although ICZM is a very comprehensive process and an effective tool for coastal development, Turkey has very limited regulations and practices in terms of ICZM programs. Efforts and actions in terms of ICZM requirements are insufficient in Turkey. This deficiency is highly based on narrow legal frame, no sanctioning rules, and weak controlling mechanism. That means creating an adequate legal framework; sanctionary rules, improving the controlling mechanism, and using regulatory power for ICZM are required. Reducing vulnerability of coastal areas and their inhabitants to natural hazards has also great importance for coastal areas, and this should be considered with the association of ICZM and UDRM.

3.4.1. Coastal Planning Areas and ICZM Efforts in Turkey

Recent tourism development regions, existing planning areas, and tourism investment areas that have plans are summarized in Table 3.2. All of the areas which take place in the table are coastal planning areas of Turkey.

Table 3.2: Tourism Development Areas and Planning Areas Located on the Coast

Name	Coast	Province	Upper Scale Plans	Lower Scale Plans
1. Aegean Coastal Strip Tourism Physical Plan	Aegean Sea		1/250.000 or 1/200.000	
2. Muğla Coastal Strip Tourism Physical Plan	Aegean Sea	Muğla	1/250.000 or 1/200.000	
3. South Antalya Coastal Strip Tourism Physical Plan	Mediterranean	Antalya	1/250.000 or 1/200.000	
İğneada - Kilyos MP*	Black Sea	Istanbul Kırklareli	1/250.000 or 1/200.000, 1/25.000	1/5000-1/1000
Bergama - Dikili MP	Aegean Sea	Izmir	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000
Çandarlı MP	Aegean Sea	Izmir	1/250.000 or 1/200.000, 1/25.000	1/5000-1/1000
Ayvalık - Küçükköy - Altınova MP	Aegean Sea	Balıkesir	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000
Edremit - Burhaniye MP	Aegean Sea	Balıkesir	1/250.000 or 1/200.000, 1/25.000	1/5000-1/1000
Çeşme - Karaburun MP	Aegean Sea	Izmir	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000
Yenihisar - Didim - Güllük - Akbük MP	Aegean Sea	Izmir - Muğla	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000
Bodrum - Karatoprak MP	Aegean Sea	Muğla	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000
Datça - Bozburun Peninsula MP	Aegean Sea	Muğla	1/250.000, 1/100.000 1/25.000	1/5000-1/1000
Marmaris MP	Mediterranean	Muğla	1/250.000 or 1/200.000 1/25.000	1/5000-1/1000
Sarıgerme Tourism Investment Area	Mediterranean	Muğla	1/100.000and 1/25.000	1/5000-1/1000
Serik - Alanya - Manavgat MP	Mediterranean	Antalya	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000
Kaş - Finike - Kumluca MP	Mediterranean	Antalya	1/250.000 or 1/200.000 1/25.000	1/5000-1/1000
Fethiye - Dalaman Tourism Investment Area	Mediterranean	Antalya	1/100.000 and 1/25.000	1/5000-1/1000
Antalya MP	Mediterranean	Antalya	1/250.000 or 1/200.000 1/25.000	1/5000-1/1000
Belek Tourism Investment Area	Mediterranean	Antalya	1/100.000 and 1/25.000	1/5000-1/1000
Anamur MP	Mediterranean	Mersin	1/250.000 or 1/200.000 1/25.000	1/5000-1/1000
Aydınlık MP	Mediterranean	Mersin	1/250.000 or 1/200.000, 1/25.000	1/5000-1/1000
Ovacık MP	Mediterranean	Mersin	1/250.000 or 1/200.000 1/25.000	1/5000-1/1000
Silifke - Erdemli - Mersin MP	Mediterranean	Mersin	1/250.000 or 1/200.000, 1/25.000	1/5000-1/1000

*MP: Master Plan

Table 3.2: Tourism Development Areas and Planning Areas Located on the Coast - Continued

Name	Coast	Province	Upper Scale Plans	Lower Scale Plans
Karataş MP	Mediterranean	Adana	1/250.000 or 1/200.000, 1/25.000	1/5000-1/1000
Iskenderun MP	Mediterranean	Hatay	1/250.000 or 1/200.000, 1/25.000	1/5000-1/1000
South Antalya Tourism Development Project	Mediterranean	Antalya	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000
Seferihisar - Dilek Tourism Development Project	Aegean Sea	Muğla	1/100.000 and 1/25.000	1/5000-1/1000
Köyceğiz - Dalyan Tourism Investment Area and Tourism Development Project	Mediterranean	Muğla	1/250.000, 1/100.000, 1/25.000	1/5000-1/1000

Beside those planning areas, at present, there are twelve Turkish examples which can be evaluated as a kind of ICZM attempt (based on Duru, 2003):

- Izmir Bay Coastal Zone Management Programme: Aim of this programme is to provide regional economical, social, environmental development (sustainable development).
- Iskenderun Bay Environmental Management Project: Aim of the project is to provide economical, social, environmental development.
- Mersin Integrated Coastal Zone Management Project: Aim of the project is to provide economical, social, environmental development (sustainable development). Focus on conservation, natural resource management, flexibility.
- Belek Coastal Management Programme: Focus on tourism development, conservation of culture and nature.
- Çıralı Coastal Management Programme: Focus on local economical development, natural sensitivity, construction control, eco-agriculture, eco-tourism,
- Bodrum Peninsula Coastal Zone Management Project: Focus on tourism, agriculture, aquaculture, natural conservation,
- Trabzon Coastal Management Project: Focus on coastal conservation, control of construction.
- Patara Specially Protected Area Management Plan: Focus on natural conservation, coordination, cooperation, localization,
- Black Sea Environment Programme: Focus on institutional structure and sectoral networking, natural conservation

- Eastern Black Sea Regional Development Plan: Focus on regional economical development and sustainable development within the principles of national coastal plan.
- Gökova Project: The project may be explained as the preparation and implementation of the Integrated Management Action Plan in collaboration with stakeholders for the Inner Gökova Bay and the Sedir Island within Gökova Specially Protected Area. The aim of the project is to stage for the first time in Turkey the development and implementation with the involvement of all stakeholders of an integrated management plan for coastal areas (Inner Gökova Bay and the Sedir Island) located within the boundaries of a Specially Protected Area
- Göcek SEPA Management Project: Definition of the carrying capacity of the bay. It is not a kind of ICZM; however, it would be the starting point a kind of ICZM.

In addition to these efforts, also ICZM specific projects are adjudicated by the General Directorate of Technical Research and Implementation at the Ministry of Public Works and Settlement and some of them are completed. Iskenderun Bay Integrated Coastal Planning and Management Project (completed at the end of 2007), Antalya Integrated Coastal Planning Project (adjudicated in 2009), Samsun Integrated Coastal Planning Project (completed in 2009) are the examples (Ministry of Public Works and Settlement, 2010).

3.4.2. Legal and Institutional Structure of ICZM in Turkey

Turkey is a very rich country in terms of its coastal length, natural and historical resources and beauties; however cannot use the benefits of this richness correctly and properly since the failures in legislation, frequently made changes and the incorrect and unconscious practices caused by the impairments in controls and sanctions (Sesli, Şişman, and Aydınoğlu, 2009).

The situation about ICZM is mostly similar to the situation of UDRM in terms of legal and institutional structure. There is not a comprehensive law code such as “ICZM Law”. Today, there are laws, by-laws, and decrees which mention coastal uses, coastal resources, security of coasts, and utilization of coastal areas and this variety is a problem as in the situation of legal, administrative and institutional structure of UDRM. According to these coast related regulations, principles of the preservation, utilization and ownership concerned with coastal zones can be ordered as; (1) coastal areas are under authority and possession of the state, (2) coastal areas are open to everybody's use as free and equal, (3) public interest is the first point in using coastal areas. However, the existing legislation shows the sectoral character of present system, suffering from overlapping responsibilities, and from insufficient communication and cooperation among different state agencies on the one hand, and among central government and the municipalities on the other. Some of these regulations are for ships and transportation, some of them define administrative levels, some of them explain the duties, some of them define more than one responsible body in the subject of permissions, and some of them are out-of-date. For instance, coastal zones may be covered by legislations more than once because of complex and multi-headed structure of the development legislation. Moreover, as in the situation of UDRM, ICZM related issues have only a limited place in the context of "Development Law" or its by-laws. In terms of planning the most significant problem related to coastal zones is the contradictory situation between conservation and development. Nevertheless, the most powerful legal arrangement is still the Coastal Law for ICZM. Accordingly, preparation of ICZM plans is not forced by Turkish legislative structure. Today, preparation of ICZM plans is at recommendation level due to the international agreements in which Turkey is involved as a party. These are the main problems of the coast related legal structure (A summary of legal arrangements and related institutions on the subject of ICZM is given Appendix I).

Reviewing the legal structure and regulations, it is clear that, some new regulations should be done to lessen the heavy dominance of hard tourism on coastal areas. Turkey's coastal regulation includes insufficient institutional set up for coordination, and includes insufficient determination of the responsibilities of actors (organizations and institutions). Also, despite the Coastal Law, there is neither legislation nor an institution that covers all aspects of ICZM. There is a lack of a central organization which looks at the coastal zone as a whole entity and sees it as an area holding a bunch of natural resources having complex relationship with each other. Again, there is a lack of a central organization which helps municipalities and provincial governors for identifying their management needs, preparing and implementing management plans. However, there has been a significant interest in Turkey for improving the ICZM practices and for integration of the management.

3.5. Evaluation of UDRM and ICZM: Association, why and how?

General context of the study underlines two subjects; coastal settlements and natural disasters and accordingly two concepts basically: ICZM and UDRM. Since ICZM and UDRM concepts have been defined as the basic starting points of the study, this part discusses and compares these concepts according to their operation conditions and basic principles, and evaluates them in a comparative point of view. Additionally, possibility of and need for an association is introduced with the explanations about the results of first implementing these management plan models in a coastal urban settlement independently, second by association.

Why?

In general, ICZM refers to a set of policies, rules, and implementation tools and institutions, and focuses mostly on human-made effects on coastal areas. ICZM includes limited actions against the effects of natural processes. Additionally, when “urban” and “coastal” come together, much more complex problems and management issues arise. Distinct from any urban area, a kind of risk management approach, which also takes ICZM requirements into consideration, should be identified for coastal urban areas. Moreover, general rules and requirements of ICZM, and also general rules and requirements of UDRM may not be applicable for all coastal urban areas because of the different spatial, social, and historical characteristics of that area. That means socio-spatial characteristics of the area have a significant role in UDRM and ICZM.

Meanwhile, there is also need for re-definition of risk creating factors for coastal areas and ecological issues should not be the one and only risk factor. Many other risk factors and security issues arise especially in urban coastal areas. This situation should bring new approaches to coastal areas, and association of UDRM and ICZM should be considered as a new approach. Definition of risk creating factors for all types of coastal areas should be the first step of this new approach.

As understood from previous explanations, both UDRM and ICZM are the models of management plans. The process of any kind of management plan includes varying steps; however, planning is the primary and most important matter of all those steps. Management of a special area requires first of all planning and programming levels. Plan of a management program defines all the things about land allocation, spatial reorganization, definition of some urban codes and use principles, permissions and limitations for instance. Starting from the definition of the management area, and to the implementation and monitoring steps, plan is the basic guideline which also permits feedbacks and updates.

In response to Turkey's emerging coastal problems, the national government, with the cooperation of a number of international organizations, such as Regional Activity Centre of the UNEP – MAP for Priority Actions Programme, the OECD, the World Bank, and the Global Environmental Facility (GEF), has played major roles in Turkish ICZM. However, there is no ICZM programme which focuses on coastal disasters or urban disasters on the coasts in Turkey. At the same time, Izmir and Istanbul Earthquake Master Plans are the only UDRM efforts; however, they have very weak association with common ICZM programs. In Istanbul for instance, Bosporus Area and Bosporus Law (this area and law on that area should be considered a kind of ICZM tool in Turkey) could be considered in the context of an associated position. Besides this weak link, this UDRM program has great efforts about spatial re-organization principles and has a wide content on the urban issues. Consequently, the lack of association between ICZM and UDRM is also a significant problem in Turkey. These two management plans should not be considered separately for coastal areas.

The differences between associated use of ICZM and UDRM and independent use of ICZM and UDRM could be explained with two examples, and these examples would be beneficial to defend associated use:

Assume that there is a coastal settlement with a river passing through the settlement, and the river falls to the sea. This settlement and its region have both ICZM and UDRM plans which have been prepared independently. Existing ICZM plan points out that the settlement has an intensive erosion problem at the point which the river falls to the sea. Considering this problem, existing ICZM plan highly recommends taking actions against this problem by using relevant technical (engineering) solutions and solutions concerning sift on land-use. Meanwhile, the UDRM plan points out that the river passing through the settlement causes floods frequently, and there is a need for some mitigation measures. One of the proposed measures of the UDRM plan is constructing a dam on the upper part of the basin above the settlement. It is seen that, the problem area on the coast where the river flows in is exposed to more and more erosion as the result of the dam construction.

In the second example, there is a coastal settlement which has a natural harbor and has made its development due to the existence of this harbor and harbor-related activities historically. The harbor also definitely has a great importance in terms of transportation system and economical development of the settlement; especially if the city has a special type of local production and uses this harbor essentially as the way of serving this product to the market. This settlement and its region have an ICZM plan and this plan gives highly importance to the local production and its relation with the harbor. Accordingly, the ICZM plan of the settlement highly considers the economical development of the region. Meanwhile, the settlement also has an UDRM plan and this plan also notices the importance of the harbor and its safety. The settlement has developed very close to the harbor, and the activities of both the harbor and the settlement are highly interrelated. The UDRM plan recognizes this close relationship between the harbor and the settlement, and does not recommend allowing the acceptance, storage, and transportation of hazardous materials around the harbor. On the other hand, the harbor is designated as the last point of an international oil pipeline by an international level decision. The harbor and its near environment turn into a storage and transportation space of oil-related products as the result of this decision. Since some issues regarding security, safety, and control occur in such a condition, there is a conflict and dispute areas in terms of administrative, institutional, and legal aspects.

As mentioned in these two examples, if these two management plans have been developed and implemented separately in the same settlement or region, this situation can cause many problems like these. If these plans, which have different approaches and different focus points, are developed and implemented independently, one of them may neglect the basic objectives and concerns of the other. Additionally, the independent use of these management plans leads to a problematic situation called "the authority conflict" which means intersection of the authorities of different administrative units or institutions. Today, different types of coastal developments, which interrupt and threat each others' existence, are seen on coastal areas as the result of not considering and implementing these management plans in association (*i.e.* The Coastal Highway of Black Sea, 592 km).

These explanations show that ICZM and UDRM should be considered together for coastal settlements, and there is an association problem between ICZM and UDRM. Table 3.2 also shows a comparative evaluation of ICZM and UDRM in summary. How ICZM and UDRM could be integrated for safer and livable coastal settlements is main problem in here. After making a comparison between these models of management plans, following parts of this chapter make brief and explanatory discussions about the current problems of ICZM and UDRM in Turkey.

Table 3.3: Comparative Evaluation of ICZM and UDRM

	ICZM	UDRM	Comment
1 Type	is a model management plan for coastal areas is a process	is a model of management plan for urban areas is a process	
2 First Appearance	Since 1960s (Starting point is the introduction of water quality management programs in estuaries and bays in USA, gains momentum after the UN Conference in 1972)	Since 1980s (Starting point is the establishment of UN – ISDR and the designation of IDNDR, gains momentum after 1990s)	
3 Definition	Is a process through which rational use patterns for coastal resources are achieved, by accounting for the social needs and the characteristics of the physical environment, and by utilizing scientific information and technological instruments.	Is a process based on building a culture of prevention which aims to mitigate any kind of disaster losses, and includes varying types of planning, implementing, and monitoring activities.	Both ICZM and UDRM highly emphasize planning activities in procedures.
4 Area Definition	For coastal areas. Defines the physical limits of the coast both seaward and landward directions, and also defines the user groups, activities, sectors	For urban areas. Defines the urban area with its all urban activities, socio-economic structure, physical features, historical data, and future projections and calculations.	Coastal area has some definitions and limitations. Urban area defines its limitations with some specific urban uses
5 Aim	- To resolve conflicts among different uses and activities - To limit impacts on coastal resources	- To reduce vulnerability to natural and human made disasters - To regulate development in high-risk areas through plan decisions.	
6 Focus Point	Takes mostly environmental issues and sustainable development into consideration (pollution, environmental quality, endangered species, coastal tourism, etc.)	Takes natural and human made disasters' probability, public safety, and socio-economic concerns into consideration	

Table 3.3: Comparative Evaluation of ICZM and UDRM (continued)

	ICZM	UDRM	Comment
7 Requirements	Requires togetherness of different sectors / multi-sectoral approach Participation is essential Ignores instant interventions.	Requires togetherness of different sectors / multi-sectoral approach Participation is essential Ignores instant interventions.	
8 Problem Area	Environmental degradation and deteriorated conditions of coastal areas, safety and sustainability of all living things on the coast. Loss of environmental resources and interruption of sustainability	Natural and human made disasters, their impacts and the ways of precaution, and protection of public safety. Loss of lives, loss of properties, loss of amenities, and loss of quality of life.	
9 Typical Activities	- Physical planning - Activity planning - Promotion of economic development - Stewardship of resources - Conflict resolution - Protection of public safety	- Physical Planning - Activity Planning - Funding - Regulation of development in high-risk areas through "contingency planning" - Creation of evacuation plans and other measures in case of emergency	
10 Instruments, Tools, and Planning Focus	- Based on policy, action, and spatial planning - Coastal and Environmental Engineering have significant roles. - Environmental concerns are more important than economic gains. - Public education is important. - Plans should be prepared at national level and implementations may vary according to the local characteristics. - GIS, EIA, Modeling and Decision Support Systems are the significant implementation tools. - National Development Plans, Regional Plans, and other lower-scale plans are also used. - Institutions and Legal Framework are other implementation instruments.	- Based on policy, action, and spatial planning. - Engineering (Civil, Geological, Geophysical, Engineering - Economic measures are important in order to reduce social vulnerability. - Public education is important. - Plans should be prepared at national level and implementations may vary according to the local characteristics. - National Development Plans, Regional Plans, and other lower-scale plans are significantly used. - GIS, Modeling and Decision Support Systems are also important. - Institutions and Legal Framework are important implementation instruments.	However, spatial planning focus is not in practice. Engineering efforts are taken much more attention than planning efforts.

Table 3.3: Comparative Evaluation of ICZM and UDRM (continued)

	ICZM	UDRM	Comment
11 Implementation Scale	At regional scale	At urban scale	There is an intersection area between these scales.
12 World experiences	There are successful world examples in USA and in some European countries; however, they have limited disaster focus.	The world examples are still at policy planning level, there is no significant implemented example.	
13 Turkish experiences	Only a few successful implemented examples, however those have no disaster focus.	Especially after 1999 the efforts gained momentum; policy planning and economic planning efforts are continuing at national level. Istanbul – Zeytinburnu is an ongoing example.	Zeytinburnu case is still at policy planning and engineering levels; destruction and construction activities have priority. Except this case, UDRM is still a kind of procedure list and has no full implementation in Turkey. Likewise, ICZM has also no full implementation; it is just a procedure list now.
14 Related Establishments in Turkey	The Ministry of Public Works & Settlements, The General Directorate of Bank of Provinces, State Planning Organization, Municipalities and Provinces, Ministry of Energy and Natural Resources, Ministry of Agriculture, Ministry of Tourism and Culture, Ministry of Transportation	The Ministry of Public Works & Settlements, The General Directorate of Bank of Provinces, State Planning Organization, Municipalities and Provinces, Ministry of Internal Affairs, Ministry of Transportation, Ministry of Finance	
15 Strong Dimensions	Has many different dimensions and have to consider all of those dimensions Easily may used for the creation of high quality and good planned living environments	Has many different dimensions and have to consider all of those dimensions Easily may used for the creation of high quality and good planned living environments	

Table 3.3: Comparative Evaluation of ICZM and UDRM (continued)

	ICZM	UDRM	Comment
16 Weak Dimensions	Usually implemented as a kind of environmental conversation tool Usually perceived as a kind of engineering business Is a long process and hard to see the consequences in a short period	Usually perceived as a kind of engineering business Is a long process and hard to see the consequences in a short period	
17 Opportunities	Requires comprehensive planning approaches and may certainly be tackled as a complete planning job Both preparation and implementation processes, and also monitoring process require extensive participation of people from different disciplines, agencies, sectors, establishments, and NGO's.	Requires comprehensive planning approaches and may certainly be tackled as a complete planning job Both preparation and implementation processes require extensive participation of people from different disciplines, agencies, sectors, establishments, and NGO's.	Participation of the all parties provides a collaborative process and agreement, and a satisfaction of all parties as well.
18 Threats	May easily turn into a kind of engineering business May miss the point of conversation – utilization balance and may highly stress on conversation approaches	May easily turn into a kind of engineering business May focus on some specific and often disaster events and may not consider other possible events	Both of them are context depended

<u>1. Type and Definition</u> *Integrated Coastal Zone Management (ICZM)* is defined by Özhan (2004) as a process through which rational use patterns for coastal resources are achieved, by accounting for the social needs and the characteristics of the physical environment, and by utilizing scientific information and technological instruments. As understood from this definition, ICZM is a plan designed for coastal areas.

Urban Disaster Risk Management (UDRM) could be defined as a process based on building a culture of prevention which aims to mitigate any kind of disaster losses, and includes varying types of planning and implementation activities which comprise before-during-after disaster periods. UDRM is also a plan and it is designed for urban areas.

ICZM is designed for coastal areas and the UDRM is designed for urban areas. However, there are many places which have both coastal and urban characteristics. That means both of these plans could be implemented in such places. Many types of uses are taking place on coastal zones and urban settlements are one of those uses. Coastal urban settlements are the intersection area of ICZM and UDRM implementations.

<u>2. First Appearance</u> Initial steps of the ICZM have come to the agenda in 1960s with the water quality management programs for estuaries and bays in the US. The need for coastal zone management was announced for the first time in Stratton Report in 1968. Coastal Management Act of US in 1972 is the first national legislation about coastal zones. This act reports the main reasons of initiating coastal zone management by a % scale as following: (Özhan, 2004)

- Depletion of resources – 18 %
- Pollution – 20 %
- Ecosystem damage – 18 %
- Economic benefits from coasts and ocean – 22 %
- New economic opportunities on coasts or in ocean – 6 %
- Damage from coastal hazards – 10 %
- Other – 4 %

The first Coastal Zone Management Conference was held in 1978 by the American Society of Civil Engineers. Late 1980s were the first announcement days of the concept "sustainable development". In 1987 Bruntland Commission Report: Our Common Future was announced. The focus of this report was sustainable development and managing coastal areas took its place in that report.

Eades (1998) reports that UDRM has come to the agenda in the late 1980s as the result of the UN General Assembly's concern of growing vulnerability of people and property to natural hazards. As a result of this concern, the United Nations General Assembly passed a resolution in 1989 designating the last decade of the twentieth century as the International Decade for Natural Disaster Reduction (IDNDR). The resolution stated: "The objective of the IDNDR is to reduce through concerted international action, especially in developing countries, the loss of life, property damage and social and economic disruption caused by natural disasters such as earthquakes, windstorms, tsunamis, floods, landslides, volcanic eruptions, wildfires, grasshopper and locust infestation, drought and desertification and other calamities of natural origin" (Eades, 1998, 8). After 1990s the efforts about UDRM have gained momentum. Finally, the World Wildlife Foundation (WWF) published a report after the UN Conference on Climate Change (December, 2007) and announced the year 2007 as the year of disasters. The foundation also stated the importance of risk management efforts.

Accordingly, ICZM is an earlier concept than UDRM. However, both of them are still lists of procedures and have limited implemented examples in different scales today.

<u>3. Aim, Goals and Focus Point</u> ICZM aims sustainable development in the coastal zone. Additionally, primary goals of ICZM can be listed as:

- to resolve conflicts among different uses and activities
- to limit impacts on coastal resources

ICZM aims to create high quality living places for all living things on the coastal zone by achieving these goals. ICZM defines sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Ozhan, 2004), and defines as the way of creating high quality living places on the coastal zone. Since the main target of ICZM is sustainable development, it also aims to build up the main elements of sustainable development like economical efficiency, social-international-integrational equity, and environmental protection. Besides sustainable development ICZM takes mostly environmental issues into consideration like pollution, environmental quality, endangered species and clean coastal tourism etc.

Sustainable development is also one of the primary aims of UDRM. Beside sustainability UDRM also defines high quality living places with sustainability, safety, security, accessibility, and publicity of the settlements. UDRM aims to reduce vulnerability of urban areas to natural and human-made disasters and to regulate development in high-risk areas through plan decisions; and tries to create safer, more secure, more accessible urban settlements which have more public spaces. With these aims, UDRM takes the probability of natural and human-made disasters, public safety, and socio-economic concerns into consideration.

Sustainability and creation of high quality of living places are the common aims of ICZM and UDRM. However they define high quality from different aspects. While ICZM defines high quality with environmental originality, publicity, and sustainability of resources, UDRM defines high quality with safety, security, accessibility, sustainability and publicity.

4. Area Definition ICZM defines the physical limits of the coast both seaward and landward directions, and also defines the user groups, activities and sectors. UDRM defines the urban area with all its urban activities, socio-economic structure, physical features, historical data, and future projections and calculations. While coastal area has certain boarders and physical limitations, it is not easy to define the certain limits or boarders of urban area. Urban area generally defines its limitations with some specific urban uses and some other social characteristics. The term urban includes much more meaning then physical limitations.

5. Problem Area Environmental degradation and deteriorated conditions of coastal areas, economic benefits from coasts and oceans, loss of environmental resources and interruption of, safety and sustainability of all living things on the coast, are compose the main problem framework of ICZM. Problem area of UDRM is composed of natural and human-made disasters, their impacts (social, economic, sociological, psychological, environmental, etc.) and the ways of precaution, protection of public safety, loss of lives, loss of properties, loss of amenities, and loss of quality of life, and planning emergency management issues. Some of the problems of ICZM and UDRM intersect in the same area; however, priorities of those problems may change at that time.

6. Typical Activities Generally, different specific issues on coastal area require different types of ICZM programs and their implementation according to those management programs. Coastal water quality management, liquid waste management, EIA for coastal projects, beach management, marine and coastal protected area management, coastal

tourism planning and management, fisheries and aquaculture management, estuarine and lagoon management, endangered marine species management, etc. are the examples of some specific ICZM programs. Each type has different plans and programs. These different kinds of management programs basically include physical planning (land allocation, land-use plans including land-use portions and permits), activity planning, policy planning, and promotion of economic development, conflict resolution and protection of public safety.

Likewise, UDRM has also different types for specific disaster cases. Flood risk management, earthquake risk management, etc. are the examples of different risk management types. Each type has different risk management programs. These management programs basically include physical planning, activity planning, funding (economical planning), regulation of development in high-risk areas through "contingency planning", planning the ways of those regulations (policy planning) creation of evacuation plans and other measures in case of emergency.

Both ICZM and UDRM reflect themselves with action plans. Action plans are prepared according to the scenarios and pre-defined standards. Instant interventions are not desired; all possible events should be taken into consideration and relevant action plans should be prepared.

As understood from the explanations above, there is an emphasis on planning activities and the significance of planning task is highlighted by operation principles of both ICZM and UDRM. However, this emphasis is in procedures, not in real implementations.

7. Requirements Both ICZM and UDRM require a management program. Management program is a comprehensive statement in words, plans, maps, illustrations, and other media of communications, prepared and adopted by the state in accordance with the provisions of this title, setting forth objectives, policies, and standards to guide public and private uses of lands and waters in the coastal zone. Additionally, management programs are prepared on a specific issue as stated before (in 6.Typical Activities). At this stage, both ICZM and UDRM require togetherness of different sectors in order to compose management plans. That means multi-sectoral approach and participation is essential.

8. Instruments and Tools Both ICZM and UDRM use some instruments and tools in order to imply their principles and proposed activities. Both of them also take their legitimacy from these tools and instruments.

For instance, ICZM presents three options for using coastal zones: preservation (don't touch), conservation (use for certain purposes, but not for all), and utilization (development - the areas where you can do all coastal activities for coastal development). In fact, these options may be possible for UDRM implementations since UDRM programs also decide land-use permits. Accordingly, preservation and conservation decisions of plans are significant tools for legitimate implementations of UDRM and ICZM.

Both ICZM and UDRM use national economic and development plans, national land-use planning regulations - restrictions and its legal arrangements, regional plans and other lower-scale development plans, critical area protection laws or related legal regulations (i.e. national parks, specially protected areas, high-risk areas, cultural or natural heritage areas, etc.), national and international institutions and organizations, international acts, public education system. Besides, geographical information systems (GIS), environmental impact assessment (EIA), modeling and decision support systems are the significant implementation tools for ICZM and UDRM. These are the tools and instruments that ICZM and UDRM use for the regulation and restriction of undesired development in coastal areas and urban areas.

9. Planning Focus and Planning Activities As stated in *Typical Activities*, ICZM and UDRM concepts are based on policy, action and spatial planning. In fact, both ICZM and UDRM are planning models from beginning to end; however, spatial planning emphasis of these models are limited. Especially, in Turkey, spatial planning focus is not in practice. Engineering efforts are taken much more attention than planning efforts. Civil Engineering, Geological Engineering and Geophysical Engineering efforts have significant role in UDRM. Also, UDRM gives importance to economic measures in order to reduce social vulnerability. Likewise, ICZM gives much more importance to Coastal Engineering and Environmental

Engineering efforts. Meanwhile, ICZM emphasizes environmental concerns since it is the source of economic gains.

On the other hand, plans for ICZM and UDRM (national action plans and emergency management plans for UDRM) should be prepared at national level, but implementations may vary according to the local characteristics. Since the concepts refer to managing activities and managing space at the same time, physical planning stage of ICZM and UDRM programs comprise land use planning, land allocation, and land use permits.

10. Implementation Scale and Process Whether preparation of programs starts at national level, implementation of ICZM and UDRM programs occurs at local level and in a narrower place. While ICZM programs are implemented at regional scale, UDRM programs are implemented at urban scale. As stated in *Type and Definition* and *Area Definition*, there is again an intersection area between these scales.

Both ICZM and UDRM are processes and include basic common steps such as:

- determination of the management type
- definition of the involving parties, sectors or groups
- determination of the implementation area
- design of the process
- monitoring the process and definition of the deficiencies and failures.

However, the time period (length / extension) of the processes of ICZM and UDRM differentiates according to the management types and especially the testing issues.

<u>11. World Experiences</u> There are successful ICZM examples in USA and in some European countries; however, they have limited disaster focus. Since UDRM is a newer concept, the world examples are still at policy planning level, there is no significant implemented example.

<u>12. Turkish Experiences</u> Only a few successful implemented ICZM examples in Turkey, however those have no disaster focus. Management plans of those examples are mostly on

sustainable tourism, specially protected areas, and environmental protection. UDRM efforts gained momentum especially after 1999; policy planning and economic planning efforts are continuing at national level. Istanbul – Zeytinburnu is an ongoing example in Turkey. Zeytinburnu case is still at policy planning and engineering levels; destruction and construction activities have priority. Except this case, UDRM is still a kind of procedure list and has no full implementation in Turkey. Likewise, ICZM has also no full implementation; it is just a procedure list now.

<u>13. Related Establishments and Laws in Turkey</u> The Ministry of Public Works & Settlements, The General Directorate of Bank of Provinces, State Planning Organization, Municipalities and Provinces, Ministry of Energy and Natural Resources, Ministry of Agriculture, Ministry of Tourism and Culture, Ministry of Transportation, coastal municipalities are the establishments relevant to ICZM

The Ministry of Public Works & Settlements, The General Directorate of Bank of Provinces, State Planning Organization, Municipalities and Provinces, Ministry of Internal Affairs, Ministry of Transportation, Ministry of Finance are the establishments relevant to UDRM.

<u>14. Strong Dimensions</u> Both ICZM and UDRM have appeared because of some missing points like deteriorated conditions of environment, loss of living things and resources, loss of property and economic benefits, insecure settlements against disasters, undemocratic decision making system, etc. Provision of these missing points will also lead the communities to a more democratic conditions and much more livable environments Setting up ICZM and UDRM programs properly easily may used for the creation of high quality and good planned living environments

<u>15. Weak Dimensions</u> ICZM has usually implemented as a kind of environmental conversation tool and perceived as a kind of engineering problem. Additionally, it takes relatively long time to set up a kind of ICZM program from beginning and to bring it at end with its implementations, and to see the consequences. These are the weak dimensions of ICZM. Likewise, UDRM is also perceived as a kind of engineering job, and doing its requirements also take long time. As stated before (in Requirements) participation is

essential for both management types; however, participation of the all parties provides a collaborative process and agreement, and a satisfaction of all parties as well. It is really a hard process and this is also one of the weak dimensions.

<u>16. Opportunities</u> Both ICZM and UDRM require comprehensive planning approaches and may certainly be tackled as a complete planning issue. Additionally, both preparation and implementation processes, and also monitoring process require extensive participation of people from different disciplines, agencies, sectors, establishments, and NGO's. Participation of the all parties provides a collaborative process and agreement, and a satisfaction of all parties as well.

<u>17. Threats</u> Both ICZM and UDRM may easily turn into a kind of engineering issue. Some ICZM programs may miss the point of conversation – utilization balance and may highly stress on conversation approaches. Likewise, some UDRM programs may focus on some specific and often disaster events and may not consider other possible events.

<u>How?</u>

Another problem about ICZM and UDRM is that these models are highly management oriented and have mostly policy planning base; however they have not enough emphasis on spatial planning. Nevertheless, these models should give more emphasis on spatial re-organization and planning. In the process of association of these two models, spatial planning dimension is improved, and the extent of this dimension is widened. Coastal Area Assessment Model is introduced as the way of association by the study. This process makes a coastal classification by highlighting socio-spatial characteristics and combines them with risk factors in a coastal area.

CHAPTER 4

RELATED TOOLS AND TECHNIQUES FOR ASSESSING COASTAL RISKS: TOWARDS A COASTAL AREA ASSESSMENT MODEL

Coastal urban settlements have unique characteristics because of bringing “urban” and “coastal” uses together. These areas require a special planning approach. Even there is no settlement on a coastal area; all coasts cannot be evaluated in the same way. Each coastal area has different and original characteristics in terms of landforms, morphology, land-use type, historical development dynamics, and related socio-spatial features. Therefore, assessment of coastal areas requires a kind of classification which groups the coastal areas according to some basic and common features. This grouping also distinguishes risk factors, orientates different types of planning approaches, and determines the main management issues for the area. As introduced in previous chapters briefly, in CAAM a coastal classification is made by highlighting socio-spatial characteristics and they are combined with risk factors in a coastal area. However, it is essential to understand the rationality of previously made classification approaches before introducing the classification used in CAAM. This chapter basically discusses the previous coastal risk assessment and coastal classification approaches starting with Coastal Vulnerability Index (CVI) and its relevancy for the study. In the following sections of this chapter previously made coastal classifications and coastal typology approaches will be evaluated and criticized in order to determine their advantageous and disadvantageous parts to be used as an input while offsetting up the CAAM.

4.1. Coastal Risk Assessment Approaches and Coastal Vulnerability Index

Improvement need of ICZM in order to be used in an associated position with UDRM requires inserting a kind of risk assessment or vulnerability assessment part to ICZM approach. In this study it is assumed that developing a kind of coastal (urban) typology and matrices, which is generated according to that typology and indicates the vulnerability of any selected coastal area to any type of disaster, is the improvement way of ICZM and its efficiency. Using this typology also makes it easier to associate ICZM to UDRM by making possible to use it also in urban coastal areas. By underlining this point, this study evaluates a specific type of vulnerability assessment model, Coastal Vulnerability Index (CVI).

As discussed by Pethick and Crooks (2000), coasts are highly dynamic and geomorphologically complex systems, which respond in a non-linear manner to extreme events. Accordingly, a manager should really understand the geomorphological, spatial, and temporal aspects of coastal system in order to response to perturbations (the disturbances from an equilibrium condition) in coastal zone management. According to Pethick and Crooks (2000), since coastal zone management aims sustainable development, to maintain a socially desirable mix of coastal zone products and services for current and future generations, coastal zone management must combine the maintenance of an optimal level of environmental integrity, functioning and resilience, with reducing the level of vulnerability of coastal systems, and hence local populations, to catastrophic events and change by adequate planning and control. Additionally, sustainable use of the coast, however, demands both spatial and temporal flexibility of its component systems, and management for change must therefore be the primary objective. These arguments reveal that assessment and planning to minimize vulnerability is a critical point within ICZM (Pethick and Crooks, 2000).

Pethick and Crooks (2000) define vulnerability as the exposure of social (and environmental) systems to stress as a result of the impacts of environmental change, and propose a simple and preliminary vulnerability index which relates disturbance event frequency to relaxation time (the time taken for the coastal feature to recover its form). This index provides a first order approximation of the temporal variability that may be expected in landform components of the shoreline system, so allowing management to provide more realistic objectives for long-term sustainability in response to both natural and artificial forces (Pethick and Crooks, 2000).

On the other hand, as highlighted by Özyurt (2007), a vulnerability assessment model aims first to compare different regions and rank them according to their vulnerabilities to a type of disaster; second to prioritize the impacts of the disaster on the region according to vulnerability of the region to each impact and finally to determine which parameters are the most vulnerable parameters that need to be considered when planning for mitigation.

Özyurt has developed and adopted Coastal Vulnerability Index (CVI) to sea-level rise in her study, however, a vulnerability index is used for assessing the vulnerability against different kinds of disasters, such as extreme storms, oil spill, wave-induced erosion, and sea-level rise as well, in coastal areas.

Both Özyurt (2007) and Pethick and Crooks (2000) underline and use physical data for the development of coastal vulnerability indices, however, there are also other studies which use socio-economic data in developing CVI. McLaughlin, McKenna, and Cooper (2002) selected socio-economic variables such as population, cultural heritage, and conservation status for the development of CVI for wave-induced erosion in Northern Ireland. Likewise; Clark, Moser, Ratick, Dow, Meyer, Emani, Jin, Kasperson, Kasperson, and Schwarz (1998) highlight and use age, disabilities, family structure and social networks, housing and the built environment, income and material resources, lifelines, occupation, and race and ethnicity as the sources of vulnerability themes in their work for the development of CVI for extreme storms in Revere, M.A., USA. On the other hand, Boruff, Emrich, and Cutter (2005) developed different types of CVI's in their study for erosion hazard vulnerability. They examined the vulnerability of US coastal counties to erosion by combining socioeconomic vulnerability index with the United States Geological Survey – USGS's physical based coastal vulnerability index. They used physical indicators and social vulnerability variables for the development of different types of CVI's such as place vulnerability index (PVI), coastal vulnerability index (CVI) and coastal social vulnerability index (CSoVI). The factors used for the development of CSoVI are poverty, age, development density, Asian and immigrants, rural / urban dichotomy, race and gender, population decline, ethnicity and farming, infrastructure employment reliance, and income. Median age, per capita income, land in farms as a percent of total land, percent rural farm population, percent living in poverty, number of commercial establishments per square mile, and percent urban population were some of the social variables used by Boruff, Emrich, and Cutter (2005) in their study. Additionally, they used mean tidal range, coastal slope, rate of relative sea-level rise, shoreline erosion and accretion rates, mean wave height, and geomorphology (erodability) as physical variables, just same as the USGS's variables. Variables of Özyurt (2007)'s study are also just same as the variables of USGS used. In this study for instance, the physical data variables such as roads and railways, land-use, and infrastructure etc. are especially used and underlined.

Evaluation of the different types of CVI development and implementation studies shows that CVI is a significant and needful tool for assessing coastal risks and vulnerabilities. Development of CVI differentiates according to the small scale areas and large scale areas. Anthropogenic inputs, monitoring for sustainable use, temporal changes in coastal system are important elements of CVI. Additionally, the index differentiates according to the different types of hazards i.e. erosion hazards vulnerability, sea-level rise vulnerability, coastal storm vulnerability or different components of the coast; i.e. coastal population vulnerability, coastal ecosystem vulnerability, coastal built environment vulnerability.

In this study a comparison that Özyurt (2007) has highlighted in her study among the aims of vulnerability assessment is also made; however this comparison is not the comparison of vulnerabilities but the critical areas. Critical area comparison determines the regions which have intervention priorities.

Pethick and Crooks (2000) explain the common methodology suggested by the Coastal Management Sub-Group of the IPCC on assessing the risks and vulnerabilities to sea-level rise. According to this methodology, CVI development has seven basic steps as explained below:

1. delineate the case study and specify the sea-level rise boundary conditions,
2. inventory the study area characteristics,
3. identify the relevant development factors,
4. assess physical changes and natural system responses,
5. formulate response strategies and assess their costs and effects,
6. assess vulnerability profile and interpret results, and
7. identify relevant sections to determine long-term ICZM planning.

Viewing from the point of this method, the CAAM set up in this study covers the 2nd and 3rd steps fully, and 4th and 5th steps partially. However, it has no emphasis on 6th and 7th steps. Therefore a complete risk and vulnerability assessment study tool is not developed in this study. The CAAM aims a little bit different things than CVI does.

CAAM is a different tool from CVI just because;

- CAAM is not a kind of risk assessment or vulnerability assessment tool, does not do that. CAAM prioritize spatial developments and constraints. Urban facts and elements are dominant ones among those developments and constraints.
- CAAM has no mathematical calculation methodologies, has no formulas, and does not aim to do that.
- CAAM does not focus on only one type of disaster. CAAM aims to evaluate all types of disaster risks in a determined area / region.

Till now, the studies on development of CVI has theoretically spatial and physical determinants or bases; however, practically social and economic determinants or bases. Moreover, there is no attempt in order to create a kind of tool for the implementation of ICZM in Turkey. Since the reasons explained above CVI is not a relevant tool for this study. This thesis study is at least a simple and basic step of this kind of attempt, helps to determine the basic parameters of future CVI development studies for Turkish coasts, and may intend to improve especially spatial inputs and outputs of CVI in order to guide future ICZM implementation (coastal planning and management) works.

With these intentions this thesis study basically develops a simple coastal urban typology and a kind of coastal classification map for Turkey. Geomorphological structures, density of development, hazard potential of a coastal area etc. are significant variables for this study. Designed as a baseline for future vulnerability assessments, this study is limited in geographic coverage, but it does provide an initial prototype for integrating human and physical systems in the understanding of place-based vulnerability.

Pethick and Crooks (2000) explain in their study that an event frequency is highly variable by geographical area and by the local exposition of the sites. Additionally, construction of a vulnerability index for specific coastal regions needs locally specific data and monitoring requirements. The brief explanations above highlight that type, form, and category of a coastal region is significant in terms of assessing vulnerabilities and other risk conditions. Therefore, following part discusses the approaches on coastal classification and typologies.

4.2. Classification of Coastal Areas; General Assumptions and Critiques

As stated at the beginning of this chapter, since the local characteristics of the area are important, classification of coastal areas has a significant use in the development of CVI's. Moreover, the development of CAAM process also needs a type of classification especially explains the situation in Turkey. However, literature on this issue shows a problematic situation. Each researcher have mostly focused on his own research area and made partially beneficial classifications considering their own research area. There is still a complaint on the absence of a comprehensive classification about coasts. Starting from this section, following parts of this chapter first discusses the different approaches on the classification of coasts, second makes a critique of these approaches, and finally explains its own approach and preferences.

Till now, many different kinds of classifications have been applied to coasts in attempts to characterize dominant features in terms of physical or biological properties, modes of evolution, or geographic occurrence (Finkl, 2004). Generally, there are two main groups of classification; first one is descriptive and the second one is genetic. The main factors on which the character of a coast depends are waves and wind. Additionally, since the erodibility of each material is different, the original material that the coast has is another significant factor. Therefore, genetic classification is preferred by many researchers (King, 1959).

King (1959) and Finkl (2004) highlight that, (a) the form (morphology) of the land surface (above and below sea level), (b) movement of sea level relative to the land, (c) modifying effect of marine processes, (d) climatic influences on process and form, and (e) age and durability of coastal materials are the important factors while making a classification. All three of these factors have been used by different authors in various proposed classifications (King, 1959). Additionally, Finkl (2004) claims that scale of the observation is also an important factor; and therefore, the range of scales in common usage should include global, continental, regional, and local.

Finkl (2004) groups the types of classifications as (a) process related, (b) material related, (c) form related, (d) age or stage of development related, and (e) environment related (e.g. ecological regions, land systems, morphodynamic zones). According to him, the problem here is focusing on one or two of these categories results with specialization, rather than comprehensiveness.

According to Finkl (2004), one of the earlier attempts at classification of coasts was made by Edward Suess, almost incidentally, when he proposed in his book "The Face of the Earth", the now well-known geotectonic classification of *Atlantic* - *transverse* and *Pacific* - *longitudinal* coasts in 1888. Allaby and Allaby (1999) describes Atlantic type of coasts as a coast characterized by subsidences and fractures that cut across the grain of the folded mountain formations inland, and Pacific type of coasts as a coast that borders or lies within a mountain chain, so its subsidences and fractures follow the grain of the folding. King (1959) finds this classification is not genetic in its approach to the problem and is too generalized to be of use for relatively small scale.

Another coastal classification criteria; *emergence* and *submergence* is used by D. W. Johnson in 1919, however, it is not the first time for the usage of these descriptions. Emergence coast is a coast which has risen or sea level has fallen from previous level, and submergence coast is a coast which coast has fallen or sea level has risen from previous level (Spiritus Temporis, 2009). All of the classifications that made by the researchers written above was based on the difference between emergence and submergence, however, Johnson enlarged their approach; used both emergence and submergence criteria and added two other groups to their classification; neutral coasts and compound coasts (Finkl, 2004).

King (1959) and Finkl (2004) criticize the classification of Johnson as being advantageous since it is genetic, however, when strictly applied; it is disadvantageous since many coasts fit into the compound category. That means, a classification should be more detailed.

A more comprehensive classification made by Francis P. Shepard in 1948; however, Shepard ignores emergent coasts which had has a significant place in the classification attempts till that time and gives a lover level place to submerging coasts (Finkl, 2004). Shepard's classification is also a process related classification like Johnson's does. Shepard's classification is comprehensive; however, the lack of a category for emergent coasts is a disadvantage. Shepard has taken many of his examples from US coastlines and discusses the issue on the examples from those coastlines. After many critiques on the application of his classification, Shepard modified and elaborated his classification in 1973, but retained its basic structure (Finkl, 2004).

In 1952, C. A. Cotton and H. Valentine made classifications. Cotton has put forward two major divisions in his classification as coasts of stable regions and coasts of mobile regions. The main distinction between the two coastal groups is, that those areas which are stable have only been affected by oscillations of sea-level, while in the mobile areas the coast itself has been uplifted or depressed and perhaps warped, either transverse to or parallel to, the direction of the coast. This distinction makes significance that all stable coasts have been affected in the recent past by the positive rise of sea-level, and mobile areas may have been elevated themselves to an equal or greater extent and thus show direct evidence of uplift or emergence (King, 1959). According to Finkl (2004), Cotton's classification could be considered partly as a subdivision of the all-embracing compound group of Johnson, and it is useful for the clarification of Johnson's scheme, the analysis of submergence and emergence enabling certain types of compound coast to be separated. Cotton's classification is primarily based on the geodynamic stability of coastal regions and secondarily on features related to relative sea-level change (Finkl, 2004).

On the other hand, in 1952, H. Valentin also made a classification which emphasizes on temporal change. The concept of a changing base level consisting of periods of rapid change alternating with periods of still-stand forms of the basis of Valentin's classification

(Finkl, 2004). This system was devised for use on a map scale (1 / 50.000.000) of global coastal configurations (Finkl, 2004). This system features present coastal change rather than the initial form of the coast before modification by marine processes (Finkl, 2004). An important aspect of this classification is the recognition that marine forces are continually active and influence the coast even during changes in base level which should, on the basis of the older classifications, initiate a new cycle of erosion on a new coastal type (Finkl, 2004).

Beside this classification, Valentin's theory on coastal classification is expressed graphically by means of diagram (Figure 4.1) on which each of four axes represents one of four possibilities, coastal erosion and submergence on the negative side and coastal outbuilding and emergence on the positive side. According to Finkl (2004), this classification of Valentin does not specifically consider coastal morphology nor provide groupings of coastal features in a hierarchical system. Nevertheless, it does provide a rudimentary yet useful frame of reference for conceptualization of the basic role of coastal advance and retreat (Finkl, 2004).

On the other hand, a work had been held by John T. McGill in 1958 as the work of "mapping coastal landforms of the world" while he was on the research staff of the Department of Geology, University of California, Los Angeles. The work was supported by the Office of Naval Research. This map indicates the distribution of the major classes of coastal landforms (plains, plateaus, hills, mountains). McGill claims that this map of coastal landforms of the world is intended to be only a first approximation (McGill, 1958).

The scale of McGill's map is 1:25.000.000. The map has a detailed legend; however, some coastal features are invisible at this scale. A practical and useful contribution of this map is it gives the major and initial information about the coastal landform features of Turkey also.

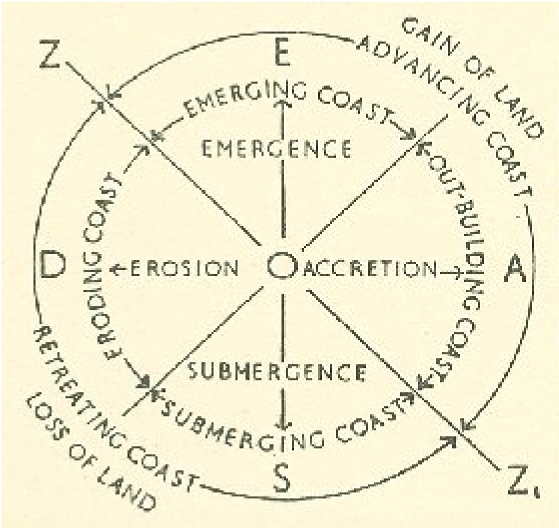

Figure 4.1: Valentin's Theory of Coastal Classification (*Source:* King, 1959)

According to the McGill's map Eastern Black Sea coasts of Turkey have complex mountains and the principal agent shaping that landform is running water. Landform of these areas occurred by erosion activities of running water. This feature of the coast is continuing from Sarp to Cide environs, except Samsun and Ünye environs. The character of the landform of Samsun and Ünye environs is mostly alluvial and delta plain which are occurred by the deposition effect of running water. The water resources which are shaping the landform of these areas are Kızılırmak and Yeşilırmak. There are also some areas which show dune plain character in the environs of Samsun and Ünye. The character of the landform from Cide to Akçakoca environs is complex plains and complex plateaus which are occurred by stream erosion. The situation is almost the same on Marmara Sea coasts except Yalova, Bandırma, and Karabiga environs. The character of the landform of Yalova coasts is the same as Eastern Black Sea coasts. Likewise, the character of the landform of Bandırma and Karabiga environs are the same as Samsun and Ünye environs.

The character of the landform Aegean Sea coasts of Turkey, from Çanakkale to Fethiye show almost the same character with Marmara Sea coasts, except the areas which the rivers of the region flow into the Aegean Sea, and the basins of those rivers. The character of the landform of those basins and river beds are the same as Samsun and Ünye environs. The region between Büyük Menderes and Küçük Menderes rivers has complex mountains and the landform of this area is occurred by the erosion activities, just same as the overall character of Eastern Black Sea coasts. The coasts between Aydın and Fethiye show the same character with Marmara Sea coasts again.

Mediterranean coasts of Turkey are mostly classified in the same landform character group with Eastern Black Sea coasts by McGill. However, there are surely some exceptions. Fethiye, Kalkan, Finike, from Antalya to Serik, and from Dörtyol to Iskenderun environs show alluvial plain character, and occurred by deposition activities. On the other hand, Silifke and Adana environs show delta plain character and have dune plains also. Additionally, from Serik to Alanya coasts have complex plains and complex plateaus which are occurred by stream erosion.

In addition to genetic and descriptive approaches to coastal classification, there are also practical attempts to map coastal features in relation to some specified purpose (Finkl, 2004). Some researchers just wanted to see “what is along the coast” in order to use this information for calculating or mapping special situations such as environmental sensitivity (Finkl, 2004). One of these classifications was made by Owens in 1994 as classification of shoreline types on the basis of materials and coastal configuration (Finkl, 2004). The factors that control coastal variability, both in time and space, are outlined by E. H. Owens as part of an effort to control the fate of spilled oil that reaches the coast (Finkl, 2004). Another similar classification of shoreline types was made by South Florida Regional Planning Council in 1984 (Finkl, 2004). Likewise, P. D. Nunn made a genetic classification of oceanic islands (Finkl, 2004). Many other similar types of specified purpose classifications was made; and some of them focused on islands, some of them focused on beach geomorphology, or coastal dune morphology, or rocky coasts. Meanwhile, also some classifications were made for coastal and marine environments. All of these efforts resulted in seeking for finding a methodology of coastal system mapping (Finkl, 2004). Considering and criticizing all of the previous classification systems, Finkl (2004) suggests a comprehensive classification approach and compares different classification approaches as summarized in Table 4.1. In this table, “H” represents the parameter or characteristic considered at a high (prominent) level in the classification system, “L” represents the parameter or characteristic considered at a lower (subordinate) level in the classification system. Blank cells in the represent the parameter or characteristic not specifically considered or inferred in the classification system. However, in his classification, Finkl makes up a de-facto system, does not represent a new classification.

Table 4.1: Materials, Processes, Forms, or Coastal Environmental Properties that are Considered in Some Classification Systems Compared to Finkl's Proposal (Finkl, 2004).

Features	Suess (1888)	Cotton (1952)	Johnson (1919)	Shepard (1948)	Valentin (1952)	Owens (1994)	Finkl (2004)
Geodynamics	H	H		L			H
Tectonics	H	H		L			H
Structure (faults, folds)	H	L	L	L	L		L
Relative Sea-Level Change		H	H	H	L		L
Marine Processes				H	L		H
Terrestrial Processes			L	H	L		H
Shoreline Position		L	L	L	H		
Materials			L	L		H	H
Form (Morphology)			L	L		H	H
Environmental						L	L
Organic			L	L	L	L	L
Erosion - Deposition					L	L	H
Climate							L
Polygenesis		L	H	L			H
Tides					L	L	L
Anthropomorphic						L	L

As Table 4.1 shows, it is hard to make a general and comprehensive classification. Most of the researchers just focused on their profession and where he wants to use the classification. Definitely, the efforts for making comprehensive and worldwide classifications cannot be disregarded and assessed as if they are not valuable. However, most of the time, those so called comprehensive classifications are not useful and practical. Therefore, making a specified purpose classification would be better, and this study has produced one which is explained in the following chapters in details.

4.3. Towards a Coastal Area Assessment Model – CAAM

Critical evaluations on previously made coastal classifications show that making a comprehensive coastal classification is both hard and highly unnecessary. Many researchers have preferred developing and using a simple classification which just helps for his research. Accordingly, a simple and useful coastal classification is needed in the context of this thesis study. Since this study focuses on coastal urban settlements and risk factors (ICZM and UDRM) embraced by the coast and urban area, the classification of this study uses the spatial characteristics of coast, urban area, and risk factors as variables. This classification is used while setting up CAAM based on "*coastal urban typologies*" and "*disaster risks.*" Coastal classification approach of the study, its classification, and development process of CAAM are covered in the following chapter.

CHAPTER 5

DEVELOPMENT OF COASTAL AREA ASSESSMENT MODEL: CLASSIFICATION OF TURKISH COASTS

As introduced briefly in the first chapter Coastal Area Assessment Model – CAAM includes the implementation processes of three main groups of matrices. The first group, *Coastal Urban Typology Matrix*, is based on a coast types and urban space features. The second group, *Risk Matrices*, is based on hazard and also coast types. And the last one, *ICZM – UDRM Comparative Matrix*, queries the current conditions for ICZM and UDRM plans and programs in the area. Since the first two groups of matrices use coast types, this three phased structure of CAAM requires making a coastal classification at first. Accordingly, in this chapter first the main components of CAAM are explained, second the classification approach of the thesis is introduced and coastal classifications are made, and third the CAAM is set and implementation basics are explained.

5.1. Main Components of Coastal Area Assessment Model

As explained in previous chapters, settlements located on coastal areas may have serious problems which may attain a disaster risk factor or condition. Additionally, urban development problems of the settlement itself also multiply those risk factors. Recent experiences of world's community have shown that there is a risk of losing coastal lands due to sea level rise caused by global warming, regular and irregular tides and winds, tsunami and typhoon, and also total effect of storm surge and extreme high tides. Sea level rise is one of the disastrous examples. Lots of coastal and urban factors are also affecting the disaster risk condition or usual management procedure of any coastal urban settlement. As being a coastal state, nearly the same subjects and problems are also in question for Turkey. This complex situation requires a systematic approach which shows the interactions between all urban and coastal elements and factors affecting the disaster risk condition or usual management procedure of any coastal urban settlement. CAAM provides this systematic approach with its sub-matrices.

Composition of CAAM's sub-matrices show the way of finding out the most vulnerable element of that coastal urban settlement, other vulnerable elements of that coastal urban settlement, the vulnerability of the settlement to any type of disaster risk, the location which has the intervention priority, intervention type to that location, implementation conditions of the plan and its interventions, and the formulization of all the management process (inputs, outputs, actors, etc.) and policies. At the same time, developing CAAM will also give help to develop a kind of national guideline for coastal development and management.

Although, CAAM takes its basic understanding from commonly known CVI, it is different from CVI and its standard approaches. Previous chapter has explained the common understandings on CVI; how it is first formulated in order to solve which problems, and its first appearance in the subject of coastal zone management issues. Explanations on CVI are also needed in order to understand the development process of CAAM; how the study has used and adopted CVI's basic understandings to CAAM.

ICZM and UDRM are the special models of management plans which focus on different kinds of problem areas. Nevertheless, these two concepts overlap on coastal urban areas and there is a need for an association between them. This need basically appears as each one ignores the other's main focus and priorities. That ignorance shows itself in UDRM as not giving the necessary importance on coastal ecological problems and environmental risks, and shows itself in ICZM as not giving the necessary importance on risk conditions of coastal urban settlements. However; for a more efficient planning and management system considering urban disasters in coastal settlements, both of them should take each other's main focus into consideration. Accordingly, this thesis study aims to set up CAAM which can also be used as a tool for this kind of association.

In order to provide that intended association CAAM comprises coastal typologies, urban typologies, risk factors and diversity of risks, vulnerability parameters of coasts and urban areas, ICZM approaches, and UDRM approaches. With its contents, CAAM also highlights the significance of spatial planning and provides a mutually associated relationship between ICZM and UDRM. UDRM gives inputs for the operation of ICZM, especially in terms of integrating risk assessment; and likewise, ICZM gives different kinds of inputs, such as ecological concerns and sustainability, for the operation of UDRM in coastal cities. This input flow is provided by CAAM's third group of matrices "ICZM – UDRM Comparative Matrices." CAAM also determines the clues about planning coastal urban areas and re-define the main principles of coastal area planning according to different variables.

The approach of this thesis study on the classification of coasts and coastal settlements is the first step of CAAM development process. For this reason, classification of Turkish Coasts, and related CAAM elements, their change and use according to varying criteria are explained in detail in the following sections.

5.2. Classification of Turkish Coasts and Distinctive Features of the Case Proposals

Turkish coasts have 8.333 kilometers length and they are richly endowed with natural beauty, cultural attractions, and bays, estuaries, and wetlands replete with resources. Turkey also has specific sea areas (territorial seas, exclusive economic zone, etc.) according to the definitions of United Nations Convention on the Law of the Sea (UNCLOS), although it is not a party of UNCLOS. 28 of the 81 provinces (Adana, Antalya, Artvin, Aydın, Balıkesir, Bartın, Bursa, Çanakkale, Düzce, Edirne, Giresun, Hatay, Içel, Istanbul, Izmir, Kastamonu, Kırklareli, Kocaeli, Muğla, Ordu, Rize, Sakarya, Samsun, Sinop, Tekirdağ, Trabzon, Yalova, and Zonguldak) are located on coastal areas. There are 15 province centers (Antalya, Çanakkale, Giresun, İçel, Istanbul, Izmir, Kocaeli, Ordu, Rize, Samsun, Sinop, Tekirdağ, Trabzon, Yalova, and Zonguldak), 132 districts, 159 towns, and 427 villages that are located by the coast. Additionally, according to the ABPRS data obtained from TURKSTAT (2010), more than 45 % of approximately 75 million population lives in coastal areas, and 25 % of this total population lives by the sea side. Figure 5.1 shows the population density of district and province centers located on the coast. Meanwhile, there are also different kinds of risk potentials due to the landforms, geological features, environmental problems, and natural coastal processes on Turkish coasts.

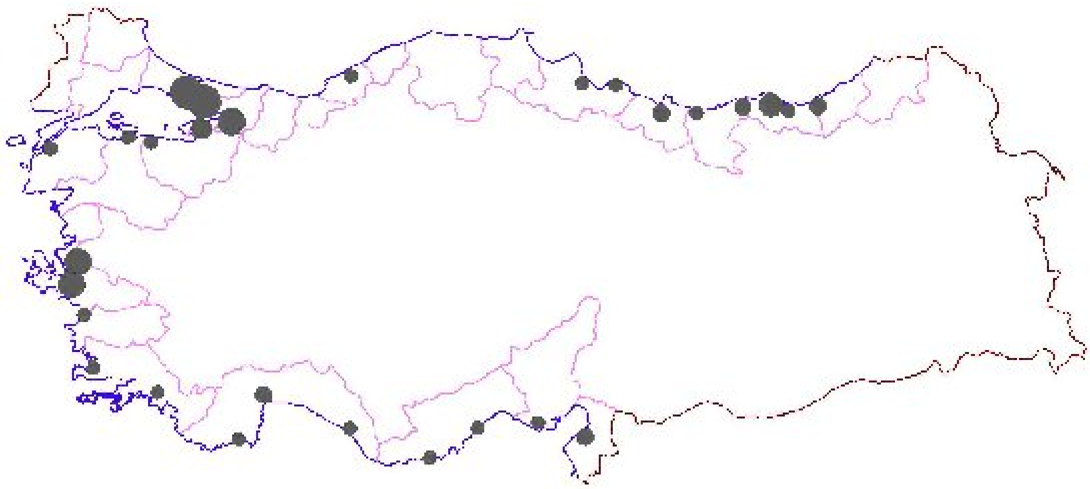

Figure 5.1: Population Density on the Coast

Starting with these brief facts about Turkish coasts, this part of the research study focuses on the classification of Turkish coasts with different aspects, and develops its own approach to the coastal areas of the Turkey in terms of defining the risk potentials of the coasts and defining the basic criteria of case selection. There may be different classification types of coastal areas which mostly consider the morphological or physical features or landforms of the areas. However, since the urban character (population features, sectoral distribution, etc.), disaster potential due to the landform, and land use types of the areas have significant roles, in the study the coasts are evaluated under three headings which are land-use character, landforms, and disaster potentials, and do not have only a morphological or physical point of view completely. After making this classification, a different classification of coastal settlements (coastal urban areas) is also made according to five different aspects which are sectoral dominance, population density, urban problems, coastal problems, and disaster risk factors. Following these steps, the study makes a general evaluation about the coastal settlements considering these classifications and prominent problems. Finally, this part of the research study comes to the end with giving basic information about proposed case study areas which are determined according to the classifications and problem definition.

5.2.1. Classification of Turkish Coasts

In this study coasts are evaluated first according to the land-use character, second according to the landforms, and third according to the disaster potentials and disaster history.

Classification of Coasts According to the Land-Use Character

According to the land-use character, coastal areas may be classified as *urban coastal areas*, *rural coastal areas*, *natural coastal areas*, and *protected coastal areas*.

Urban coastal areas may be defined as dense (in terms of both structures and population) settlement areas located on the coast that consists of varying economic sectors and working branches, social and cultural facilities and activity areas and complexes. This character may sometimes reach to the metropolitan character in some areas. However, basic distinction between urban and metropolitan is due to the population size and population density. In Turkey, minimum population of an urban area is 10.000 people[4]. Besides population density and great variety of economic activities, administrative power and ability of metropolitan coastal areas is also greater and harder than any coastal urban area. According to these assumptions, Zonguldak, Çanakkale, Aliağa (Izmir), Fethiye (Muğla), Tuzla (Istanbul), Bandırma (Balıkesir), Iskenderun (Hatay) are some of the examples of coastal urban areas in Turkey. Istanbul, Izmir, İçel, are the examples of metropolitan coastal areas in Turkey.

Rural coastal areas may be either settled or unsettled, however, population of the settlement is generally less than 2500 people and those areas are completely different from the intensively settled coastal urban areas. The economic and social character of rural coastal areas may vary, but generally, the economies of the settled ones are based on

[4] This study assumes 10.000 as the minimum population of urban area; however 442 Coded Village Law defines this criterion as 20.000. The reason of this assumption is there are also some settlements which have both varying types of urban activities, urban management issues and the population less than 20.000.

agriculture, fishing or small scale tourism activities. On the other hand, some rural coastal areas may be unsettled because of the unsuitable landforms or geographical conditions, and particularly rich in natural amenities. That means those areas have no settlements or housing uses, human interventions, but only natural landforms and resources. Those areas may also be classified under the *natural coastal areas* according to the intervention level of human-being or the intervention level of the natural forces. Ocaklar (Erdek – Balıkesir), Yenikent (Gerze- Sinop), Gökmeydan (Iskenderun – Hatay), Kaldırım (Yumurtalık – Adana), Elikesik (Alanya – Antalya), Kılcak (Alaplı – Zonguldak), Kapaklı (Armutlu – Yalova), Gözsüzce (Bozyazı – İçel), Koşuköy (Bafra – Samsun), and Behram (Ayvacık – Çanakkale) are some of the examples of rural coastal areas in Turkey.

Definition of the *natural coastal areas* is a little bit harder than others just because of the harder situation of the term "naturalness". Many people consider the definition of the naturalness is still in evolution process[5]. As stated above, the level of intervention is the critical point in here. Those natural coastal areas are unsettled, exposed to minimum human-being intervention, have significant beauties and diverse species. At the same time, to save those areas as "natural" is the second critical point because of the development and rapid growth potentials of those areas. Therefore, some of those natural coastal areas are announced as protected or preserved area because of many reasons including the critical points stated above.

Protection of the coastal areas is achieved in different ways in Turkey, and the levels of protection and the status of the protected areas are changing according to different criteria. *Protected coastal areas* may be as special environment protection areas (SEPAs), as a national park, as archeological-urban-natural-historical sites, or tourism areas. The level of protection and intervention are changing according to the type and status. The SEPA's and National Parks which are located on the coast are shown in Table 5.1 and Table 5.2; and their locations on Turkish coasts are shown in Figure 5.2.

[5] That evolution opinion is stated at the discussions centered on valuing the marine environment at a workshop held from 6 to 8 December 2006 at Ghent (Belgium). (http://www.encora.eu/coastalwiki/Naturalness - Access Date: 05.05.2008).

Table 5.1: The Special Environment Protection Areas – SEPAs Located on the Coast

(*Source*: www.ockkb.gov.tr – Access Date: 18.07.2005)

Name of the Special Environment Protection Areas	Size of the Area (km^2)
Belek SEPA (Antalya)	111.79
Datça - Bozburun SEPA (Muğla)	1443.89
Fethiye - Göcek SEPA (Muğla)	774.07
Foça SEPA (Izmir)	227
Gökova SEPA (Muğla)	576.9
Göksu SEPA (İçel)	226.31
Kekova SEPA (Antalya)	232.36
Köyceğiz - Dalyan SEPA (Muğla)	462.46
Patara SEPA (Antalya)	189.18

Table 5.2: The National Parks Located on the Coast

(*Source*: www.ockkb.gov.tr – Access Date: 18.07.2005)

Name of the National Park	Size of the Area (ha)
Dilek Peninsula – Büyük Menderes Delta National Park (Aydın)	27.675
Olympos National Park (Antalya)	34.425
Gelibolu Peninsula Historical National Park (Çanakkale)	33.000
Troya Historical National Park (Çanakkale)	13.350
Marmaris National Park (Muğla)	33.350

Figure 5.2: SEPA's and National Parks Located on the Coast

Another protected coastal area type is Nature Park. Today, there is only one Nature Park located on the coast announced by the Ministry of Culture and Tourism in 1995. This park is Ayvalık Islands Nature Park located on the Aegean Coast in Balıkesir province, and it has 17.950 ha area. Additionally, there are five natural protection areas which are located on the coasts, and they are shown in Table 5.3.

Table 5.3: Natural Protection Areas Located on the Coast

Name	Location	Size (ha)
Yumurtalık Nature Reserve	Yumurtalık - Adana	16430
Demirciönü Nature Reserve	Akçakoca - Düzce	430
Gala Lake Nature Reserve	Enez - Edirne	2369
Kasatura Gulf Nature Reserve	Vize - Kırklareli	329
Sarıkum Nature Reserve	Abalı - Sinop	78

There are also tourism investment and development regions (such as Çeşme Tourism Development Region, Dalaman Tourism Development Region, and Didim Tourism Development Region) and tourism centers (such as Belek Tourism Center) in our coasts. Other protected coastal areas may be as an archeological site, as an urban site, as a natural site, and as an historical site.

Classification of Coasts According to the Landforms – A Morphological Classification

This classification mostly considers the morphological structures of the coasts and generally preferred and used by the geographers. Approximately ten types of morphologically classified coastal areas exist in the world's coasts, however not all of them are seen on Turkish coasts. These ten types are; concordant coastlines, discordant coastline, volcanic coastlines (does not exist in Turkey), skier type coastlines (does not exist in Turkey), fjord type coastlines (does not exist in Turkey), Dalmatian type coastlines (south west coasts of Antalya – coasts of Finike and Kaş may be the examples), harbor type coastlines (B.Çekmece and K.Çekmece coasts may be the example), estuary type coastlines (does not exist in Turkey), ria type coastlines (south west Anatolian coasts and the Bosporus may be the examples), and reef type coastlines (does not exist in Turkey).

According to the study's morphological approach, also taking the global classification attempts explained in 4.2 into consideration, coastal areas may be classified simply and basically into four groups in Turkey:

- *Concordant coastline:* This type of coasts consist different rock types which are running parallel to the coastline. There may be distinctive landforms such as coves and natural harbors on that kind of coasts. These areas are open to the threats coming from the sea. Black Sea coasts of Turkey, Samsun and Trabzon for instance, and most of the Mediterranean coasts are the examples of this type of coast.
- *Discordant coastline:* These types of coasts consist of different rock types which are running perpendicular to the coastline. There may be distinctive landforms because of the wave erosion such as bays, headlands. This type of coastal areas is relatively safer than concordant coastal areas in terms of threats coming from the sea. There are more natural harbors than concordant coastal areas. Aegean coasts of Turkey are the examples of this type of coast.
- *Emergent coastline:* Occurring by the impacts of fall in sea level or by breaking down of the some parts of the land, such as raised beaches and cliffs (*falez*) in Antalya.
- *Submergent coastlines:* Occurring by the impacts of rise in sea level. Drowned landforms such as ria and fjord types, and also South-West Anatolian coasts are the examples of this type.

Classification of Coasts According to the Disaster Potentials and Disaster Related History

When disaster risks are added on varying types of coastal problems, the situation of Turkish coasts becomes much more serious. The scope of the study requires another classification according to the disaster potentials and disaster history. At this point, definition of coastal risks becomes important. While predictability and having information about disasters are the essential parts of managing those risks, what the coastal risk is for Turkish coasts should be defined primarily.

Mainly four types of disaster risks can be identified. First of all, there are *geological and topographical disaster risks* such as earthquakes and erosion. Second, there are *meteorological disaster risks*; hurricanes and typhoons for instance. Third, there are *hydrological and marine disaster risks* such as tsunamis, storm surges, floods, and sea level rise. And finally, there are *human – made or technological disaster risks*; water pollution, rapid and uncontrolled urbanization, and nuclear – chemical accidents for instance. All of these kinds of risks are possible for Turkish coasts. Disaster potentials and disaster history of the Turkish coastal areas are evaluated in this study in order to understand what the real situation of Turkish coasts is. According to the conclusion of this evaluation, the focus is on three basic events; flood, earthquake, and tsunami.

A huge part of coastal areas in Turkey takes place on 1st and 2nd Degree Earthquake Zone according to the documentary study. Aydın, Balıkesir, Bartın, Bursa, Çanakkale, Düzce, Hatay, Istanbul, Izmir, Kastamonu, Kırklareli, Kocaeli, Muğla, Sakarya, Trabzon, Yalova are located on the 1st Degree Earthquake Zone. Adana, Antalya, Samsun, Tekirdağ, and Zonguldak are located on the 2nd Degree Earthquake Zone. The one and only secure zone is the area which lies between Gazipaşa and Silifke, on the south coast of Turkey. Middle and East Black Sea coasts and north-east Thracian coasts may also be evaluated as other secure coastal zones in terms of earthquake risk. Muğla, Izmir, Sakarya, and Kocaeli are the critical locations when the destructive earthquakes in the past are considered.

Significant flood and storm surge events happened especially on Antalya, Bartın, Izmir, Aydın, Zonguldak, and Kastamonu; and also some small-scale events on Black Sea coast should be considered in this context. Flood and storm surge events should be taken into consideration for lower parts of the Turkish coasts such as İçel coasts, and some parts of the Black Sea coasts.

Some significant points also reveal themselves for Turkish coasts when the tsunami history is considered. The south Istanbul coasts, Saros Gulf, Iskenderun Gulf, Kocaeli Gulf, Kapıdağı Peninsula, and Aegean coasts of Çanakkale are evaluated as higher tsunami risk potential areas in this study. Figure 5.3, 5.4, and 5.5 show the distribution of flood areas, historical tsunami areas, and earthquake zones characteristics of Turkish Coasts.

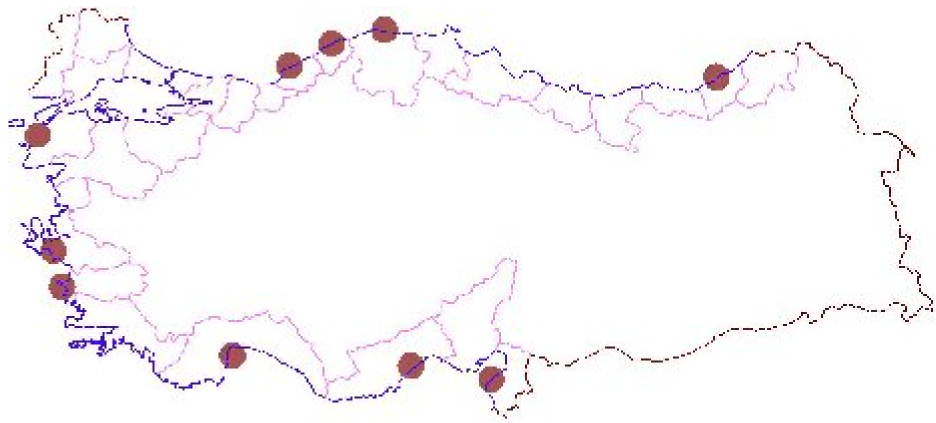

Figure 5.3: Flood Areas on the Coast

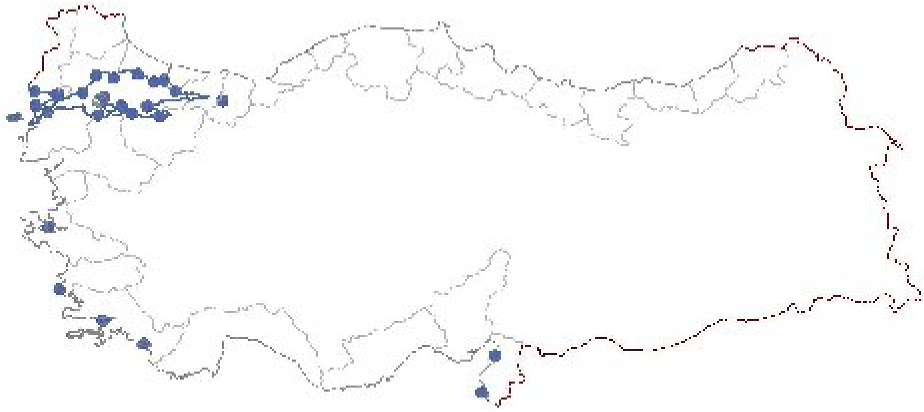

Figure 5.4: Historical Tsunami Areas

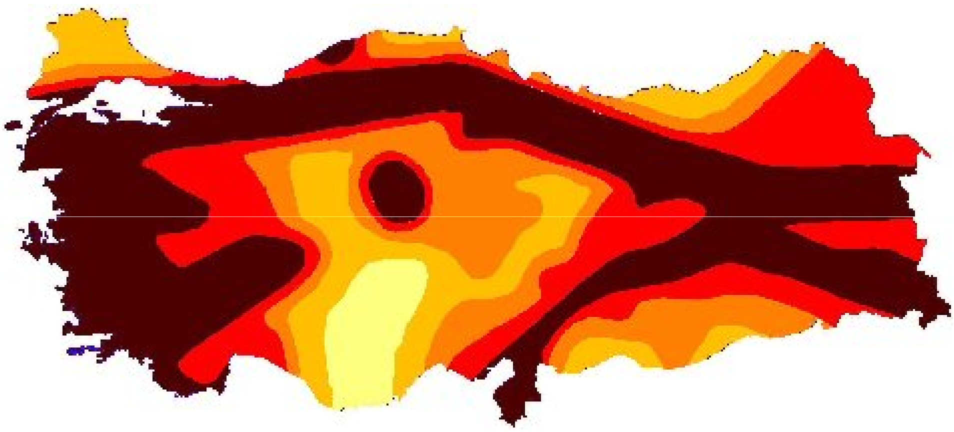

Figure 5.5: Earthquake Zones

(*Source:* Prime Ministry, Disaster and Emergency Management Headship; http://www.deprem.gov.tr/Sarbis/Shared/DepremHaritalari.aspx - Access Date: 11.10.2009)

In Figure 5.5, the earthquake zones are identified by the colors where the darkest areas correspond to the 1^{st} Degree Earthquake Zones while the lightest one corresponds to the 5^{th} Degree Earthquake Zone.

5.2.2. Classification of Turkish Coastal Settlements

The study classifies coastal settlements of Turkey in five groups; according to sectoral dominance and its density, according to population density, according to urban problems, according to coastal problems, and according to natural disaster risk factors and disaster related background.

Classification of Coastal Settlements According to Sectoral Dominance and Density

Sectoral (functional) diversification in the coastal provinces of Turkey has six basic components; agriculture, commerce, construction, industry, mining, and service sectors. Tourism is evaluated in the content of service sector. According to the evaluation of the distribution of functions, Antalya, Çanakkale, Giresun, İçel, Ordu, Rize, Samsun, Sinop, Tekirdağ, Trabzon province centers primarily have service functions. Additionally, some settlement areas have another main function with service sector at the same time.

Büyükçekmece (Istanbul) and Datça (Muğla) have primarily construction functions. On the other hand, Amasra (Bartın) and Zonguldak primarily have mining functions. Kocaeli and Yalova province centers and Gemlik (Bursa), Mudanya (Bursa), Aliağa (Izmir), Gebze (Kocaeli), Körfez (Kocaeli), Ardeşen (Rize), Derepazarı (Rize), Alaplı (Zonguldak), Ereğli (Zonguldak) districts primarily have industry functions. Additionally, some settlement areas have another main function with industry sector.

Alanya (Antalya), Kaş (Antalya), Kemer (Antalya), Manavgat (Antalya), Kuşadası (Aydın), Silivri (Istanbul), Çeşme (Izmir), Bodrum (Muğla), Fethiye (Muğla), Marmaris (Muğla) districts primarily have commercial functions. Armutlu (Yalova) and Çiftlikköy (Yalova) districts have both commercial functions and service functions at the same time.

Additionally, Bozyazı (İçel), and Dikili (Izmir) districts have both agriculture and service functions.

According to these detailed explanations, two of the main metropolitan settlements of the Turkey, Istanbul and Izmir, are classified as the cities of industry, commerce, and service in this study. Additionally, most of the province centers that are located on the coast have primarily service functions. Tourism activities are evaluated under the activities of service; however, some of the settlements of service sector (such as Kemer, Çeşme, Bodrum, Marmaris, Fethiye, Kuşadası, Didim, and Alanya) run their economies especially by tourism activities. Besides these, settlements like Kocaeli, Iskenderun, Ereğli are also known as industrial cities, and settlements like Istanbul, Izmir, İçel, Samsun, Trabzon, Iskenderun, and Zonguldak are also known as port or harbor cities.

Distributions of the settlements which primarily have service (blue areas) and commerce (brown areas) functions are shown in Figure 5.6. The districts which have primarily agriculture (orange areas) and mining (grey areas) activities are shown in Figure 5.7. Additionally, distributions of the settlements which primarily have construction (light grey areas) and industry (dark grey areas) functions are shown in Figure 5.8.

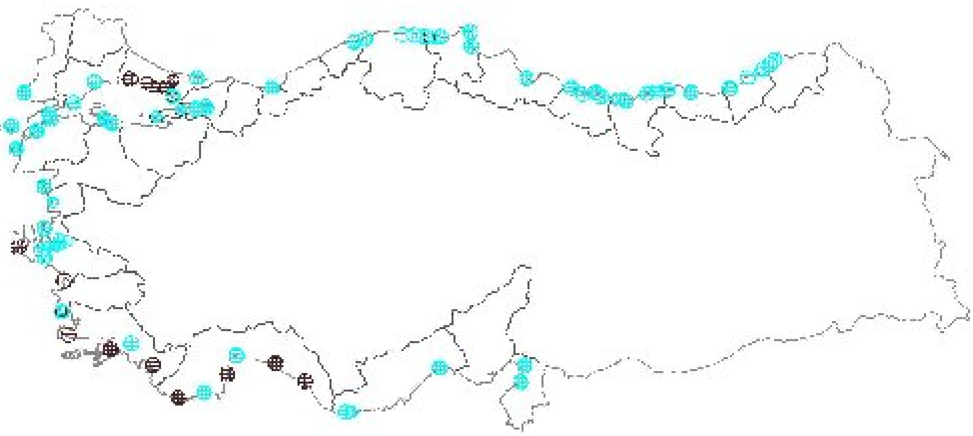

Figure 5.6: Distribution of Service and Commerce Activities on the Coast

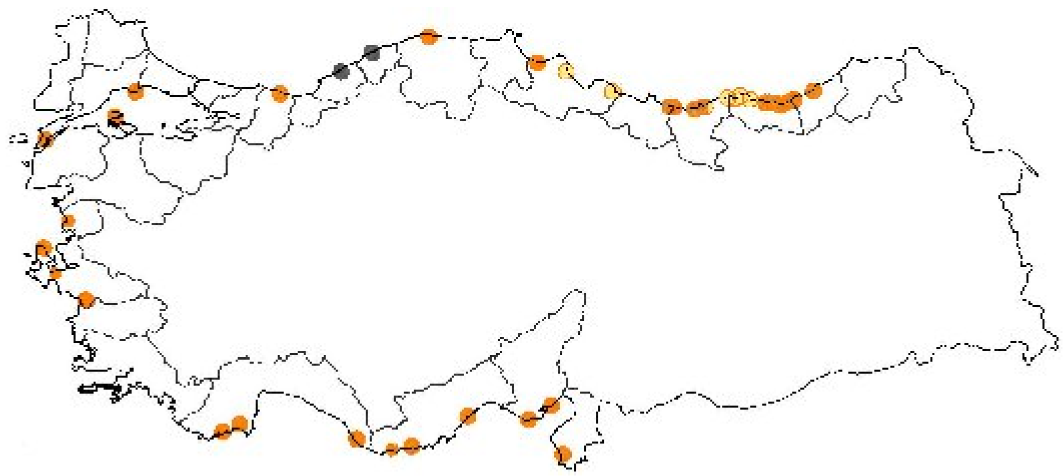

Figure 5.7: Distribution of Agriculture and Mining Activities on the Coast

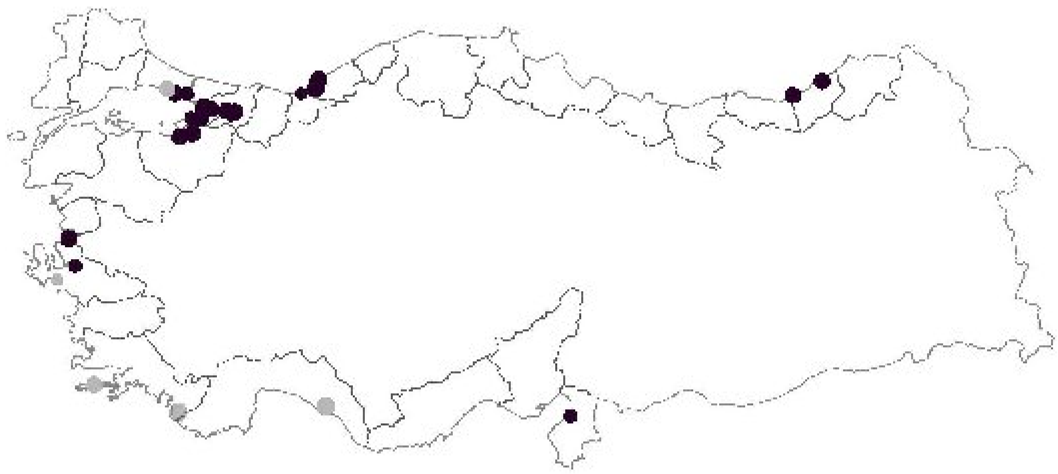

Figure 5.8: Distribution of Construction and Industry Activities on the Coast

Classification of Coasts according to Population Density

According to the demographical analysis made by using the ABPRS data obtained from TURKSTAT (2010), the study classifies the coastal settlements into five groups as:

- The settlements having less than 10.000 people living on the coast,
- The settlements having between 10.000 and 50.000 people living on the coast,
- The settlements having between 50.000 and 100.000 people living on the coast,
- The settlements having between 100.000 and 500.000 people living on the coast,
- The settlements having more than 500.000 people living in the coast.

According to this grouping, 30 districts (Doğanyurt – Kastamonu, Kurucaşile – Bartın, Marmara – Balıkesir, Bozcaada – Çanakkale, Çatalzeytin – Kastamonu, Karaburun – Izmir, Abana – Kastamonu, Gülyalı – Ordu, Enez – Edirne, Derepazarı – Rize, İyidere – Rize, Gökçeada – Çanakkale, Yakakent – Samsun, Yumurtalık – Adana, Armutlu – Yalova, Eceabat – Çanakkale, Türkeli – Sinop, Cide – Kastamonu, Amasra – Bartın, Kaş – Antalya, Piraziz – Giresun, Çarşıbaşı – Trabzon, Eynesil – Giresun, Aydıncık – İçel, Karataş – Adana, Keşap – Giresun, Köyceğiz – Muğla, İnebolu – Kastamonu, Perşembe – Ordu, and Datça – Muğla) have less than 10.000 people living on the coast.

On the other hand, 57 districts (Fındıklı – Rize, Arsin – Trabzon, Marmara Ereğlisi – Tekirdağ, Lapseki – Çanakkale, Ayancık – Sinop, Yomra – Trabzon, Çınarcık – Yalova, Finike – Antalya, Gerze – Sinop, Ondokuzmayıs – Samsun, Beşikdüzü – Trabzon, Şile – Istanbul, Tirebolu – Giresun, Vakfıkebir – Trabzon, Adalar – Istanbul, Sürmene – Trabzon, Pazar – Rize, Arhavi – Artvin, Demre (Kale) – Antalya, Bozyazı – İçel, Görele – Giresun, Dikili – Izmir, Espiye – Giresun, Şarköy – Tekirdağ, Hopa – Artvin, Çiftlikköy – Yalova, Of – Trabzon, Alaplı – Zonguldak, Kemer – Antalya, Çeşme – Izmir, Erdek – Balıkesir, Araklı – Trabzon, Gazipaşa – Antalya, Çayeli – Rize, Güzelbahçe – Izmir, Akçakoca – Düzece, Seferihisar – Izmir, Foça – Izmir, Ardeşen – Rize, Selçuk – Izmir, Karasu – Sakarya, Gelibolu – Çanakkale, Marmaris – Muğla, Terme – Samsun, Kumluca – Antalya, Bodrum – Muğla, Anamur – İçel, Ayvalık – Balıkesir, Akçaabat – Trabzon, Bulancak – Giresun, Didim – Aydın, Urla – Izmir, Aksu – Antalya, Samandağ – Hatay, Erdemli – İçel, Karamürsel – Kocaeli, and Mudanya - Bursa) and Sinop province center have the population between 10.000 and 50.000.

13 districts (Alanya – Antalya, Ereğli – Zonguldak, Aliağa – Izmir, Kuşadası – Aydın, Fatsa – Ordu, Narlıdere – Izmir, Canik – Samsun, Dörtyol – Hatay, Fethiye – Muğla, Ünye – Ordu, Balçova – Izmir, Manavgat – Antalya, and Gemlik - Bursa) and 4 province centers including Çanakkale, Rize, Giresun, and Yalova have the population between 50.000 and 100.000.

27 districts (Konyaaltı – Antalya, Atakum – Samsun, Bandırma – Balıkesir, Derince – Kocaeli, Silivri – Istanbul, Körfez – Kocaeli, Gölcük – Kocaeli, Çiğli – Izmir, Büyükçekmece – Istanbul, Tuzla – Istanbul, Beşiktaş – Istanbul, Iskenderun – Hatay, Bakırköy – Istanbul, Beykoz – Istanbul, Beyoğlu – Istanbul, Sarıyer – Istanbul, Gebze – Kocaeli, Zeytinburnu – Istanbul,

Karşıyaka – Izmir, İlkadım – Samsun, Avcılar – Istanbul, Muratpaşa – Antalya, Bornova – Izmir, Konak – Izmir, Kartal – Istanbul, Maltepe – Istanbul, and Fatih - Istanbul) and 5 province centers including Zonguldak, Tekirdağ, Ordu, Kocaeli, and Trabzon have the population between 100.000 and 500.000.

Üsküdar (Istanbul), Küçükçekmece (Istanbul), Kadıköy (Istanbul), Pendik (Istanbul) have more than 500.000 people living on the coast.

Another classification is made according to the population density. The 2000 population census data is used for density calculations in this study and four groups are defined as;

- Settlements, population density is less than 100 people/km^2 (There are 44 settlements in this group as shown in Table 5.4),
- Settlements, population density is between 100 and 1.000 people/km^2 (There are 72 settlements in this group as shown in Table 5.5),
- Settlements, population density is between 1.000 and 10.000 people/km^2 (There are 16 settlements in this group as shown in Table 5.6),
- Settlements, population density is more than 10.000 people/km^2 (There are 7 settlements in this group as shown in Table 5.7).

Previously given Figure 5.1 visualizes the population density located on the coast.

Table 5.4: The Settlements having less than 100 people / km^2

Settlement	Location	P. Density (people/km^2)	Settlement	Location	P. Density (people/km^2)
Köyceğiz	Muğla	18	Kurucaşile	Bartın	52
Eceabat	Çanakkale	21	Bozcaada	Çanakkale	56
Çatalzeytin	Kastamonu	23	Gelibolu	Çanakkale	56
Kaş	Antalya	25	Dikili	Izmir	59
Aydıncık	İçel	26	Demre (Kale)	Antalya	59
Karaburun	Izmir	28	Şarköy	Tekirdağ	59
Enez	Edirne	28	Marmara	Balıkesir	61
Datça	Muğla	29	Anamur	İçel	63
Ayancık	Sinop	29	Finike	Antalya	64
Lapseki	Çanakkale	30	Arhavi	Artvin	65
Gökçeada	Çanakkale	31	Urla	Izmir	70
Armutlu	Yalova	33	Erdemli	İçel	70
Cide	Kastamonu	35	Bozyazı	İçel	77
Şile	Istanbul	36	Bulancak	Giresun	86
Karataş	Adana	36	Türkeli	Sinop	89
Doğanyurt	Kastamonu	38	İnebolu	Kastamonu	89
Yumurtalık	Adana	41	Manavgat	Antalya	89
Gerze	Sinop	41	Seferihisar	Izmir	90
Fındıklı	Rize	42	Marmaris	Muğla	90
Gazipaşa	Antalya	48	Amasra	Bartın	90
Kumluca	Antalya	50	Ardeşen	Rize	93
Fethiye	Muğla	52	Erdek	Balıkesir	96

Table 5.5: The Settlements having between 100 and 1.000 people/km^2

Settlement	Location	P. Density (people/km^2)	Settlement	Location	P. Density (people/km^2)
Akçakoca	Düzce	100	Dörtyol	Hatay	210
Marmara Ereğlisi	Tekirdağ	101	Çiftlikköy	Yalova	212
Keşap	Giresun	102	Ayvalık	Balıkesir	222
Ondokuzmayıs	Samsun	108	Gemlik	Bursa	235
Çanakkale		112	Alaplı	Zonguldak	241
Çayeli	Rize	113	Ünye	Ordu	259
Didim	Aydın	113	Çarşıbaşı	Trabzon	261
Sinop		114	Yakakent	Samsun	280
Çınarcık	Yalova	115	Kuşadası	Aydın	292
Karasu	Sakarya	115	Eynesil	Giresun	293
Piraziz	Giresun	116	Pazar	Rize	293
Kemer	Antalya	118	Görele	Giresun	293
Selçuk	Izmir	120	Samandağ	Hatay	293
Silivri	Istanbul	121	Körfez	Kocaeli	296
Tekirdağ		128	Akçaabat	Trabzon	341
Abana	Kastamonu	134	**Zonguldak**		346
Gülyalı	Ordu	145	**Antalya**		354
Çeşme	Izmir	145	**Kocaeli**		361
Bodrum	Muğla	149	Vakfıkebir	Trabzon	372
Hopa	Artvin	154	**Giresun**		380
Güzelbahçe	Izmir	155	Fatsa	Ordu	403
Perşembe	Ordu	158	**İçel**		414
Alanya	Antalya	161	Derince	Kocaeli	436
Mudanya	Bursa	162	İyidere	Rize	438
Ereğli	Zonguldak	164	Of	Trabzon	441
Araklı	Trabzon	167	Derepazarı	Rize	445
Karamürsel	Kocaeli	168	Iskenderun	Hatay	451
Foça	Izmir	176	**Ordu**		497
Tirebolu	Giresun	176	**Rize**		509
Yomra	Trabzon	178	Gölcük	Kocaeli	520
Sürmene	Trabzon	187	**Yalova**		525
Terme	Samsun	189	**Samsun**		591
Espiye	Giresun	190	Gebze	Kocaeli	722
Arsin	Trabzon	196	Beşikdüzü	Trabzon	751
Bandırma	Balıkesir	204	Narlıdere	Izmir	859
Aliağa	Izmir	209	Beykoz	Istanbul	886

Table 5.6: The Settlements having between 1.000 and 10.000 people/km^2

Settlement	Location	P. Density
Adalar	Istanbul	1110
Çiğli	Izmir	1171
Sarıyer	Istanbul	1497
Trabzon		1499
Büyükçekmece	Istanbul	1746
Bornova	Izmir	1771
Tuzla	Istanbul	1812
Pendik	Istanbul	2466
Maltepe	Istanbul	3145
Balçova	Izmir	3185
Küçükçekmece	Istanbul	5556
Avcılar	Istanbul	5994
Bakırköy	Istanbul	6512
Karşıyaka	Izmir	6648
Eminönü	Istanbul	6954
Beşiktaş	Istanbul	9086

Table 5.7: The Settlements having more than 10.000 people/km^2

Settlement	Location	P. Density
Üsküdar	Istanbul	10763
Konak	Izmir	11338
Kartal	Istanbul	11996
Kadıköy	Istanbul	16582
Zeytinburnu	Istanbul	20639
Beyoğlu	Istanbul	25767
Fatih	Istanbul	31039

According to this classification, the densest settlements are located on North Marmara coasts (Istanbul) and Izmir coasts.

Classification of Coastal Settlements according to Urban Problems

Coastal settlements of Turkey definitely have significant urban problems. Most of Turkey's industrialization has taken place in the coastal provinces, including Istanbul, Izmir, Kocaeli, İçel, Samsun, and Zonguldak. Having good capacity harbors and transportation possibilities has dramatically triggered industrialization process and industrial facilities of those provinces. Although such industrial development is economically important, its rapid expansion along the coasts has caused serious coastal water pollution and deterioration. More importantly, this rapid industrialization and urbanization has brought the critical urban service problems and infrastructure problems because of the expansion of the settlements. Besides industry, construction of tourist accommodations and summer houses along the coasts, especially on the south-western coasts, has contributed significantly to sewage and solid waste problems and degradation of water quality. Increase in tourism activities on coastal zone also creates a competition among industry, agriculture, and tourism activities. Commercial fishing also has a significant portion in both coastal areas and economic income of the country. This activity also contributes to the coastal problems.

In this context, Kaş (Antalya), Kemer (Antalya), Aliağa (Izmir), Alanya (Antalya), Zonguldak, Şile (Istanbul), Side (Antalya), Samandağ (Hatay), and mainly Istanbul, Izmir, Antalya, Trabzon, and Samsun have critical urban problems in terms of rising population, development pressure, economic gains, working places, and urban infrastructure such as sewage, solid waste, transportation, and drinking water.

Classification of Coastal Settlements according to Coastal Problems

The problems explained above, under the heading of "classification of coastal settlements according to urban problems" also have caused basic coastal problems. Starting from mid 1980s, there is a sharp shift of population toward the coast, particularly with the migration from central and eastern Anatolia in search of better living conditions. In addition, rapid growth of the tourism industry, which has gained momentum since 1980s, along the coastal areas has doubled the population pressure on the coastal zone, resulting in many environmental and socio-economic effects. Industrial and other economic activities depending on the coasts have resulted with disappearance of natural resources and unique beauties of the coast itself.

Wave movements (especially the effects on erosion and accretion events), unplanned and uncontrolled development, changes on the coast and destruction of dunes, pollution, wildlife areas and agricultural areas are the main headings of coastal areas. Therefore the study observes the unplanned change and development of coastal area as the origin of problems, and evaluates that urban problems on the coast and coastal problems are combined multiplying each other's conditions and effects in a negative way. Coping with these problems requires a systematic approach including technological hardware, accumulation and sharing of information about the coast and its changes.

Coastal problems have shown themselves for the last three decades especially and Turkish Government has started to take some actions against those problems. In response to Turkey's emerging coastal problems, the national government, with the cooperation of a number of international organizations, such as Regional Activity Centre of the UNEP – MAP for Priority Actions Programme, the OECD, the World Bank, and the Global Environmental Facility – GEF, has played major roles in Turkish coastal management efforts. The national government's involvement in management of coastal resources and environment mandated numerous laws and regulations on a sector basis; the laws were passed primarily during the period between 1980s and 1990s. The planning related efforts mainly includes nation-wide development plans, sectoral development plans, land use plans, specially managed areas (SEPA's, national parks, cultural sites etc.), coastal law, environmental impact assessment, critical area / endangered species protection, UNEP's regional seas program (Mediterranean since 1975, Black Sea since 1992), union of municipalities around important enclosed basins (the Sea of Marmara, Izmir Bay, etc.). Major areas of the problem issues in Turkey evaluated by the government as;

- urban sprawl, tourism development, near-shore illegal construction (i.e. Bodrum – Muğla, Alanya – Antalya, Samandağ – Hatay),
- coastal waters polluted by municipal, industrial, agricultural, and ship waste (i.e. Aliağa - Izmir, Bodrum – Muğla, Iskenderun – Hatay) and
- biodiversity protection required for extremely rich biodiversity and last natural habitat for monk seal, green turtles, and other rare species (i.e. Fethiye – Muğla, Samandağ - Hatay).

Classification of Coastal Settlements according to Natural Disaster Risk Factors and Disaster Related Background

Current disastrous conditions of 15 province centers which are located on the coast are summarized in the Table 5.8.

Table 5.8: Disaster Factors and Disastrous Problems of Coastal Province Centers

Settlement	Current Disaster Risk Factors
Antalya	Flood and storm surge risks in the case of negative meteorological conditions, some risky harbor activities, 1st Degree Earthquake Zone settlement, disappearing natural resource due to the tourism impact,
Çanakkale	In the case of negative meteorological conditions accident risk of the tankers and other marine vehicles, 1st Degree Earthquake Zone settlement,
Giresun	In the case of negative meteorological conditions flood and storm surge risks, agricultural industry activities,
İçel	Tourism and port activities, rapid development of construction sector on the coast due to the tourism and secondary housing impacts,
Istanbul	In the case of negative meteorological conditions and because of the physical conditions of the Bosporus, there are accident risks of the tankers and other marine vehicles, 1st Degree Earthquake Zone settlement, pollution caused by urbanization, industry, and marine vehicles, dense population and settlement pattern, uncontrolled urbanization issues,
Izmir	Marine transportation and port activities may include dangerous materials and facilities sometimes, 1st Degree Earthquake Zone settlement, urbanization and coastal pollution problems due to the tourism development, urban infrastructure problems
Kocaeli	It has a great industrial activities beside being a 1st Degree Earthquake Zone Settlement,
Ordu	Flood, storm surge, and landslide risks in the case of negative meteorological conditions,
Rize	In the case of negative meteorological conditions landslide, flood and storm surge risks, agricultural industry activities,
Samsun	In the case of negative meteorological conditions flood and storm surge risks, industry and port activities,
Sinop	Being a peninsula settlement increases hurricane impacts, urbanization and development pressure,
Tekirdağ	It has earthquake, storm surge and flooding risks, historical tsunami area,
Trabzon	Port city, dense marine activities, urban infrastructure problems
Yalova	Industry and tourism area, has earthquake and tsunami risk,
Zonguldak	Industrial port activities, mining centre,

5.3. Evaluation of the Prominent Coastal Settlements and Case Selection

As explained in the first chapter, the study claims that *setting up a CAAM based on <u>coastal urban typology</u> and <u>disaster risk</u> is the way of associating ICZM and UDRM, for better and* *more effective planning and management of coastal urban areas; especially in terms of implementing disaster risk mitigation strategies and determining prior intervention areas in those settlements.* Therefore, with the aim of developing CAAM, coastal settlements of Turkey have been classified according to different aspects in the previous parts of this chapter. Coastal areas are grouped in two categories; first by coasts, and second by coastal settlements. First one comprises land-use characteristics, landform characteristics, and disaster potential issues. Second one comprises sectoral variation and population characteristics, and urban problems. These groupings are also made for determining a case study area. Accordingly, considering the main aim, problem, and the hypothesis of the study; and also the detailed explanations and information about coastal settlements of Turkey, nine settlements are determined as the case study proposals. These settlements are Amasra (Bartın), Aliağa (Izmir), Kemer (Antalya), Fethiye (Muğla), Derince (Kocaeli), Iskenderun (Hatay), Yumurtalık (Adana), İçel province center, and Antalya province center. Distinctive features and basic information about these eight settlements are summarized in Table 5.9 and Table 5.10.

Table 5.9: Nine Proposals and their Distinctive Features

Name	Location	Type	Coast to	Urban Pop. (2009)	Pop. Density	Annual Population Growth Rate (‰)	Number of Villages and Small Municipalities on the Coast	Population of Villages and Small Municipalities on the Coast	Coast Type	Coast Type	Coast Type Sectoral Weight
Amasra	Bartın	District	Black Sea	6 505	90	-2,68	5	1112	Rural	Discordant, Emergent	Mining
Aliağa	Izmir	District	Aegean Sea	51108	209	38,85	3	4700	Urban	Discordant, Submergent	Industry
Kemer	Antalya	District	Mediterranean Sea	20110	118	71,39	4	33086	Urban	Concordant, Submergent	Commerce
Fethiye	Muğla	District	Aegean Sea	72003	52	30,22	8	18100	Urban	Discordant, Submergent	Commerce
Derince	Kocaeli	District	Marmara Sea	119704	436	35,14			Urban	Concordant, Submergent	Industry, Service
Iskenderun	Hatay	District	Mediterranean Sea	190279	451	2,77	19	43336	Urban	Concordant, Submergent	Industry, Service
İçel	İçel	Province	Mediterranean Sea	842230	414	24,16	6	68026	Urban	Concordant, Submergent	Service
Antalya	Antalya	Province	Mediterranean Sea	955573	354	46,67	3	3337	Urban	Concordant, Emergent	Service
Yumurtalık	Adana	District	Mediterranean Sea	5220	41	28,08	7	7000	Rural	Concordant, Submergent	Agriculture

Table 5.10: Nine Proposals and their Current Problems

Name	Near	Current Problems and Disaster Risk Factors	Coast Length (km)
Amasra	*	1st Degree Earthquake Zone settlement, development pressure and population impact on natural resources.	ID
Aliağa	Foça SEPA	Industry and harbor activities on the coast with close tourism activities, chemical materials and accident risks with close settlement area and its population, 1st Degree Earthquake Zone settlement, pollution caused by urbanization, industry, and marine vehicles.	ID
Kemer	Olympos National Park	Seasonal population density and its pollution impacts, impacts on natural resources, 1st Degree Earthquake Zone settlement.	ID
Fethiye	Fethiye - Göcek SEPA	In the case of negative meteorological conditions flood and storm surge risks, 1st Degree Earthquake Zone settlement, tsunami risk area, disappearing natural resource due to the tourism impact, especially seasonal dense population, historical tsunami events.	ID
Derince	*	Industry and harbor activities on the coast, dense population and settlement pattern, chemical materials and accident risks with close settlement areas, 1st Degree Earthquake Zone settlement, pollution caused by urbanization, industry, and marine vehicles	ID
Iskenderun	*	Industry and harbor activities on the coast with close tourism activities, chemical materials and accident risks with close settlement area and its population, 1st Degree Earthquake Zone settlement, pollution caused by urbanization, industry, and marine vehicles, historical tsunami events.	ID
İçel	*	Tourism and port activities, rapid development of construction sector on the coast due to the tourism and secondary housing impacts,	ID
Antalya	*	In the case of negative meteorological conditions flood and storm surge risks, some risky harbor activities, 1st Degree Earthquake Zone settlement, disappearing natural resource due to the tourism impact,	ID
Yumurtalık	Yumurtalık Nature Reserve	Industrial, natural, urban (settlements) and military activities within the same coastal region, their confusing effects on each others	ID

A coastal urban settlement, which has a multi-sectoral economy, coastal land-use conflicts and development problems, environmentally and ecologically negative aspects, and also disaster related issues on urban uses, had to be selected for the study. Additionally, in order to observe and analyze the effects and implementation results of the CAAM process in different aspects, the selected case area would not only have a local or regional, but also a national significance. When these nine settlements are evaluated by considering these criteria;

- Amasra has a sensitivity for the study in terms of having sea-related hazard potentials, being exposed to development pressures and population impact on natural resources, and being a 1st Degree Earthquake Zone settlement. The economy of the settlement is based on first mining, and second service (tourism) sector. It has mostly a rural settlement characteristic.
- Aliağa has a specialty in terms of having heavy industry and port activities on the coast also with tourism and agricultural activities. There are accident risks and serious contamination problems caused by urbanization, industry depending on basically ship wrecking activities, and marine vehicles. The settlement is very close to the Foça Special Environmentally Protected Area (SEPA). The settlement is also located on a 1st Degree Earthquake Zone. The economy of the settlement is based on first mining, and second agriculture. It has mostly an urban settlement characteristic.
- Kemer has significance in terms of seasonal population density and its impact on natural resources. The settlement is very close to the Olympus National Park. The settlement is also located on a 1st Degree Earthquake Zone. The economy of the settlement is based on first commerce, and second service (tourism) sector. It has mostly an urban settlement characteristic.
- Fethiye is evaluated as a historically tsunami prone coastal settlement. It has additionally seasonal flood and storm surge risks seasonally. The problems of the settlement are disappearing natural resources due to the tourism impact, development pressures, and seasonally dense population forcing the limits of carrying capacity. The settlement is very close to the Fethiye - Göcek SEPA. The settlement is also located on a 1st Degree Earthquake Zone. The economy of the settlement is based on first commerce, and second service (tourism) sector. It has an urban settlement characteristic.

- Derince is an intensive port activity center with mostly industrial establishments. The settlement area also has a dense population and settlement pattern. Most of the coastal industrial port facilities include chemical and explosive materials, and have accident risks. The settlement has a pollution problem caused by urbanization, industry, and marine vehicles. It is located on a 1st Degree Earthquake Zone and has experienced a serious earthquake in the near past. The economy of the settlement is based on first industry, and second service. It has an urban settlement characteristic.
- Iskenderun is evaluated as a historically tsunami prone settlement. There are intensive port activities on the coast also with tourism activities. Its industry has a significant place in the national economy. Industrial activities on the coast have accident risks. The area also has pollution problems caused by chemicals, marine vehicles, and population (urbanization). The settlement is located on a 1st Degree Earthquake Zone, and also has sea-related hazard potentials. The economy of the settlement is based on first industry, and second service sector. However the economic activities based on agriculture and aquaculture are also significant. It has an urban settlement characteristic.
- İçel has a seriously sprawled settlement area starting from the coast to outskirts of the Taurus Mountains; such that housing areas, agricultural lands, industrial zones, historical conservation areas, tourism facilities intertwine with each other. There is a rapid development of construction sector on the coast due to tourism and secondary housing. The economy of the settlement is based on first service sector, and second commerce. There are also port activities and agricultural business. It has an urban settlement characteristic.
- Antalya is a 1st Degree Earthquake Zone settlement. It has flood and storm surge risks on the coast. Disappearing natural resources due to the tourism impact is a problem. The economy of the settlement is based on first service (tourism) sector. Significant activities also exist in commerce and agriculture. It has an urban settlement characteristic.
- Yumurtalık has industrial, urban, and military activities within the same coastal zone and all has negative impacts on each other. There is also a nature reserve area (Yumurtalık Nature Reserve) close to those conflicting activities. The economy of

the settlement is heavily based on agriculture and the character of the settlement is mostly rural.

Results of the evaluations reveal the critical positions of basically three settlements; Aliağa (Izmir), Derince (Kocaeli), and Iskenderun (Hatay). Aliağa stays as a simple example to discuss on, whereas Derince is a very complex one. Iskenderun is chosen as a case study area because of its dominant characteristics according to all classification types. Iskenderun has a multi-sectoral economy, and there are also coastal land-use conflicts and development problems. Some of the coastal uses have environmentally and ecologically negative impacts. Some of the urban and coastal uses have also disaster related issues. Landslide, flood, erosion, earthquake, and tsunami risks exist in different parts of the settlement. There are also pollution risks caused by sea-vehicle accidents, industrial activities, and different types of urban uses. Additionally, Iskenderun not only has local and regional, but also a national significance in economy, industry, and transportation. These characteristics of Iskenderun are almost same with those of Derince. However, Iskenderun also has some tourism and recreational activities in nearby settlements such as Denizciler, Karaağaç, and Arsuz. Meanwhile, Iskenderun also considerably has agricultural areas and rural areas. On the other hand, Derince presents a much more dense urban structure and dominant with its port and port activities. Apart from other prominent settlements, natural setting of Iskenderun is very unique. The highland of the province starts very close to the city-center, and these hilly areas also host local people for their summer resort needs. Besides, as a result of its natural setting, coastal area for utilization is very limited and narrow in Iskenderun. For these reasons, Iskenderun presents a more problematic situation than Derince. Detailed explanations about Iskenderun and its importance for the study, current condition, and evaluations are made in the following chapter. Also CAAM is implemented in Iskenderun and the results of the implementation are introduced in the following chapter.

5.4. Developing the CAAM

In the case of natural disasters; type, location, and density of a coastal settlement should be reconsidered and prior intervention methods should be implemented according to this review. Considering this point, CAAM can be defined as "*a model which is composed of the implementations of coastal urban typology matrix, risk potential matrices, and ICZM-UDRM comparison matrix.*"

Accordingly, elements of CAAM have basically taken shape according to the disaster types. Additionally, elements of ICZM and UDRM, and typologies of coasts and coastal urban settlements are used to shape the matrix groups of CAAM. **Coastal settlements** and **natural disasters** remind ICZM and UDRM concepts; therefore, the original basis of these two concepts are evaluated and used in this thesis study in order to set up the whole CAAM process. However, the focus area of the study is a special form of coastal area (urban one). Additionally, the area is also a special form of urban settlement (coastal one). Accordingly, developing **Coastal Urban Typology Matrix** is the first step, developing **Risk Matrices** is the second step, and developing **ICZM-UDRM Comparative Matrix** is the third step of setting up the CAAM.

5.4.1. Developing the Coastal Urban Typology Matrix

Main headings of Coastal Urban Typology Matrix basically consist of physical urban elements and characteristics of coastal land. The components of urban vulnerability elements are composed of typical urban features and urban uses. Subheadings of these main headings also indicate and give information about the administrative structure and legal status which are also critical for the later actions to be taken after the evaluations made by using the CAAM. Coastal urban typology matrix is given in Figure 5.9.

This matrix could surely be expanded by using detailed information about natural thresholds, geological and geomorphologic features, building stock, urban infrastructure, special planning areas, special protection areas, natural and urban sites, land-use pattern, sectoral variation, population features, ownership pattern, administrative structure, residential buildings, commercial centers, industrial plants, open areas, educational buildings, health services, socio cultural and public assembly, fire stations, office of security services, communication centers, infrastructures near shoreline (waste water discharge systems, fresh and waste water network), support units, tourism, transportation structures (piers, breakwaters, coastal protection structures, ports or harbors, marinas, fishery harbors, shelters for small crafts, airport, heliport etc.) agricultural uses, historical or cultural buildings, monuments, military areas, cemeteries, and areas for solid wastes.

"Characteristics of the land" column of the matrix takes its components from the *classifications of coasts according to the land-use character* explained in previous sections of this chapter. Likewise, components of the "morphological type of the coastal land" and "status of the coastal land" columns are also explained in the classifications made in previous parts of this chapter, under the headings of *protected coastal areas* and *classifications of coasts according to the landforms – a morphological classification*.

A given area or the problem area is evaluated first by using coastal urban typology matrix. While evaluating an area by using this matrix, given specialties in the matrix are marked according to the existing characteristics of the area. Marking operation can be made by using three different colors;

- "**grey**" indicates "desired (or does not exist or no problem)",
- "***orange***" indicates "partly desired (or partly exists or a little problematic)", and
- "***red***" indicates "not desired (or highly/densely exists or very problematic)" features.

Therefore, desired situations should be previously defined according to the future expectations and local characteristics of the selected area. At the end of this operation, initial information about the area could easily be obtained. Implementation of this matrix and definition of the desired situations proposed by the matrix is explained in Chapter 6, in Iskenderun case.

Table 5.11: Coastal Urban Typology Matrix

		Characteristics of the Coastal Land				Status of the Coastal Land							Morphological type of the Coastal Land			
Urban Physical Vulnerability Elements		Urban	Rural	Natural	Protected	SEPA	National Park	Nature Park	Nature Reserve	Archaeological, Urban, Historical, Natural Site	Tourism Area	Urban Development Area	Concordant	Discordant	Emergent	Submergent
Density	Housing Density															
	Building Density															
Ownership	Private															
	Public															
	Military															
Natural Restrictive Thresholds	Water Resources (river, lake, etc.)															
	Slope (valley, hill, etc.)															
Infrastructure	Ports and Harbours / Shipyards															
	Information and Telecommunication															
	Transportation Systems															
	Public health / Emergency services															
	Energy plants, gas or oil industries															
	Sewerage and Drainage Systems															
Land-use Type	Housing (Residential) Area															
	Industrial Area															
	Tourism Area															
	Recreation Area															
	Military Area															
	Commercial Centre or Urban Centre															
	Aquaculture and Fisheries															
	Agricultural Land															
Settlement Type (Population)	Small Town (less than 10.000)															
	Large Town (10.000 - 50.000)															
	Small City (50.000 - 100.000)															
	Large City (100.000 - 500.000															
	Metropolitan Area (more than 500.000)															

5.4.2. Developing Disaster Risk Matrices

In the following step, planner or manager should collect the information about possible threats and risk potentials of the area. All of the possible and experienced disaster risk factors should take their places in Risk Matrices. Components of this matrix basically come from the *categories of hazards* and *types of disasters* which explained in Chapter 2. However, the classifications made in Chapter 2 are used and explained in a much more detailed form in the risk matrices.

The most important thing in these matrices is the comprehensiveness and variability of risk factors affecting the area. These matrices also give information about natural and human-made disaster history, and also possible threats which are professionally determined. Therefore, evaluation of this matrix has great sensitivity and significance in terms of making future decisions and determining actions should be taken in the follow-up process.

Risk Matrices are combined matrices of several sub-matrices and can be called as "risk matrix" in a short way. Disaster risk in any place is never defined at zero. As discussed previously, disaster risk is the function of disaster proneness and vulnerability[6]. That means, the seriousness of risk is directly related with the extent of hazard and vulnerability. And, hazard risk also is a function of consequence and predicted frequency. These explanations show that there is always risk. However, the level of risk is sometimes lower, or may be sometimes higher, changing according to the local conditions. Risk matrices, which constitute the basis of CAAM in this study, help to understand the level of risk at any place. Since risk is defined as a function of consequence and predicted frequency[7], risk matrices basically consist of consequence and frequency components. Therefore, before developing a risk matrix for any kind of risk sector, a consequence matrix and a frequency matrix should be prepared. These kinds of matrices first prepared and used for the analysis of risk in industrial establishments and technical facilities, and since then generally used for these purposes. However, those matrices can be adopted and used for analyzing urban risks and urban related hazards, for coastal areas also. This part of the study focuses on disastrous

[6] $Risk_{Disaster}$= Disaster Proneness x Vulnerability

[7] $Risk_{Hazard}$= Consequence x Predicted Frequency

events affecting coastal areas, and defines the development process and usage procedure of risk matrices which help to understand and analyze the level of risk and disaster risk potentials of any coastal area.

Disastrous events which has the possiblity to occur at any coastal area are listed as; climate change related impacts such as sea-level rise, threats to biodiversity and ecological processes, decline in fresh water, heavy rain, wildfires, and drought; geological and topographical disaster risks such as earthquake, liquefaction, and landslide; hydrological and marine disaster risks such as tsunami, storm surge, flood, and coastal erosion; and human-made or technological disaster risks such as maritime accidents, air pollution, land pollution, water pollution, and nuclear – chemical accidents / industrial explosions. General rules of developing risk matrices and implementation principles of risk matrices about these events are explained here in this section. However, all of these events are not the issue of the case study on Iskenderun.

Threats to biodiversity and ecological processes, decline in fresh water and drought are definitely also some of the consequences of sea-level rise. These long-term consequences may be used as the indicators of sea-level rise in detailed studies focusing on sea-level rise. However, these are time consuming monitoring actions and also the issues of long-term (more than 30-50 years) scientific studies. Therefore these events are not evaluated in the development process of risk matrices, and separate matrices for these events are not produced in this study. These events may be listed and evaluated among the consequence variables of consequence matrix for sea-level rise. Sea-level rise, wildfire, earthquake, landslide, tsunami, coastal flooding due to storm surge, flood, coastal erosion, pollution, and marine accidents and explosions are covered in this study. Consequence matrices, frequency matrices, and risk matrices are prepared for each event, and evaluation methods of risk matrices are explained in the following parts. Implementation of the risk matrices is discussed in this study only for the possible events for Iskenderun.

Before discussing the generation process of consequence matrices, frequency matrices, and risk matrices for each event, it is better to express the reading style of consequence matrices. One should not try to find a relation between consequence variables in terms of consequence categories. Each variable should be evaluated and compared with the consequence categories distinctly. That means one consequence category of a consequence variable may not be the same with consequence category of another consequence variable.

<u>Sea-Level Rise:</u> According to IPCC (2008)[8], "global mean sea-level has been rising and there is high confidence that the rate of rise has increased between the mid-19th and the mid-20th centuries. The average rate was 1.7 ± 0.5 mm/ yr for the 20th century, 1.8 ± 0.5 mm/yr for 1961–2003, and 3.1 ± 0.7 mm/yr for 1993–2003. It is not known whether the higher rate in 1993–2003 is due to decadal variability or to an increase in the longer-term trend. Spatially, the change is highly non-uniform; e.g., over the period 1993 to 2003, rates in some regions were up to several times the global mean rise while, in other regions, sea levels fell." That means clearly rising sea-level primarily will affect coastal regions.

Consequence matrix of sea-level rise on the coast could be prepared based on coastal elevation and slope values, characteristics of the coastal land, status of the coastal land, morphological type of the coast, and land-use type and land-use characteristics. These characteristics are defined as consequence variables. Additionally, four consequence categories have been determined for consequence matrix on sea-level rise: Low (1), Moderate (2), Severe (3), and Very Severe (4). Meanings of the consequence categories related to consequence variables are explained in the consequence matrix (Figure 5.9).

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[8] Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, (Eds.), 2008, "Climate Change and Water", Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 pp.

Consequence Variables / Consequence Categories	Slope (the negative angle between land surface and sea level)	Elevation	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	90 - 46	Above 10 m	Mountains	Urban	No Status	Discordant and Emergent	Forest, Tourism and recreation area with low building density,
Major (2)	45 - 20	Max 10 m. higher than sea level	Coastal Hills and Cliffs	Rural	Tourism Area, Urban Development Area	Concordant and Emergent	Tourism and recreation area with high building density,
Hazardous (3)	19 - 0	Same as sea level	Coastal Plains, Coastal Flood Plains	Natural	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Urban centres and commercial centres, Industrial areas, Transportation units, Military areas
Catastrophic (4)	Same as ground (0) or if there is negative slope (<0)	Lower than sea level (< 0)	Deltas, Lagoons, Coastal Wetlands	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Submergent	Agricultural Land, Fresh water supply area, Critical and dense urban Infrastructure (energy plants, transportation units), Dense Industrial Infrastructure

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	> 1000 years	The occurrence of the event is almost impossible.
Moderate (2)	100 - 1000 years	The occurrence of the event is conceivable.
High (3)	10-100 years	The event may happen once in a lifetime.
Very High (4)	< 10 years	It is likely to be happen frequently and seriously

B. Frequency Matrix

Risk Matrix for SLR		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.9: Consequence, Frequency, and Risk Matrices for Sea-Level Rise

In the consequence matrix, urban area has been evaluated in the category “low”, because; sea-level rise is not an immediate event and occurrence of a significant rise in sea-level takes long time. The coastal uses may be relocated or their functions may change within this time. Therefore, the consequence category is getting more serious for immoveable coastal uses and functions. That means, most of the large-scale coastal investments, essential urban infrastructure located on the coast, agricultural lands, and different types of coastal conservation areas in varying scales have serious consequence category in this matrix. Besides, lower and plain coastal lands have also serious position.

Four frequency categories as Low (1), Moderate (2), High (3), and Very High (4) have been determined, and meanings of those categories are also explained in frequency matrix of sea-level rise (Figure 5.9). The same frequency categories are also adopted for each type of risk factor. Probabilities explained in frequency matrix for sea-level rise are developed according to the assumption of 5 m rise in sea-level. Scientists and researchers assume the frequency of sea-level rise is 100 years, however, they also observe sea-level rise as a preventable event. Therefore, frequency matrix should be evaluated from this viewpoint and frequency category may be assumed as “high” and, risk matrix values should cover the actions which present environment friendly, ecological, CO_2 minimizing design principles both in planning and engineering solutions.

Evaluation of the risk matrix of sea-level rise (SLR), and therefore risk levels, is case specific. General structure of risk matrices for all events are same with explained here for SLR. The values (A, B, C, D) in the cells explain the actions should be taken and they change according to the event. According to these explanations; A (red) indicates very high risk condition (immediate interventions are required); B (orange) indicates high risk conditions (required analysis should be made in a short time and risk should be minimized); C (yellow) indicates significant risk conditions (however, intervention may take some more time than the situation in B); D (green) indicates low importance (however, risk mitigation actions should be considered in long term).

Before the operation, the actions correspond to A, B, C, and D situations for each risk type should be predefined by the implementation body according to the resources and opportunities of the administrative body of the implementation area. The same method is implemented for each type of risk matrix.

<u>Wildfire:</u> Wildfires usually occur out of urban centers, in wild areas; and they occur in an uncontrolled way. The cause of the wildfire is unknown most of the time. They are usually large scale and huge events, and this is related with vegetation and extreme (high) temperature values. Accordingly, this event could also be evaluated among the climate change related impacts in terms of its causes and consequences. The consequence of this event is usually disastrous. As USGS underlines that erosion, landslides, changes in water and air quality, changes in rainfall regime, and ecosystem destruction caused by wildfires are much more disastrous than wildfire itself[9]. Therefore, this event poses a threat to life and property, especially where native ecosystems meet developed areas. This type of threats is sometimes seen in our country also, especially in summer seasons at relatively high temperatures in dense forest regions. The risk is increasing in long, hot, and dry periods. Wildfire is evaluated as almost a preventable event in this study.

Consequence matrix of wildfire in the coastal areas could be prepared based on coastal land-use type, vegetation type (if it is a vegetated area), which type of coastal land-use takes place next to the vegetation cover (if it is a delicate vegetation cover), monthly average relative humidity of summer season, monthly average temperature of summer season, characteristics of the coastal land, and status of the coastal land. These characteristics are defined as consequence variables. Additionally, four consequence categories are determined for consequence matrix on wildfire as; Low (1), Moderate (2), Severe (3), and Very Severe (4). Meanings of the consequence categories related to consequence variables are explained in the consequence matrix (Figure 5.10).

[9] USGS Official Website - http://www.usgs.gov/hazards/wildfires/ - Access Date: 07.10.09.

Consequence Variables / Consequence Categories	Vegetation Type	Delicate Vegetation Cover next to	Monthly Average Moisture (Relative Humidity - Summer) (%)	Monthly Average Temperature (OC)(summer)	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological type of the Coastal Land	Coastal Land-use Type
Minor (1)	Dense Forest, Moistured Vegetation	Empty places has no vegetation cover	more than 85	less than 35	Urban	No Status	Discordant and Submergent	Tourism and Recreation Areas
Major (2)	Lawn	Roads and Rivers	70-85	35-40	Natural	Tourism Area, Urban Development Area	Concordant and Submergent	Urban and Commercial Centres
Hazardous (3)	Bushes and Scrubs	Tourism and Recreation Areas, Transportation Units	50-69	41-45	Protected	Archaeological, Urban, Historical, Natural Sites	Discordant and Emergent	Industrial Areas, Military Areas, Transportation Units
Catastrophic (4)	Less Dense Forest, Dry Farming Agricultural Area	Power Lines, Energy Plants, Explosive Industry, Urban and Commercial Centres, Rocky Hills	less than 50	more than 45	Rural	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Forests and Dry Farming Agricultural Land

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 5-10 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once in 5 years	The occurrence of the event is highly possible and frequent.
High (3)	2-4 times in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	At least once in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Wildfires		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.10: Consequence, Frequency, and Risk Matrices for Wildfire

As needed for other events, a perfect data record is also needed in order to prepare and evaluate frequency matrix for wildfires. Four frequency categories are determined as; Low (1), Moderate (2), High (3), and Very High (4) and their meaning are also explained in frequency matrix of wildfire (Figure 5.10).

Earthquake: Earthquakes cause death of thousands of people and loss of millions of dollars every year. Earthquake is probably the most uncontrolled and harmful event among others. It is the most well-known and widespread event also in our country. Almost everyone considers earthquake when someone talks about "natural disaster". Therefore, awareness on earthquake is the most widespread one. However, it is different from other events in terms of being not preventable.

Consequence matrix of earthquake in the coastal areas could be prepared based on coastal land-use type, characteristics of the coastal land, status of the coastal land, open space availability, housing density, proportion of old structures, distance from the nearest fault line, the place of the area in the seismic hazard map, and serious earthquake experiences in the past. Also, liquefaction potential of the area affects the consequence. These characteristics are defined as consequence variables. Additionally, four consequence categories are determined for consequence matrix on earthquake: Low (1), Moderate (2), Severe (3), and Very Severe (4). Meanings of the consequence categories related to consequence variables are explained in the consequence matrix (Figure 5.11).

Preparation of a frequency matrix for earthquake requires regular and complete data record, however; those records should be based on an instrumental measurement which discriminates larger and smaller shocks. Additionally, at least a 100-year-period data should be available. Even if there is a perfect data set including much longer period data, it may not give exact information for the preparation of frequency matrix. In fact, we are experiencing small shocks in every day. On the other hand, instrumental measurements are not available for older periods. Therefore, frequency matrix for earthquake should be prepared according to the ideas generalized from the instrumental records. Those ideas should give an opinion on the possibility of experiencing large shocks which are larger than

M=5[10]. Four frequency categories are determined as Low (1), Moderate (2), High (3), and Very High (4) and their meaning are also explained in frequency matrix of earthquakes (Figure 5.11).

On the other hand liquefaction is also a seismicity related event. Liquidity or liquifactability of ground is related with water saturation of the soil. When the general characteristic of the ground is non-rigid, alluvial, sandy (or clayed or gravelly), and saturated then the area is prone to liquefaction. Arık (2004) insists that young geological formations and shallow groundwater levels make the ground susceptible to liquefaction. Liquefaction is generally triggered by a sudden seismic shock like earthquake, and this shock does not have to be the earthquake itself (main shock). Initial shocks happening before an earthquake or rear shocks happening after an earthquake also cause liquefaction. Liquefaction may easily cause of building to lean to one side even if it is an earthquake resistant building. Settling downs, disseminations, decadences, and liftings are seen as a result of liquefaction. Additionally; critical infrastructure elements like sewage pipes, fresh water pipes, natural gas lines, and telecommunication cables may be damaged as a result of this event. Liquefaction is evaluated as a non-preventable event in this study. Risk is changing according to the soil type and seismicity, however; deltas, flood plains, terraces, and coastal sediments, also rehabilitated lake-sides, river-sides and sea-sides are the most risky places.

In fact, earthquake and liquefaction are highly related events. Accordingly, data about liquefaction is evaluated within the matrices of earthquake. Earthquake and liquefaction may be evaluated separately. Risk is higher for liquefaction than earthquake since smaller shocks may also trigger liquefaction. Liquefaction potential of an area is also a triggering factor for landslides. Earthquake is evaluated as a non-preventable event in this study. As needed for other events, a perfect data record is also needed in order to prepare and evaluate frequency matrix for earthquake.

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[10] B. Gutenberg and C. F. Richter have studied on the frequency of earthquakes in California and defined M (magnitude) = 2 is the smallest shocks ordinarily reported felt, M = 4,5 is the smallest shocks causing slight damage, M = 6 is the moderately destructive earthquakes, and M = 8,5 is the largest recorded shocks recorded in California Region. This study accepts the shocks larger than M = 5 and prepares the frequency matrix according to this assumption.

Consequence Variables / Consequence Categories	Earthquake Magnitude (500 years - over M=5.0)	Open Space Availability (m2/person and % of municipal area)	Building Density (% of municipal area)	Population Density (person / hectare)	Proportion of Old Structures (older than 50 years - %)	Liquefaction Potential of the Area (Related with the type of sediment and ground water level)	The Place of The Area in The Seismic Hazard Map	Distance from the Nearest Fault Line	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological type of the Coastal Land	Coastal Land-use Type
Minor (1)	Never	more than 15 and more than 20 %	less than 50	less than 100	less than 5	Chesionless clayed terrains, Tertiary - ground water level is more than 20 m	5th and 4th Degree Zone	125 km and more	Natural	No Status	Discordant and Emergent	Agricultural Land and Forest
Major (2)	2 - 10 times	10 - 15 and 15 - 20 %	50 - 65	100 - 199	5 - 25	Pleistocene Ground water level is between 20 - 15 m	3th Degree Zone	125 - 100 km	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Military Area
Hazardous (3)	11-20 times	5 - 10 and 15 - 10 %	66 - 80	200 - 300	26 - 50	Holocene young, Ground water level is between 15 -10 m	2nd Degree Zone	99 - 50 km	Rural	Archeological, Urban, Historical, Natural Sites	Discordant and Submergent	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	more than 20 times	less than 5 and less than 10 %	more than 80	more than 300	more than 50	Alluvial, sandy, cohesionless terrains (Holocene - old) - Ground water level is less than 10 m	1st Degree Zone	less than 50 km	Urban	Tourism Area, Urban Development Area	Concordant and Submergent	Urban and Commercial Centres, Energy-Oil-Gas Plants, Transportation Units, Dams

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 500 years	The occurrence of the event is possible.
Moderate (2)	Once in 100 years	The occurrence of the event is highly possible.
High (3)	Once in 50 years	It is likely to be happen very frequently and seriously
Very High (4)	Once in 10 years	The occurrence of the event is a serious and critical part of lifetime

B. Frequency Matrix

Risk Matrix for Earthquake		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.11: Consequence, Frequency, and Risk Matrices for Earthquake

Landslide: Landslide is a type of ground movement which may be caused by earthquakes, earthquake-caused liquefactions, volcanic eruptions, wildfires, coastal erosion caused by waves, snowmelts or heavy rains, blasting and explosions, vibrations from machinery or traffic; and shows itself sometimes as a debris flow (mud flow), or a submarine landslide, or an earth flow. The possibility of a landslide is related with several factors such as geomorphological factors (different types of geomorphological formations), geological factors (different types of geological formations, soil type and depth, faults, etc.), land-use / land cover factors (vegetation or different types of land-uses), and hydrogeologycal (permeability, ground water levels, saturation, etc.) factors.

Consequence matrix for landslides on the coastal areas could be prepared based on coastal land-use type, characteristics of the coastal land, status of the coastal land, slope, soil type and rigidity, critical geological thresholds and location, morphological type of the coast, and vegetation. These characteristics are defined as consequence variables. Additionally, four consequence categories are determined for consequence matrix of landslides: Low (1), Moderate (2), Severe (3), and Very Severe (4). Meanings of the consequence categories related to consequence variables are explained in the consequence matrix (Figure 5.12).

Landslide is also heavy rain and flood related event. Heavy rain, flood, and landslides; or earthquake, liquefaction, and landslides may be evaluated together in an integrated consequence matrix in some areas. Liquefaction is evaluated in the scope of earthquake, heavy rain is evaluated in the scope of flood, and landslide is evaluated separately in this study. The four frequency categories are also adoptable for landslide: Low (1), Moderate (2), High (3), and Very High (4) and their meaning are also explained in frequency matrix for landslide (Figure 5.12).

Consequence Variables / Consequence Categories	Slope (%)	Total Monthly Rainfall (intensity) (mm)	Sediment or rock type	Vegetation Type	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological type of the Coastal Land	Coastal Land-use Type
Minor (1)	0 - 2	Less than 100	Basalt, limestone (consolidated or integrated formations)	Dense Forests	Plains	Natural	No Status	Submergent and Concordant	Forests
Major (2)	3 - 7	100 - 199	Sandstone	Less dense forests, Agricultural areas	Plateau	Protected	SEPA, National Park, Nature Park, Nature Reserve	Submergent and Discordant	Military Areas, Agricultural Land
Hazardous (3)	8 - 12	200 - 299	Claystone, Mudstone	Bushes and Scrubs	Cliffs and mountains	Rural	Archeological, Urban, Historical, Natural Sites	Emergent and Concordant	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	More than 12	300 and more	Unconsolidated or disintegrated formations	Lawn or no vegetation	Valleys, hillsides, coastal hills.	Urban	Tourism Area, Urban Development Area	Emergent and Discordant	Urban and Commercial Centers, Energy-Oil-Gas Plants, Transportation Units, Dams

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	At least once in 25 years	The occurrence of the event is possible.
Moderate (2)	Once in 10 years	The occurrence of the event is highly possible.
High (3)	2 or 3 times in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	At least once in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Landslide		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.12: Consequence, Frequency, and Risk Matrices for Landslide

Tsunami: Tsunami is also a seismicity related event that generally defined as the sudden replacement of great volumes of water in the sea, generally in oceans; and shows itself as large powerful waves. This event usually triggered by earthquakes, volcanic eruptions, and landslides. Those great volumes of water have extremely significant energy that can destroy coastal areas. Yalçıner (2004) highlights that, in deep oceans the energy in these seismic sea waves can travel virtually unnoticed, and when this energy reaches the shallow waters of coastlines, bays, or harbors, it forces the water into a giant wave.

Consequence of a tsunami event depends on its intensity which is related with wave height, fault type, and distance from the epicenter. The risk on the coast on the other hand is highly related with coast types its distance from the epicenter. However, it is not easy and also not true to determine a range in terms of distance. Technical experts may calculate or estimate this. Accordingly; elevation, type of fault, tsunami Intensity (intensity and wave height correlation), earthquake magnitude, distance from the epicenter, slope, critical geographical thresholds and location, characteristics of the coastal land, status of the coastal land, morphological type of the coast, and coastal land-use type are defined as the consequence variables. Also four frequency categories are determined as; Low (1), Moderate (2), High (3), and Very High (4) and their meaning are also explained in frequency matrix for tsunami (Figure 5.13).

Tsunami is evaluated as a non-preventable event in this study. However early warning systems are used in heavily tsunami prone areas around the world and most of the time these systems save lives. As needed for other events, a perfect data record is also needed in order to prepare and evaluate frequency matrix for tsunami.

Consequence Variables / Consequence Categories	Elevation	Type of Fault	Tsunami Intensity (Intensity and Wave Height Correlation)	Earthquake Magnitude	Distance from the Epicentre	Slope (%)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	Above 10 m	Normal and Reverse Faults	I= 1-6, WH< 2 m	Less than 5.0		More than 12	Mountains	Natural	No Status	Emergent and Discordant	Forests
Major (2)	Max 10 m. higher than sea level	Normal and Reverse Faults	I= 7-8, WH= 2-8 m	5.0 - 5.9		8 - 12	Cliffs and hills	Protected	SEPA, National Park, Nature Park, Nature Reserve	Emergent and Concordant	Military Areas, Agricultural Areas
Hazardous (3)	Same as sea level	Oblique Faults, Horst Graben Faults	I= 9-10, WH= 9-15 m	6.0 - 7.0		3 - 7	Deltas	Rural	Archaeological, Urban, Historical, Natural Sites	Submergent and Discordant	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	Lower than sea level (< 0 point)	Strike Slip Faults, Dip Slip Faults, Thrust Faults	I= 11 and 12, over 16 m	More than 7.0		0 - 2	Plains	Urban	Tourism Area, Urban Development Area	Submergent and Concordant	Urban and Commercial Centres, Energy-Oil-Gas Plants, Transportation Units, Fresh Water Resources

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 100 years	The occurrence of the event is possible.
Moderate (2)	Once in 50 years	The occurrence of the event is highly possible.
High (3)	Once in 25 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in 5 years.	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Tsunami		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.13: Consequence, Frequency, and Risk Matrices for Tsunami

Storm Surge and Coastal Flooding: Storm surge is an extreme and rapid rise in sea level and generally occurs due to inclement and intense meteorological conditions such as hurricanes, cyclones, typhoons, or thunderstorms etc. Water of the sea or ocean is usually pushed away by wind across decreasing depths at those times. Shoreward sides of the sea or ocean are the most influenced parts, and the result is seen as coastal flooding on the landward parts of the coast. Since it is also causes meteorological phenomena, wave movement is also related with atmospheric pressure values. Storm surge may be a disastrous sometimes depending on the land-use type and density of the coast.

Consequences variable of storm surge are defined as elevation, wave height, central pressure, climatic belt of the region, slope, critical geographical thresholds, characteristics of the coastal land, status of the coastal land, morphological type of the coast, and coastal land-use type. Frequency categories for storm surge related coastal flooding are; Low (1), Moderate (2), High (3), and Very High (4). Consequence, frequency, and risk matrices for coastal flooding due to storm surge are shown in Figure 5.14.

Storm surge is evaluated as a non-preventable event in this study; however risk could be minimized. As needed for other events, a perfect data record is also needed in order to prepare and evaluate frequency matrix for storm surge.

Consequence Variables / Consequence Categories	Elevation (m)	Average Wave Height in a Season / Surge Magnitude (Oct - Feb.) (m)	Central Pressure (hPa)	Climatic Belt	Experienced Max. Wind Speed (km/h)	Slope (%)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	Higher than 10 m and above	1 and less	More than 980	Polar Climate	Less than 180	10 and more	Mountains	Natural	No Status	Discordant and Emergent	Forests
Major (2)	5 - 10	2 - 3	980 - 951	Cold Climate and Dry Climate	180 - 209	5 - 10	Cliffs and hills	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Military Areas, Agricultural Areas
Hazardous (3)	0 - 4	4 - 5	950 - 920	Temperate Climate	210 - 250	2 - 5	Deltas	Urban	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	Same with or lower than sea level	More than 5	Less than 920	Tropical Climate	More than 250	0 or negative slope	Plains	Rural	Tourism Area, Urban Development Area	Concordant and Submergent	Urban and Commercial Centres, Energy-Oil-Gas Plants, Transportation Units, Fresh Water Resources

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 100 years	The occurrence of the event is possible.
Moderate (2)	Once in 25 years	The occurrence of the event is highly possible.
High (3)	Once in 10 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in a year.	The occurrence of the event is a serious and critical part of lifetime

B. Frequency Matrix

Risk Matrix for Coastal Flooding Due To Storm Surge		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.14: Consequence, Frequency, and Risk Matrices for Coastal Flooding Due to the Storm Surge

Coastal Erosion: Erosion on the coast means the loss of land; activity place, defense area, and also existing land-use as well. Mainly wave movements cause coastal erosion; however intervening on the regular operation of waves (i.e. constructing some specific type of marine structures such as breakwaters) may result with much more erosion. Changes in sea-level also cause erosion; and accordingly some other types of hazards (storm surge, tsunami, sea-level rise due to climate change, landslide, and deterioration of coastal vegetation by wildfires) discussed in this section definitely result with coastal erosion. The character of the land (main rock or soil type) is also significant in terms of erosion; some coastal lands are easily erodible and some are not.

In this study, consequence variables of coastal erosion are defined as existence of marine structures, average wave height, coastal sediment or rock type, slope, rate of land loss on the coast, critical geographical thresholds, characteristics of the coastal land, status of the coastal land, morphological type of the coast, and coastal land-use type. Frequency categories for coastal erosion are also same with the categories used for other types of hazards. These categories are; Low (1), Moderate (2), High (3), and Very High (4). Consequence, frequency, and risk matrices for coastal erosion are shown in Figure 5.15.

This study evaluates coastal erosion as mostly a preventable event. As needed for other events, a perfect data record and continuous monitoring operations are needed in order to prepare and evaluate frequency matrix for coastal erosion.

Consequence Variables / Consequence Categories	Existence of Marine Structures	Average Wave Height (cm)	Coastal Sediment or Rock Type	Slope (%)	Land Loss in the Last 5 years (cm)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	Ports and Harbours	Less than 20	Basalt, limestone (consolidated or integrated formations)	10 and more	Less than 20	Mountains	Urban	No Status	Discordant and Emergent	Forest, Recreation Area
Major (2)	Marinas, Docks, Shipyards	20 - 29	Sandstone	5 - 10	20 - 34	Cliffs and Hills	Protected	Tourism Area, Urban Development Area	Concordant and Emergent	Tourism Area, Military Area
Hazardous (3)	Piers, Jetties	30 - 39	Claystone, Mudstone	2 - 5	35 - 50	Deltas, Lagoons, Coastal Wetlands	Rural	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Industrial Area, Commercial and Urban Centre
Catastrophic (4)	Breakwaters	40 and more	Unconsolidated or disintegrated formations (alluvial deposits)	0 or negative slope	More than 50 cm	Coastal Plains, Coastal Flood Plains	Natural	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Submergent	Agricultural Land, Housing Area, Transportation Systems

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 20 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once in 15 years	The occurrence of the event is highly possible and frequent.
High (3)	Once in 10 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in 5 years	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Coastal Erosion		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.15: Consequence, Frequency, and Risk Matrices for Coastal Erosion

Flood: Flood is usually seen seasonally in stream beds, its catchment areas and river basins; and flooding occurs due to excessive rainfall, rapid snowmelt, natural stream blockages, tidal waves, and wind storms over lakes or any combination of such conditions (Şenol Balaban, 2009). Previously examined coastal flooding due to storm surge, flood due to dam collapse, river flood, and even tsunami are some specific types of floods. Flood may also be seen as flash floods as a result of heavy rain. River floods and flash floods due to heavy rain are considered in this section. In this sense, flooding may be partially considered as a climate change related event. This event is partially a preventable one and risk could be minimized. Most of the time meteorological warnings may orientate the precautionary efforts. However, in terms of river flooding, land-use planning has a significant role. Accordingly consequence categories diversify mainly depending on the coastal conditions and coastal land-use type.

Consequence matrix of flood in the coastal areas could be prepared based on total monthly rainfall in a season (that means the intensity of rainfall), soil permeability (related with soil type), soil depth, slope, flood risk mitigation infrastructure (flood protection embankment, storm sewer pump station etc.), critical geographical thresholds and location, characteristics of the coastal land, status of the coastal land, morphological type of the coast, and coastal land-use type. These characteristics are defined as consequence variables for flood. Frequency categories for flood are same with the previously defined categories. These are; Low (1), Moderate (2), High (3), and Very High (4). Consequence, frequency, and risk matrices for coastal erosion are shown in Figure 5.16.

Flood is evaluated as mostly a preventable event in this study. As needed for other events, a perfect data record, continuous monitoring operations, detailed analyses are needed in order to prepare and evaluate frequency matrix for flood.

Consequence Variables / Consequence Categories	Total Monthly Rainfall in a Season - Intensity (Oct. - Nov. - Dec.) (mm)	Soil Permeability (related with soil type)	Soil Depth (cm)	Slope (%)	Flood Risk Mitigation Infrastructure (flood protection embankment, storm sewer pump station etc.)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	Less than 100	Fast Permeable	90 and more	0 - 2	Exists	Plains	Natural	No Status	Discordant and Emergent	Forest, Agricultural Land, Tourism and Recreation Area with low density
Major (2)	100 - 199	Moderate Permeable	75 - 89	3 - 7	-	Coastal Plains	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Tourism and Recreation Area with high density, Military Areas
Hazardous (3)	200 - 299	Slowly Permeable	25 - 74	8 - 12	-	Valleys, Deltas, Coastal Flood Plains	Urban	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Urban Centres and Commercial Centres, Industrial Areas
Catastrophic (4)	300 and more	Impermeable	Less than 25	More than 12	Doesn't exist	River Basin, River Flood Area, Hillsides	Rural	Tourism Area, Urban Development Area	Concordant and Submergent	Critical urban infrastructure (fresh water supply area, transportation units, energy plants)

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once or twice in 25 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once or twice in 10 years	The occurrence of the event is highly possible and frequent.
High (3)	Once or twice in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once or twice in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Flood		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.16: Consequence, Frequency, and Risk Matrices for Flood

Pollution: Pollution can be defined as the permeation of different types of contaminants to water, air, or land (soil) from different sources, and therefore can be examined as air pollution, water pollution, and land (or soil) pollution. Pollution is measured by identifying the contaminant type (its chemical structure) and amount (in terms of concentration and persistence) in a unit of water, soil, or air. Contaminant types and acceptable levels for each contaminant in water, air or soil are defined according to general rules and standards in scientific ways.

Control of the pollution and pollution risk management is also significant because of the effects of pollution to human health, other living things, and especially environment. Generally heavy metals (manganese, mercury, lead, arsenic, mercury, lead, cadmium, copper, nickel, cadmium, copper, chromium) and persistent organic pollutants are the main contaminants for air, water, and land (http://www.ciel.org – Access Date: 10.07.2010). This study defines nitrogen as a simple and significant contaminant in determination of pollution; however, detailed contaminant or pollutant analysis should be made by the professionals of the issue before the preparation and implementation of the consequence matrix.

Level of nitrogen and other chemical contaminants (air), level of nitrogen and other chemical contaminants (water), type of industry, existence of solid waste treatment unit and recycling, chemical fertilizer, usage , existence of waste water treatment unit, characteristics of the coastal land, status of the coastal land, are coastal land-use type defined as the consequence variables for pollution. Frequency categories for pollution are same with the previously defined categories as; Low (1), Moderate (2), High (3), and Very High (4). Consequence, frequency, and risk matrices for coastal erosion are shown in Figure 5.17.

Pollution is considered as a preventable event in this study. Continuous data record, continuous monitoring operations, and detailed analyses are needed in order to prepare and evaluate frequency matrix for pollution.

Consequence Variables / Consequence Categories	Level of Nitrogen and Chemical Contaminants (air)	Level of Nitrogen and Chemical Contaminants (water)	Type of Industry	Solid Waste Treatment Unit and Recycling	Chemical Fertilizer Usage	Waste Water Treatment Unit	Characteristics of the Coastal Land	Status of the Coastal Land	Coastal Land-use Type
Minor (1)	Below acceptable level according to the standards	Below acceptable level according to the standards	Storage, Communication, Wholesale and Retail Facilities	Exists	Less than 10 %	Full Treatment	Protected	No Status	Forest, Recreation Area
Major (2)	At acceptable level according to the standards	At acceptable level according to the standards	Textile, Food, and Machinery industries	-	10 - 15 %	Biological and Chemical Treatment	Natural	SEPA, National Park, Nature Park, Nature Reserve	Tourism Area, Military Area
Hazardous (3)	Over acceptable level according to the standards (the surplus is between 10 % - 20 % of the standards)	Over acceptable level according to the standards (the surplus is between 10 % - 20 % of the standards)	Energy Production Plants, Filling Plants, Oil and Gas Industry	-	16 - 20 %	Biological Treatment	Rural	Archaeological, Urban, Historical, Natural Sites	Agricultural Land, Housing Area
Catastrophic (4)	Over acceptable level according to the standards (the surplus is more than 20 % of the standards)	Over acceptable level according to the standards (the surplus is more than 20 % of the standards)	Mining, Chemical and Construction Material Industries, Ship Dismantling Industry, Metal Industry	Doesn't exists	More than 20 %	No Treatment	Urban	Tourism Area, Urban Development Area	Industrial Area, Transportation Systems, Commercial and Urban Centre

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once or twice in 25 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once or twice in 10 years	The occurrence of the event is highly possible and frequent.
High (3)	Once or twice in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once or twice in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Pollution		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.17: Consequence, Frequency, and Risk Matrices for Pollution

<u>Maritime Accidents and Explosions:</u> Maritime accidents and explosions refer to the risk on coast related hazardous facilities located on the coast and marine vehicle accidents. These events facilities and events may cause disastrous events due to the type and density of coastal facility, type of the load that the vehicles carrying, and their distance to settlement areas. Additionally the size of the plant or establishment, size of the port, sizes of the marine vehicles are important in terms of consequences.

Accordingly, consequence variables for maritime accidents and explosions are defined as the type of industry, type of transportation system, predominant type of marine traffic (or load type of vehicles), size of port or harbor (handling capacity ton / year), type of marine transportation unit, characteristics of the coastal land, status of the coastal land, and coastal land-use type. Additionally, frequency categories for marine accidents and explosions are same with the previously defined categories. These are; Low (1), Moderate (2), High (3), and Very High (4). Consequence, frequency, and risk matrices for coastal erosion are shown in Figure 5.18.

In this study maritime accidents and explosions are evaluated as preventable events. Preparation of action plans for the establishments and taking required emergency and precautionary actions definitely minimize the risk. Detailed analyses are needed in order to prepare and evaluate frequency matrix for maritime accidents and explosions.

Consequence Variables / Consequence Categories	Type of Industry	Type of Transportation System	Predominant Type of Marine Traffic (or Load type of Vehicles)	Size of Port or Harbour (Handling Capacity ton/year)	Type of Marine Transportation Unit	Characteristics of the Coastal Land	Status of the Coastal Land	Coastal Land-use Type
Minor (1)	Storage, Communication, Wholesale and Retail Facilities	Marine	Fishing Boats and Yachts	Less than 3000000	Fisherman Shelter	Protected	No Status	Forest, Recreation Area
Major (2)	Textile, Food, and Machinery Industries	Railway, Marine	Cruise Ships, Bulk Carriers (carrying wey, food, livestock, or timber)	3000000 - 3999999	Docks and Shipyards	Natural	SEPA, National Park, Nature Park, Nature Reserve	Tourism Area, Military Area
Hazardous (3)	Mining, Chemical and Construction Material Industries, Ship Dismantling Industry, Metal Industry	Highway, Marine	Bulk Carriers (carrying slack or ore)	4000000 - 5000000	Jetties and Piers	Rural	Archaeological, Urban, Historical, Natural Sites	Agricultural Land, Housing Area
Catastrophic (4)	Energy Production Plants, Filling Plants, Oil and Gas Industry	Highway, Railway, Marine (Intersection Point)	Tankers (carrying petroleum and its products, biological - nuclear - chemical waste)	5000000 and over	Ports and Harbours	Urban	Tourism Area, Urban Development Area	Industrial Area, Transportation Systems, Commercial and Urban Centre

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 25 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once in 10 years	The occurrence of the event is highly possible and frequent.
High (3)	Once in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Marine Accidents and Explosions		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 5.18: Consequence, Frequency, and Risk Matrices for Marine Accidents and Explosions

A summary matrix like in Table 5.12 may be prepared as the result of this second step, development of risk matrices. This summary matrix makes understanding the main risk factor for the coastal settlement easier.

Table 5.12: Summary Matrix for the Risk Matrices

Event / Risk Level	Sea Level Rise	Wildfires	Earthquake	Landslide	Tsunami	Coastal Flooding Due To Storm Surge	Flood	Coastal Erosion	Pollution	Marine Accidents and Explosions
A										
B										
C										
D										

5.4.3. Developing the ICZM – UDRM Comparative Matrices

Third part of the CAAM is development of ICZM – UDRM comparative matrices. It is comprised of two matrices; the first one is ICZM Programme Checking and Implementation Guide Matrix, and the second one is UDRM Programme Checking and Implementation Guide Matrix. These matrices do not require using and following all the requirements and contents of ICZM and UDRM. Urban related issues of ICZM and coast-specific issues of UDRM are the main concerns of the matrix. Basically, the necessary elements of ICZM and UDRM (a kind of combination which includes urban problems and coastal problems generally) is picked up and determined according to the sectors.

Components of ICZM Programme Checking and Implementation Guide Matrix and UDRM Checking and Implementation Guide Matrix come from the basic structures and procedures of these two management programs which explained in Chapter 3. Elements of ICZM Programme Checking and Implementation Guide Matrix (Table 5.13) basically evaluate the current situation of the area and determine the missing points, requirements, and needs. The matrix should be comprehensive and contain all possibilities in order to be used in all types of coastal areas.

First of all, this matrix checks out if there is a management program or not. The following components determine the issues and contents of present management program or required management program according to the features of the area. Matrix can be evaluated in two forms; (a) if the situation is “absent” for the first query element, and (b) if the situation is “present” for the first query element. In “absent” situation, matrix should be filled and evaluated according to the needs and for a new management program. In “present” situation, matrix should be filled and evaluated according to missing points, currently wrong ways caused by recent changes, and new requirements. In both forms matrix should sensitively underline the current situation and real needs and requirements by using a ranking system between 0-2 in which;

- 0 indicates “no need”
- 1 indicates “should be highlighted and needs a little improvement”
- 2 indicates “strongly needed and should be improved” elements / subjects.

Elements of UDRM Programme Checking and Implementation Guide Matrix (Table 5.14) basically evaluate the current situation of the area and determine the missing points, requirements, and needs like ICZM Programme Checking and Implementation Guide Matrix does. The matrix should be comprehensive and contain all possibilities in order to be used in all types of urban areas.

UDRM Programme Checking and Implementation Guide Matrix checks out first if there is a management program. The following components determine the issues and contents of present management program or required management program according to the features of the area. Matrix basically evaluates all of the possible risk factors of au urban settlement and orientates the proposed management programme by taking these issues into account.

Like in ICZM Programme Checking Guide Matrix, UDRM Programme Checking and Implementation Guide Matrix can also be evaluated in two forms; (a) if the situation is “absent” for the first query element, and (b) if the situation is “present” for the first query element. In “absent” situation, matrix should be filled and evaluated according to the needs and for a new management program. In “present” situation, matrix should be filled and evaluated according to missing points, currently wrong ways caused by recent changes, and new requirements. In both two forms matrix should sensitively underline the current situation and real needs and requirements by using a ranking system between 0-2 in which;

- 0 indicates “no need”
- 1 indicates “should be highlighted and needs a little improvement”
- 2 indicates “strongly needed and should be improved” elements / subjects.

Table 5.13: ICZM Programme Checking and Implementation Guide Matrix

			Yes / No	Degree (0,1,2)
Any ICZM Programme	Absent			
	Present			
Main ICZM Issue	Tourism and Recreation			
	Conservation Reserves and Protection of Biodiversity			
	Infrastructure - Transportation, Ports, Harbors, Shoreline Protection Works and Defense			
	Resource Exploitation - Fishery, Forestry, Gas, Oil, and Mining			
Any Plan Approach on Coast	Absent			
	Present			
Problems on Implementation	Coastal Use Conflict and Land Allocation	Multiple Use		
		Single Use		
	Coastal Hazards and Climate Change	Types of Hazard and Mitigation Methods		
ICZM Plan Focus	Strategic Plan			
	Operational Plan			
Implementation Tools of the ICZM Programme	Administrative	Policy and Legislation		
		Guidelines		
		Zoning		
		Regulation and Enforcement		
	Social	Traditional Practices		
		Collaborative and Community-based Programmes		
		Capacity Building and Education		
	Technical	Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA)		
		Risk and Hazard Assessment and Management		
		Landscape and Visual Resource Analysis		
		Financial Programmes / Economic Analysis		

Table 5.13: ICZM Programme Checking and Implementation Guide Matrix - Continued

			Yes / No	Degree (0,1,2)
Type of ICZM Plan and Programme	By Geographic Coverage	International Integrated Plans		
		Whole-of-jurisdiction Integrated Plans		
		Regional Scale Integrated Plans		
		Local-area Integrated Plans		
		Site-level Integrated Plans		
	...			
Determination of the Stake-Holders in Implementation / Responsible Bodies	Central Government / Related Ministries			
	Metropolitan Area Municipality			
	City Municipality			
	Town Municipality			
	Private Sector			
	Public - Private Partnerships			
	NGO's			
	Local Communities			

Table 5.14: UDRM Programme Checking and Implementation Guide Matrix

			Yes / No	Degree (0,1,2)
Any UDRM Programme on Any Specific Risk Issue		Absent		
		Present		
Possible Risk Factors of the Area / Main UDRM Issue	Risks Identified in terms of Types of Hazards	Earthquake		
		Coastal Erosion		
		Landslide		
		Tsunami		
		Coastal Flooding due to Storm Surge		
		Flood		
		Sea-level Rise		
		Pollution		
		Marine accidents and Explosions		
		Wildfire		
	Risks Distinguished with Reference to the Consequences of the Disaster	Fire		
		Natural life / wildlife disruption		
		Environmental Degradation		
		Water / Air Pollution		
		Loss of Services and Capacities		
		Damage to Infrastructure and Buildings		
	Risks Classified According to the Subjects or Vulnerable Assets	People		
		Buildings		
		Economic Wealth		
		Historical Wealth		
		Natural Wealth and Other Living		
		Resources		

Table 5.14: UDRM Programme Checking and Implementation Guide Matrix - Continued

		Yes / No	Degree (0,1,2)
Analysis in Urban Risk Sectors	Risks in Macro-form		
	Risks in Urban Texture		
	Risks in Land-use Incompatibilities		
	Risks in Urban Productivity		
	Risks in Hazardous Uses		
	Risks in Building Stock		
	Risks in Lifelines and Urgent Infrastructure		
	Risks in Emergency Facilities		
	Risks in Historic Areas		
	Risks in Open Space Deficiency		
	Risks in Administrative Incapacities		
	Risks in Alienation of Citizens		
	Risks in External Vulnerabilities		
Special Risk Areas in Urban Context	Landslide Zones		
	Liquefaction Areas		
	Sub-marine Landslide Areas		
	Coastal Infill Areas		
	Dams and Downstream basins		
	River Basins		
Plan Approach and Emphasize on Possible and Present Risk Factors	Possible		
	Present		
Type of Plan Intervention	Recommends Evacuation to New Areas		
	Recommends Decrease on Density		
	Recommends Technical Solutions		
	Recommends Change on Land-use		
	Recommends Change on Status		
	Recommends a Specific UDRM Programme		
Implementation Tools of the UDRM Programme / Organizational Plans	Policy and Legislation		
	Guidelines / Coding Systems		
	Physical Plan		
	Financial Programmes / Economic Analysis		
	Action Plans		
	Construction Strengthening Programmes		
	Crisis or Disaster Management Plan		
	Collaborative and Community-based Programmes		
	Capacity Building and Education		
Targets of the UDRM Programme Implementation Tools	Conservation		
	Mitigation		
	Reconstruction		
	Regeneration		
	Strengthening		
	Aesthetically Beautification		
	New Development		

Table 5.14: UDRM Programme Checking and Implementation Guide Matrix – Continued

		Yes / No	Degree (0,1,2)
Sectoral Emphasize of UDRM Programme	Housing		
	Industry		
	Tourism and Recreation		
	Historical Conservation		
	Transportation and Other Urban Infrastructure		
Determination of the Stake-Holders in Implementation / Responsible Bodies	Central Government / Related Ministries		
	Metropolitan Area Municipality		
	City Municipality		
	Town Municipality		
	Private Sector		
	Public - Private Partnerships		
	NGO's		
	Local Communities		

This third part of CAAM requires integrated evaluation of ICZM Programme Checking and Implementation Guide Matrix and UDRM Programme Checking and Implementation Guide Matrix. This evaluation and implementation of the CAAM are presented for the case are, Iskenderun Coastal Region, in chapter 6.

5.4.4. Coastal Area Assessment Model Implementation Procedure

As emphasized at the beginning of this study, CAAM includes a process which also helps to determine critical parts of a coastal urban settlement in terms of risk factors and its level, and the findings of this process guides future ICZM and UDRM plans, also development plans. The operation of CAAM implementation process is summarized with a schema in Figure 5.19.

In Figure 5.19, ***I-1*** is the abbreviation of ***"inputs for the part 1"***, and these inputs are;

- Coastal classification (according to land-use character, according to landforms, according to conservation status)
- Economic and demographic data (population, population density, basic economic sectors)
- Urban physical and administrative data (thresholds, land-use, infrastructure, building density, ownership, administration, responsible bodies).

I-A is the abbreviation of ***"inputs for the part A"***, and these inputs are;

- Basic needs of the **coastal area**
- Sectoral variation based on the coast
- Problem areas on the coast (land-use conflicts and hazards)
- Related regulations and legislations
- Related stakeholders and responsible bodies
- Technical, social, and administrative tools of implementation
- Physical, social, administrative, and legal limitations and components of implementation
- International, national, regional, and local plans, programmes, and regulations.

I-B is the abbreviation of ***"inputs for the part B"***, and these inputs are;

- Basic needs of the **urban area**
- Main urban risk factors
- Main urban risk sectors
- Special urban risk areas
- Related regulations and legislations
- Related stakeholders and responsible bodies
- Physical, social, administrative and legal limitations and components of implementation
- Technical, social, and administrative tools of implementation
- National, regional, and local plans, programmes, and regulations.

I-2 is the abbreviation of ***"inputs for the part 2"***, and these inputs are;

- Classifications on Natural Hazards and Disasters
- Topographical data (slope, elevation, and geographical thresholds)
- Coastal classification (according to land-use character, according to landforms, according to conservation status)
- Climatic and meteorological data (rainfall, humidity, temperature, wave height, wind speed, current system, central pressure,
- Land-use type and density, type of industry, type of transportation systems

- Marine structures type, durability, and capacity
- Periodic monitoring data on coastal changes (shoreline changes and changes on water quality, level of chemical material and nitrogene, level of heavy metals)
- Vegetation type and type of agricultural activities
- Solid waste treatment and waste water treatment units' operation and capacity
- Geological and geomorphological data (sediment type, rock type, seismicity, soil type and depth, fault lines and fault types, land-form types,
- Periodic records of past events (date, intensity, duration, results, loss, post-event activities, etc.)

As highligted previously and also shown in Figure 5.19, CAAM includes the implementation of three groups of matrices. In CAAM there is a kind of feedback system between the explained groups (three parts in the figure; ***1, 2, and A and B***). Directions of the arrows indicate input flow.

The figure shows that the process starts with the implementation of ***Coastal Urban Typology Matrix*** shown as ***part 1***. This matrix gives the information about the coastal characteristics of the urban area and urban characteristics of the coastal area. In other words, this matrix gives the information about the urban area in the context of formerly made classifications. These information is used in the evaluation process of ICZM Programme Checking and Implementation Guide Matrix and UDRM Programme Checking and Implementation Guide Matrix ***(parts A and B)***. ***A*** and ***B*** both give inputs to each other and to the final evaluation ***(Joint Evaluations = Results of CAAM)***. Meanwhile, the risk matrices, which use a much more detailed database, are implemented ***(part 2)***; and the results of the implementation is used at the last part ***(part 3)***. These results also feeds ***part A*** and ***part B*** . As stated above, part A and B gives the general and summarised input to the final evaluation in CAAM process. Results of the implementation of the whole CAAM process compose the essential and significant part of the planning studies of a settlement; such as existing land use, risk issues, sectoral variation and dominance, trends, social-economic and socio-spatial conditions, natural setting, built environment, ... etc. ***Now the planner group know nearly all about the coastal settlement, basically in terms of physical characteristics, and there is no need to make a SWOT analysis since CAAM is also a***

complete analysis technique. Detailed explanations on CAAM implementation and requirements for a full implementation are discussed for Iskenderun case in Chapter 6.

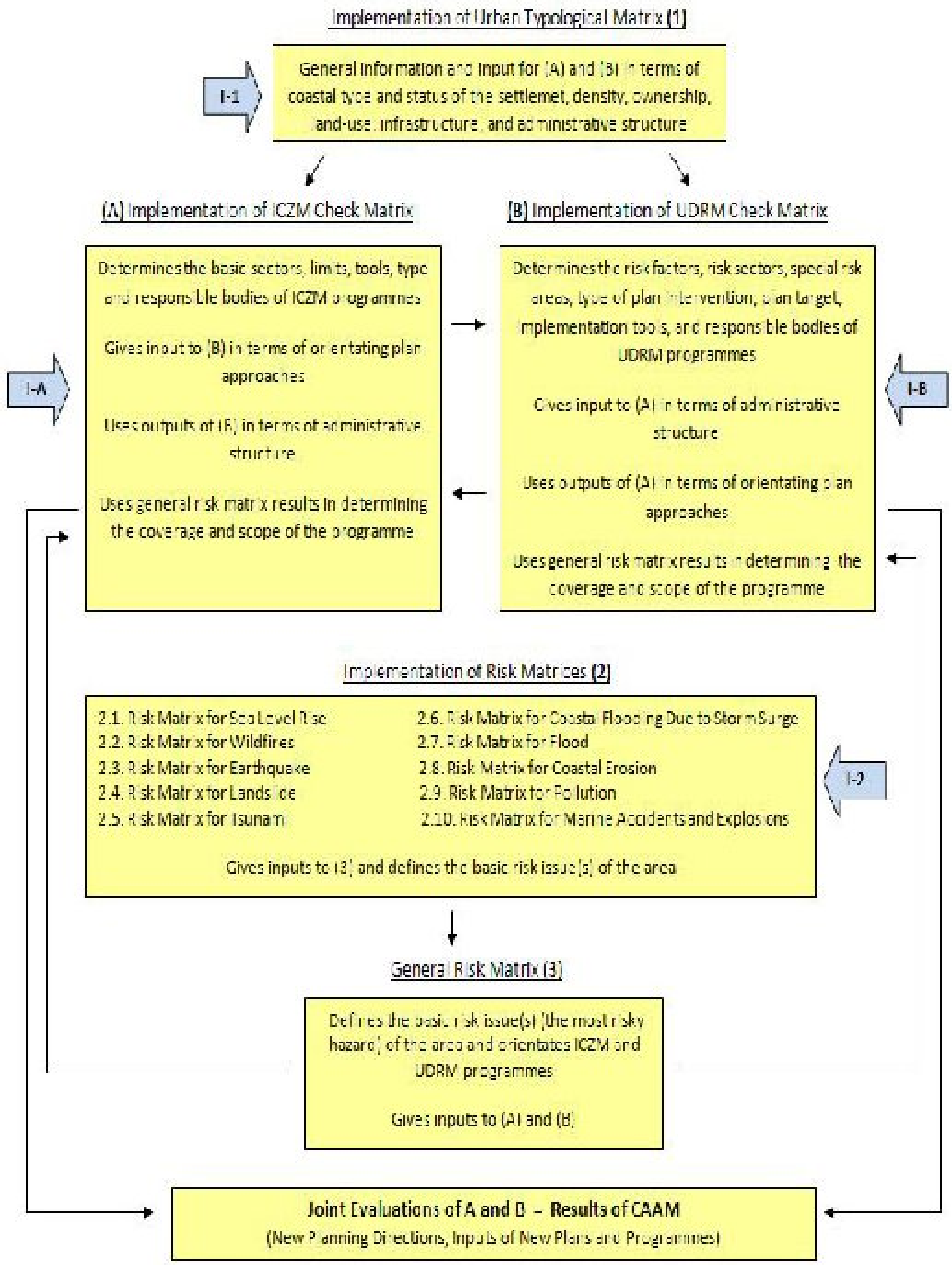

Figure 5.19: Development and Implementation Procedure of Coastal Area Assessment Model – CAAM

CHAPTER 6

ISKENDERUN COASTAL REGION

6.1. Definition of Iskenderun Coastal Region

Iskenderun, located on the Eastern Mediterranean Coast between the northern latitude of 36^{o} 55’ 34’’ and the eastern longitude of 36^{o} 39’ 10’’, is one of the most important port settlements of Turkey. Iskenderun and its towns and villages lie on the outskirts of the Nur (Amonos) Mountains and on an approximately 5-km-width coastal plain. However, the settlement is located on a point that allows a connection between the inner side of the Nur Mountains and the Mediterranean by a natural historical passage at Belen district (Özyılmaz, 2000). Together with Hatay – Iskenderun State Highway (D817) which mostly extend by the shore, it has also a strong connection to the rest of the Turkey by Ceyhan – Iskenderun Motorway (O-53, E91 - TEM) which enclosures the settlement and ends by the near shore. An old railway line, which was constructed before the Republic, also extends to the center of Iskenderun. Additionally, having a naturally sheltered port as a gate opening to the world by seaway makes the settlement an extensive focal point. In other words, Iskenderun Port is the transit gate of Middle East. Iskenderun has its own airport which is only 2 km far from the city-center but it is not in operation (the airport area is utilized as the campus area of Mustafa Kemal University today); however, another transportation opportunity was provided by Hatay Airport which went into operation at the end of 2007, and only 45 km far from Iskenderun city-center. This special condition of the settlement’s location has made the development and expansion of the settlement easier for years; in terms of economic development, sectoral variation, urban expansion, and population increase. Figure 6.1 shows the general features of Iskenderun mentioned above, and the position of Iskenderun in the Iskenderun Bay.

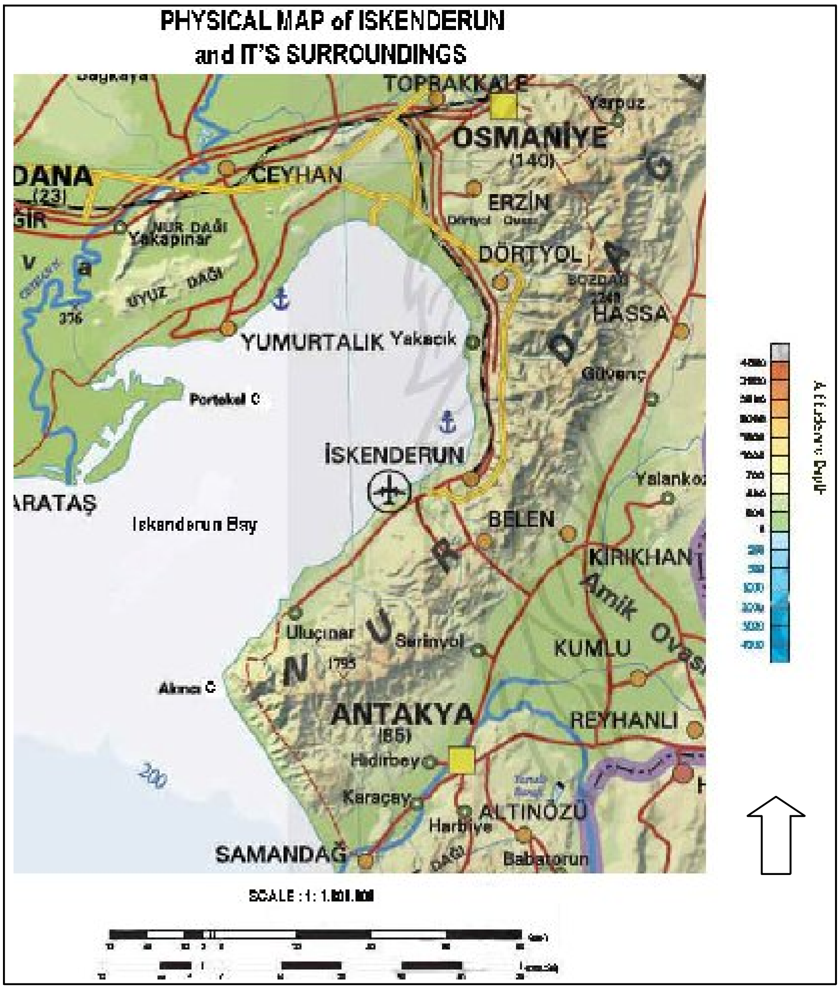

Figure 6.1: Map of Iskenderun and its Surroundings

(Modified from the map prepared by General Command of Mapping - Turkey, 2009)

The settlement of Iskenderun is also located on the bay shares the same name with the settlement, and Iskenderun Bay has a significant place in whole Mediterranean Sea. Iskenderun Bay, which penetrates between Adana and Hatay provinces, is the north-eastern corner of the Mediterranean Sea with an area of approximately 2275 km^2, a length of 65 km and a width of approximately 35 km (UN-FAO, 1988). The bay starts from Kazanlı (Mersin) district and ends close to Işıklı - Arsuz (Hatay). The bay itself is famous for its intensive port activities, filling plants, industrial facilities and establishments; especially its iron-steel industry which is called ISDEMİR (Iskenderun Iron-Steel Co.) located at the northern part of Iskenderun, on the coast of Karayılan Municipality.

Ports and piers, and filling plants are the basic marine industrial structures of the bay. Mainly three ports exist on Iskenderun Bay. Yumurtalık Port located in Yumurtalık town has a large free zone housing the production units of up to thirty companies presently in operation or in phase of being built. Fields of activities include industries ranging from petrochemicals, synthetic fibers and steel industry, and there are also plans for establishing a major shipyard. Sugözü Thermal Power Plant and Yumurtalık Lagoons also exist on Yumurtalık coast.

Port of ISDEMİR is another port located on Iskenderun Bay. It has 6 piers. The third one is Iskenderun Port which is located at the center of Iskenderun. The port has 11 piers. In addition to these ports, there are also marine terminals with piers located on the Iskenderun Bay. These are BOTAŞ Oil Terminal and Toros Fertilizer Terminal at Ceyhan; BOTAŞ Oil Terminal, TPAO Pier, Aygaz LPG Filling Plants and Pier, and Mobil Oil Filling Plants and Pier at Dörtyol; Gübretaş Fertilizer Pier and Ekinciler Iron-Steel Industry Pier at Sarıseki Organized Industrial Estate (OIE); Highways Asphalt Plants Pier, Petrol Ofisi Filling Plants and Pier, and Shell Liquid Cargo Filling Plants at Iskenderun (http://iskenderunshipping.com - Access Date: 09.12.2009). Figure 6.2 shows the locations of these ports and piers on the Iskenderun Bay.

Figure 6.2: Ports and Piers Located on the Iskenderun Bay

(*Source:* http://www.cerrahogullari.com.tr – Access Date: 07.12.2009)

6.1.1. Definition of the Research Area Boundaries and Distinctive Features of Iskenderun Coastal Region

The area analyzed in the study namely "Iskenderun Coastal Region" includes Karayılan, Sarıseki, Denizciler, Iskenderun, and Karaağaç municipalities with their municipality borders.

- Coastal municipality settlements and their potential development areas,
- Activities that have to be located on the coast,
- Coastal uses such as tourism, industry, storage, recreation, and secondary housing areas,
- Environmental and ecological systems, resources, and conservation areas such as deltas, sand dunes, lagoons, and wetlands,
- Tourism centers, tourism conservation and development zones, and
- Municipalities' adjacent areas which are located on the coast

are considered in this study while determining the boundaries of the case area on landward. Depending on these issues, the width of the case study area changes from 2 km to 5 km. On the other hand, seaward boundary of the area accepts the territorial sea limits of Turkey in the Mediterranean defined as 12 nautical miles. There are marine structures, conservation areas of living marine resources, conservation and production areas of fisheries, military security zones on the offshore, strategically important military zones on the offshore, underwater pipelines, piers and buoys, seaward effect areas of inland activities, marine trade and marine transportation lines, and fisheries activity areas within this territorial sea boundary.

The criteria highlighted above are the general considerations of the study while determining the limitations of the area. By clear explanations, the boundaries of the "Iskenderun Coastal Region (ICR)" could be defined as below:

- Southern border of the Payas District is accepted as the northern border of the "Iskenderun Coastal Region". Yakacık Stream defines the border in here. Accordingly the border starts from the point where Yakacık Stream falls to the Mediterranean Sea, includes ISDEMİR, continues to the Ceyhan – Iskenderun Motorway (O-53, E91) by following Yakacık Stream, and turns to the south from the point where the motorway and the stream intersect.
- Eastern border continues along the Ceyhan – Iskenderun Motorway by including the seaward parts of Karayılan, Sarıseki, Denizciler, Iskenderun, and Karaağaç municipalities.
- Southern border is again defined by the motorway (O-53). The ending point of the motorway located on the south-west part of the Karaağaç is connected to the Mediterranean Sea by approximately a 500-meter-long-road. This road is the continuous part of the southern border of the "Iskenderun Coastal Region".
- Western border of the area is Mediterranean but including the marine activity areas and structures within the territorial sea boundary.

Figure 6.3: Schema of the Case Study Area; "Iskenderun Coastal Region"

Therefore, this study only covers Karayılan, Sarıseki, Denizciler, Iskenderun, and Karaağaç Municipalities and their adjacent areas on seaward (west parts or seaward parts of the motorway) by considering the explained limitations above as the case study area called "Iskenderun Coastal Region (ICR)". Figure 6.3 shows the limits of and the settlements covered by the case study area on landward. According to the defined boundaries, the size of the ICR is approximately 5500 hectares, and the approximate coast length is 41 km.

The city of Iskenderun is the hearth of the ICR; other settlements are the depended towns of Iskenderun. Coastal zone in Iskenderun is the most productive area of the municipality. It houses majority of the population and industrial activities and represents a unique environment, which requires special attention in its planning, development and management. The situation is also same with other four coastal towns in ICR. Since the mountains starts to rise very close to the sea and there is a little space to settle on the coastal strip, all the social, cultural, and economic activities have to locate on this limited area. In the following sections; explanations, discussions, and evaluations on natural characteristics, historical development and urbanization, demography and socio-economic characteristics, planning issues and risk factors of the area are given. These explanations and discussions focus on the center of Iskenderun District together with its coastal towns; Karayılan, Sarıseki, Denizciler, and Karaağaç. Some issues are also discussed with reference to general conditions and characteristics of the Iskenderun Bay.

6.1.1.1. Natural Setting

Topographic structure is an important part of the natural characteristics of the area. Iskenderun Bay does not have a hilly character. However, in the south-east part of the Iskenderun Bay, the Amonos Mountain chain runs parallel to the sea-shore and slopes sharply down to the coast. On the other hand, the west side of the Bay is covered by river deltas, lagoons and coastal plains. There is one small bay in the area, Yumurtalık Bay, and five lagoons (Çamlık, Yelkoma, Hurma Boğazı, Akyatan, and Tuzla) along the west coast of the Iskenderun Bay. The main agricultural area in the region is Çukurova plain. This plain stays north-west part of the Iskenderun Bay (UN-FAO, 1988). However, geomorphologically ICR mostly consist of terraced plains.

Slope at the south-west part of the Bay is sharper than other parts; however this part still have plains; even though they are narrow. Sub-marine slope values (bathymetry) of the Bay do not change rapidly. South-east part's morphological topography of the Bay continues almost in same way at the bottom of the Bay. Therefore, sub-marine slope values of the south-east part are a little bit sharper than other parts of the Bay. Figure 6.4 shows topography and water depth features (bathymetry) of the Bay. It's understood from the schema that sub-marine slope values of the area, ICR, are sharper than other parts of the Bay.

ICR is in the eastern part of the Ceyhan Basin, and it is also in the northern part of the Asi Basin. Even though ICR stays in the outer part of these main basins of the Bay, it has many streams which fall into the Mediterranean. From north to south, their names are Yakacık Stream, Ballıca Stream, Derebanı (Sarıseki) Stream, Çınarlı Stream, Güzelçay Stream, Surlak

Stream, Aşgarbeydi (Fezeyan) Stream, Şekere Stream, and Belen Stream. Yakacık Stream also creates the northern border of the case study area, ICR. Figure 6.5 shows this water resource wealth of the region.

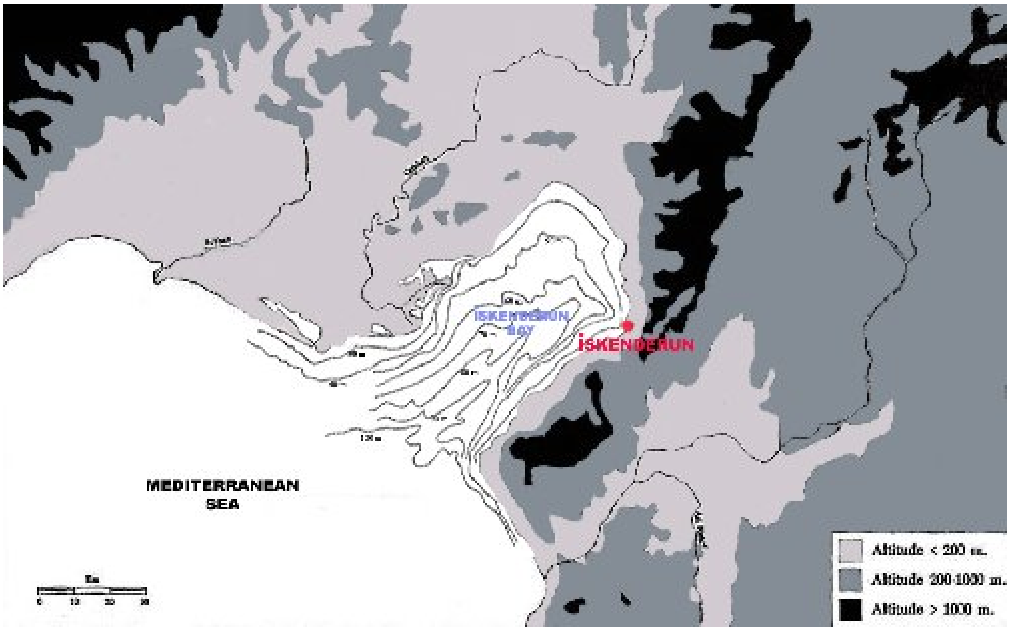

Figure 6.4: Topography and Bathymetry of Iskenderun Bay
(Modified from UNEP, 1994a and UN-FAO, 1988)

Figure 6.5: Stream Falls into the Mediterranean Sea in ICR

When geological structure is considered, rock type of the area is generally composed by sandstone, mudstone, and limestone; and generated in Paleozoic time, except the area between Sarıseki and Denizciler, and Karaağaç adjacent area. The rock type of the area between Sarıseki and Denizciler was generated in Mesozoic time. These rocks are characterized by limestone in the Jurassic, and ophiolite and limestone in the Upper Cretaceous. The part in the Karaağaç adjacent area is composed by debris avalanche and alluvial cone which characterized in Quaternary (Cenozoic) time (Ministry of Public Works and Settlement, 2007). These geological explanations mean that Karaağaç adjacent area is the younger part of the area. The area between Sarıseki and Denizciler is older than Karaağaç and its surroundings. Other parts of the field are relatively older than explained exceptions.

Typical Mediterranean climate characteristics are seen in Iskenderun Bay. It is hot and dry in summers, warm and wet in winters. Climatic conditions are getting harder through the inner parts of the Bay. Approximately 10°C temperature difference exists between the coastal parts and inner parts (Ministry of Public Works and Settlement, 2007). Iskenderun Bay is affected by waters of open sea origin, by relatively strong winds and by evaporation. The annual air and sea temperatures occur depending on these effects. During the summer, sea temperature increases up to 32°C, and in winter, sea temperature drops to 15°C. In the Bay, the sea surface temperature of the whole water column starts to decrease in autumn and minimum sea surface temperature occurs in February and extends to the bottom layers (UN-FAO, 1988). Average air temperature on the other hand, increases up to 31°C during the summer, and drops to 11°C in winter between the years 1975-2008 (State Meteorological Service, 2009).

From October through to March winds at Iskenderun are predominantly from the south and southeast, while during the period April-September, winds are mostly from the north - northwest direction. Strong north easterly winds, blowing down from the mountains and strong south - southeast winds occur throughout the year (UN-FAO, 1988). Strong winds are affecting marine transportation negatively sometimes in winter. Westerly winds cause an increase in the rate of precipitation. That’s why the average relative humidity values reach at 69 % for the Bay. Average rainfall is 1173 mm/year (or 61,45 kg/m^2) in Iskenderun between the years 1975-2008 (State Meteorological Service, 2009; and Ministry of Public Works and Settlement, 2007).

Extreme temperature values between the years 1975 – 2008 are also obtained from the State Meteorological Service. According to the obtained data, maximum air temperature was measured as 40°C on 16th May, 1988 and on 14th September, 1994; minimum air temperature was measured as -0,8°C on 4th January, 1989. Maximum rainfall was received on 12th May, 1993 as 132.3 kg/m^2, and maximum speed wind was measured as 140.8 km/h on 6th February, 1978.

6.1.1.2. Historical Development and Urbanization

Kabatepe (1972) claims that, there have been settlements in the Çukurova Region ever since the earliest times; Paleolithic remains in Mağaracık – Samandağ and Neolithic sites in Mersin and Tarsus are the proofs of this claim. Past civilizations lived in the region and their cultural development were fed by regional natural resources such as the region’s natural harbors, rivers, climate, mines, geology, forests, etc. According to Kabatepe (1972), these resources helped those civilizations in the areas of agriculture, ship building, navigation, and mining.

Settlement patterns in the Çukurova Region shows that a substantial portion of the population is concentrated in an area extending from Mersin to Antakya and includes the districts of Mersin, Tarsus, Adana, Ceyhan, Osmaniye, Dörtyol, Iskenderun, and Antakya. These eight districts encompassed in this area contain nearly 60 % of the population of the Çukurova but only 30 % of the land area. Population growth of the region has been occurring primarily in these urban areas of the region (Kabatepe, 1972).

Iskenderun was established on a Phoenician city known as Myriandus in ancient times, by Alexander the Great in 333 B.C., and the name was given as “Alexandretta” which means “city of Alexander”. After those times, the city had experienced the hegemonies of Seleucid Empire, Romans, Byzantines, Arabians, and Ottomans in order (Ministry of Public Works and Settlement, 2007). These lands have also been occupied by Cilicians, Hittites, Assyrias, and Achaeans before the Phoenecians.

Iskenderun maintained its strategic and commercial specialty with an ever-increasing intensity in the time of Ottoman Empire. As being a crucial harbor of the Eastern Mediterranean trade, the city had taken its place in import and export facilities with the Middle East. Iskenderun, Belen, and Payas were left under the administrative tutelage of Adana State with the administrative reforms made in 1839 (*Tanzimat*). After the destructive earthquake happened in 1872; in 1881, a detailed development report had been prepared and presented to the ministry of public finance of the Ottoman Empire. A railway link to the city was decided, the harbor was enlarged, and the construction works of Iskenderun - Halep road was speeded up as a result of that report. Petroleum was found for the first time in the land of Ottoman Empire at the end of 19th century in Çengen Village, Iskenderun. However the shafts were not efficient and the works was stopped. Toprakkale - Iskenderun railway was opened in 1912 as a collateral part of Baghdad railway, and the connection of the city with Anatolia had gained energy. Iskenderun was a district which has four neighborhoods, a town, and 24 villages at that time. French armies entered the city after Mondros in 1918. Iskenderun Sanjak[11] Government was established according to the requirements of Ankara Agreement which was signed on 21st October, 1921 between France and Turkey. After the establishment of Hatay as an independent state, Iskenderun devolved under the administrative tutelage of Hatay for a while. When Hatay joined to the motherland, Iskenderun was also within the national boundaries of Turkey in 1938 (Akyüz, 2008).

Growth and urbanization of Iskenderun mostly occurred due to its location and strong transportation opportunities. Iskenderun developed mainly because of its port, and development of the city always gained momentum in active times of its port. Iskenderun port has been used for trade since 1600s (Doygun and Alphan, 2006). Modern port was established in 1922 and renewed in 1972 as the second important marine transportation and trade center of Turkey in the Mediterranean region, which serves for Middle East transit traffic (Doygun and Alphan, 2006). Figure 6.6 shows a view of the Iskenderun port today.

[11] An administrative region under the Ottoman Empire, a subdivision of a vilayet.

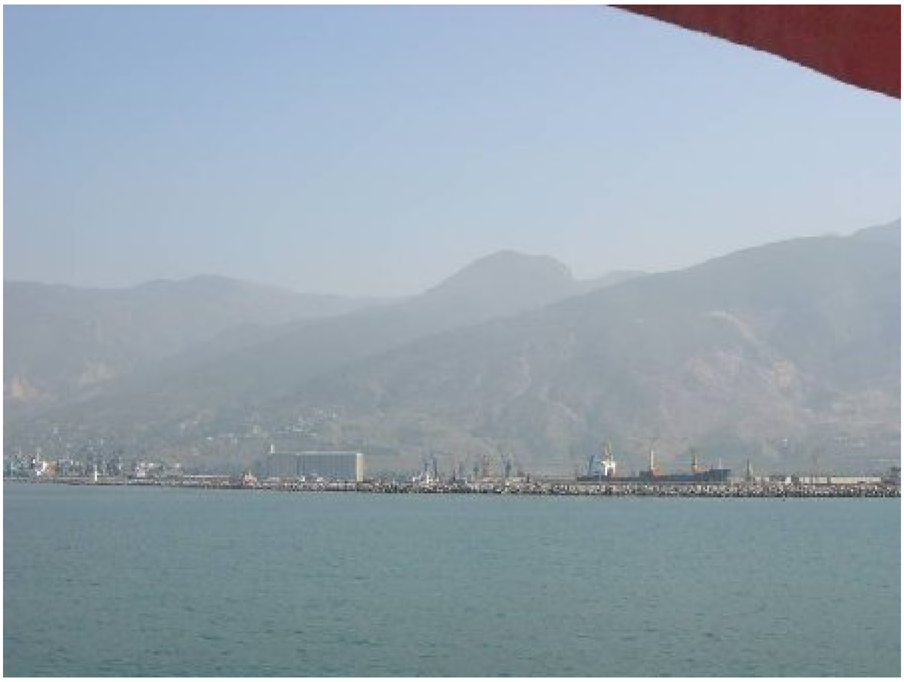

Figure 6.6: Iskenderun Port Today

The situation affected not only Iskenderun city but also the whole Bay. Since 1950, there has been a rapid urbanization in Iskenderun Bay. If the district centers located on the bay are regarded as cities, the level of urbanization in the coastal settlements (Karataş, Yumurtalık, Belen, Dörtyol, Erzin, Iskenderun, Samandağ, and Yayladağ) increased from 36,6 % in 1960 to 47,2 % in 1990 (UNEP, 1994a). Table 6.1 shows this change over the years.

Table 6.1: Urbanization Level in Coastal Settlements of Iskenderun Bay, 1960 – 1990 (*Source*: UNEP, 1994a)

YEAR	TOTAL	TOWNS Province and district centers	VILLAGES Small districts and villages	Urbanization Level (%)
1960	255092	93571	161521	36,6
1965	283019	105268	177751	37,1
1970	327584	120193	207391	36,6
1975	412279	161798	250481	39,2
1980	497862	187844	310018	37,7
1985	569410	227627	341783	39,9
1990	611652	289018	322634	47,2

The situation for the study area which includes Karayılan, Sarıseki, Denizciler, Iskenderun, and Karaağaç is almost similar for the same period. The situation after 1990 is explained in Table 6.2 and 6.3 for the ICR. According to the tables, Iskenderun Bay has experienced a rapid urbanization and population growth since 1960. Likewise, ICR also urbanized and urbanization level reached 59,7 % in Iskenderun in 2009.

Table 6.2: Urbanization Level of Iskenderun (*Source*: TURKSTAT, 2010)

	Years	**Total**	**Urban**	**Village**	**Urbanization Level (%)**
	1990	264545	154807	109738	58,8
	2000	293973	159149	134824	54,1
Iskenderun	2009	318540	190279	192238	59,7

Table 6.3: Population Growth in IRC (*Source:* TURKSTAT, 2010)

Settlement	**Years**	**Total**
	1990	13883
	2000	11187
Karayılan	2009	10911
	1990	4917
	2000	5329
Sarıseki	2009	4255
	1990	9280
	2000	17495
Denizciler	2009	15804
	1990	10920
	2000	16250
Karaağaç	2009	18719

As stated at the beginning of this chapter, two main international highways (Hatay – Iskenderun State Highway [D817] and Ceyhan – Iskenderun Motorway, [O-53, E91]) connect the city to other regions of Turkey and the Middle East countries. Established in 1904, the railway network provides vital links to the port and nearby factories. Another link is also provided by airway. Hatay Airport is only 45 km far from Iskenderun. These transportation opportunities create the one leg of trivet. All of the development process is the result of first the development of Iskenderun Port and its environs, second combination of different types of transportation lines, and third the establishment of ISDEMİR. The trivet has made the development and expansion of the settlement easier for years; in terms of economic development, sectoral variation, urban expansion, and population increase.

Another leg of the trivet that encouraged the growth of the city, and the region largely is definitely the establishment of ISDEMİR. Iskenderun is also one of the most rapidly industrializing regions of Turkey. A quite rapid industrialization process took place in this region during the period between 1950 and 1980. The first chemical fertilizer factory (1953) in Turkey, the third largest integrated steel factory of the country – ISDEMİR - (1975), and the cement factory (1977) are among the most important industrial investments in the region (Doygun and Alphan, 2006). Another significant point is the multi- scale development of regional industrialization. Established in 1990, the Organized Industrial Estate (OIE) located in Sarıseki, has a capacity to provide central infrastructure facilities for up to 50 small-scale factories. Today, there are 16 factories operating within the OIE. A total of approximately 50 factories in small and medium sizes, owned and operated either by the state or private sector, are lined up along a narrow strip between the Mediterranean Sea and the Amanos Mountains (Dokgöz, 2008).

Besides mentioned trivet composed by the Iskenderun Port, combination of different types of transportation opportunities, and the establishment of ISDEMİR, some other international industrial projects such as Crude-Oil Pipeline Project (between Ahwas-Iran and Iskenderun), Gas Line Project (between Zubain-Iraq and Istanbul) also affected development process of the region (Kabatepe, 1972). These projects possibly triggered the establishment process of Sarıseki Organized Industrial Estate, and brought associated industries such as refineries, petrochemical complexes, and production of pipes for the internal city distribution systems, development of equipment industry for natural gas systems, cement factories, glass factories, ceramics and metal processing factories. There are also transportation equipment, machinery, fertilizer, chemicals, soap, rubber, paint, plastics, food beverage, oil, textile and leather products, furniture industries within the Organized Industrial Estate area. Today, the north of the city is utilized for military, port and industry activities generally while the south part is utilized for housing and recreation.

All of these reasons affecting urbanization, industrialization, and development processes of Iskenderun and its region in a relation with population growth since end of 19th century are summarized by Doygun and Alphan (2006) as shown in the Figure 6.7. Additionally, Figure 6.8 shows spatial expansion of Iskenderun city since end of 19th century. These figures show that construction of the railway (1904) and modern port (1922) are the breaking points in terms of urban expansion, population growth, and industrialization of both Iskenderun and its region. Population of the city increased six times and coverage of urban area expanded three times between the years 1858 and 1942. After this point, urban area expanded more than five times and the population increased eight times till 1972 with the impact of migration started in 1950s, and the impact of decisions about national investments. The renewal of the port facilities, the pipeline constructions, and the development of the transportation network attracted industrialization in the region and caused an increase in urbanization due to population increase (Doygun and Alphan, 2006).

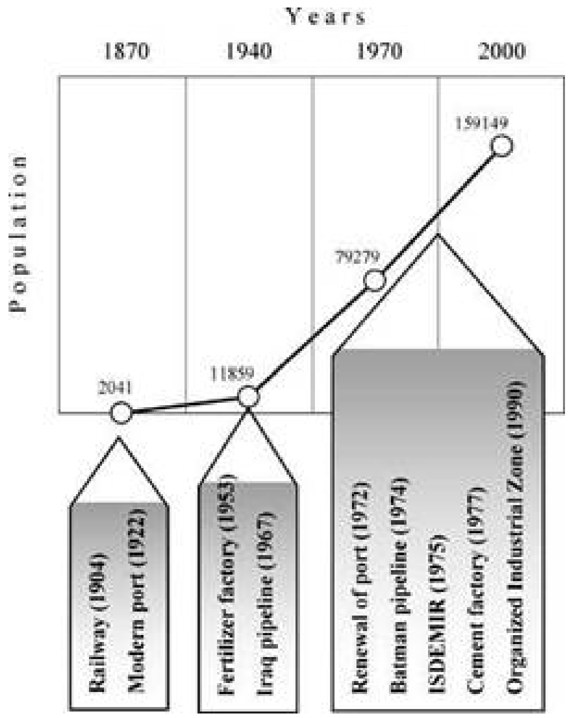

Figure 6.7: Relationships between Population Increase and the Regional Development (*Source*: Doygun and Alphan, 2006; 149)

The population density showed a significant decrease between 1970s and 2002 during which, the population and urban area almost doubled. This may be considered as evidence to low dwelling density that occurred during this period. In this process, the urban area grew outwards from the intensively urbanized city core (Doygun and Alphan, 2006). Coverage of urban area, population increase and population density in relation to years between 1858 and 2002 is summarized in Table 6.4.

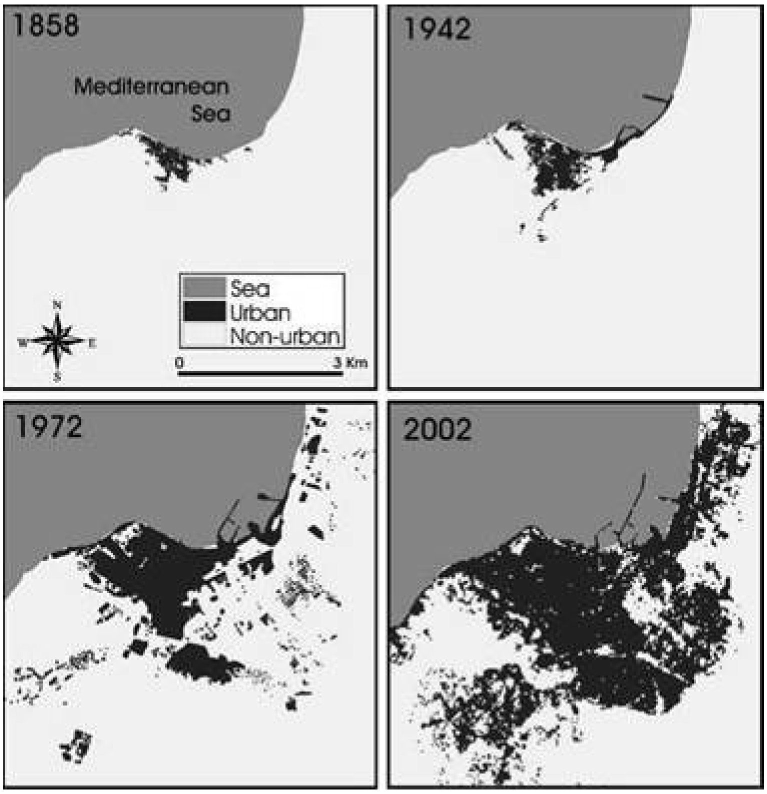

Figure 6.8: The Growth of Iskenderun city over the 144-year Period

(*Source*: Doygun and Alphan, 2006; 150)

Table 6.4: Changes in the Population, Urban Coverage and Population Density in Iskenderun (*Source*: Doygun and Alphan, 2006)

Year	Population	Year	Urban Area (ha)	Population Density (person/ha)
1870	2041	1858	31,3	65,2
1940	11859	1942	91	124,8
1970	79279	1972	500,7	158,3
2000	159149	2002	1260,8	126,2

6.1.1.3. Demography and Socio-Economic Characteristics

As shown the evidences in previous part, the region has received large numbers of immigrants since 1950s. The fishery is an important livelihood for the local people living in the rural parts of the region. Others, especially immigrants, mostly work in industry and service sectors (Şahin, 2008).

There is almost no difference between summer population and winter population in ICR; which includes Karayılan, Sarıseki, Denizciler, Iskenderun, and Karaağaç, while other parts of the Iskenderun Bay show differences. The reason of this situation is other parts have tourism activities in summers and have secondary houses which are used generally in summers. Table 6.5 shows the change in population in the area between the years 1970 and 2009. Total population of the area is expected to reach approximately at 350.000 in 2025 (Ministry of Public Works and Settlement, 2007).

Table 6.5: Population Increase in ICR, 1970 – 2007
(Modified from Ministry of Public Works and Settlement, 2007)

	1970	1975	1980	1985	1990	1997	2009
ICR	86520	114305	136656	171625	295641	206962	237864

The population of Iskenderun, one of the most rapidly growing urban centers in the region, increased dramatically from 2041 to 159149 people between 1870 and 2000 while Turkey's population only grew by 2.8 times during the same period (Doygun and Alphan, 2006). Establishment of the modern port, development of transportation infrastructure and heavy industries have played an important role in development of commercial activities and social welfare (Doygun and Alphan, 2006). Settled population of Iskenderun is 177.294 in 2007 and it is expected to reach at 234.000 in 2025 (Ministry of Public Works and Settlement, 2007).

Migration rate is very high in the Iskenderun Bay districts. This is one of the reasons of population increase in the region. Immigrants mostly come from the districts of Adana and Hatay, and districts of Southeastern Anatolia Project (SAP) region just because the Iskenderun Bay serves as a gateway for SAP to the outside world (UNEP, 1994).

Fishery is an important livelihood for the local people living in the rural parts of the region. (Doygun and Alphan, 2006). Additionally, agriculture and aquaculture are other dominant sectors in rural parts (UNEP, 1994). However the situation is different in urban centers. 2002 data show that 13.000 people work in industry in Iskenderun in 66 firms in total (Hatay Province - Directorate of Environment and Forestry, 2007). Secondary and tertiary activities are service and commerce which mostly focusing on tourism and others are energy and transportation (Şahin, 2008). It is said that density of industry increases through the northern parts of ICR, and density of service (tourism) increases through the southern parts of the area.

Depending on the considerable amount of military group living in Iskenderun, service activities are improving. Beside, establishment of Mustafa Kemal University and its varying units also affected the social and economic life in the region.

6.1.2. Land-use Pattern in Iskenderun Region and Significant Coastal Uses

At the end of 1940s, basic land-use elements are port and railway related activities around those units, light industry areas, and residential areas in Iskenderun City-center. West and southwest parts of the city center (western side of the Aşgarbeydi Stream) were empty and unsettled because of the swampy character of the area (Kimyon, 2010). Sarıseki, Denizciler, Karaağaç, and Karayılan settlements were just small villages and their location was a little far from the coast. Accordingly the region had no tourism activity at those times. ISDEMIR was not on its today's place as seen in Figure 6.9.

ISDEMIR started to be constructed at the beginning of 1970s. The highway of the region gains strength and importance; some types of industrial activities develop on the coast due to the establishment of ISDEMIR. Accordingly, the village of Karayılan gets closer to the coast (to the highway at the same time) and expands a little bit. Likewise, Sarıseki and Denizciler also get closer to the coast and get larger. Piers are constructed on Sarıseki coast. Iskenderun city-center gets larger; constructions start on the west side of the Aşgarbeydi Stream, and the settlement expands along the stream. Meanwhile, Karaağaç also gets larger and gets closer to the sea; however, macro-form of the settlement is very scattered than the others (Figure 6.10).

In 1992, Karaağaç and Iskenderun city-center starts to get closer to each others. Organized Industrial Estate and its piers in Sarıseki expand and develop, and get closer to ISDEMIR. Iskenderun city-center and its harbor also expand and develop. Iskenderun city-center gets a denser and compact form (Figure 6.11).

Aerial photo of 2006 (Figure 6.12) shows that the region extremely expands especially with having stronger transportation lines such as the motorway. Settlements in the region expand to the both sides of the motorway and get denser. Denizciler seems to become an alternative residential area. Karaağaç also expands in a scattered form and presents mostly a rural landscape. The opportunities and specialties of the port and other piers in the region are also developed. Shortly, north side of the Iskenderun city-center presents a denser and compact form, however south parts present a scattered form.

Figure 6.9: Aerial photo of ICR in 1948

(*Source*: General Command of Mapping, 2010

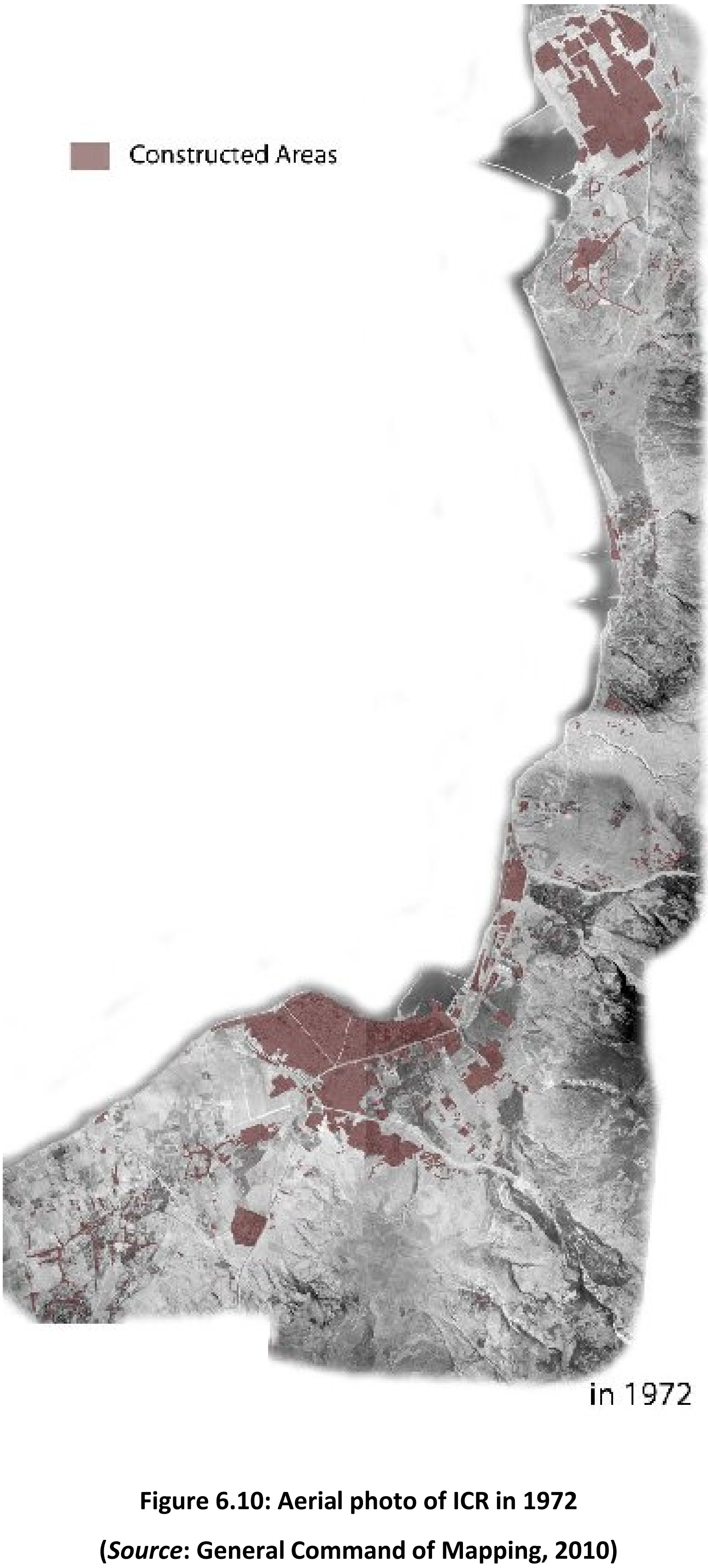

Figure 6.10: Aerial photo of ICR in 1972

(*Source*: General Command of Mapping, 2010)

Figure 6.11: Aerial photo of ICR in 1992

(*Source*: General Command of Mapping, 2010)

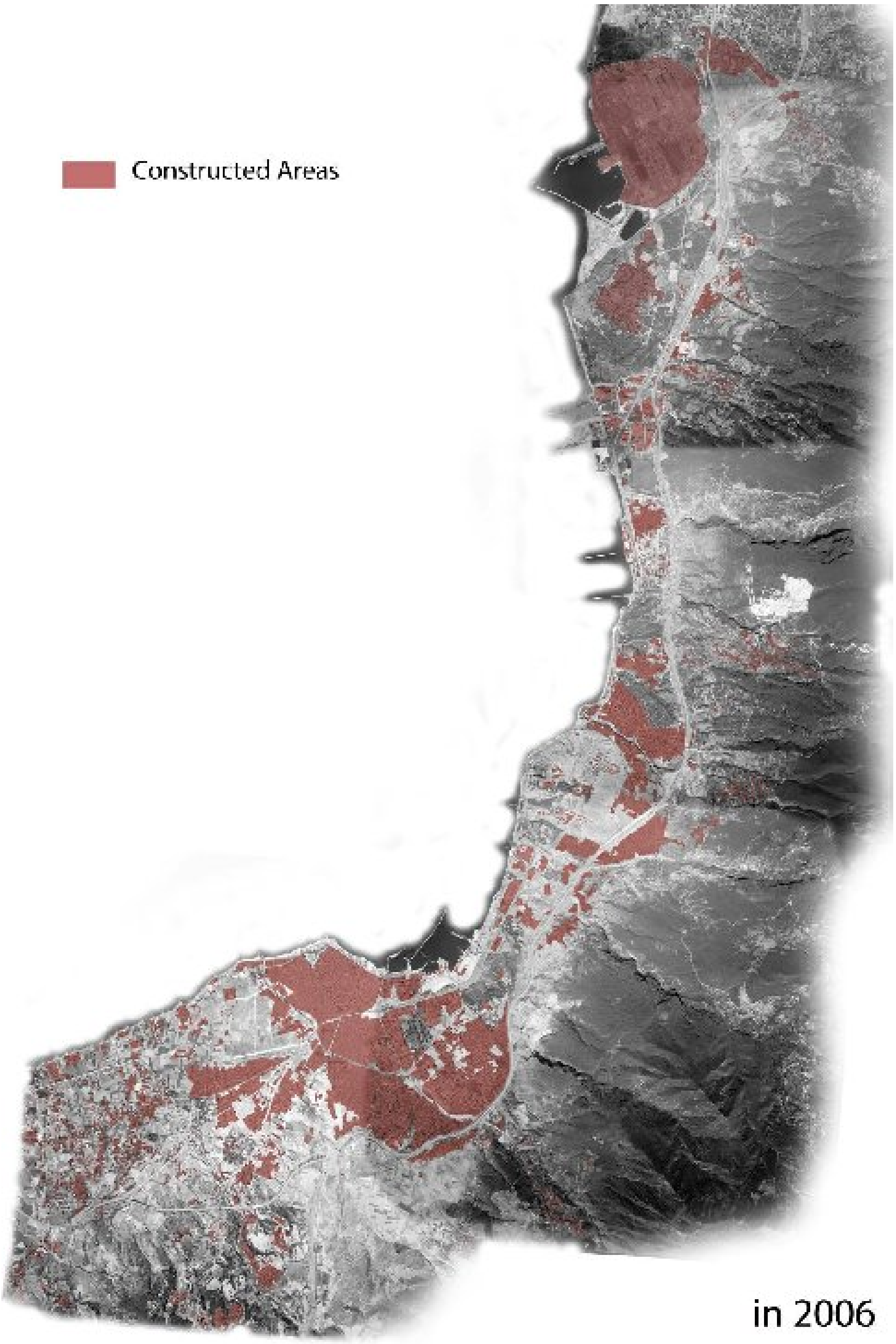

Figure 6.12: Aerial photo of ICR in 2006

(*Source:* General Command of Mapping, 2010)

Today, urban area lies along the shore in ICR, and there are several settlements in varying sizes, also industrial areas, military areas, and the areas allocated to tourism and recreation. 63,7 % of ICR is settled area, and 36,3 % of the area is unsettled (Ministry of Public Works and Settlement, 2007).

The area which lies between Iskenderun and ISDEMİR and locates on the north is generally a settled area. A limited area stays outside of this settled area is suitable for dry farming and covered with 2nd class colluvial land (Ministry of Public Works and Settlement, 2007). There is very limited sand dune area only in southern part of Iskenderun and Karaağaç coastal strip. There are also limited area covered with forests; first part exists in the area of ISDEMİR, around the apartments of the factory, another part exists between Denizciler and Sarıseki settlements, and the final part exists at the southern border of the ICR, within the adjacent area of Karaağaç Municipality. Rate of the settled areas in ICR is 48,8 % in total, and the situation is summarized in Table 6.6 with primary land-use functions.

Table 6.6: Settled and Unsettled Areas with Primary Land-use Characters in ICR (*Source:* Ministry of Public Works and Settlement, 2007)

<table>
<tr><td rowspan="4">Iskenderun Coastal Region</td><td colspan="6">Settled Areas</td><td colspan="6">Unsettled Areas</td></tr>
<tr><td colspan="2">Primary Land-use Type</td><td colspan="2">Secondary Land-use Type</td><td colspan="2">Tertiary Land-use Type</td><td colspan="2">Primary Land-use Type</td><td colspan="2">Secondary land-use Type</td><td colspan="2">Tertiary Land-use Type</td></tr>
<tr><td>Land-use</td><td>%</td><td>Land-use</td><td>%</td><td>Land-use</td><td>%</td><td>Land-use</td><td>%</td><td>Land-use</td><td>%</td><td>Land-use</td><td>%</td></tr>
<tr><td>industry</td><td>18,8</td><td>urban housing</td><td>13,2</td><td>military area</td><td>12,8</td><td>agricultural</td><td>26,9</td><td>forest</td><td>7,4</td><td>-</td><td>-</td></tr>
</table>

Existence of Iskenderun Port and significant industrial establishments which are crucial not only in regional scale but also national scale around the Iskenderun city are the main dynamics which have speeded up the urban development within the region. Besides industry, urban housing areas and military areas; there are also marine structures such as ports and piers, and storage units located on the coast. ISDEMİR is located on a 680 ha land on Karayılan Municipality coast. Sarıseki Organized Industrial Estate – OIE is located on a 114,3 ha land on Sarıseki coast and next to ISDEMİR. Other industrial establishments are

Petrol Ofisi Filling Plants, Highways Asphalt Plants and Shell Liquid cargo Filling Plants at Iskenderun. There are also tourism and leisure areas mainly located in Karaağaç Municipality. Views from ISDEMİR (Figure 6.13), Sarıseki OIE (Figure 6.14), and tourism and leisure areas are in Karaağaç Municipality (Figure 6.15) are shown in the figures below.

Figure 6.13: A View of ISDEMİR from Karayılan (06.11.2008)

Figure 6.14: A View from Sarıseki OIE

(*Source:* http://osbbs.osbuk.org.tr – Access Date: 13.01.2010)

Figure 6.15: A View of Karaağaç Beach

(*Source:* www.Iskenderun.org – Access Date: 13.01.2010)

6.1.3. Risk Factors for the Settlements and other Coastal Uses in ICR

Disasters interrupt the normal operation of human life by causing physical, economic, social, and environmental losses. And disaster risk is the possible total loss of the events which cause damage, cost, loss and negative results. In that case, hazards are the most important factor that determines the disaster risk. Hazards as risk sources for the ICR are defined as earthquake, tsunami, river flood, coastal flooding caused by storms, coastal erosion, sea-level rise, industrial and marine accidents, pollution, landslide, and liquefaction. These subjects are defined by considering the area's geological and morphological disaster risks which caused by the area's natural structure, and possible large-scale urban faults and uses.

As discussed before, ICR is in 1st Degree Earthquake Zone. A great earthquake happened in 1872 and caused loss and damages in the area (www.Iskenderun.bel.tr – Access Date: 09.09.2009). In fact, whole Mediterranean especially including Aegean Sea has active seismicity. This situation is also affecting Iskenderun Bay and ICR. The seismicity affecting ICR comes both from Anatolian fault zones and Mediterranean Basin. Therefore, affects on the region are doubled, and earthquake risk of ICR is high. This seismicity also makes the area a historical tsunami impact area. The investigations and researches showed that the area was affected by tsunamis thousands year ago (Yalçıner, 2004).

ICR has also experienced serious floods. Aşgarbeydi (Feyezan) Stream which also passes throughout the Iskenderun city-center has caused significant loss and damages for years. November, 2006 and September, 2008 floods were disastrous. Figure 6.16 shows the situation occurred after the flood of Aşgarbeydi Stream in 2006. Figure 6.17 shows the situation occurred after the heavy rain and coastal flooding in September, 2008. Figure 6.18 shows the situation occurred after the heavy rain and flood of the Aşgarbeydi Stream in 2008.

Figure 6.16: Results of the Flooding Happened in 2006

(*Source:* www.iskenderun.bel.tr – Access Date: 13.01.2010)

Besides Iskenderun city-center, there are also other flood areas in ICR. Belen Stream and Şekere Stream which are mostly affecting Karaağaç Municipality are the significant ones. These streams have large flood plains which start from the very outer parts of the study area and reaches to the sea at Karaağaç coast. Outer parts of the flood plains also affecting rural and agricultural lands. Derebanı Stream which falls into the Mediterranean at Sarıseki coast is another significant one. Flood of Ballıca Stream which falls into the Mediterranean at Karayılan coast is also influential sometimes. It's said that floods of the streams which are locating on the southern parts of the Iskenderun city are much more influential on settlements (Şahin, 2008). The reasons of this situation are first, these streams come from the much higher parts of the region, and second the area which these streams pass throughout is the densest part of the ICR. This situation carries the flood risk level of ICR to a higher degree.

Figure 6.17: Results of the Coastal Flooding happened in 2008

(*Source:* www.iskenderun.org – Access Date: 13.01.2010)

Coastal storms are also influential in ICR. Maximum observed tide height is about between 40 and 60 cm. However, in periods of strong winds, an exceptional 150 cm increase in sea-level has been observed (UN-FAO, 1988). This situation also causes coastal erosion. Besides storms and winds, some coastal and marine structures may also cause coastal erosion and accretion since they are affecting usual regimes of the tides and currents. Figure 6.19 shows a picture taken at a time of storm hitting the coast of Iskenderun city.

Figure 6.18: Results of the Flood of the Aşgarbeydi Stream Happened in 2008

(*Source:* www.iskenderun.org – Access Date: 13.01.2010)

Figure 6.19: Time of a Storm Hitting the Coast of Iskenderun City

(*Source:* www.iskenderun.org – Access Date: 13.01.2010)

Sea-level rise is also a highly possible event for ICR. Sea-level rise occurs as a result of global warming and climate change. It is expected that level of the seas around the world will rise approximately 50-60 cm in upcoming 30 years. Sea-level rise causes frequent flooding, rise of the groundwater level, salination, coastal erosion and loss of the land, and deterioration of the ecological balance. Therefore, there is a risk of affecting agricultural production and socio-economic processes in the long run, also risks of affecting coastal settlements, other coastal uses, and marine structures physically. However, the region is evaluated in the group of low risk in terms of sea-level rise by the Ministry of Public Works and Settlement (2007).

Since it is almost an industry region and has a heavy marine traffic, industrial and marine accident risk is very high in ICR. As explained before, Iskenderun has become an important gate of international transport since 1950’s. Moreover, there are industrial establishments whose numbers are increasing day by day. Petroleum, petrochemical, and iron-steel productions which are produced and processed here are transported to the international ports of other countries. Therefore both marine accidents and other industrial accidents risks are very high in the region. First of all, industrial and marine accidents have negative effects on ecological and economic structure. Mostly, managerships of the establishments and port operations take actions, prepare emergency plans and action plans, in order to decrease the level of risk and provide the security and safety of both their establishments and employees.

Land, air, and water pollution risk also exist in the region. However, variation and level of the pollution changes seasonally in the region. This situation is mostly governed by seasonal changes of physical parameters and the associated changes in microorganisms. Additionally, current system of the Bay is responsible for this situation. Contaminants and waste products of the industrial establishments located on the coast, and slacks, even the contaminants originally produced by Egypt and Israel come to the Bay with the help of current system, and remain very long time (Ödemiş, 2009). The measurements of tin, mercury and petroleum hydrocarbons display a very wide range in space and time. Pollution levels were found to be very high in front of the industrial plants and pollutants become trapped in the center of gyres and transported towards the open sea by strong winds (UN-FAO, 1988). Pollution is determined with the measurement of acid, sulfur, nitrogen, carbon monoxide, organic material, and heavy metal concentrations in air, water, and land (Özyılmaz, 2000). Measurements carried out in front of the industrial discharge point have shown a high level of pollution. These are mostly acidic discharges, with a mean pH value of 3,5. Mercury pollution has been observed near the local iron and steel factory with values up to 550 ppb (dry weight) in sediment. Chemical oxygen demand measurements in sediment are generally less than 1% of the quantity of organic carbon. Humic matter measurements show an average of 0.5–1 mg/l. Heavy use of pesticides may cause harmful effects on the biotope of the lagoons which drain water used for agricultural purposes (UN-FAO, 1988). A specific example related with marine traffic and pollution can be given here. Ecoists and fishermen mostly talking about the effects of Ulla Ship which departed from Spain in 2000 carrying 2200 tons toxic waste and had anchored in Iskenderun Bay for 55 months. Despite all the reactions and protestations of ecoists and fishermen it didn't unanchored, and it sank with its load in the 6th September, 2004 (Ödemiş, 2009). All of these explanations show that there is a high risk of pollution in ICR.

Another risk factor for ICR is landslide. Landslide is only the point of issue for Iskenderun city. A few neighborhoods (Esentepe, Buluttepe, Gültepe, and Numune) including more than 250 houses and located on the slopes were determined as house cleaning area due to landslide risk. These neighborhoods are also affected by floods. However they are still families living that area because of re-settlement area problems and ownership problems (Şahin, 2008).

Liquefaction arises as a result of ground characteristics, and there is also liquefaction risk especially on flood plains and stream beds. The land mostly shows alluvial character in this type of areas, and all of the flood plains of all streams (approximately 100 m width flood plain area) are risky zones in terms of liquefaction. Additionally, liquefaction risk is high in the areas where groundwater level is high; include sand dunes and young formations. ICR is located on a coastal plain, and is mostly a combination of young formations and alluvial deposits. Additionally, seismicity and tectonic activities trigger liquefaction activities. Liquefaction is a highly possible event for this kind of lands and the level of risk is moderate.

6.2. Evaluation of the Plan Approaches to the Coastal Strip and Natural Disaster Risk Factors in Iskenderun City-Center and District Municipalities

The planning approaches of Karayılan, Sarıseki, Denizciler, Iskenderun, and Karaağaç to the general structure of settlements and coastal strip especiallyis evaluated in this section of the study. However, detailed evaluations about district municipalities and some upper scale plans of the region are made in Appendices K, L and M. The reason of this situation is explained in the following sections. Evaluations start with the explanations on planning history of Iskenderun City.

6.2.1. Planning History of Iskenderun

Date of the oldest obtained plan of Iskenderun is 1858. As shown in the Figure 6.20, 1858 plan of Iskenderun is prepared under the administration of Syria and titled as a part of "Coast of Syria". In 1930s, cadastral land survey studies of the Iskenderun are completed by the French cartographers in detail (Şahin, 2008). The first plan of Iskenderun in Republic Period is prepared in 1948 by Gündüz Özdeş (General Directorate of Bank of Provinces, 2009). The second plan of Iskenderun is prepared in 1969. The third and the latest one is prepared in 1981 by Istanbul technical University (ITU). Additional 1/5000 and 1/1000 scaled revision plans are also prepared later on (General Directorate of Bank of Provinces, 2009).

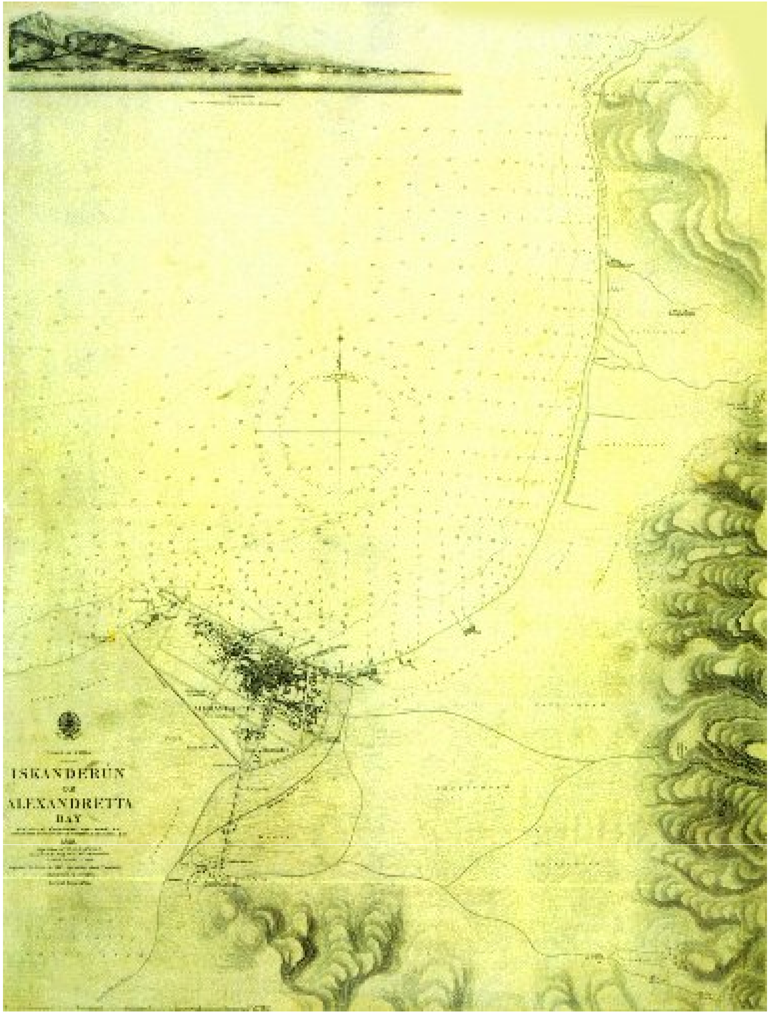

Figure 6.20: 1858 Plan of Iskenderun (*Source:* Urban Planning and Development Dept. of Iskenderun Municipality, 2010)

Although the image of the 1858 plan has very low quality and is not clear, it is understood that there is no modern port, and housing areas are not very close to the coast line. Road system is clear but that's all understood from the image.

However, 1858 plan and other Republic Period plans should be evaluated separately. Plan evaluations should be started by upper scale plans to the lower scales. 1/100.000 scaled Master Plan of Hatay province is not in operation today. The plan was prepared in 2006 and become operative on 8th March, 2007. However, exacution of this plan was stayed on 10th

November, 2008; and cancelled on 10th March, 2009. New plan preparation studies are going on for the time being. The details about the cancelled plan are given in Appendix K.

Preparation of the 1/25.000 scaled Master Plans for the sub-regions of Hatay Province with reference to the 1/100.000 scaled Master Plan for the Hatay Province is still in progress (Figure 6.21). However, today 1/100.000 scaled Master Plan for the Hatay Province is still in cancelled condition. Therefore, there is no 1/100.000 scaled master plan and no 1/25.000 scaled master plan for the province and its sub-regions yet. There is a 1/25.000 scaled Master Plan prepared in 1994 for Iskenderun Bay and Near Environment. Despite it is not linked to any upper scale plan it seems to be in operation. More detailed information about the 1/25.000 scaled master plan could not be get and decisions of this plan is given in Appendix L.

The first Republic Period plan of Iskenderun was made by Gündüz Özdeş in 1948. Second plan of Iskenderun was done by the Bank of Provinces in 1969. There is no more detailed information about these plans.

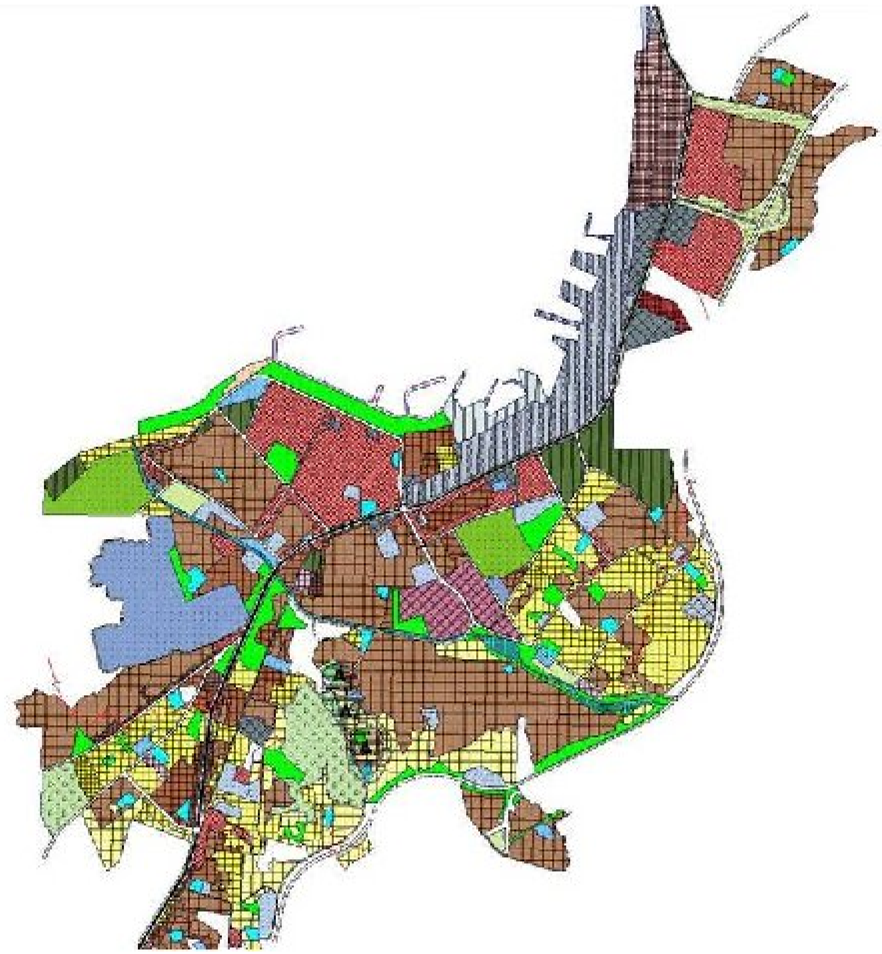

Figure 6.21: Draft of 1/25.000 scaled Master Plan for Iskenderun and Its Environs

(*Source:* www.hoi.gov.tr – Access Date: 22.03.2010)

The latest approved plan of Iskenderun was prepared by Istanbul Technical University in 1981. Additional 1/5000 scaled plans and revisions are also prepared in 1988 and 1989. This 1981 plan is in fact a comprehensive plan in terms of the area that the plan covers. Karayılan, Sarıseki, Denizciler and Karaağaç municipalities are all covered by the plan. The plan has great sensitivity in terms of the preservation of nature and its resources, expansion areas of the settlements, future projections and calculations, impact areas of the uses; and also it has careful approaches to flood areas, river basins, and catchment areas. The approach of the plan to the landslide impact area and its relation to the flood area is inadequate. Therefore, density calculations and recommendations for these areas are not suitable. As in the previously discussed plans, this plan also proposes recreational and tourism activities also secondary housing areas for the southern coast of the city and industrial activities with port and transportation facilities for the northern coast. Newly proposed development areas mostly placed around transportation lines; however, the ones around the motorway are also inconvenient. Figure 6.22 shows the general appearance of the 1981 plan.

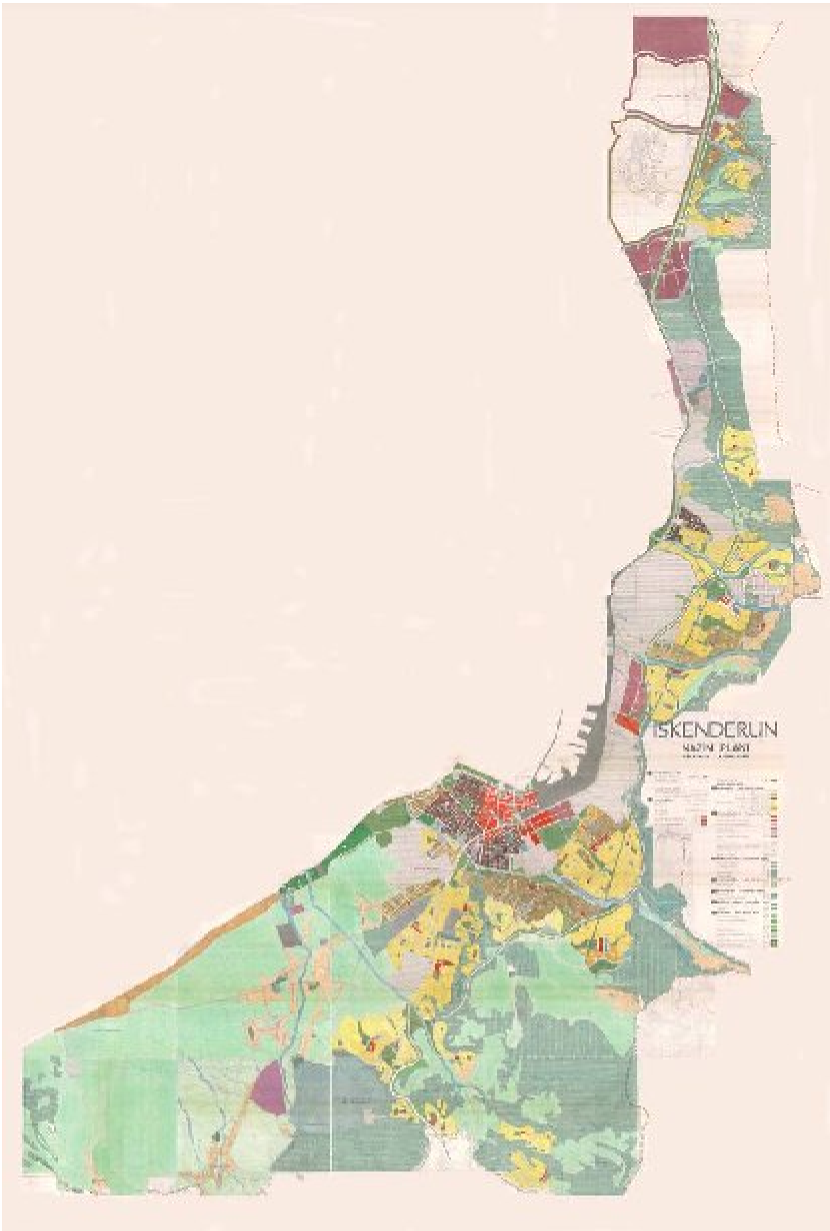

Figure 6.22: 1981 Plan of Iskenderun (*Source:* Bank of Provinces, 2009)

A significant point about this plan is the decisions of the plan on the utilization of the coastal area stay out-of-date today according to the actual law on coastal areas. Not only from this point of view, but from today's needs and tendencies this plan is insufficient. The city needs a new, improved, and comprehensive plan; and it is now in progress.

Plans of the Denizciler, Sarıseki, Karayılan and Karaağaç and detailed evaluations on the plans are given in Appendix M.

All the latest ratified plans prepared for the all of five settlements are out-of-date today. These plans do not meet the needs of today's requirements. Preparation of a new 1/25.000 scaled Master Plan for the Province of Hatay is still going on nowadays. According to the surveys made in the scope of the new 1/25.000 scaled Master Plan preparation works, background of a new plan is also a little bit troublesome.

First of all, existing situation maps of some settlements are not in digital version. Also, dates of some existing situation maps are old. Date of existing situation map of Denizciler is 2009, date of existing situation map of Iskenderun is 1990, and dates of existing situation map of Sarıseki are 1989 and 1991. Except the one of Iskenderun, none of them is in digital version. At the same time geological survey reports of all five settlements are either old or do not exist. Geological survey report of Iskenderun was prepared in 1978 for instance; Sarıseki has no geological survey report. Besides, except the latest revisions made for Karayılan and Sarıseki, none of the plans are in digital version. Working on digitalized plans, processing existing situation maps and other data makes controlling CAAM set up and implementation easier.

Additionally, there are some new projects on the agenda of the study area ICR. Mass housing, sport complexes, and treatment unit projects in Denizciler, development and expansion of the Organized Industrial Estate in Sarıseki, and squatter rehabilitation and house cleaning projects in Iskenderun city-center are some of these projects. These projects will definitely affect urban settlements and urban life in the mentioned settlements. As a result, all of these five settlements need new development plans with upper scale (1/5000, 1/25.000, 1/100.000) master plans.

Newly prepared plans are expected to be more sensitive in terms of the approaches to the disaster prone areas. New plan should propose new areas for the house cleaning projects in Iskenderun city-center. Currently some coastal filling works are going on in Iskenderun city, or some parts of these works have just finished. Even though these types of interventions to the coastal strip is not preferred, these interventions could be beneficial in terms of the protection of formerly built onshore (or littoral) buildings or cultural assets from the negative impacts coming from the sea, and these areas could be used as a buffer zone. Additionally, these filling areas could be benefited as the part of urban open system which is strongly needed in Iskenderun city-center. Definitely, these coastal filling areas should be allocated for daily recreational uses and these should be no permission on construction. These areas also provide utilization and accessibility of the coast equally by the entire city, and provide open space necessity which is needed strongly within the dense urban pattern of the city-center. However these interventions should certainly be taken its place in new plans, or additional plans and revisions legally.

6.3. Implementing Coastal Area Assessment Model in Iskenderun Coastal Region

<u>Implementation Result of Coastal Urban Typology Matrix</u>

After explaining the basic characteristics, and evaluating the existing condition of the region, implementation of Coastal Area Assessment Model starts with the implementation of Coastal Urban Typology Matrix in ICR.

As explained in Chapter 5, the matrix is marked by using three different colors;

- "**grey**" indicates "desired (or does not exist or no problem)",
- "***orange***" indicates "partly desired (or partly exists or a little problematic)", and
- "***red***" indicates "not desired (or highly/densely exists or very problematic)" features.

Matrix shown in Figure 6.23 explains that the region has a complex urban structure which has no area with conservation status, but has archeological sites and tourism areas within residential areas, also industrial areas and intersection points of different types of transportation systems. The area has a critical position in terms of morphological type of the coastal land. These types of coastal lands are vulnerable to sea-level rise for instance. That means the region is relatively open to the threats coming from the sea. In a short expression, all urban elements defined in the matrix exist in the urban areas of ICR on a concordant and submergent coastal land.

Implementation Results of Risk Matrices

Implementation of risk matrices is carried out in three steps. First, consequence categories of each consequence variable are determined and marked on the matrix. Consequence category of one risk type is calculated as the arithmetic mean of consequence categories of all consequence variables. That means, total value of consequence categories should be divided by the number of consequence variable. If one consequence variable has two categories, mean value of those categories are accepted as the consequence category of that variable. Second, frequency category of one risk type is determined and marked on the frequency matrix. At third step, intersection points of consequence and frequency values of the risk type are marked on the risk matrix of that risk type. That intersection point presents the risk level of the settlement for that risk type. Risk level calculations are explained below. Additionally, implementation of risk matrices by implementing those three steps is presented in the figures following.

Sea-Level Rise (see Figure 6.24):

Consequence Category: [3 + 1 + (2+3)/2 + 1 + 2 + 4 + (2+3)/2] / 7 = 2,28 (MAJOR)

Frequency Category: 2 (MODERATE)

Risk Level: C (2,28 x 2 = 4,56)

Wildfire (see Figure 6.25):

Consequence Category: [3 + (3+4)/2 + 2 + 1 + 1 + 2 + 2 + (1+2+3)/3] / 8 = 2,06 (MAJOR)

Frequency Category: 2 (MODERATE)

Risk Level: C (2,06 x 2 = 4,12)

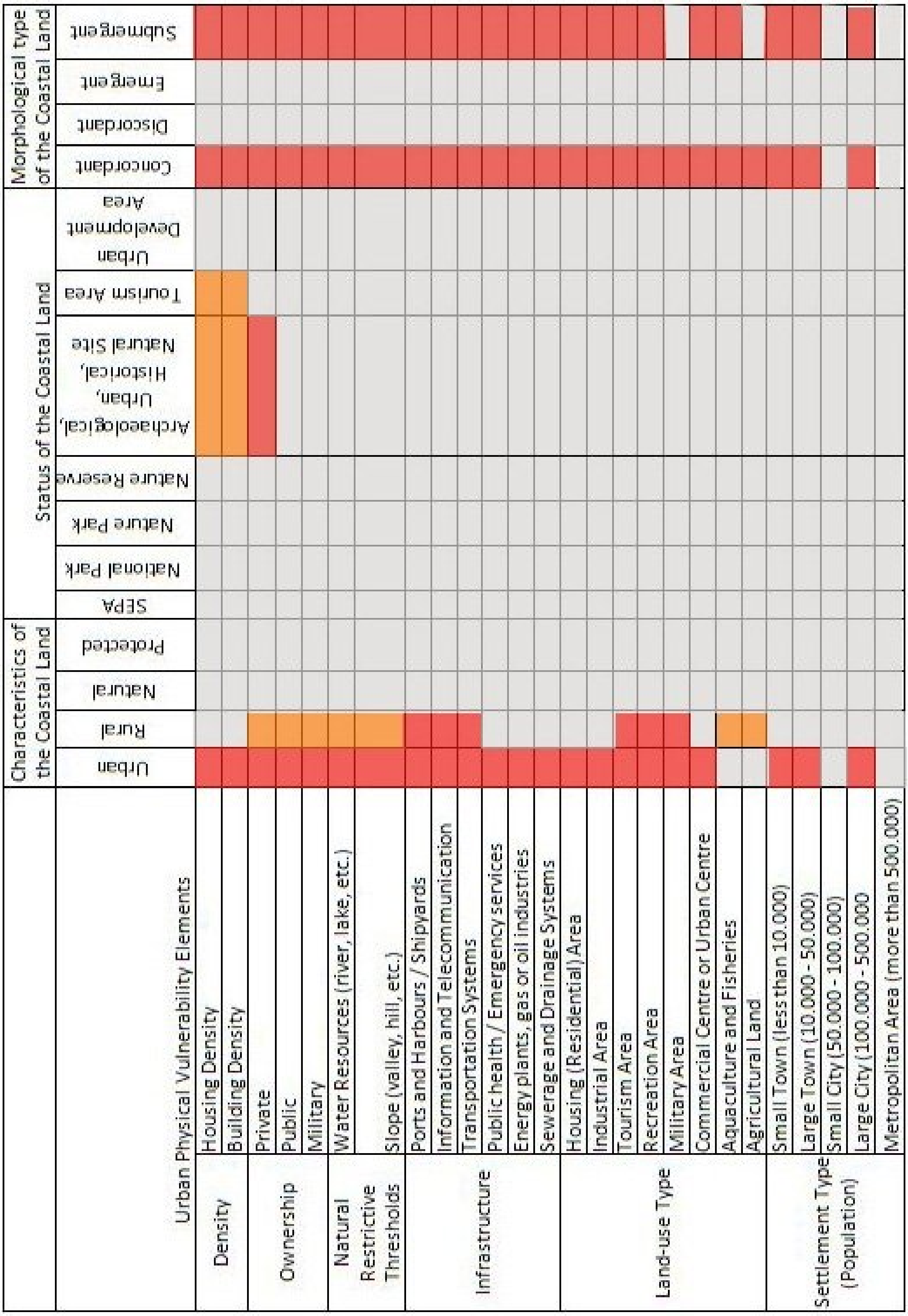

Figure 6.23: Implementation of Coastal Urban Typology Matrix in ICR

Consequence Variables / Consequence Categories	Slope (the negative angle between land surface and sea level)	Elevation	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	90 - 46	Above 10 m	Mountains	Urban	No Status	Discordant and Emergent	Forest, Tourism and recreation area with low building density,
Major (2)	45 - 20	Max 10 m. higher than sea level	Coastal Hills and Cliffs	Rural	Tourism Area, Urban Development Area	Concordant and Emergent	Tourism and recreation area with high building density,
Hazardous (3)	19 - 0	Same as sea level	Coastal Plains, Coastal Flood Plains	Natural	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Urban centres and commercial centres, Industrial areas, Transportation units, Military areas
Catastrophic (4)	Same as ground (0) or if there is negative slope (<0)	Lower than sea level (< 0)	Deltas, Lagoons, Coastal Wetlands	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Submergent	Agricultural Land, Fresh water supply area, Critical and dense urban infrastructure (energy plants, transportation units), Dense Industrial Infrastructure

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	> 1000 years	The occurrence of the event is almost impossible.
Moderate (2)	100 - 1000 years	The occurrence of the event is conceivable.
High (3)	10-100 years	The event may happen once in a lifetime.
Very High (4)	< 10 years	It is likely to be happen frequently and seriously.

B. Frequency Matrix

Risk Matrix for SLR		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	D	A	A

C. Risk Matrix

Figure 6.24: Implementation of Risk Matrix for the Sea-Level Rise Risk in ICR

Consequence Variables / Consequence Categories	Vegetation Type	Delicate Vegetation Cover next to	Monthly Average Moisture (Relative Humidity - Summer) (%)	Monthly Average Temperature (0C)(summer)	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological type of the Coastal Land	Coastal Land-use Type
Minor (1)	Dense Forest, Moistured Vegetation	Empty places has no vegetation cover	more than 85	less than 35	Urban	No Status	Discordant and Submergent	Tourism and Recreation Areas
Major (2)	Lawn	Roads and Rivers	70-85	35-40	Natural	Tourism Area, Urban Development Area	Concordant and Submergent	Urban and Commercial Centres
Hazardous (3)	Bushes and Scrubs	Tourism and Recreation Areas, Transportation Units	50-69	41-45	Protected	Archaeological, Urban, Historical, Natural Sites	Discordant and Emergent	Industrial Areas, Military Areas, Transportation Units
Catastrophic (4)	Less Dense Forest, Dry Farming Agricultural Area	Power Lines, Energy Plants, Explosive Industry, Urban and Commercial Centres, Rocky Hills	less than 50	more than 45	Rural	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Forests and Dry Farming Agricultural Land

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 5-10 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once in 5 years	The occurrence of the event is highly possible and frequent.
High (3)	2-4 times in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	At least once in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Wildfires		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.25: Implementation of Risk Matrix for the Wildfire Risk in ICR

Earthquake (see Figure 6.26)

Consequence Category: [2 + 3 + 2 + 2 + 2 + 4 + 4 + 3 + 4 + 4 + 4 + 4] / 12 = 3,16 (HAZARDOUS)

Frequency Category: 3 (HIGH)

Risk Level: B (3,16 x 3 = 9,48)

Landslide (see Figure 6.27):

Consequence Category: [3 + 2 + (2+3+4)/3 + 3 + 3 + 4 + (3+4)/2 + 1 + 4] / 9 = 2,94 ~ 3 (HAZARDOUS)

Frequency Category: 3 (HIGH)

Risk Level: B (2,94 x 3 = 8,82)

Tsunami (see Figure 6.28):

Consequence Category: [1 + 4 + 2 + 2 + 2 + 2 + 2 + 4 + 4 + 4 + 4] / 10 = 3,1 (HAZARDOUS)

Frequency Category: 1 (LOW)

Risk Level: C (3,1 x 1 = 3,1)

Coastal Flooding due to the Storm Surge (see Figure 6.29):

Consequence Category: [(1+2)/2 + 2 + 2 + 3 + 2 + 2 + (2+3)/2 + 3 + 4 + 4 + (2+3+4)/3] = 2,63 ~ 3 (HAZARDOUS)

Frequency Category: 3 (HIGH)

Risk Level: B (2,63 x 3 = 7,89)

Coastal Erosion (see Figure 6.30):

Consequence Category: [(1+3)/2 + 4 + (3+4)/2 + 2 + 2 + (2+3)/2 + 1 + 2 + 4 + (2+3+4)/3] / 10 = 2,6 ~ 3 (HAZARDOUS)

Frequency Category: 3 (HIGH)

Risk Level: B (2,6 x 3 = 7,8)

Consequence Variables / Consequence Categories	Earthquake Magnitude (500 years - over M=5.0)	Open Space Availability (m2/person and % of municipal area)	Building Density (% of municipal area)	Population Density (person / hectare)	Proportion of Old Structures (older than 50 years - %)	Liquefaction Potential of the Area (Related with the type of sediment and ground water level)	The Place of The Area in The Seismic Hazard Map	Distance from the Nearest Fault Line	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological type of the Coastal Land	Coastal Land-use Type
Minor (1)	Never	more than 15 and more than 20 %	less than 50	less than 100	less than 5	Chesionless clayed terrains, Tertiary - ground water level is more than 20 m	5th and 4th Degree Zone	125 km and more	Natural	No Status	Discordant and Emergent	Agricultural Land and Forest
Major (2)	2 - 10 times	10 - 15 and 15 - 20 %	50 - 55	100 - 199	5 - 25	Pleistocene - Ground water level is between 20 - 15 m	3th Degree Zone	125 - 100 km	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Military Area
Hazardous (3)	11 - 20 times	5 - 10 and 15 - 10 %	66 - 80	200 - 300	26 - 50	Holocene - young, Ground water level is between 15 - 10 m	2nd Degree Zone	99 - 50 km	Rural	Archeological, Urban, Historical, Natural Sites	Discordant and Submergent	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	more than 20 times	less than 5 and less than 10 %	more than 80	more than 300	more than 50	Alluvial, sandy, cohesionless terrains (Holocene - old) - Ground water level is less than 10 m	1st Degree Zone	less than 50 km	Urban	Tourism Area, Urban Development Area	Concordant and Submergent	Urban and Commercial Centres, Energy-Oil-Gas Plants, Transportation Units, Dams

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 500 years	The occurrence of the event is possible.
Moderate (2)	Once in 100 years	The occurrence of the event is highly possible.
High (3)	Once in 50 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in 10 years	The occurrence of the event is a serious and critical part of lifetime

B. Frequency Matrix

Risk Matrix for Earthquake		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.26: Implementation of Risk Matrix for the Earthquake Risk in ICR

Consequence Variables / Consequence Categories	Slope (%)	Total Monthly Rainfall Intensity (mm)	Sediment or rock type	Vegetation Type	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological type of the Coastal Land	Coastal Land-use Type
Minor (1)	0 - 2	Less than 100	Basalt, limestone (consolidated or integrated formations)	Dense Forests	Plains	Natural	No Status	Submergent and Concordant	Forests
Major (2)	3 - 7	100 - 199	Sandstone	Less dense forests, Agricultural areas	Plateau	Protected	SEPA, National Park, Nature Park, Nature Reserve	Submergent and Discordant	Military Areas, Agricultural Land
Hazardous (3)	8 - 12	200 - 299	Claystone, Mudstone	Bushes and Scrubs	Cliffs and mountains	Rural	Archeological, Urban, Historical, Natural Sites	Emergent and Concordant	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	More than 12	300 and more	Unconsolidated or disintegrated formations	Lawn or no vegetation	Valleys, hillsides, coastal hills,	Urban	Tourism Area, Urban Development Area	Emergent and Discordant	Urban and Commercial Centers, Energy-Oil-Gas Plants, Transportation Units, Dams

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	At least once in 25 years	The occurrence of the event is possible.
Moderate (2)	Once in 10 years	The occurrence of the event is highly possible.
High (3)	2 or 3 times in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	At least once in a year.	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Landslide		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	D
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.27: Implementation of Risk Matrix for the Landslide Risk in ICR

Consequence Variables / Consequence Categories	Elevation	Type of Fault	Tsunami Intensity (Intensity and Wave Height Correlation)	Earthquake Magnitude	Distance from the Epicentre	Slope (%)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	Above 10 m	Normal and Reverse Faults	I= 1-6, WH< 2 m	Less than 5.0		More than 12	Mountains	Natural	No Status	Emergent and Discordant	Forests
Major (2)	Max 10 m higher than sea level	Normal and Reverse Faults	I= 7-8, WH= 2-8 m	5.0 - 5.9		8 - 12	Cliffs and hills	Protected	SEPA, National Park, Nature Park, Nature Reserve	Emergent and Concordant	Military Areas, Agricultural Areas
Hazardous (3)	Same as sea level	Oblique Faults, Horst-Graben Faults	I= 9-10, WH= 9-16 m	6.0 - 7.0		3 - 7	Deltas	Rural	Archaeological, Urban, Historical, Natural Sites	Submergent and Discordant	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	Lower than sea level (<0 point)	Strike Slip Faults, Dip Slip Faults, Thrust Faults	I= 11 and 12, over 16 m	More than 7.0		0 - 2	Plains	Urban	Tourism Area, Urban Development Area	Submergent and Concordant	Urban and Commercial Centres, Energy-Oil-Gas Plants, Transportation Units, Fresh Water Resources

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 100 years	The occurrence of the event is possible.
Moderate (2)	Once in 50 years	The occurrence of the event is highly possible.
High (3)	Once in 25 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in 5 years.	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Tsunami		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.28: Implementation of Risk Matrix for the Tsunami Risk in ICR

Consequence Variables / Consequence Categories	Elevation (m)	Average Wave Height in a Season / Surge Magnitude (Oct. - Feb.) (m)	Central Pressure (hPa)	Climatic Belt	Experienced Max Wind Speed (km/h)	Slope (%)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land use Type
Minor (1)	Higher than 10 m and above	1 and less	More than 980	Polar Climate	Less than 180	10 and more	Mountains	Natural	No Status	Discordant and Emergent	Forests
Major (2)	5 - 10	2 - 3	980 - 951	Cold Climate and Dry Climate	180 - 209	5 - 10	Cliffs and hills	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Military Areas, Agricultural Areas
Hazardous (3)	0 - 4	4 - 5	950 - 920	Temperate Climate	210 - 250	2 - 5	Deltas	Urban	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Tourism and Recreation Areas, Light Industry
Catastrophic (4)	Same with or lower than sea level	More than 5	Less than 920	Tropical Climate	More than 250	0 or negative slope	Plains	Rural	Tourism Area, Urban Development Area	Concordant and Submergent	Urban and Commercial Centres, Energy-Oil-Gas Plants, Transportation Units, Fresh Water Resources

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 100 years	The occurrence of the event is possible.
Moderate (2)	Once in 25 years	The occurrence of the event is highly possible.
High (3)	Once in 10 years	It is likely to be happen very frequently and seriously
Very High (4)	Once in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Coastal Flooding Due To Storm Surge	Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency Low (1)	D	D	C	C
Moderate (2)	D	C	C	B
High (3)	C	C	B	A
Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.29: Implementation of Risk Matrix for the Coastal Flooding (due to Storm Surge) Risk in ICR

Flood (see Figure 6.31):

Consequence Category: [3 + 2 + 2 + 3 + 1 + (3+4)/2 + 3 + 4 + 4 + (2+3+4)/3] / 10 = 2,85 ~ 3 (HAZARDOUS)

Frequency Category: 4 (VERY HIGH)

Risk Level: A (2,85 x 4 = 11,4)

Pollution (see Figure 6.32):

Consequence Category: [2 + 2 + (3+4)/2 + 1 + 2 + 2 + 4 + 4 + (2+3+4)/3] / 9 = 2,61 ~ 3 (HAZARDOUS)

Frequency Category: 4 (VERY HIGH)

Risk Level: A (2,61 x 4 = 10,44)

Marine Accidents and Explosions (see Figure 6.33):

Consequence Category: [(3+4)/2 + 4 + (3+4)/2 + 3 + (3+4)/2 + 4 + 4 + (2+3+4)/3] / 8 = 3,56 (CATASTROPHIC)

Frequency Category: 3 (HIGH)

Risk Level: A (3,56 x 3 = 10,68)

Consequence Variables / Consequence Categories	Existence of Marine Structures	Average Wave Height (cm)	Coastal Sediment or Rock Type	Slope (%)	Land Loss in the Last 5 years (cm)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	Ports and Harbours	Less than 20	Basalt, Limestone (consolidated or integrated formations)	10 and more	Less than 20	Mountains	Urban	No Status	Discordant and Emergent	Forest, Recreation Area
Major (2)	Marinas, Docks, Shipyards	20 - 29	Sandstone	5 - 10	20 - 34	Cliffs and Hills	Protected	Tourism Area, Urban Development Area	Concordant and Emergent	Tourism Area, Military Area
Hazardous (3)	Piers, Jetties	30 - 39	Claystone, Mudstone	2 - 5	35 - 50	Deltas, Lagoons, Coastal Wetlands	Rural	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Industrial Area, Commercial and Urban Centre
Catastrophic (4)	Breakwaters	40 and more	Unconsolidated or disintegrated formations (alluvial deposits)	0 or negative slope	More than 50 cm	Coastal Plains, Coastal Flood Plains	Natural	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Submergent	Agricultural Land, Housing Area, Transportation Systems

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 20 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once in 15 years	The occurrence of the event is highly possible and frequent.
High (3)	Once in 10 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in 5 years	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Coastal Erosion		Consequence			
		Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.30: Implementation of Risk Matrix for the Coastal Erosion Risk in ICR

Consequence Variables / Consequence Categories	Total Monthly Rainfall in a Season - Intensity (Oct. - Nov. - Dec.) (mm)	Soil Permeability (related with soil type)	Soil Depth (cm)	Slope (%)	Flood Risk Mitigation Infrastructure (flood protection embankment, storm sewer pump station etc.)	Critical Geographical Thresholds and Location	Characteristics of the Coastal Land	Status of the Coastal Land	Morphological Type of the Coast	Coastal Land-use Type
Minor (1)	Less than 100	Fast Permeable	90 and more	0 - 2	Exists	Plains	Natural	No Status	Discordant and Emergent	Forest, Agricultural Land, Tourism and Recreation Area with low density
Major (2)	100 - 199	Moderate Permeable	75 - 89	3 - 7	-	Coastal Plains	Protected	SEPA, National Park, Nature Park, Nature Reserve	Concordant and Emergent	Tourism and Recreation Area with high density, Military Areas
Hazardous (3)	200 - 299	Slowly Permeable	25 - 74	8 - 12	-	Valleys, Deltas, Coastal Flood Plains	Urban	Archaeological, Urban, Historical, Natural Sites	Discordant and Submergent	Urban Centres and Commercial Centres, Industrial Areas
Catastrophic (4)	300 and more	Impermeable	Less than 25	More than 12	Doesn't exist	River Basin, River Flood Area, Hill sides	Rural	Tourism Area, Urban Development Area	Concordant and Submergent	Critical urban infrastructure (fresh water supply area, transportation units, energy plants)

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once or twice in 25 years	The occurrence of the event is possible but occasional
Moderate (2)	Once or twice in 10 years	The occurrence of the event is highly possible and frequent
High (3)	Once or twice in 5 years	It is likely to be happen very frequently and seriously
Very High (4)	Once or twice in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Flood		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.31: Implementation of Risk Matrix for the Flood Risk in ICR

Consequence Variables / Consequence Categories	Level of Nitrogen and Chemical Contaminants (air)	Level of Nitrogen and Chemical Contaminants (water)	Type of Industry	Solid Waste Treatment Unit and Recycling	Chemical Fertilizer Usage	Waste Water Treatment Unit	Characteristics of the Coastal Land	Status of the Coastal Land	Coastal Land-use Type
Minor (1)	Below acceptable level according to the standards	Below acceptable level according to the standards	Storage, Communication, Wholesale and Retail Facilities	Exists	Less than 10 %	Full Treatment	Protected	No Status	Forest, Recreation Area
Major (2)	At acceptable level according to the standards	At acceptable level according to the standards	Textile, Food, and Machinery Industries	-	10 - 15 %	Biological and Chemical Treatment	Natural	SEPA, National Park, Nature Park, Nature Reserve	Tourism Area, Military Area
Hazardous (3)	Over acceptable level according to the standards (the surplus is between 10 % - 20 % of the standards)	Over acceptable level according to the standards (the surplus is between 10 % - 20 % of the standards)	Energy Production Plants, Filling Plants, Oil and Gas Industry	-	16 - 20 %	Biological Treatment	Rural	Archaeological, Urban, Historical, Natural Sites	Agricultural Land, Housing Area
Catastrophic (4)	Over acceptable level according to the standards (the surplus is more than 20 % of the standards)	Over acceptable level according to the standards (the surplus is more than 20 % of the standards)	Mining, Chemical and Construction Material Industries, Ship Dismantling Industry, Metal Industry	Doesn't exists	More than 20 %	No Treatment	Urban	Tourism Area, Urban Development Area	Industrial Area, Transportation Systems, Commercial and Urban Centre

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once or twice in 25 years	The occurrence of the event is possible but occasional
Moderate (2)	Once or twice in 10 years	The occurrence of the event is highly possible and frequent
High (3)	Once or twice in 5 years	It is likely to be happen very frequently and seriously
Very High (4)	Once or twice in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Pollution		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.32: Implementation of Risk Matrix for the Pollution Risk in ICR

Consequence Variables / Consequence Categories	Type of Industry	Type of Transportation System	Predominant Type of Marine Traffic (or Load type of Vehicles)	Size of Port or Harbour (Handling Capacity ton/year)	Type of Marine Transportation Unit	Characteristics of the Coastal Land	Status of the Coastal Land	Coastal Land-use Type
Minor (1)	Storage, Communication, Wholesale and Retail Facilities	Marine	Fishing Boats and Yachts	Less than 3000000	Fishermen Shelter	Protected	No Status	Forest, Recreation Area
Major (2)	Textile, Food, and Machinery Industries	Railway, Marine	Cruise Ships, Bulk Carriers (carrying wey, food, livestock or timber)	3000000 - 3999999	Docks and Shipyards	Natural	SEPA, National Park, Nature Park, Nature Reserve	Tourism Area, Military Area
Hazardous (3)	Mining, Chemical and Construction Material Industries, Ship Dismantling Industry, Metal Industry	Highway, Marine	Bulk Carriers (carrying slack or coal)	4000000 - 5000000	Jetties and Piers	Rural	Archaeological, Urban, Historical, Natural Sites	Agricultural Land, Housing Area
Catastrophic (4)	Energy Production Plants, Filling Plants, Oil and Gas Industry	Highway, Railway, Marine (Intersection Point)	Tankers (carrying petroleum and its products, biological - nuclear - chemical waste)	5000000 and over	Ports and Harbours	Urban	Tourism Area, Urban Development Area	Industrial Area, Transportation Systems, Commercial and Urban Centre

A. Consequence Matrix

Frequency Categories	Frequency	Comments
Low (1)	Once in 25 years	The occurrence of the event is possible but occasional.
Moderate (2)	Once in 10 years	The occurrence of the event is highly possible and frequent.
High (3)	Once in 5 years	It is likely to be happen very frequently and seriously.
Very High (4)	Once in a year	The occurrence of the event is a serious and critical part of lifetime.

B. Frequency Matrix

Risk Matrix for Marine Accidents and Explosions		Consequence: Minor (1)	Major (2)	Hazardous (3)	Catastrophic (4)
Frequency	Low (1)	D	D	C	C
	Moderate (2)	D	C	C	B
	High (3)	C	C	B	A
	Very High (4)	C	B	A	A

C. Risk Matrix

Figure 6.33: Implementation of Risk Matrix for the Marine Accidents and Explosions Risk in ICR

According to the implementation results of risk matrices and as shown in Table 6.7; flood, pollution and marine accidents and explosions risks are at highest level (Level A) in ICR. Risk levels of earthquake, landslide, coastal flooding due to storm surge and coastal erosion are at second level (Level B). Sea-level rise, wildfire and tsunami risks are at third level (Level C) in ICR. However, same level risks are in fact not in same levels. As defined and discussed in previous chapters, risk is the function of consequence and frequency, and calculated by multiplying these two. Results of risk matrices also include these multiplying. Accordingly it is also possible to make sequencing among same level risks.

Table 6.7: Summary Matrix of the Risk Matrices for ICR

Event / Risk Level	Sea Level Rise	Wildfire	Earthquake	Landslide	Tsunami	Coastal Flooding Due To Storm Surge	Coastal Erosion	Flood	Pollution	Marine Accidents and Explosions
A								√	√	√
B			√	√		√	√			
C	√	√			√					
D										

Flood risk gains the highest rate (with 11,4) according to this sequence; and is followed by marine accident and explosion risk (with 10,68) and pollution risk (with 10,44).

As discussed among the functions of CAAM, it could also be used for preparation of integrated risk maps (or Multi-risk Maps) of an urban area. Its detailed risk analysis is summarized and spatialized by these maps. Figure 6.34 shows the risk areas (Level A and level B) in ICR. In other words; this figure is the result of the implementation of risk matrices of CAAM process.

The first schema of the Figure 6.35 highlights flood risk areas. River beds, bottom ends of the valleys, and the flow points (areas) of the streams to the sea are defined as high risk areas in terms of flood. The second schema shows marine accident and explosion risk areas. The harbor area and harbor related storage areas (especially petroleum product storage units), the area of OIE, intersection points of transportation systems and transfer areas (terminals), and the area of ISDEMIR are shown as high risk areas in terms of marine accidents and explosions. The areas under pollution risk are shown in the third schema of Figure 6.35. These areas cover both air and water pollution risk areas. Basically the areas allocated for transportation and industrial activities, and their adjacent areas are under risk conditions in terms of pollution. Earthquake risk is higher in harbor area, the area of OIE, and the area of ISDEMIR, similar to previous risk areas. Additionally, residential area located on the southern edge of Iskenderun has earthquake risk significantly. These areas are shown by the fourth schema of the figure.

Since the slope is high and the ground is unstable, the same area is also has higher landslide risk as shown by the fifth schema of Figure 6.35. The risk of coastal flooding due to storm surge is definitely the subject of whole coasts of the region. However, risk is higher for residential areas (especially for the areas located on south-west parts of the region) since industrial areas (ISDEMIR and OIE) and terminal areas have emergency management and action plans. Similarly, coastal erosion risk is also the subject of all coastal parts; and again the risk is lower for terminal points, harbors, and industrial areas because of the existence of coastal defense structures. Coastal erosion risk is higher especially in south-west parts of the region.

The last schema of Figure 6.35 is a kind of synthesis map which shows multi-risk (two or more types of risks) areas. Mainly four zones are defined by the synthesis. The 1st zone includes flood, earthquake, coastal flooding due to storm surge, and landslide risks. The 2nd zone includes marine accident and explosion risk, pollution risk, and earthquake risks. The 3rd zone includes pollution, earthquake, coastal flooding due to storm surge, and marine accidents and explosion risks. Lastly, the 4th zone includes coastal erosion, coastal flooding due to storm surge, and flood risks. This figure is prepared only for the demonstration of one of the beneficial functions of CAAM.

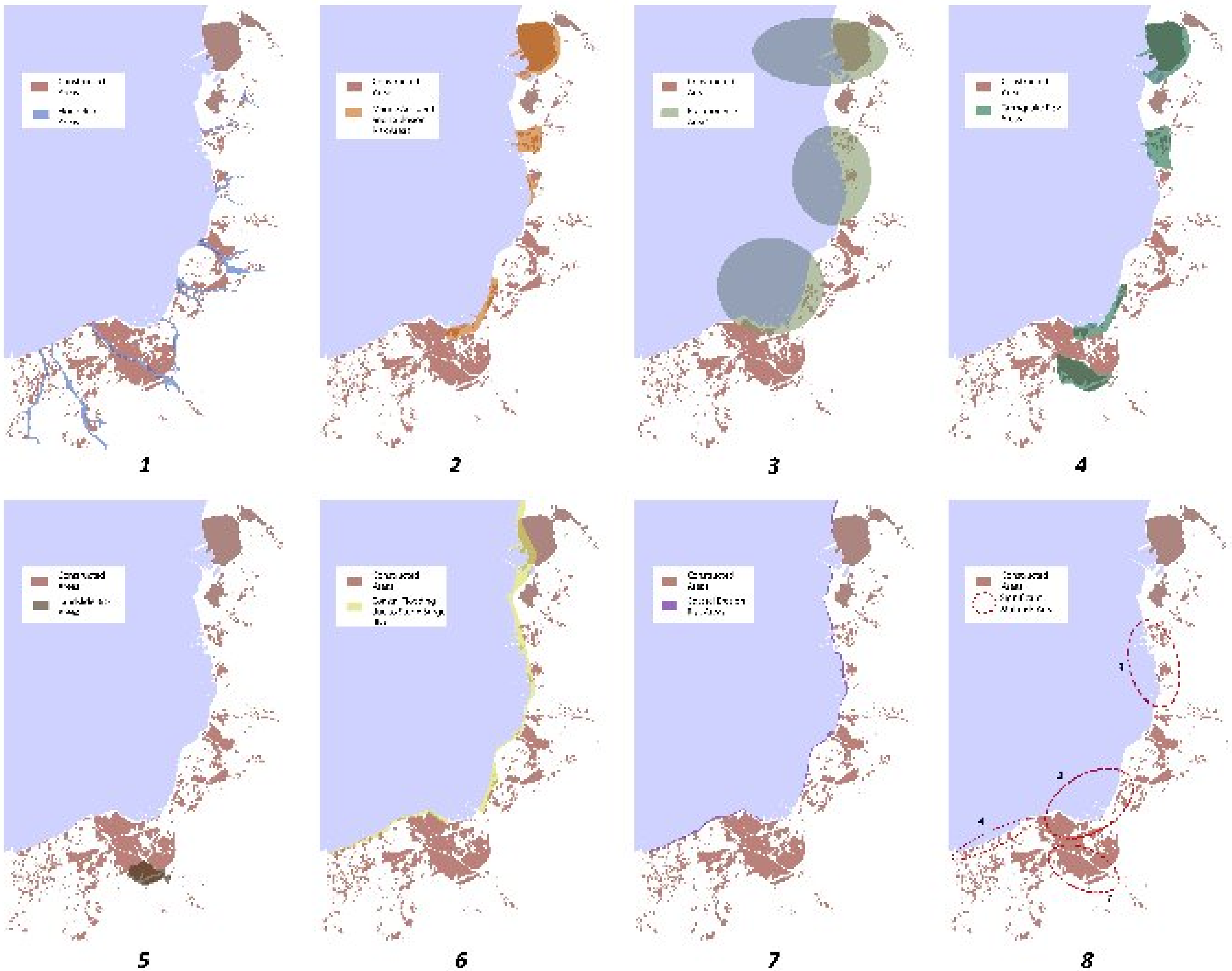

Figure 6.34: Risk Areas in ICR

Implementation Results of ICZM and UDRM Matrices

“ICZM Programme Checking and Implementation Guide Matrix” and “UDRM Programme Checking and Implementation Guide Matrix” are not given here again but only the results of these two matrices are discussed. According to the implementation results of ICZM – UDRM Comparative Risk Matrix; the region has an ICZM plan but does not have any plan of UDRM.

The ICZM plan (Iskenderun Bay Integrated Coastal Planning and Management Project) was prepared for whole Iskenderun Bay including the case area of this thesis study. However it is a newly prepared plan and has no law enforcement according to Turkish legal structure. This plan has elaborated the Iskenderun Bay within eight regions and related sub-regions as shown by Figure 6.35. Case area of this thesis study is also covered by this project with the name of Iskenderun Region. This project determines the permissions and limitations for the new investments and establishments, and evaluates these kinds of approaches in terms of regional capacity, environmental concerns, sectoral variation, and risk conditions; and proposes a kind of regional coordination institution. Main risk concerns of the project are marine accident and explosions and all types of over-pollution (Figure 6.36).

This plan has an advisory position in preparing and implementing master plans and development plans. Other planning regions and spatial planning strategies of Iskenderun Bay Integrated Coastal Planning and Management Project are given in Appendix N.

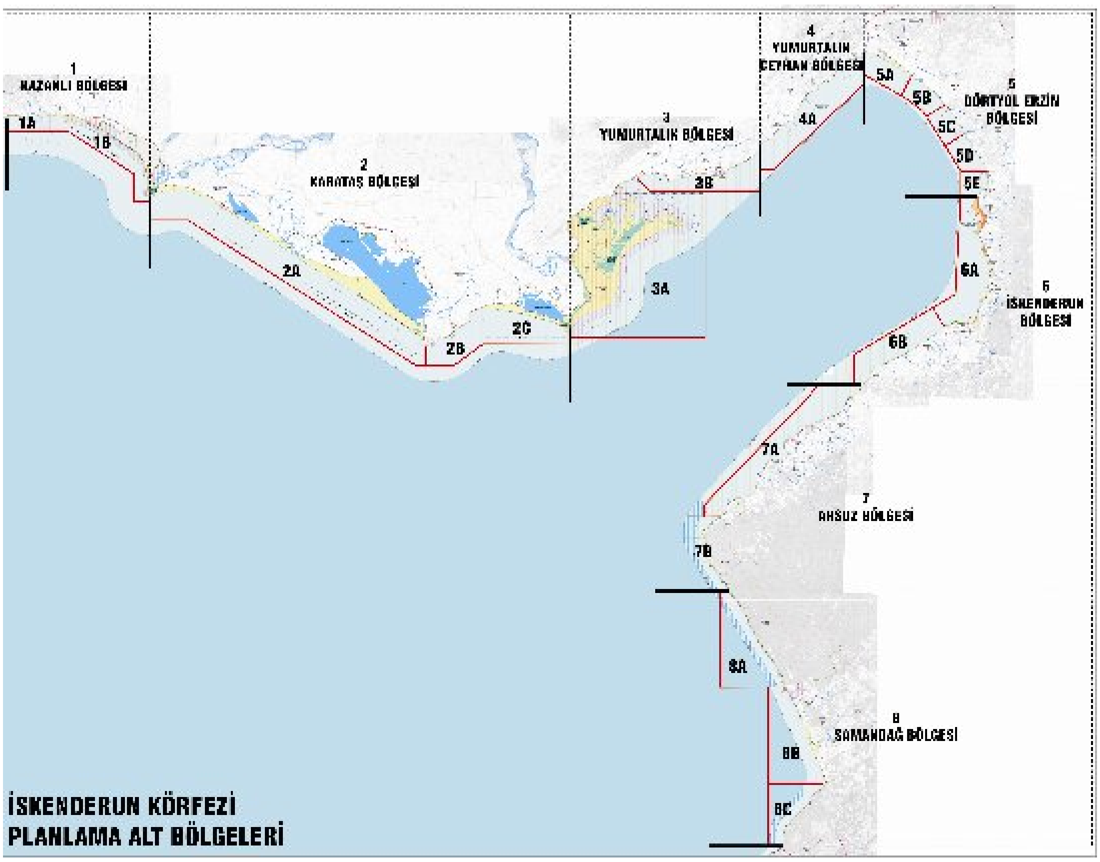

Figure 6.35: Planning Regions and Sub-regions of Iskenderun Bay Integrated Coastal Planning and Management Project

(*Source:* Ministry of Public Works and Settlements, 2007)

Meanwhile, the results of risk matrices show that the region has significant disaster risks and flood has the highest rate. Floods happen almost every year in the region and its outcomes reach high-cost levels sometimes. A proposed UDRM plan must cover all levels and sections of flood risk mitigation. Additionally, that plan must cover other types of high-rate risk factors of the region (marine accident and explosion risk, pollution risk, earthquake, and landslide, coastal flooding, and coastal erosion) especially for the residential areas. Large scale industrial activities of the region such as ISDEMIR and OIE have comprehensive emergency management plans and action plans which have prepared strictly and carefully. Also their mitigation strategies for different kinds of risk are in operation with technical solutions overwhelmingly. This situation shows that those kinds of plans require a consistent and coordinated institutional structure. The region has some capacity and coordination problems in terms of preparing and implementing an UDRM or ICZM plan except those large scale establishments.

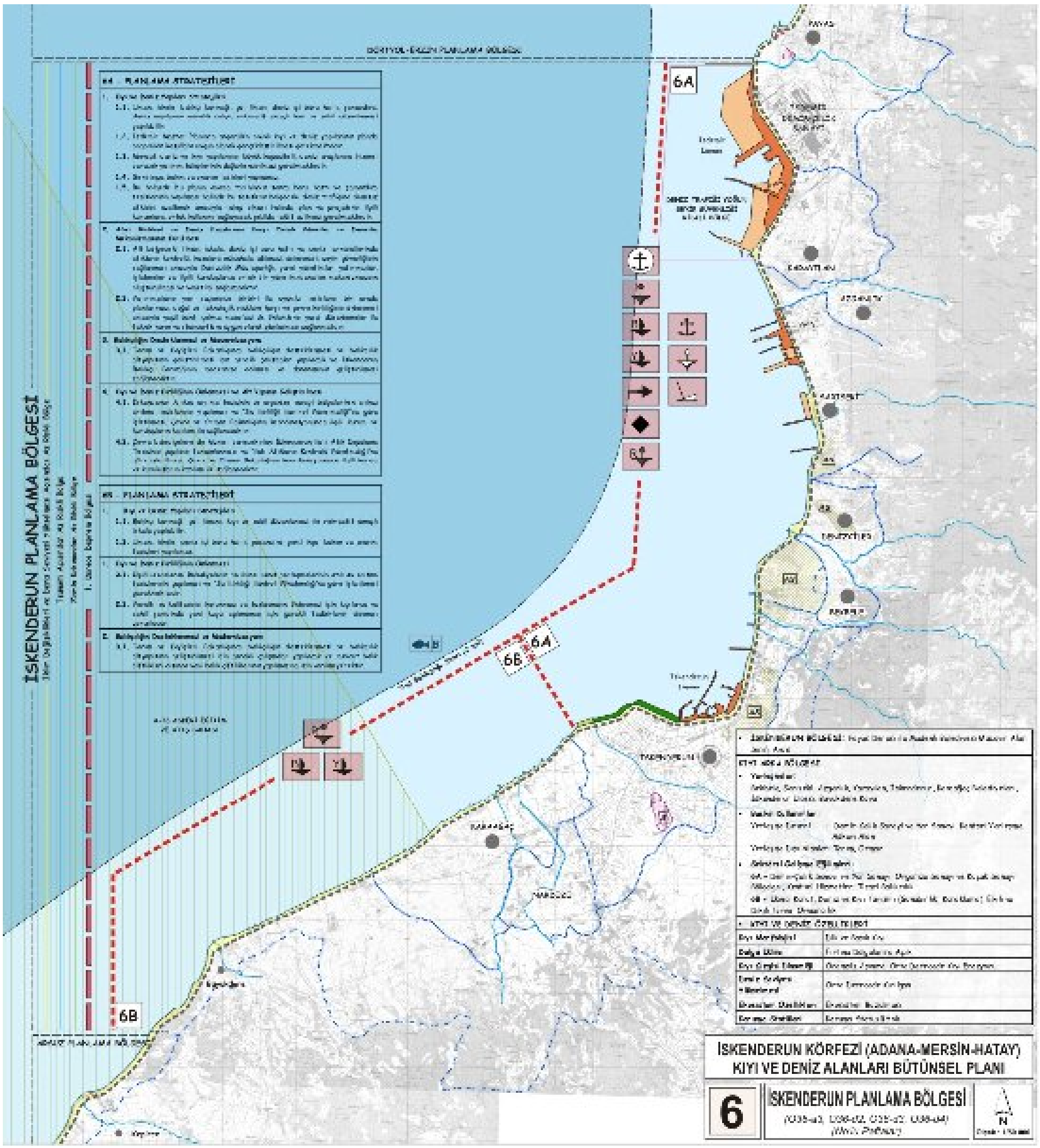

Figure 6.36: Iskenderun Planning Region of Iskenderun Bay Integrated Coastal Planning and Management Project (*Source:* Ministry of Public Works and Settlements, 2007)

6.4. Results of Coastal Area Assessment Model Implementation in ICR

As defined at the beginning of Chapter 6, the case study area called "Iskenderun Coastal Region" includes municipal areas of Karaağaç, Iskenderun, Denizciler, Sarıseki, and Karayılan. The Coastal Area Assessment Model is implemented by using the general characteristics of those municipal areas. The overall area is in fact a large area and has differentiating features from one municipality to another or from one large scale establishment to another. Therefore the CAAM should be implemented by dividing a large area to small parts whose characteristics are similar. In this case study, CAAM implementation could be carried by dividing the overall area to twelve micro-zones as shown in the Figure 6.37. This division is made according to administrative borders, transportation lines, similar function or land-use type areas, similar urban pattern, and by separating large-scale establishments or industrial areas. Similar divisions could be made for all kinds of urban or coastal areas. A division according to neighborhood borders could be used for larger urban areas. That kind of implementation could be more beneficial in terms of giving contributions to the preparation of municipal development plans. However, as being a model introducing and methodology proposing one, and having mostly a theoretical base, this thesis study has preferred a comprehensive implementation by using generalized data.

Implementation results of CAAM show that ICR has some problems in terms of coastal risks. Likewise the region also has urban problems such as finding new settlement areas or protecting existing urban area and its inhabitants from urban risks. Meanwhile the region has the opportunity of new plan preparation and implementation. Forthcoming new plan should use the opportunity of benefiting the results of CAAM, which associates ICZM and UDRM contents by examining both ICZM and UDRM issues for the region at the same time, and should intend improving the quality of life in the region in terms of safety, security, health, accessibility, recreation, resource use and allocation, and in total, sustainable development.

On the other hand, implementation of CAAM in ICR shows that this process is beneficial in terms of making a comprehensive assessment of urban areas and coastal areas.

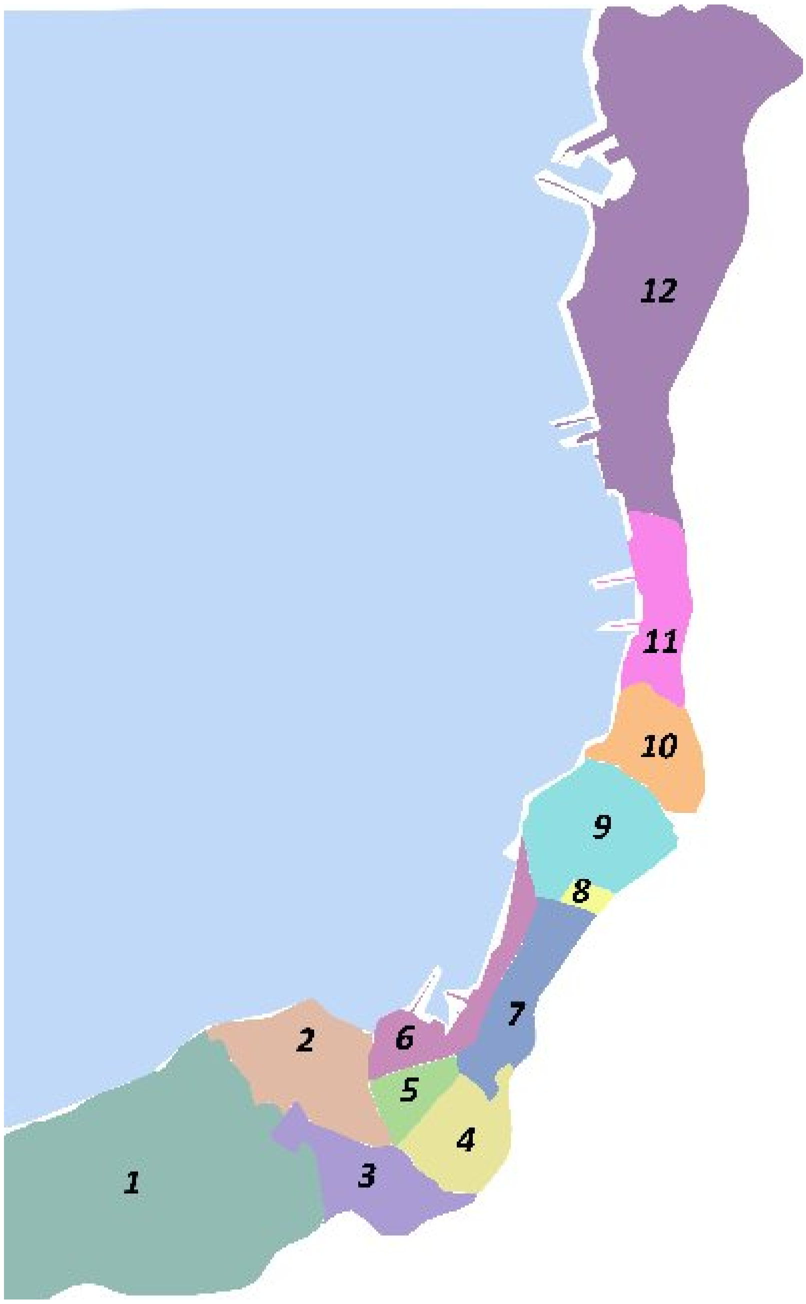

Figure 6.37: Division of the Case Area - ICR for Detailed Implementation of CAAM

CHAPTER 7

RESULTS AND RECOMMENDATIONS

Civilization starts with water. Being close to the sea and being the master of the sea have effected both periods and sizes of the civilizations through the history. That means, sea is a gate opening the doors of civilization to the rest of the world and to development. However, it is also a gate which receives the devastating impacts of the sea at the same time. The critical point in here is living by the sea does not always means living with the rules of the sea. The essential point of view is, living by the sea and living by ruling the sea in rationality.

The “urban” environment and the “coastal” environment overlap in coastal urban settlements. Rationality brings “management” capability, and human-beings could manage all types of situations by using rationality; science and technology. As all types of situations could be managed, “urban areas” and “coastal areas” could and should also be managed. Intensively discussed models of management plans, ICZM and UDRM, have been developed in order to use the rationality of human-being. ICZM is for coastal areas, and UDRM is for urban areas. In case of coastal urban areas there is the possibility of implementing both of them. However, rationalities of these plans are different from each other. As a result of this difference, they surely ignore some basic objectives, and basic principles of others operation. In other words, if these management plans are prepared and implemented independently and separately in the same coastal urban area, several problems occur due to the ignorance of one another. Trying to find solutions for these problems at the time they occurred lead to the loss of essential resources such as financial resources, natural resources, human resources, and especially the loss of time which is not tolerable especially at a time of emergency or a specific threat. Furthermore, since each model of management plan refers to a different administration, regulation or institution, such a situation may possibly disrupt the usual operation of existing institutional and administrative structure. When it lasts for a while, this disruption may result with a chaos at local, regional, and even at national levels. Accordingly, there is a need for a tool, which gives a place for the basics of both management plans and provides an associated operation of them, in order to prevent the emergence of these kinds of disruptions. **Coastal Area Assessment Model (CAAM)** set up and implemented in this study is a tool that provides the associated use and operation of ICZM and UDRM in coastal areas. From the point of view of its basic components, as many different conditions possible for a coastal area is considered, CAAM is useful and adoptable for any kind of coastal area, even if it has urban or natural characteristics.

On the other hand, CAAM does not make a vulnerability analysis like CVI. Since it gives place to more than one risk factor, CAAM makes a multi-risk analysis possible. CAAM prioritizes spatial development opportunities and constraints. In sum, CAAM is a guiding model based on coastal typologies and disaster risks.

7.1. Coastal Area Assessment Model and Planning Discipline

Implementing CAAM in ICR has just showed the associated operation possibility of ICZM and UDRM with their basics. CAAM process is used for both ICZM plans and UDRM plans of an area. Meanwhile, in terms of its implementation results, this associated use also operates in an advisory position for planning.

Coastal areas develop according to their characteristics and historical tendencies. All coast types could not be evaluated in same way or by same approaches in planning. Planning studies start with the evaluation of current situation and historical tendencies of the planning area. This is the analysis process. Natural wealth and resources, social, demographical, and economical structures, historical development and tendencies, and all types of relations and linkages (social, spatial, natural, historical… etc.) of the area with the rest part of its region, and the country as well, are analyzed; and possible constraints on the way of development in terms of these analysis topics are defined. At this point CAAM provides a comprehensive and useful analysis tool for planning. Since CAAM comprises and uses a coastal classification and highlights spatial characteristics of an area, it also provides different approaches to different coastal settlements. CAAM introduces and assesses the real development conditions and pressures on a coastal urban area; risk factors, urban characteristics, and other spatial features of any coastal area. This clarification determines the main sectors of an ICZM plan or UDRM plan. Additionally, results of this analysis also determine the main issues of the development plan. Integration of two separate models of management plans or approaches refer to broadened criteria for coastal area planning with the implementation of CAAM. Accordingly, as presenting a complete analysis technique; CAAM, and also ICZM and UDRM plans have a very useful advisory position for the planning process at all scales.

Planning discipline have a unique strategic comprehensive approach which leaves the fragmented approaches in today's global world where any little step or action affects the the operation or results of another. Therefore, results and effects of any decision should be analyzed in a detailed manner. All possible processes, risks, effects, direct and indirect impacts, and results should be taken into consideration. National spatial development policies should also be developed in the same way. Fragmented approaches cause the loss of the natural, social, spatial, economical, cultural, and operational resources and time. In this sense, CAAM strengthens the contributions and effects of ICZM and UDRM on different scales and levels of development plans by providing associated use of ICZM and UDRM, and prevents resource loss.

CAAM introduces a detailed viewpoint to the space, therefore causes the space to find more place in those kind of management plans by assessing and using local socio-spatial information efficiently. CAAM has also significant contributions to the planning process in terms of site selection and land utilization processes and analysis of the conflicting and compatible conditions among land-use types. CAAM provides determination of the most problematic parts of the urban area and makes preparation of management plans for some special areas within the borders of master plan easier. CAAM is also beneficial in calculating how resistant is a part (a neighbourhood for instance) of an urban area (existing or to be developed) in the case of unexpected or extraordinary conditions. Results of CAAM implementation in these areas show the ways of how the area could be supported by planning and new designs.

In addition to all of these contributions to planning, CAAM has technically and practically dynamic and improvable structure which allows inserting new query elements or weighting existing query elements to a certain scale depending on the needed information.

Components of CAAM process (coastal urban typologies, risk factors and risk matrices, and ICZM – UDRM evaluations) are also used to generalize coastal area planning principles according to varying coast types. Each component could be determined as the heading of "coastal code" for a specific coastal area.

In general, in this study;

- An inventory of coastal settlements of Turkey is prepared
- A coastal classification of Turkish Coasts is made, and
- A model that provides the associated use of two different kinds of management plans in the same are is set up.

However, this model is set up by using the basis of two different management plans with different theoretical backgrounds. These plans are relatively new in Turkey. These plans are also still the subjects of discussions in the international scientific area. The countries that adopt and use these plans also have their own practices and all are different from eachothers'. Taking these facts into consideration, setting up a complex and theoretical model suggests both some opportunities and difficulties in implementation. The most significant opportunity is the possibility of inserting all kinds of spatial components to the model. Meanwhile, this kind of deductive approach has difficulties especially in terms of finding sufficient and continuous data for the implementation area, and adopting the features of the implementation area to this kind of an idealised model. However, this difficulty also presents an opportunity in terms of defining further areas of the research. What is further needed in order to implement this kind of theoretical model is the issues of an additional research.

7.2. Implementation Conditions of Coastal Area Assessment Model in Turkey

This kind of a model which mostly based on theoretical basics of two models of management plans could be implemented in some specific conditions. Implementation of CAAM in Iskenderun Coastal Region is carried out by using generalized data for the region. However, as explained in the previous chapter, a full implementation could be provided by detailed data for each specific zone and larger areas should be divided into small zones which are divided according to generalized characteristics and features. The reason of that kind of implementation is ***the inaccessibility of sufficient data*** for smaller zones. This situation shows that full implementation requires a comprehensive and continuously recorded database which has data records of as old as possible. This requirement also reveals another requirement, database management. Database management requires specialized ***institutional structure*** that also has latest technologies on database management. Another deficiency about institutional structure is ***the lack of strict controlling and monitoring mechanism*** which is the most important part of this kind of management applications. Institutional structure; and accordingly database management, controlling and monitoring mechanisms, are all related with ***decision making system and responsible bodies***. All of these parts of institutional structure should be arranged by relevant laws or by-laws. In sum; administrative, institutional, and legal structures of planning should be rearranged in order to provide new spatial re-organization principles by implementing these kinds of special models of management plans.

7.3. Recommendations and New Directions for Further Studies

Implementation of CAAM process depends on first of all the existence of the bases of ICZM and UDRM approaches. As discussed in detail previously, these models of management plans are relatively new approaches in Turkey.

The authority of preparing the ICZM plans belongs to the Ministry of Public Works and Settlement. UDRM plans on the other hand are prepared by metropolitan area municipalities by using national or international aids and projects, within the borders of upper scale master plans. However, there is no legal document which forces the authorized administrations (ministries, municipalities,... etc.) to prepare these plans, or determines the methods and techniques of them. Today, the status of ICZM stays in advisory position for development plans. Likewise, UDRM plans are prepared for some metropolitan areas depending on the upper scale master plans.

Preparation and implementation process of ICZM and UDRM needs critical regulations on administrative, institutional, and legal structures; and these regulations have priorities. Following studies should be carried out on these issues. Administrative structure has a very complex and unclear situation today. Who has the authority, who makes these plans prepared, and who ratifies the plans are not clear. Moreover, these issues are not written in any law or legislation. 562 km-long continuous Coastal Highway of Black Sea is one of the negative results of the lack of national spatial development policy or strategy, and preparing and implementing those plans independently.

Models of ICZM and UDRM plans have been creating the agenda of international society recently. Accordingly, Ministry of Public Works and Settlement of Turkey also wants to set up the institutional and administrative structure about these issues. Although there is not sufficient legal structure of these models, The Ministry has made several ICZM projects prepared within last five years. These projects could be called as “a strategical view document.” These documents include responsible authorities and coordination system among the institutions and related parties, also draw out a road map which explains who does which works and orientates the spatial organization on the coast. The document could focus on one theme or several themes depending on the characteristics of the area. The Ministry transforms this document to a plan and approves. After the approval of the Ministry the document becomes a restrictive one. Meanwhile UDRM plans are on the agenda of both central and local governments for ten years. Similar to ICZM, UDRM plans also have spatial and sectoral dimensions, and these plans are used as strategic documents which defines who does which work in which time and duration, who provides financial resource, which work has how much cost, and who coordinates all of them. Generally local administrations are responsible for the preparation and implementation. However, current situation is problematic for both ICZM and UDRM plans in terms of coordination mechanisms, responsible authorities, data resources, financial resources, and qualified human resources. Additionally, a complex and conflicting situation exists in terms of plan levels and scales, approval of plans and authorized institutions.

The critical point in here is decisions made by central authority at national scale (such as decisions in national development plans) are out of local capacity and information most of the time. Central authority generally disregards or ignores the existing operations, capacity, significant characteristics of a planning area while making decisions on planning and implementation of an investment which has national or even international significance.
How the existing physical, social, and economic structure of the planning area will change due to the results of that investment decision is not considered most of the time. Dam projects in Artvin, Coastal Highway of Black Sea, nuclear plant project in Sinop, and nuclear plant project in Akkuyu are the examples of that disregarding and ignorance. The rights which are considered and are guaranteed by the constitution are demolished and existing legislations are disregarded by state. Moreover, not only national legislations but also international conventions (treaties, protocols, declarations) which our country also agrees on are also disregarded sometimes.

To summarize, discussions on implementing a new a new model like coastal area assessment model; it’s place in the national system, it’s institutional – political – legal – administrative base and structure are significant in terms of science and theoretical background, however it is meaningless in terms of actual dynamics and practical approaches. Even if all institutional – political – legal – administrative and bureaucratic structures are well operated, the most important and critical point of these subjects are political and social willpower, and consciousness’ and proficiencies of decision making mechanisms at the same time. Accordingly, a strong and well-coordinated institutional structure of decision making system supported by relevant legislations and controlling mechanisms are needed in the national planning system. From spatial and policy planning point of view the institutional system and its operation could be evaluated, even recommended as explained in Table 7.1.

In the table, sectoral themes and issues give inputs to spatial plans. These themes could also be special project areas. ICZM plans could be considered under the subject of

"Environment and Nature", where UDRM could be considered under the subject of "Contingency, Risks and Hazards"

Table 7.1: Spatial Planning System of Turkey (A summary and recommendation)

<table>
<tr><th>Central Authority about Planning (State Planning Organization – SPO) - Duties and Responsibilities</th><th>Levels</th><th>Tools – Institutions – Organizations</th><th>Strategies and Projects on Sectoral Themes and Issues</th></tr>
<tr><td rowspan="16">Definition of spatial strategy, policy, and plan

Generation and determination of standards

Supervision, Auditing, and Monitoring

Generation of secondary legislation

Preparation of Guides on planning and implementation

Preparation of programs on development of local capacities and programs on technical aids

Preparation of circulars and code of rules

Preparation of Financial Aid Programs</td><td rowspan="5">At National Level</td><td>National and Regional Spatial Development Strategy</td><td rowspan="16">Housing

Agriculture

Tourism

Industry

Energy

Transportation

Infrastructure

Conservation

Environment and Nature

Contingency, Risks and Hazards</td></tr>
<tr><td>Development Plan</td></tr>
<tr><td>Regional Development Committee</td></tr>
<tr><td>Expertise Commission of Spatial Planning</td></tr>
<tr><td>State Planning Organization - SPO, Council of Ministries, Turkish grand National Assembly</td></tr>
<tr><td rowspan="4">At Regional Level</td><td>Regional Spatial Development Plan (1/250.000 - 1/100.000)</td></tr>
<tr><td>Regional Development Strategy</td></tr>
<tr><td>Regional Planning Unit (SPO, Ministry of Public Works and Settlement, Governorships, Special Provincial Administration, Metropolitan Area Municipalities, Municipalities of Provinces and Districts</td></tr>
<tr><td>Regional Development Agency, State Planning Organization – Higher Planning Council</td></tr>
<tr><td rowspan="3">At Provincial Level</td><td>Spatial Plan of the Province (1/100.000 - 1/25.000)</td></tr>
<tr><td>Strategical Plan of the Province</td></tr>
<tr><td>Special Provincial Administration, Metropolitan Area Municipalities, Municipalities of Provinces and Districts</td></tr>
<tr><td rowspan="4">At Local Level</td><td>Spatial Plan of the Metropolitan Area (1/50.000 - 1/25.000 Metropolitan Municipalities)</td></tr>
<tr><td>Spatial Plan of the Province (1/25.000 - 1/5.000 Municipalities)</td></tr>
<tr><td>Development Plan and Implementation Plans (1/1.000 - 1/500 Municipalities)</td></tr>
<tr><td>Spatial Plan of Villages (1/1.000 - 1/500 Special provincial Administration, Special District Administration)</td></tr>
</table>

In conclusion, in this summarized system

- right and usable information could be obtained at least for some parts of the country,
- the conflict between ICZM and UDRM could be prevented, and
- local and national decisions could be orientated

with setting up and implementing CAAM. A number of changes and regulations should be made in the areas of finance, administration, institution, law in order to solve the problem of ***"conflict among the authorities"*** and ***"multi-headed structure."*** Implementation of CAAM provides at least the opportunity of channelizing the potentials and resources of the country to the right places till the regulations and changes are made.

Depending on the results and recommendations of this study, further studies could / should be carried on the subjects listed below:

- Development of ***National Coastal Areas Strategy and Policy***
- Studies on building up a detailed coastal inventory and digitalized national database
- Studies on database management
- Studies on institutional coordination mechanisms
- Researches on ecosystem and carrying capacities of coastal areas
- Studies on urban hazardous uses and locations in various cases
- Process design studies on special area management
- Studies on a ***spatial development law***

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Appendix A: Glossary

ABPRS	: ADNKS – Adrese Dayalı Nüfus Kayıt Sistemi
Achaean	: Klasik Yunan
Assyrias	: Asurlar
Avarage Relative Humidity	: Ortalama nisbi nem
Bulk Carrier	: Dökme Yük Taşıyıcı
Cilicians	: Kilikyalılar
Current System	: Akıntı sistemi
District	: İlçe
Dry Farming	: Kuru tarım
Easement	: İrtifak hakkı
Ecoist	: Çevreci
General Command of Mapping	: Harita Genel Komutanlığı
Gyre	: Girdap
Handling	: Elleçleme
Highway	: Karayolu
Hittites	: Hititler
House Cleaning	: Tasfiye
Limestone	: Kireçtaşı
Motorway	: Otoyol
Mudstone	: Çamurtaşı
Nautical Miles	: Deniz mili
Ore	: Maden filizi / cevheri
Phoenicians	: Fenikeliler
Province	: İl
Sand Dune	: Kumul
Sandstone	: Kumtaşı
Sanjak	: Sancak
Seleucid Empire	: Seleucus – Selevkoslar
Shaft	: Petrol kuyusu

Slack	: Kömür tozu, curuf
Town	: Belde
Wey	: Kuru yük

Appendix B: Last 50 Years' Worst Natural Disasters

Table B.1: List of Last 50 Years' Worst Natural Disasters

Date	Disaster Type	Location	Death	Notes
02/12/1959	Flood caused Collapse of Malpasset Dam	France	412	
10/01/1962	Huascaran Volcano	Peru	3,000	
09/10/1963	Vaiont Dam Flood	Italy	2,000	Landslide into the dam
00.00.1964	Easter Tsunami caused by Earthquake	Alaska - USA	120	
13/11/1970	Bhola Cyclone Tidal Wave	Ganges Delta - Bangladesh and East Pakistan	500,000	More than 100.000 missing
01/08/1971	Heavy Rain Flooding	Hanoi - North Vietnam	100,000	Red River Delta
05/08/1975	Yangtz River Flooding	China	85,000	More than 60 dams failed following a series of storms , causing a widespread flooding and femine
00.00.1976	Pacific Tsunami	Moro Bay - Philippines	5,000	
28/07/1976	Tang Shan Earthquake	Tang Shan - China	242,000	
01/08/1976	Flash Flood	Loveland, Colorado - USA	139	Route 34 in Big Thompson Canyon
13/11/1985	Nevado del Ruiz Volcano Eruption	Near Armero - Colombia	25,000	
00.00.1988	Armenian Earthquake	Armenia	30,000	
01/08/1988	Heavy Monsoon	Bangladesh	1,300	30 million are left homeless
20/06/1990	Iran Earthquake	Iran	50,000	
00.00.1991	Bangladesh Hurricane	Bangladesh	100,000	
15/07/1991	Mt. Pinatubo Volcano Eruption	Luzon Island - Philippines	800	
00.00.1995	Kobe Earthquake	Kobe - Japan	5,000	
00.00.1998	Tsunami	Papua New Guinea	2,300	
27/06/1998	Ceyhan Earthquake	Ceyhan, Adana - Turkey	145	15.000 injured
26/10/1998	Hurricane Mitch	Honduras and Nicaragua	11,000	2,5 million are left homeless
17/08/1999	Eastern Marmara Earthquake	Marmara Region - Turkey	25,000	Thousand are injured and lost their homes
01/07/1999	Torrential Downpours and Flooding	S.Korea, China, Japan, Philippines, Thailand	950	Millions are left homeless
12/11/1999	Düzce Earthquake	Düzce - Turkey	894	
01/02/2000	Southeastern African Flood	Mozambique, Zimbabwe, and Madagascar	700	280.000 left homeless
01/08/2000	Torrential Rains and Flash Flood	Northeastern India, Nothern Bangladesh, Southern Bhutan	300	More than 3 million left homeless

Table B.1 (continued): List of Last 50 Years' Worst Natural Disasters

Date	Disaster Type	Location	Death	Notes
01/09/2000	River Flood	Thailand, Cambodia, Vietnam	235	4,5 million are homeless
13/01/2001	Earthquake and Landslides	San Miguel - El Salvador	844	100.000 houses are destroyed
26/01/2001	Gujarat Earthquake	Bhuj - India	19,000	Magnitude 7.7 earthquake rocked the western Indian state of Gujarat, leaving 600.000 homeless.
13/02/2001	Earthquake and Landslides	San Miguel - El Salvador	276	1,2 million are homeless
06/07/2001	Typhoon Utor	Northern Philippines, Taiwan, and Southern China	160	Roads and bridges are destroyed
03/03/2002	Central Asia Earthquake	Uzbekistan, Tajikistan, Afghanistan, Pakistan, India, and Kazakhistan	100	
25/03/2002	Earthquake	Northeast Afghanistan	1,000	7000 families are homeless
01/06/2002	Torrential Rainfall	Central and Southeast China	750	Resulted with thousands of homeless
22/06/2002	Earthquake	Northwest Iran	220	60 villages are destroyed, resulted with thousands of homeless
01/08/2002	Monsoon Floods	China, India, Nepal, Bangladesh	2000	
24/02/2003	Xingjiang Earthquake	Xingjiang - China	260	More than 2000 are injured, thousands of homes and hundereds of other buildings are destroyed
01/04/2003	Flooding	Uganda, Kenya, Somali, and Ethiopia	150	
01/05/2003	Earthquake	Bingöl - Turkey	177	
17/05/2003	Floods and Landslides	Sri Lanka	300	More than 200 are missing and more than 150.000 are homeless
21/05/2003	Earthquake	Algeria	2,266	Thousands are injured
01/06/2003	Monsoon Floods	Jiangsu and Anhui Provinces - China	500	3,5 million are homeless
02/11/2003	Flash Floods	Bohonok - Indonesia	150	
26/12/2003	Bam Earthquake	Bam - Iran	40,000	Thousands are injured
24/02/2004	Morocco Earthquake	Northern Morocco	628	15.000 are homeless
18/05/2004	Torrential Rains, Floods, and Mudslide	Dominican Republic	3,000	

Table B.1 (continued): List of Last 50 Years' Worst Natural Disasters

Date	Disaster Type	Location	Death	Notes
01/06/2004	South Asia Monsoon Flooding	India, Nepal, Bangladesh	1,800	5 million are homeless
12/08/2004	Typhoon Rananim	Zhejiang Province - China	164	
18/09/2004	Tropical Storm Jeanne	Gonaives - Haiti	2,500	More than 1000 are missing
29/11/2004	Typhoon Winnie	Eastern Coast and Quezon Province - Philippines	500	
02/12/2004	Typhoon Nanmadol	Eastern Coast of Philippines	1,800	
26/12/2004	South Asian Earthquake and Tsunami	Sumatra - Indonesia	280,000	Thousands are missing, millions lost their homes
01/02/2005	Extreme Winter Weather	Afghanistan, India, Pakistan	1,400	
13/02/2005	Flooding	Pakistan	460	Thousands are missing
22/02/2005	Zarand Earthquake	Zarand - Iran	612	More than 400 are injured, lots of villages are destroyed
18/03/2005	Heavy Rain and Melting Snows	Afghanistan	200	Thousands are homeless
28/03/2005	Earthquake	Sumatra - Indonesia	1,313	
01/06/2005	Flooding	Southern China	536	
12/06/2005	Flash Flood	Northwest China	117	
10/07/2005	Hurricane Dennis	Florida, Haiti, Cuba, Jamaica	70	Thousands of homes are destroyed
26/07/2005	Heavy Rainfall	Mumbai - India	1,000	
01/08/2005	Hurricane Katrina	Louisiana and Mississippi - USA	1,800	
01/09/2005	Typhoon Damrey	Philippines, China, Thailand, Nepal	112	
01/09/2005	Hurricane Rita	Gulf Coasts, Louisiana, Texas - USA	119	
01/09/2005	Typhoo Talim and Flooding	China	129	
01/10/2005	Hurricane Stan	Central America	2,000	
08/10/2005	Earthquake	Kashmir - Pakistan	80,361	
04/01/2006	Mudslide	Cijeruk - Indonesia	200	A mudslide burried 200 homes
17/02/2006	Mudslide	Guinsaugon - Philippines	1,000	A mudslide caused by collapse of a mountain engulfed the town Guinsaugon, more than 3300 people left homeless
31/03/2006	Earthquake	Western Iran	70	40 villages are destroyed

Table B.1 (continued): List of Last 50 Years' Worst Natural Disasters

Date	Disaster Type	Location	Death	Notes
26/05/2006	Java Earthquake	Java - Indonesia	5,700	135.000 homes are destroyed
01/06/2006	Flooding	Southern China	340	Worst flooding in 30 years
01/07/2006	Flooding	Ethiopia	870	
14/07/2006	Tropical Storm Bilis and Flooding	Fujian, Guangdong, and Hunan Provinces - China	500	Millions are evacuated
15/07/2006	Severe Floods	North Korea	800	
17/07/2006	Java Earthquake and Tsunami	Java - Indonesia	730	Thousands are displaced from homes and hotels
01/08/2006	Flooding from Heavy Rain	India and Pakistan	300	
06/08/2006	Flash Floods	Dawa - Ethiopia	800	With many still missing
27/09/2006	Typhoon Xangsane and Flooding	Luzon Island - Philippines and Vietnam	178	
01/11/2006	Flash Floods	Southeast Turkey	32	
30/11/2006	Typhoon Durian and Mudslide	Philippines	500	
01/04/2007	Honiora Earthquake and Tsunami	Solomon Islands	34	Thousands left homeless
24/06/2007	Severe Storms	Karachi - Pakistan	226	
08/07/2007	Monsoon Rains and Flooding	West Bengal - India	660	
31.09.2007	Tropical Storm Neel and River Flooding	Caribbean	215	More than 70.000 homes are destroyed, 240.000 people are evacuated from low-lying areas
03/05/2008	Cyclone Nargis	Irrawaddy Delta and City of Yangon - Myanmar	78,000	Worst natural disaster since the tsunami in 2004
12/05/2008	Western China Earthquake	Sichuan, Gansu, and Yunnan Provinces - China	87,587	
17/06/2008	Flooding	Southern China	60	The worst flooding in 50 years, destroyed 5,4 million acresof crops, and caused landslides.
28/08/2008	Kosi River Flooding	Bihar - India	75	Flooding caused displacement of over 2 million more from their homes, at least a half million of people are left stranded
13/09/2008	Hurricane Ike	Southern USA		Serious damage on water, power, and sewer lines

Table B.1 (continued): List of Last 50 Years' Worst Natural Disasters

Date	Disaster Type	Location	Death	Notes
29/10/2008	Pakistan Earthquake	South-western Pakistan	170	6.4 Magnitude, 15.000 homes are destroyed
23/11/2008	Floods and Mudslides caused by Heavy Rain	Santa Catarina - Brazil	119	80.000 homes are destroyed
09/02/2009	Australian Wildfires	Australia	160	
06/04/2009	Central Italy Earthquake	Italy	200	1000 injured, 26 towns affected
10/08/2009	Morakot Typhoon	Taiwan	600	Mudslide buried schools
02/09/2009	Java Earthquake	Indonesia	60	7.1 Magnitude
09/09/2009	Ayamama Flooding	Istanbul, Turkey	30	
28/09/2009	Tropical Storm Ketsana	Manila, Philippines	90	Flood and rain
29/09/2009	Earthquake and Tsunami	Samoa and American Samoa	115	8.0 Magnitude
30/09/2009	Earthquake	Sumatra Island - Indonesia	1000	7.6 Magnitude Earthquake caused the collapse of buildings in city og Padang
09/11/2009	Storm	El Salvador	140	A small, low-pressure storm brought an enormous amount of rainfall that causes flooding and mudslides; 1500 homes are destroyed
12/01/2010	Earthquake	Port-au-Prince - Haiti	200,000	7.0 Magnitude
04/02/2010	Earthquake	Chile	750	8.8 Magnitude
14/04/2010	Earthquake	Qinghai - China	500	7.1 Magnitude
14/04/2010	Volcanic Explosion	Eyjafjallajokull - Iceland		
20/04/2010	Collapse of the Deepwater Horizon Oi Rig	Gulf of Mexico - Louisiana	11	An environmental disaster
30/07/2010	Flood	Pakistan	1600	14 million have displaced

Appendix C: Deadliest Earthquakes (more than 50.000) in History

Table C.1: List of Deadliest Earthquakes in History

Date	Location	Deaths	Magnitude
23.01.1556	Shansi - China	830,000	~8
27/07/1976	Tangshan - China	255,000	7.5
09.08.1138	Aleppo - Syria	230,000	n.a.
26/12/2004	Off west coast of northern Sumatra	280,000	9.0
22.12.856	Damghan - Iran	200,000	n.a.
22/05/1927	Near Xining, Tsinghai - China	200,000	7.9
12/01/2010	Port-au-Prince Earthquake - Haiti	200,000	7.0
16/12/1920	Gansu - China	200,000	7.8
23/03/893	Ardabil - Iran	150,000	n.a.
01/09/1923	Kwanto - Japan	143,000	7.9
05/10/1948	Ashgabat, Turkmenistan - USSR	110,000	7.3
28/12/1908	Messina - Italy	100,000	7.2
01.09.1290	Chihli - China	100,000	n.a.
12/05/2008	Eastern Sichuan, China	87,587	7.9
08/10/2005	Pakistan	80,361	7.6
01.11.1667	Shemakha - Caucasia	80,000	n.a.
18.11.1727	Tabriz - Iran	77,000	n.a.
25/12/1932	Gansu - China	70,000	7.6
01.11.1755	Lisbon - Portugal	70,000	8.7
31/05/1970	Peru	66,000	7.9
30/05/1935	Quetta - Pakistan	60,000	7.5
11.01.1693	Sicily - Italy	60,000	n.a.
1268	Silicia - Asia Minor	60,000	n.a.
June 20, 1990	Iran	50,000	7.7
04.02.1783	Calabria - Italy	50,000	n.a.

Appendix D: Deadliest Tsunamis in History

Table D.1: List of Deadliest Tsunamis in History

Fatalities	Year	Magnitude	Principal Areas
280,000	2004	9.0	Indian Ocean
100,000	1410 b.c.		Crete-Santorini, Ancient Greece
60,000	1755	8.5	Portugal, Morocco
40,000	1782	7.0	South China Sea
36,500	1883		Krakatau, Indonesia
30,000	1707	8.4	Tokaido-Nankaido, Japan
26,360	1896	7.6	Sanriku, Japan
25,674	1868	8.5	Northern Chile
15,030	1792	6.4	Kyushu Island, Japan
13,486	1771	7.4	Ryukyu Trench, Japan

Appendix E: Previously Made Coastal Classifications

Table E.1: Finkl's Classification (2004)

I. Lithologically Controlled Morphostructures (Most "hard rock" coasts; produced by automorphism) [Scales: Myriametric - local to global coverage, modifiers of coasts on any scale]	**A. Lithic Criteria for Hard Rock (Automorphic) Coasts** [Primary, basic, self-derived coasts formed by magmatic, geotectonic, or subaerial processes; includes most coasts that are composed of terrestrial morphostructures with little or no modification by marine activity]	**1.** Petrology / Structure of Cristalline and Indurated Materials	**a.** Massive (e.g. granite, basalt)
			b. Cemented (e.g. coral limestone, eolianite, beach rock)
			c. Banded (e.g. Flysch, turbidite)
		2. Competance (Resistance) [Based on Exogenic Mechanical Factors]	**a.** Abrasion (Crystallinity)
			b. Percussion (Friability)
			c. Thermal Processes
			d. Cryoclastic Susceptibility (frost)
		3. Environmental Determinants	**a.** Igneous (Fisuure or Flow) Eruptions (Endogene)
			b. Biogenic Constructors (coral, coralgal reefs; Exogene)
		4. Geodynamic Determinants for Cliffed Coasts	**a.** Lithospheric Modulation (geotectonic, isostatic movement)
			b. Oceanographic Modulation (eustatic, steric, tides, tsunamis, fluvial inputs)
	B. Lithic Criteria for Soft Rock (Allomorphic) Coasts (Most "soft rock" coasts; produced by allomorphism) [Created by marine processes of erosion and deposition; relief forms and types comprised by uncemented sedimentary materials]	**1.** Petrology / Structure of Sedimentary Materials	**a.** Gravel and Boulders (e.g. steep beaches)
			b. Sand and Silt (e.g. moderate slope beaches, littoral dunes)
			c. Mud (e.g. tidal flats, sealine marsh)
		2. Competance (Resistance) [Based on Endogenic Physico-Chemical Factors]	**a.** Diagenesis and Lithification
			b. Water Saturation (mud; flowage potential)
			c. Compaction (pore spaces)
		3. Environmental Determinants	**a.** Igneous (Cone or Ejecta) Eruptions (ash/cinders, clastics; Endogene)
			b. Sedimentological Input (marine, fluvial, eolian, biogenic; Exogene)

Table E.1 (continued): Finkl's Classification (2004)

II. Chronometrically Determined Morphostructures	**A. Rates of Erosion versus Accumulation**	**1.** Erodability (*cf* IA2, B2)	
		2. Preservation Potential	
	B. Rates of Coastal Retreat versus Progradation	**1.** Ephemeral Events	
		2. Controls of Longevity	
	C. Antiquity of Littoral Landforms (Neomorphs versus Paleomorphs)	**1.** Hypsometry (Paleogeography over Phanerozoic time: high/loe envelope constraints)	**a.** Panthalassic (e.g. mid Cretaceous)
			b. Intermodal (e.g. Holocene)
			c. Pantelurric (e.g. Triassic)
		2. Eustatic Sequence Orders (based on Vail / Exxon system)	**a.** Protollitoral (< 100 years) (Protomorphostructural units)
			b.Neolittoral (~ 1000 years) (Neomorphostructural units)
			c. Eolittoral (~ 10000 years) (Eomorphostructural units)
			d. Pliolittoral (~ 100000 years) (Pliomorphostructural units)
			e. Meiolittoral (~1 million yeras) (Meiomorphostructural units)
			f. Paleolittoral (> 1 million yeras) (Paleomorphostructural units)
		3. Paleogeography of Global Shorelines	**a.** Neomorphogenesis (e.g. newly created volcanic material)
			b. Paleomorphogenesis (e.g. ancient cristalline rocks, exposed by structural or eustatic processes)

Table E.1 (continued): Finkl's Classification (2004)

<table>
<tr><td rowspan="15">III. Geodynamic - Climatomorphogenic Process Zones [Myriametric scales for regional and continental coverage]</td><td rowspan="6">A. Geodynamic Provinces (Plate Tectonics) (Broad differences in tectonic style, form and outline of rock coasts) [Note: Convergent, divergent, translation, island are - types after Emery & Uchupi (1984); epicontinental, mobile belt, quasicratonic, volcanic island types after Fairbridge (1968)]</td><td rowspan="4">1. Divergent (Passive Continental Margins (Atlantic Type Coast) [Transverse or discordant coasts that truncate the tectonic grain of the hinterland; truncated peneplains, Precambrian to Cenozoic] [Type Sites: New Foundland, Brittany, Ireland, NW Spain]</td><td>a. Juvenile (or rising) Coasts</td></tr>
<tr><td>b. Semi-stable (or neutral) Coasts</td></tr>
<tr><td>c. Oscillatory Coasts (block-faulted coasts e.g. Rio de Janerio to Recife, Brazil)</td></tr>
<tr><td>d. Mature or Subsiding Coasts</td></tr>
<tr><td rowspan="2">2. Convergent (Active) Continental Margins (Pacific Type Coast)</td><td>a. Cordilleran Subtype (Associated with subdiction zones and deep sea trenches; California Subtype, western sides of North and South America)</td></tr>
<tr><td>b. Dalmatian Subtype [Turkey, partially drowned basins (Gregory,1920)]</td></tr>
<tr><td rowspan="9">B. Climatomorphogenic Provinces</td><td colspan="2">1. Humid Tropical (deep chemical weathering, extreme fluvial activity, continuous flux of sediments, especially 1:1-type clays, to coast)</td></tr>
<tr><td colspan="2">2. Tropical Wet-Dry (episodic fluvial activity, sheet floods, discontinuous supply of silisiclastic sediments to coast)</td></tr>
<tr><td colspan="2">3. Savanna (episodic fluvial activity, sheet wash, etchplanation)</td></tr>
<tr><td colspan="2">4. Tropical / Subtropical Desert (eolian activity, episodic floods)</td></tr>
<tr><td colspan="2">5. Humid Subtropical (monsonal areas; periodic heavy flux of sediment to the coast)</td></tr>
<tr><td colspan="2">6. Humid Mesothermal (extensive but slow valley formation; 2:1-type clays in alluvium)</td></tr>
<tr><td colspan="2">7. Humid Microthermal (taiga zone with valley formation, permafrost, periglacial activity, thermokarst; feldspars and 2:1-type clays reach the coast)</td></tr>
<tr><td colspan="2">8. Polar / Subpolar (tundra, ice rafting and frost debris; seasonal sediment flux to coast during spring thaw)</td></tr>
<tr><td colspan="2">9. Glaciated, Nivation (ice, snow-related geomorphic processes</td></tr>
</table>

Table E.1 (continued): Finkl's Classification (2004)

IV. Relief Types (Morphoregions) (Major Regional Morphostructure, Morphosculpture Complexes; from a few tens to a few hundreds of km; regional units comprising distinctive & homogeneous assemblages of forms characterized by similar morphology and genesis; synoptic units) [Hectometric to kilometric and larger for regional, subregional coverage]	**A. Mountains (Hills)**	**1.** Lithologic Dominance [Type Site: Do]	
		2. Structural Dominance [Type Site: Do]	
	B. Plainlands	**1.** Plateaus (Truncated to form coastal cliffs > MSL)	**a.** Limestone Morphotype [Dover, U.K.]
			b. Weathered Morphotype [Charles Point near Darwin, NT (Hays, 1967)]
			c. Volcanic Rock Morphotype [Giants Causeway (Steers, 1962) Easter Island (Paskoff, 1978)]
		2. Coastal Plains (~ MSL)	**a.** Arctic Morphotype [Alaska-Canadian Beaufort Shelf (Hill *et al*., 1994)]
			b. Mid-Latitude Morphotype [U.S. Atlantic Coastal Plain]
			c. Tropical Morphotype [Type Site: Do]
		3. Submerged Plains (< MSL) [Type Sites: Do]	
	C. Valleys	**1.** Glacial (Ice-carved)	**a.** Rock-cut Morphotype [Fjord, fjard, sea lochs - Norway, Sweeden]
			b. Sedimentary (infilled) Morphotype; [Sandur coast, SE Iceland (Forbes and Syvitski, 1994)]
		2. Fluvial & Alluvial (Funnel-shaped sea inlets formed by drowned river valleys; rias, voes, abers)	**a.** Chesapeake Bay Morphotype [Incised valley or ria (Evans and Prego, 2003)]
			b. Barrier-fronted Morphotype [Type Site: Albemarle Sound, USA]
			c. Boreal (Arctic, seasonal) Morphotype [Mackenzie, Lena]
		3. Submarine (Complex genesis; gravity slides, turbidity currents)	**a.** La Jolla Morphotype - Scripps, Canyon, La Jolla, California (Shepard, 1973)
			b. Rhone Morphotype (O'Connel *et al*., 1995)
	D. Continental Freeboard & Relief Roughness	**1.** Elevation of hinterland summit within 5 km of coast	
		2. Slope (MSL to summit)	
		3. Roughness (D= 2.0 v. smooth, D= 3.0 v. rough)	

Table E.1 (continued): Finkl's Classification (2004)

V. Morphogenetic Relief Features (Macromorphostructures and Mesomorphostructures and their elements;a few tens of km) [Decametric to hectometric scales for subregional to local coverage; range in area from 100s m2 to 100s km2; concrete units]	A. Erosional (destructional) Process-Forms	Morphodynamic Process **1.** Hydromechanical (Wave-worn benches, including differential erosion of variegated lithology, hard & soft bands, and prior-weathering of joints in massive lithology such as granite & basalt)	
		Morphodynamic Process **2.** Mechanical (Sea-ice, "glacial", seasonal freeze-up, grounding of ice flows & bergs; frozen spray; strandflat formation)	
		Morphodynamic Process **3.** Chemical and Biological (Water-level weathering & notch cutting of calcareous rocks including differential erosion of polygenetic calcarenties by boring algae, gastropods, boring calms, echinoids, crabs, fish, *etc*.)	
		Morphometry (Shape and orientation of landforms, relative to the present coastline) **1.** Linear Shapes (due to leimorphogenesis: from Gr. *leois*, connotative of smooth or straight; coastal planforms that are broadly smooth or straight)	**a.** Shore Parallel (Parabathic) Morphostructures
			b. Transverse (Diabathic) Morphostructure
		Morphometry (Shape and orientation of landforms, relative to the present coastline) **2.** Curvilinear (due to scoliomorphogenesis: from Gr. *skolios*, connotative of curved, wavy, or crooked; crooked; coastal planforms that are uniformly curved or wavy)	**a.** Shore Parallel (Parabathic) Morphostructures
			b. Transverse (Diabathic) Morphostructures
	B. Depositional (constructional) Process-Forms	Morphodynamic Process **1.** Hydromechanical (Wave-built, current-built, tide-built)	
		Morphodynamic Process **2.** Mechanical (Ice-push)	
		Morphodynamic Process **3.** Biogenic (Coral, calcareous algae, mangrove)	
		Morphodynamic Process **4.** Anthropogenic (Archaelogical midden hills & ridges)	
		Morphometry (Shape and orientation of landforms, relative to past/present coastline) **1.** Linear Shapes (due to leimorphogenesis)	**a.** Shore Parallel (Parabathic) Morphostructures
			b. Transverse (Diabathic) Morphostructures
		Morphometry (Shape and orientation of landforms, relative to past/present coastline) **2.** Curvillinear Shapes (due to scoliomorphogenesis) Morphostructures	**a.** Shore Parallel (Parabathic) Morphostructures
			b. Transverse (Diabathic) Morphostructures

Table E.1 (continued): Finkl's Classification (2004)

V. Morphogenetic Relief Features (Macromorphostructures and Mesomorphostructures and their elements;a few tens of km) [Decametric to hectometric scales for subregional to local coverage; range in area from 100s m2 to 100s km2; concrete units]	**C. Polygenetic (complex) Forms (*e.g.* drowned submerged landscape and seascape features)**	**1.** Ingressional (Submerged) Relict Forms [Initial topography of continental shelf and landward portion of coastal zone]	**a.** Karst Landscapes (blue hole doline, poljes, caves)
			b. Glacial Landscapes (erosional and depositional terraines)
			c. Fluvial Landscapes (stream channels, incised valleys)
			d. Eolian Landscapes (submerged dunes on the Campeche Shelf, Logan *et al.*, 1969)
			e. Alluvial Landscapes
			f. Coastal Seascapes
		2. Egressional (Emerged) Relict Forms [Emerged, elevated landscape and seascape features]	**a.** Barrier Shorelines (incl. Paraglacial & non-paraglacial barrier coasts, barrier islands, mainland-attached barriers, perched barriers, barrier island facies, lagoon-salt marsh facies) [Central and Southern US Atlantic Coastal Plain: Hails and Hoyt, 1969; Davis, 1994; Glaeser, 1978; FitzGerald and Heteren, 1999; Pilkey, 2003]
			b. Beach / beachridge [Boxgrove, Sussex Coastal Plain, UK; Carnlaugh Coastal Peat and Raised Beach Ridges, County Antrim, Northern Ireland]
			c. Cliffs
			d. Coral Reef
			e. Marine Planation Surfaces (incl. terraces) (Type sites: N&W Britain: Hollingworth, 1938; S. California: Shepard and Wanless, 1971)
			f. Seabed Features (Uplifted marine terraces: Shelmann and Radtke, 2003)
			g. Sea Stacks (kerkurs)

Table E.1 (continued): Finkl's Classification (2004)

VI. Relief Elements (RE) and Genetically Homogeneous Surfaces (GHS) (Units) [Metric to decametric scales for local area coverage ; smallest taxonomic units of some tenths of m2 up to some km2]	**A. Elements**	**1.** Solution Pits (Limestone corrosion morphotypes)
		2. Pinnacles (Limestone corrosion morphotype)
	B. Miniforms	**1.** Tidal Pools (mediolittoral rock pools: Molinier and Picard, 1959)
		2. Honeycomb Weathering Fields
		3. Macro-atoll (Contrabandiers, near Rabat, Morocco; Russell, 1967)
		4. Algal Rims (Palmas Atlas, Puerto Rico; Russell, 1967)
	C. Microforms	**1.** Rillen and Karren
		2. Tafoni, Lapies

Appendix F: Inventory of Turkish Coastal Settlements

Table F.1: Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
A. Kalamış	Village	Şarköy - Tekirdağ	Marmara	370	218
A. Yapıcı	Village	Erdek - Balıkesir	Marmara	374	314
Abana	District	Kastamonu	Black Sea	3590	2947
AdaKöy	Village	Marmaris - Muğla	Aegean	418	2469
Adalar	District	Istanbul	Marmara	17760	14341
Adalı	Village	Karataş - Adana	Mediterranean	741	722
Adatepe	Village	Lapseki - Çanakkale	Marmara	1181	1156
Ağaçlı	Village	Eyüp - Istanbul	Black Sea	640	472
Ağaçlı	Village	Bodrum - Muğla	Aegean	ND	
Ağva	Town	Şile - Istanbul	Black Sea	3023	0
Ahmetbeyli	Village	Menderes - Izmir	Aegean	1702	
Akarca	Village	Iskenderun - Hatay	Mediterranean	1133	962
Akbayır	Village	Cide - Kastamonu	Black Sea	226	209
Akbük	Town	Didim - Aydın	Aegean	2997	3841
Akçaabat	District	Trabzon	Black Sea	39102	37500
Akçabeyli	Village	Kandıra - Kocaeli	Black Sea	417	403
Akçakale	Town	Akçaabat - Trabzon	Black Sea	2921	2683
Akçakoca	District	Düzce	Black Sea	25560	23378
Akçapınar	Village	Ula - Muğla	Aegean	516	563
Akçay	Village	Terme - Samsun	Black Sea	989	923
Akçay	Town	Edremit - Balıkesir	Aegean	9039	10112
Akgüney	Village	Gerze - Sinop	Black Sea	141	122
Akkaya	Village	Akçakoca - Düzce	Black Sea	493	603
Akkonak	Village	Amasra - Bartın	Black Sea	168	137
AkKöy	Village	Didim - Aydın	Aegean	1233	1076
Akpınar	Village	Eyüp - Istanbul	Black Sea	2260	1205
Aksaz	Village	Biga - Çanakkale	Marmara	414	535
Aksu	District	Antalya	Mediterranean	0	43660
Akyaka	Town	Ula - Muğla	Aegean	2193	2612
Akyarlar	Village	Bodrum - Muğla	Aegean	1457	2590
Alacalı	Village	Şile - Istanbul	Black Sea	396	431
Alaçatı	Town	Çeşme - Izmir	Aegean	8401	8952
Alanya	District	Antalya	Mediterranean	88346	94316
Alaplı	District	Zonguldak	Black Sea	18487	18194
Alatepe	Village	Milas - Muğla	Aegean	362	378
Alayazı	Village	Cide - Kastamonu	Black Sea	154	100
Aliağa	District	Izmir	Aegean	37537	51108
AliKöy	Village	Ayancık - Sinop	Black Sea	ND	268
Alınca	Village	Perşembe - Ordu	Black Sea	524	562

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Altınoluk	Town	Edremit - Balıkesir	Aegean	10437	13800
Altınova	Town	Ayvalık - Balıkesir	Aegean	10791	10799
Altıntaş	Village	Mudanya - Bursa	Marmara	1500	419
Amasra	District	Bartın	Black Sea	6335	6505
Ambarseki	Village	Karaburun - Izmir	Aegean	236	211
Anatoliafeneri	Village	Beykoz - Istanbul	The Bosphorus - Anatolia	571	640
Anamur	District	İçel	Mediterranean	49948	34227
Anıtlı	Village	Anamur - İçel	Mediterranean	987	824
Antalya - Centre	Province	Antalya - Centre	Mediterranean	714 129	
Araklı	District	Trabzon	Black Sea	22506	21541
Ardeşen	District	Rize	Black Sea	45392	27330
Arhavi	District	Artvin	Black Sea	14079	15362
Armutlu	District	Yalova	Marmara	4221	5223
Arpaçbahşiş	Town	Erdemli - İçel	Mediterranean	7466	6068
Arpagedik	Village	Iskenderun - Hatay	Mediterranean	769	807
Arsin	District	Trabzon	Black Sea	13038	10395
Arsuz	Town	Iskenderun - Hatay	Mediterranean	2931	2238
Artun	Village	Gömeç - Balıkesir	Aegean	ND	
Aşağıkepirce	Village	Iskenderun - Hatay	Mediterranean	1075	900
Asmalı	Village	Marmara - Balıkesir	Marmara Adası	295	118
Atakent	Town	Centre - Samsun	Black Sea	5064	0
Atakent	Town	Silifke - İçel	Mediterranean	14553	6099
Atakum	District	Samsun - Centre	Black Sea	0	105764
Avcılar	Village	Edremit - Balıkesir	Aegean	1425	2019
Avcılar	District	Istanbul	Marmara	233749	348635
Avsallar	Town	Alanya - Antalya	Mediterranean	8433	8515
Ayancık	District	Sinop	Black Sea	10919	10930
Aydınbahçe	Village	Yayladağı - Hatay	Mediterranean	785	429
Aydıncık	District	İçel	Mediterranean	7941	8004
Aydınlar	Village	Centre - Giresun	Black Sea	382	
Ayvalık	District	Balıkesir	Aegean	31986	35986
Azganlık	Town	Iskenderun - Hatay	Mediterranean	3140	3023
Babakale	Village	Ayvacık - Çanakkale	Aegean	534	471
Bademli	Village	Dikili - Izmir	Aegean	1508	1033
Bağırkanlı	Village	Kandıra - Kocaeli	Black Sea	853	833
BahçeKöy	Town	Karataş - Adana	Mediterranean	2612	2070
Bahçeli	Village	Ayancık - Sinop	Black Sea	113	98
BakırKöy	District	Istanbul	Marmara	208389	218352
Balçova	District	Izmir	Aegean	66877	77915

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Balıklı	Village	Erdek - Balıkesir	Paşa Limanı Adası	69	39
Balıklıova	Village	Urla - Izmir	Aegean	1252	877
Ballıkaya	Village	Karacabey - Bursa	Marmara	151	104
Ballıpınar	Village	Erdek - Balıkesir	Marmara	510	477
Bandırma	District	Balıkesir	Marmara	97419	113385
Barbaros	Town	Centre - Tekirdağ	Marmara	4387	5051
BatıKöy	Village	Didim - Aydın	Aegean	246	224
Bayındır	Village	Kaş - Antalya	Mediterranean	626	727
Bayramdere	Village	Karacabey - Bursa	Marmara	3365	1375
Beğendik	Village	Demirköy - Kırklareli	Black Sea	410	281
Behram	Village	Ayvacık - Çanakkale	Aegean	686	601
Bekbele	Town	Iskenderun - Hatay	Mediterranean	5469	7329
Beldibi	Town	Kemer - Antalya	Mediterranean	9718	
Belek	Town	Serik - Antalya	Mediterranean	11139	6125
Belyaka	Village	Doğanyurt - Kastamonu	Black Sea	141	155
Beşikdüzü	District	Trabzon	Black Sea	29766	11725
Beşiktaş	District	Istanbul	The Bosphorus - Europe	190813	185054
Beyhanlı	Village	Akçakoca - Düzce	Black Sea	222	234
Beykonak	Town	Kumluca - Antalya	Mediterranean	8922	6682
Beykoz	District	Istanbul	The Bosphorus - Anatolia	172291	220008
Beymelek	Town	Demre - Antalya	Mediterranean	3662	3832
Beyoğlu	District	Istanbul	The Bosphorus - Europe	231900	244516
Bodrum	District	Muğla	Aegean	23698	31590
The Bosphorusiçi	Village	Milas - Muğla	Aegean	810	1076
The Bosphoruskent	Town	Serik - Antalya	Mediterranean	2191	2797
Bolaman	Town	Fatsa - Ordu	Black Sea	10709	5641
Bornova	District	Izmir	Aegean	391128	402453
Bostancılı	Village	Centre - Sinop	Black Sea	926	890
Bozburun	Town	Marmaris - Muğla	Aegean	1632	2121
Bozcaada	District	Çanakkale	Aegean	2500	2496
Bozdoğan	Village	Anamur - İçel	Mediterranean	2114	1913
BozKöy	Village	Karaburun - Izmir	Aegean	168	111
Boztepe	Village	Manavgat - Antalya	Mediterranean	554	564
Boztepe	Village	Centre - Ordu	Black Sea	727	673
Bozyazı	District	İçel	Mediterranean	26314	15615
Bulancak	District	Giresun	Black Sea	32182	37514
Burhanlı	Village	Gelibolu - Çanakkale	Marmara	294	287

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Bürücek	Village	Derepazarı - Rize	Black Sea	253	283
Burunucu	Village	Bulancak - Giresun	Black Sea	564	611
Büyükçekmece	District	Istanbul	Marmara	384089	171222
Büyükdere	Village	Iskenderun - Hatay	Mediterranean	923	1037
Büyükkumla	Village	Gemlik - Bursa	Marmara	829	736
Caferiye	Village	Kocaeli - Sakarya	Black Sea	361	410
Çağlalık	Village	Dörtyol - Hatay	Mediterranean	1566	2003
Çakıllı	Village	Erdek - Balıkesir	Marmara	ND	
Çakmaklı	Village	Aliağa - Izmir	Aegean	915	765
Çakraz (Çakrazboz)	Village	Amasra - Bartın	Black Sea	245	203
Çalca	Village	Ereğli - Zonguldak	Black Sea	ND	
Çalışkanlar	Village	Bandırma - Balıkesir	Marmara	294	
Çaltı	Village	Çarşamba - Samsun	Black Sea	1218	993
Çamburnu	Town	Sürmene - Trabzon	Black Sea	3489	2031
Camitepe	Village	Karasu - Sakarya	Black Sea	118	120
ÇamlıKöy	Village	Marmaris - Muğla	Aegean	806	680
Çamyuva	Town	Kemer - Antalya	Mediterranean	7480	4646
Çanakkale - Centre	Province	Çanakkale - Centre	Marmara	75 810	96588
Çandarlı	Town	Dikili - Izmir	Aegean	5032	4858
Çandır	Village	Köyceğiz - Muğla	Mediterranean	449	411
Canik	District	Samsun - Centre	Black Sea	0	69363
Çardak	Town	Lapseki - Çanakkale	Marmara	3267	3250
Çarşıbaşı	District	Trabzon	Black Sea	8532	7332
Çatalağzı	Town	Centre - Zonguldak	Black Sea	9582	8919
Çatalçam	Town	Centre - Samsun	Black Sea	3225	0
Çatalzeytin	District	Kastamonu	Black Sea	3452	2572
ÇavuşKöy	Village	Manavgat - Antalya	Mediterranean	848	868
ÇavuşKöy	Town	Kumluca - Antalya	Mediterranean	2556	2521
Çavuşlu	Town	Görele - Giresun	Black Sea	4894	2307
Çayağzı	Village	Erdek - Balıkesir	Marmara	597	525
Çayağzı	Village	Beykoz - Istanbul	Black Sea	839	
Çayeli	District	Rize	Black Sea	22590	22613
Cebeci	Village	Kandıra - Kocaeli	Black Sea	2082	270
Celaliye - Kamiloba	Town	Silivri - Istanbul	Marmara	6747	6747
Çeltikçi	Village	Erdek - Balıkesir	Marmara	175	235
Çenger	Village	Manavgat - Antalya	Mediterranean	781	866
Çerli	Village	Perşembe - Ordu	Black Sea	894	1006
Çeşme	District	Izmir	Aegean	25257	20455
Çeşmeli	Town	Erdemli - İçel	Mediterranean	6434	4285
Cevizdere	Village	Ünye - Ordu	Black Sea	530	638

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Çevreli	Village	Demre - Antalya	Mediterranean	486	657
Cide	District	Kastamonu	Black Sea	5834	5608
ÇiftlikKöy	District	Yalova	Marmara	14631	17052
Çiftlikköy	Town	Centre - İçel	Mediterranean	5590	
Çiğli	District	Izmir	Aegean	106740	154397
Çınarcık	District	Yalova	Marmara	8953	11080
Çınarlı	Village	Şarköy - Tekirdağ	Marmara	900	646
Çınarlı	Village	Marmara - Balıkesir	Marmara	631	
Curunlu	Village	Kurucaşile - Bartın	Black Sea	140	104
Dağlar	Village	Ereğli - Zonguldak	Black Sea	377	470
Dalyan	Village	Ezine - Çanakkale	Aegean	298	309
Dalyan	Town	Ortaca- Muğla	Mediterranean	4848	4619
Dalyan	Village	Karataş - Adana	Mediterranean	ND	
Danişment	Village	Keşan - Edirne	Aegean	131	126
Darıca	Town	Gebze - Kocaeli	Marmara	85818	
Datça	District	Muğla	Aegean	8108	9958
Davultepe	Town	Centre - İçel	Mediterranean	5981	
Davutlar	Town	Kuşadası - Aydın	Aegean	6620	9530
Değirmenağzı	Village	Keşap - Giresun	Black Sea	128	187
Değirmencik	Village	Biga - Çanakkale	Marmara	557	476
Değirmendere	Town	Gölcük - Kocaeli	Marmara	22086	
Demircili	Village	Urla - Çeşme	Aegean	153	203
Demirören	Village	Anamur - İçel	Mediterranean	827	858
Demirtaş	Village	Yumurtalık - Adana	Mediterranean	730	692
Demirtaş	Town	Alanya - Antalya	Mediterranean	3864	3030
Demirtepe	Village	Gelibolu - Çanakkale	Marmara	358	190
Demre (Kale)	District	Antalya	Mediterranean	13900	15574
Denizciler	Town	Iskenderun - Hatay	Mediterranean	17495	15804
Denizgören	Village	Yayladağı - Hatay	Mediterranean	134	148
Denizkent	Village	Manavgat - Antalya	Mediterranean	370	321
Denizkent	Village	Gönen - Balıkesir	Marmara	ND	
Denizkonak	Village	Cide - Kastamonu	Black Sea	114	81
DenizKöy	Village	Dikili - Izmir	Aegean	265	290
DenizKöy	Village	Karasu - Sakarya	Black Sea	433	340
DenizKöy	Village	Didim - Aydın	Aegean	915	996
Denizler (Kç. Taşlık)	Village	Çarşamba - Samsun	Black Sea	566	492
Denizli	Village	Beşikdüzü - Trabzon	Black Sea	216	199
Denizyaka	Village	Manavgat - Antalya	Mediterranean	596	525
DereKöy	Village	Bodrum - Muğla	Aegean	725	874
DereKöy	Town	Ondokuzmayıs - Samsun	Black Sea	ND	3145
Derepazarı	District	Rize	Black Sea	6172	4186
Derince	District	Kocaeli	Marmara	93997	119704

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Deveciuşağı	Village	Yumurtalık - Adana	Mediterranean	905	738
Didim	District	Aydın	Aegean	20797	41246
Dikili	District	Izmir	Aegean	30115	16269
Doğanbey	Town	Seferihisar - Izmir	Aegean	6160	0
Doğancı	Village	Tirebolu - Giresun	Black Sea	580	556
Doğancılı	Village	Şile - Istanbul	Black Sea	537	579
Doğanlar	Village	Erdek - Balıkesir	Marmara	265	237
Doğanyurt	District	Kastamonu	Black Sea	1470	1177
Dolay	Village	Ayancık - Sinop	Black Sea	521	1101
Döngelli	Village	Akçakoca - Düzce	Black Sea	562	802
Dörtyol	District	Hatay	Mediterranean	53597	69507
Doyuran	Village	Edremit - Balıkesir	Aegean	426	350
Durusu	Village	Çarşamba - Samsun	Black Sea	1014	934
Dutliman	Village	Bandırma - Balıkesir	Marmara	121	97
DüzKöy	Village	Keşap - Giresun	Black Sea	504	442
Eceabat	District	Çanakkale	Marmara	4776	5403
Edincik	Town	Bandırma - Balıkesir	Marmara	5084	4468
Efirli	Village	Perşembe - Ordu	Black Sea	1834	2922
Eğlenhoca	Village	Karaburun - Izmir	Aegean	541	443
Ekincik	Village	Köyceğiz - Muğla	Mediterranean	420	403
Ekinlik	Village	Marmara - Balıkesir	Ekinlik Adası	95	64
Elikesik	Village	Alanya - Antalya	Mediterranean	1228	1628
Emecik	Village	Datça - Muğla	Aegean	773	866
Eminönü	District	Istanbul	The Bosphorus - Europe	55635	
Enez	District	Edirne	Aegean	3914	3820
Engiz	Village	Ondokuzmayıs - Samsun	Black Sea	905	0
Erdek	District	Balıkesir	Marmara	18626	20876
Erdemli	District	İçel	Mediterranean	40175	45241
Ereğli	District	Zonguldak	Black Sea	79486	98545
Ereğli	Town	Karamürsel - Kocaeli	Marmara	3439	
ErenKöy	Village	Ondokuzmayıs - Samsun	Black Sea	843	0
Erikli	Village	Keşan - Edirne	Aegean	476	350
Eriklice	Village	ŞarKöy - Tekirdağ	Marmara	1270	1017
Esenkıyı	Village	Hopa - Artvin	Black Sea	550	259
EsenKöy	Village	Centre - Zonguldak	Black Sea	531	632
EsenKöy	Town	Çınarcık - Yalova	Marmara	2997	2870
Eskihisar	Village	Gebze - Kocaeli	Marmara	325	485
Eskikızılcakese	Village	Ünye - Ordu	Black Sea	473	455
Eskipazar	Town	Of - Trabzon	Black Sea	2096	1941
Espiye	District	Giresun	Black Sea	12990	16572
Eyerci	Village	Mudanya - Bursa	Marmara	ND	228

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Eynesil	District	Giresun	Black Sea	7844	7876
Fatih	District	Istanbul	Marmara	403508	433796
Fatsa	District	Ordu	Black Sea	64087	65384
FenerKöy	Village	Çarşıbaşı - Trabzon	Black Sea	997	1038
Fethiye	District	Muğla	Mediterranean	50689	72003
Filyos (Hisarönü)	Town	Çaycuma - Zonguldak	Black Sea	6283	5776
Fındıklı	District	Rize	Black Sea	11043	10066
Finike	District	Antalya	Mediterranean	9746	11199
Fıstıklı	Village	Armutlu - Yalova	Marmara	1489	1486
Foça	District	Izmir	Aegean	14604	27074
Garipçe	Village	Sarıyer - Istanbul	The Bosphorus - Anatolia	500	337
GaziKöy	Village	ŞarKöy - Tekirdağ	Marmara	564	489
Gazipaşa	District	Antalya	Mediterranean	16536	21730
Gebeş	Village	Cide - Kastamonu	Black Sea	175	175
Gebze	District	Kocaeli	Marmara	253478	282444
Gelemiş	Village	Kaş - Antalya	Mediterranean	648	736
Gelibolu	District	Çanakkale	Marmara	23030	28989
Gemiciler	Village	İnebolu - Kastamonu	Black Sea	443	307
Gemlik	District	Bursa	Marmara	63710	90834
Gençali	Village	Gemlik - Bursa	Marmara	ND	
Gerze	District	Sinop	Black Sea	10013	11226
Giresun -Centre	Province	Giresun -Centre	Black Sea	83636	94961
Göbü	Village	Centre - Zonguldak	Black Sea	1220	1186
Göcek	Town	Fethiye - Muğla	Mediterranean	4005	4039
Göçkün	Village	Amasra - Bartın	Black Sea	195	132
Göçkün	Village	Alaçam - Samsun	Black Sea	778	714
Gökbel	Village	Milas - Muğla	Aegean	580	317
Gökbel	Village	Ortaca- Muğla	Mediterranean	649	543
Gökçe	Village	Ula - Muğla	Aegean	914	1401
Gökçeada	District	Çanakkale	Aegean	7254	4971
Gökmeydan	Town	Iskenderun - Hatay	Mediterranean	1748	2068
Göksüleymanlı	Village	Bozyazı - İçel	Mediterranean	ND	
Gölcük	District	Kocaeli	Marmara	55790	129713
Gölova	Village	Menderes - Izmir	Aegean	291	279
Gölovası	Village	Yumurtalık - Adana	Mediterranean	1253	845
Göltürkbükü	Town	Bodrum - Muğla	Aegean	3851	4134
Gölyaka	Village	Karataş - Adana	Mediterranean	204	176
Görele	District	Giresun	Black Sea	22554	15733
Göynük	Town	Kemer - Antalya	Mediterranean	10119	6121
Gözlüce	Village	Yayladağı - Hatay	Mediterranean	451	391
Gözsüzce	Village	Bozyazı - İçel	Mediterranean	175	173
Gülbahçe	Village	Urla - Izmir	Aegean	49269	0

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Gülbahçe	Village	Çarşıbaşı - Trabzon	Black Sea	200	326
Gülburnu	Village	Espiye - Giresun	Black Sea	275	453
Gülcihan	Village	Iskenderun - Hatay	Mediterranean	431	432
Güllük	Town	Milas - Muğla	Aegean	3418	4076
Gülüç	Village	Ereğli - Zonguldak	Black Sea	ND	7630-Town
Gülümpaşalı	Village	Silifke - İçel	Mediterranean	533	452
Gülyalı	District	Ordu	Black Sea	5245	3507
Gümüldür	Town	Menderes - Izmir	Aegean	8716	
Gümüşyaka	Town	Silivri - Istanbul	Marmara	5406	5406
Gündoğan	Town	Bodrum - Muğla	Aegean	3387	5586
Gündoğdu	Village	Marmara - Balıkesir	Marmara Adası	350	172
Gündoğdu	Town	Centre - Rize	Black Sea	4136	6129
Güney	Village	Gazipaşa - Antalya	Mediterranean	621	565
Gürçamlar	Village	Milas - Muğla	Aegean	435	408
Gürpınar	Town	Büyükçekmece - Istanbul	Marmara	20702	
Güvercinlik	Village	Bodrum - Muğla	Aegean	1897	1203
Güzelbahçe	District	Izmir	Aegean	14924	22990
Güzelçamlı	Town	Kuşadası - Aydın	Aegean	5569	5923
Güzelcehisar	Village	Centre - Bartın	Black Sea	928	926
GüzelKöy	Village	Iskenderun - Hatay	Mediterranean	1320	1914
Güzelyalı	Town	Mudanya - Bursa	Marmara	7019	0
Güzelyalı	Village	Ünye - Ordu	Black Sea	412	432
Güzelyalı	Village	Centre - Çanakkale	Marmara	1616	906
Hacıobası	Village	Manavgat - Antalya	Mediterranean	2152	618
Hacıselli	Village	Gerze - Sinop	Black Sea	518	366
Halıdere	Town	Gölcük - Kocaeli	Marmara	2924	
Hamamlı	Village	Erdek - Balıkesir	Marmara	277	203
Harmanlı	Village	Erdek - Balıkesir	Paşa Limanı Adası	149	191
Hasanaliler	ND	İçel	Mediterranean	ND	
Hasseki	Village	Karaburun - Izmir	Aegean	109	96
Hasyurt	Town	Finike - Antalya	Mediterranean	6197	6698
Hatipler	Village	Amasra - Bartın	Black Sea	107	101
Hatipler	Village	Centre - Bartın	Black Sea	484	408
Hatipler	Village	Manavgat - Antalya	Mediterranean	931	1549
Haylazlı	Village	Yumurtalık - Adana	Mediterranean	620	414
Helaldı (Güzelkent)	Town	Türkeli - Sinop	Black Sea	4429	1720
Hereke	Town	Körfez - Kocaeli	Marmara	16198	
Hersek	Village	Altınova - Yalova	Marmara	354	300

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Hırmanlı	Village	Silifke - İçel	Mediterranean	741	355
Hisarönü	Village	Marmaris - Muğla	Aegean	2245	2129
Hisarüstü	Village	Keşap - Giresun	Black Sea	295	245
Hizarçayı	Village	Gerze - Sinop	Black Sea	65	52
Hopa	District	Artvin	Black Sea	15445	17018
Horozgediği	Village	Aliağa - Izmir	Aegean	745	352
HoşKöy	Town	Şarköy - Tekirdağ	Marmara	2329	2013
İçel - Centre	Province	İçel - Centre	Mediterranean	537842	
İçmeler	Town	Marmaris - Muğla	Aegean	9380	5069
İğneada	Town	DemirKöy - Kırklareli	Black Sea	2215	1964
İhsaniye	Village	Karasu - Sakarya	Black Sea	662	674
Ildır	Village	Çeşme - Izmir	Aegean	1699	601
Provincehan	Village	Erdek - Balıkesir	Marmara	415	451
Ilıca	Town	Manavgat - Antalya	Mediterranean	16807	6609
Provincekadım	District	Samsun - Centre	Black Sea	0	307746
Provinceyasbey	Village	Cide - Kastamonu	Black Sea	340	350
İmrenli	Village	Şile - Istanbul	Black Sea	219	188
İncirpınar	Village	Erfelek - Sinop	Black Sea	400	373
İnebolu	District	Kastamonu	Black Sea	9486	9547
İnecik	Village	Karaburun - Izmir	Aegean	323	138
İnlice	Village	Fethiye - Muğla	Mediterranean	695	830
İnnaplıhüyük	Village	Karataş - Adana	Mediterranean	201	194
İntepe	Town	Centre - Çanakkale	Marmara	1697	1957
Irmak	Village	Cide - Kastamonu	Black Sea	324	355
İshaklı	Village	Alanya - Antalya	Mediterranean	558	531
Işıklı	Village	Türkeli - Sinop	Black Sea	193	254
Işıklı	Village	Iskenderun - Hatay	Mediterranean	714	857
Işıklı	Village	Ardeşen - Rize	Black Sea	2157	1066
Iskenderun	District	Hatay	Mediterranean	160150	190279
İslamhaneleri	Village	Bodrum - Muğla	Aegean	2503	2100
İslamlar	Village	Dikili - Izmir	Aegean	334	265
İyidere	District	Rize	Black Sea	5466	4767
Kabakum	Village	Dikili - Izmir	Aegean	1526	1361
KadıKöy	Village	Kocaali - Sakarya	Black Sea	400	448
KadıKöy	District	Istanbul	The Bosphorus - Anatolia	663299	529191
Kadriye	Town	Serik - Antalya	Mediterranean	13067	4912
Kahyalar	Town	Gazipaşa - Antalya	Mediterranean	3258	3230
Kalafat	Village	Cide - Kastamonu	Black Sea	157	180
Kaldırım	Town	Yumurtalık - Adana	Mediterranean	1804	1675
Kale	Village	Iskenderun - Hatay	Mediterranean	155	162
KaleKöy	Village	Gökçeada - Çanakkale	Aegean	90	121
KaleKöy	Village	Centre - İçel	Mediterranean	988	

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Kalemli	Village	Yumurtalık - Adana	Mediterranean	148	200
Kalkan	Town	Kaş - Antalya	Mediterranean	2543	3092
Kapaklı	Village	Demre - Antalya	Mediterranean	207	434
Kapaklı	Village	Armutlu - Yalova	Marmara	908	839
Kapı	Village	Karataş - Adana	Mediterranean	243	353
Kapısuyu	Village	Samandağ - Hatay	Mediterranean	1984	1725
Karaağaç	Town	Iskenderun - Hatay	Mediterranean	16250	18719
Karabiga	Town	Biga - Çanakkale	Marmara	3131	2985
Karaburun	Village	Görele - Giresun	Black Sea	97	125
Karaburun	District	Izmir	Aegean	2932	2785
Karaburun	Village	Çatalca - Istanbul	Black Sea	1605	
Karaca	Village	Marmaris - Muğla	Aegean	618	610
Karacaköy	Village	Şile - Istanbul	Black Sea	285	288
Karaçallı	Village	Centre - Antalya	Mediterranean	597	812
Karademir	Village	Tirebolu - Giresun	Black Sea	497	516
Karadere	Town	Fethiye - Muğla	Mediterranean	2426	3350
Karakaya	Village	Bodrum - Muğla	Aegean	ND	
Karakeşli	Village	Erdemli - İçel	Mediterranean	133	837
KaraKöy	Village	Datça - Muğla	Aegean	737	786
Karaman	Village	Kurucaşile - Bartın	Black Sea	556	502
Karamürsel	District	Kocaeli	Marmara	29353	46132
Karasu	Village	Karasu - Sakarya	Black Sea	1182	1338
Karasu	District	Sakarya	Black Sea	13793	27914
Karataş	Village	Karataş - Adana	Mediterranean	305	224
Karataş	District	Adana	Mediterranean	9189	8504
Karayılan	Town	Iskenderun - Hatay	Mediterranean	11187	10191
Kargı	Village	Fethiye - Muğla	Mediterranean	1163	1501
Kargıcak	Town	Alanya - Antalya	Mediterranean	4146	2965
Kargıpınarı	Town	Erdemli - İçel	Mediterranean	12714	11559
Karşıyaka	Town	Erdek - Balıkesir	Marmara	2786	2713
Karşıyaka	District	Izmir	Aegean	438430	304220
Kartal	District	Istanbul	Marmara	337390	426680
Kaş	District	Antalya	Mediterranean	6361	6857
KavakKöy	Village	Kumluca - Antalya	Mediterranean	643	676
Kavaklı	Town	Akçaabat - Trabzon	Black Sea	3128	4007
Kavaklı	Village	Büyükçekmece - Istanbul	Marmara	ND	
Kavaklıoluk	Village	Iskenderun - Hatay	Mediterranean	186	175
Kayaönü	Village	Milas - Muğla	Aegean	ND	0
Kayran	Village	Doğanyurt - Kastamonu	Black Sea	231	178
Kaytazdere	Town	Altınova - Yalova	Marmara	6404	5308
Kazancılı	Village	Perşembe - Ordu	Black Sea	544	476

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Kazanlı	Town	Centre - İçel	Mediterranean	10812	
Kazıklı	Village	Milas - Muğla	Aegean	891	776
Kazıklıbucak (Bozbük)	Village	Milas - Muğla	Aegean	400	366
Kefken	Village	Kandıra - Kocaeli	Black Sea	1520	1308
Kemalpaşa	Town	Hopa - Artvin	Black Sea	4124	4480
Kemer	Village	Biga - Çanakkale	Marmara	860	868
Kemer	District	Antalya	Mediterranean	17255	20110
Kemerağzı	Village	Centre - Antalya	Mediterranean	1125	1679
Kemiklialan	Village	Lapseki - Çanakkale	Marmara	162	150
Kepez	Town	Centre - Çanakkale	Marmara	7918	10771
KeremKöy	Village	Gömeç - Balıkesir	Aegean	314	303
Kerim	Village	Dikmen - Sinop	Black Sea	407	296
Kerpe	Village	Kandıra - Kocaeli	Black Sea	ND	
Keşap	District	Giresun	Black Sea	9475	8525
Keşefli	Village	Alanya - Antalya	Mediterranean	595	567
Kestanelik	Village	Erdek - Balıkesir	Marmara	381	394
Kestel	Town	Alanya - Antalya	Mediterranean	5623	6974
Kılçak	Village	Alaplı - Zonguldak	Black Sea	646	1366
Kilimli	Town	Centre - Zonguldak	Black Sea	24626	24092
Kıran	Village	Centre- Muğla	Aegean	681	729
Kirazlı	Village	ŞarKöy - Tekirdağ	Marmara	412	351
Kirazlıyalı	Town	Körfez - Kocaeli	Marmara	2831	
Kısırkaya	Village	Sarıyer - Istanbul	Black Sea	471	423
Kıyıcak	Village	Ereğli - Zonguldak	Black Sea	670	661
Kıyıcık	Village	Fındıklı - Rize	Black Sea	294	284
Kıyıcık	Town	Of - Trabzon	Black Sea	5797	3238
Kıyıkışlacık	Village	Milas - Muğla	Aegean	1624	1392
KıyıKöy	Town	Vize - Kırklareli	Black Sea	2248	2136
Kızılağaç	Village	Manavgat - Antalya	Mediterranean	5612	1419
Kızılcaterzi	Village	Şarköy - Tekirdağ	Marmara	394	245
Kızılçukur	Village	Dikili - Izmir	Aegean	268	257
Kızılot	Town	Manavgat - Antalya	Mediterranean	2611	2132
Kızlan	Village	Datça - Muğla	Aegean	783	1039
Kocaali	Village	Gemlik - Bursa	Marmara	727	
Kocaçeşme	Village	Gelibolu - Çanakkale	Aegean	227	192
Kocadere	Town	Çınarcık - Yalova	Marmara	2095	2198
Kocaeli - Centre	Province	Kocaeli - Centre	Marmara	373034	293339
Kocahasanlı	Town	Erdemli - İçel	Mediterranean	5741	6010
Kocaman	Village	Alaplı - Zonguldak	Black Sea	139	116
Kömürcüler	Village	Anamur - İçel	Mediterranean	ND	
Konacık	Village	Bodrum - Muğla	Aegean	4035	9351-Town
Konak	District	Izmir	Aegean	781363	411112

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Konaklı	Village	Dörtyol - Hatay	Mediterranean	771	956
Konaklı	Town	Alanya - Antalya	Mediterranean	28801	12499
Konaklı	Village	Karataş - Adana	Mediterranean	ND	
Konyaaltı	District	Antalya	Mediterranean	0	101461
Körfez	District	Kocaeli	Marmara	81938	126616
Köroğlu	Village	İnebolu - Kastamonu	Black Sea	130	114
Koru	Town	Çınarcık - Yalova	Marmara	2678	5545
Korucuk	Village	Centre - Sinop	Black Sea	1716	2097
Koruköy	Village	Gelibolu - Çanakkale	Aegean	440	349
Kösedere	Village	Karaburun - Izmir	Aegean	490	369
Köseli	Village	Cide - Kastamonu	Black Sea	129	97
Köşkerler	Village	Demre - Antalya	Mediterranean	2210	2212
KoşuKöy (Orta)	Village	Bafra - Samsun	Black Sea	1110	1304
Kovanlı	Village	Perşembe - Ordu	Black Sea	815	673
Köyceğiz	District	Muğla	Mediterranean	7523	8677
Kozbeyli	Village	Foça - Izmir	Aegean	534	549
Kozlu	Town	Centre - Zonguldak	Black Sea	33767	34381
Küçükbahçe	Village	Karaburun - Izmir	Aegean	608	445
Küçükçekmece	District	Istanbul	Marmara	593520	674795
Küçükkolpınar	Village	Centre - Samsun	Black Sea	501	0
KüçükKöy	Town	Ayvalık - Balıkesir	Aegean	9088	8699
Küçükkuyu	Town	Ayvacık - Çanakkale	Aegean	5261	6580
Kuğuköy	Village	Çatalzeytin - Kastamonu	Black Sea	47	42
Kulak	Village	Tarsus - İçel	Mediterranean	636	949
Kultak	Village	Milas - Muğla	Aegean	416	375
Kumbağ	Town	Centre - Tekirdağ	Marmara	2635	2084
Kumburgaz	Town	Büyükçekmece - Istanbul	Marmara	10352	
Kumburun	Village	Ezine - Çanakkale	Aegean	593	503
KumKöy	Village	Serik - Antalya	Mediterranean	1074	1284
KumKöy (Kilyos)	Village	Sarıyer - Istanbul	Black Sea	2580	2321
Kumluca	Village	Cide - Kastamonu	Black Sea	352	406
Kumluca	District	Antalya	Mediterranean	25081	30939
Kumluova	Town	Fethiye - Muğla	Mediterranean	2917	3620
Kumtepe (Yaraslı)	Village	Çarşamba - Samsun	Black Sea	867	775
Kumyaka	Village	Mudanya - Bursa	Marmara	552	616
Küpçıkan	ND	Hatay	Mediterranean	ND	
Küplüağzı	Village	Yakakent - Samsun	Black Sea	998	379
Kurşunlu	Village	Karacabey - Bursa	Marmara	678	667

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Kurşunlu	Town	Gemlik - Bursa	Marmara	2591	
Kurtuluş	Village	Silifke - İçel	Mediterranean	264	1212
Kurtuluş (Ağçasaz)	Village	Çarşamba - Samsun	Black Sea	ND	
Kurucaşile	District	Bartın	Black Sea	2074	1733
Kuşadası	District	Aydın	Aegean	65765	61648
Kuşçu	Village	Cide - Kastamonu	Black Sea	132	134
Kuyucak	Village	Milas - Muğla	Aegean	ND	0
Kuyucak	Village	Centre- Muğla	Aegean	433	395
Kuzupınarı	Village	Yumurtalık - Adana	Mediterranean	1537	1748
Lapseki	District	Çanakkale	Marmara	8489	10624
LimanKöy	Village	DemirKöy - Kırklareli	Black Sea	ND	409
Limonlu	Town	Erdemli - İçel	Mediterranean	5173	3955
Macar	Village	Gazipaşa - Antalya	Mediterranean	1178	1075
Maden	Village	Ayancık - Sinop	Black Sea	190	168
Madenli	Town	Iskenderun - Hatay	Mediterranean	4630	4710
Mağaracık	Town	Samandağ - Hatay	Mediterranean	3636	4746
Mahmutlar	Town	Alanya - Antalya	Mediterranean	14463	20517
Maltepe	District	Istanbul	Marmara	355384	427041
Manavgat	District	Antalya	Mediterranean	71679	81903
Marmara	District	Balıkesir	Marmara Adası	2215	2444
Marmara Ereğlisi	District	Tekirdağ	Marmara	8779	10491
Marmaris	District	Muğla	Aegean	28660	30101
Mavikent	Town	Kumluca - Antalya	Mediterranean	9276	8281
MazıKöy	Village	Bodrum - Muğla	Aegean	1696	1088
Melenağzı	Village	Akçakoca - Düzce	Black Sea	853	641
Memiş	Village	Cide - Kastamonu	Black Sea	ND	
Menderesönü	Town	Perşembe - Ordu	Black Sea	4535	2784
Mersin	Town	Akçaabat - Trabzon	Black Sea	3399	3318
Mesudiye	Village	Datça - Muğla	Aegean	ND	564
Meydan	Village	Samandağ - Hatay	Mediterranean	2061	2601
Mezitli	Town	Centre - İçel	Mediterranean	34155	
Mimarsinan	Town	Büyükçekmece - Istanbul	Marmara	25858	
Misakça	Village	Bandırma - Balıkesir	Marmara	677	509
Mordoğan	Town	Karaburun - Izmir	Aegean	5986	3362
MuallimKöy	Village	Gebze - Kocaeli	Marmara	879	981
Mudanya	District	Bursa	Marmara	20682	49805
Muratpaşa	District	Antalya	Mediterranean	0	396906
Mürefte	Town	ŞarKöy - Tekirdağ	Marmara	3510	2859
Muslu	Town	Centre - Zonguldak	Black Sea	2406	2065
Muzkent	Village	Gazipaşa - Antalya	Mediterranean	870	973

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Narlı	Village	Gemlik - Bursa	Marmara	462	380
Narlı	Village	Erdek - Balıkesir	Marmara	770	800
Narlı	Village	Edremit - Balıkesir	Aegean	1062	1030
Narlıdere	District	Izmir	Aegean	54107	65714
Nasrettin	Village	Anamur - İçel	Mediterranean	ND	
Ocak	Village	Pazar - Rize	Black Sea	542	589
Ocaklar	Town	Erdek - Balıkesir	Marmara	1657	1731
Of	District	Trabzon	Black Sea	25478	18092
Okçular	Village	Cide - Kastamonu	Black Sea	143	102
Okçulu	Village	Perşembe - Ordu	Black Sea	791	621
Okurcalar	Town	Alanya - Antalya	Mediterranean	11876	4312
Ölüdeniz	Town	Fethiye - Muğla	Mediterranean	2748	4532
Ömerli (BaliKöy)	Village	Ereğli - Zonguldak	Black Sea	715	
Ondokuzmayıs	District	Samsun	Black Sea	9000	11539
Ordu - Centre	Province	Ordu - Centre	Black Sea	887765	135878
OrduKöy	Village	Centre - Sinop	Black Sea	687	1435
Ören	Town	Milas - Muğla	Aegean	2575	2991
Ören	Town	Anamur - İçel	Mediterranean	6110	3898
Ören	Village	Burhaniye - Balıkesir	Aegean	ND	
Orhangazi	Village	Iskenderun - Hatay	Mediterranean	427	567
Orhaniye	Village	Centre - Ordu	Black Sea	190	220
Orhaniye	Village	Marmaris - Muğla	Aegean	862	1058
Ormanlı	Village	Erdek - Balıkesir	Marmara	158	124
Ormanlı	Village	Çatalca - Istanbul	Black Sea	1240	1147
Ortakentyahşi	Town	Bodrum - Muğla	Aegean	4662	6262
Ortalık	Village	Ayancık - Sinop	Black Sea	ND	87
Osmaniye	Village	Marmaris - Muğla	Aegean	516	470
Osmaniye	Village	Marmaris - Muğla	Mediterranean	ND	470
Ovacık	Village	Çeşme - Izmir	Aegean	1091	1627
Ovacık (Büyükeceli)	Town	Gülnar - İçel	Mediterranean	2209	2292
OvaKöy	Town	Kaş - Antalya	Mediterranean	4162	4514
Özdere	Town	Menderes - Izmir	Aegean	10300	
Özlü	Village	Centre - Antalya	Mediterranean	1615	1677
Parekende	Village	Manavgat - Antalya	Mediterranean	187	171
Parlak	Village	Karaburun - Izmir	Aegean	165	130
Paşalimanı	Village	Erdek - Balıkesir	Paşa Limanı Adası	141	91
Pazar	District	Rize	Black Sea	14682	15328
Pendik	District	Istanbul	Marmara	384668	558485
Perşembe	District	Ordu	Black Sea	10804	9643

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Piraziz	District	Giresun	Black Sea	18846	7124
Pirinçlik	Village	Iskenderun - Hatay	Mediterranean	1106	1262
Poyraz	Village	Beykoz - Istanbul	The Bosphorus - Anatolia	829	875
Poyrazlı	Village	Erdek - Balıkesir	Paşa Limanı Adası	105	139
Rize - Centre	Province	Rize - Centre	Black Sea	78144	96503
Sahilkent	Town	Finike - Antalya	Mediterranean	7218	8391
Sahilkent (Ordulular)	Village	Bafra - Samsun	Black Sea	342	239
SahilKöy	Village	Pazar - Rize	Black Sea	378	501
SahilKöy	Village	Şile - Istanbul	Black Sea	724	588
SahilKöy	Village	Çarşamba - Samsun	Black Sea	1072	
Saip	Village	Karaburun - Izmir	Aegean	213	155
Sakallı	Village	Cide - Kastamonu	Black Sea	129	97
Salacık	Village	Akçaabat - Trabzon	Black Sea		951
Salman	Village	Karaburun - Izmir	Aegean	119	121
Samandağ	District	Hatay	Mediterranean	34641	44137
Samsun - Centre	Province	Samsun - Centre	Black Sea	363180	0
Sancaklı	Village	Terme - Samsun	Black Sea	471	323
Sandıktaş	Village	Derepazarı - Rize	Black Sea	308	288
Saraylar	Village	Marmara - Balıkesir	Marmara Adası	ND	2563-Town
Sarıgerme	Village	Ortaca- Muğla	Mediterranean	861	601
SarıKöy	Village	Cide - Kastamonu	Black Sea	ND	
Sarıkum	Village	Centre - Sinop	Black Sea	155	142
Sarıseki	Town	Iskenderun - Hatay	Mediterranean	5329	4255
Sarısu (BabaKöy)	Village	Kandıra - Kocaeli	Black Sea	326	313
Sarıyer	District	Istanbul	The Bosphorus - Europe	219032	252658
ŞarKöy	District	Tekirdağ	Marmara	17401	16624
Sarp	Village	Hopa - Artvin	Black Sea	525	233
Sarpıncık	Village	Karaburun - Izmir	Aegean	259	136
Sasallı	Town	Çiğli - Izmir	Aegean	3564	
Sayvancık	Village	Beşikdüzü - Trabzon	Black Sea	211	103
SazKöy	Village	Çaycuma - Zonguldak	Black Sea	301	199
Sazlıdere	Village	Keşan - Edirne	Aegean	242	242
Seddülbahir	Village	Eceabat - Çanakkale	Marmara	427	298
Seferihisar	District	Izmir	Aegean	17550	25308
Selçuk	District	Izmir	Aegean	25564	27801
Selimiye	Village	Marmaris - Muğla	Aegean	885	1026
Selimpaşa	Town	Silivri - Istanbul	Marmara	9151	9151
ŞenKöy	Village	Çınarcık - Yalova	Marmara	ND	475

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Şenyurt	Village	Ardeşen - Rize	Black Sea	289	233
Şerefiye	Village	Erfelek - Sinop	Black Sea	521	311
Şevketiye	Village	Lapseki - Çanakkale	Marmara	443	375
Side	Town	Manavgat - Antalya	Mediterranean	21000	10505
Şile	District	Istanbul	Black Sea	10262	12545
Silivri	District	Istanbul	Marmara	44530	121961
Sinop - Centre	Province	Sinop - Centre	Black Sea	30502	36734
Sipahili	Village	Gülnar - İçel	Mediterranean	422	399
Şirinçavuş	Village	Bandırma - Balıkesir	Marmara	277	205
Sivaslılar	Village	Terme - Samsun	Black Sea	615	631
Soğucak	Village	Kuşadası - Aydın	Aegean	1689	1554
Soğukpınar (İvyan)	Village	Of - Trabzon	Black Sea	ND	0
Söğüt	Village	Marmaris - Muğla	Aegean	1886	1750
Söğütlü	Village	Centre - Rize	Black Sea	344	324
Söğütlü	Town	Akçaabat - Trabzon	Black Sea	7173	10622
Şuayıplı	Village	Şile - Istanbul	Black Sea	198	233
SultanKöy	Town	Marmara Ereğlisi - Tekirdağ	Marmara	2491	3577
Suluca	Village	Lapseki - Çanakkale	Marmara	436	340
Sürmene	District	Trabzon	Black Sea	17063	14418
Sütlüce	Village	Gelibolu - Çanakkale	Marmara	745	639
Süzbeyli	Village	Menemen - Izmir	Aegean	64	
Tabaklar	Village	Karataş - Adana	Mediterranean	684	638
Tahtakuşlar	Village	Edremit - Balıkesir	Aegean	686	764
Tarlaağzı	Village	Amasra - Bartın	Black Sea	397	361
Taşburun	Village	İnebolu - Kastamonu	Black Sea	143	121
Taşköprü	Town	ÇiftlikKöy - Yalova	Marmara	3722	3262
Taşlıca	Village	Marmaris - Muğla	Aegean	524	526
Taşlık	Village	Terme - Samsun	Black Sea	ND	201
Taşucu	Town	Silifke - İçel	Mediterranean	10466	8700
Tatarlı	Village	Iskenderun - Hatay	Mediterranean	663	843
Tatlısu	Village	Erdek - Balıkesir	Marmara	1121	772
Tavşancıl	Town	Gebze - Kocaeli	Marmara	4200	
Tece	Town	Centre - İçel	Mediterranean	10500	
Tekebaşı	Town	Samandağ - Hatay	Mediterranean	6393	8733
Tekeli	Town	Bozyazı - İçel	Mediterranean	7503	3336
Tekirdağ - Centre	Province	Tekirdağ - Centre	Marmara	107191	140535
Tekirova	Town	Kemer - Antalya	Mediterranean	5769	3614
Tekmen	Town	Bozyazı - İçel	Mediterranean	5983	3022
Tepeboz	Village	Karaburun - Izmir	Aegean	257	258
Tepeören	Village	Ereğli - Zonguldak	Black Sea	260	182

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Terme	District	Samsun	Black Sea	25052	30184
Tirebolu	District	Giresun	Black Sea	16112	13419
Topağaç	Village	Marmara - Balıkesir	Marmara Adası	479	450
Topçalı	Village	Ereğli - Zonguldak	Black Sea	423	509
Toplu	Village	Alaçam - Samsun	Black Sea	547	386
Tosmur	Town	Alanya - Antalya	Mediterranean	2170	5880
Trabzon - Centre	Province	Trabzon - Centre	Black Sea	216000	230399
Turan	Village	Erdek - Balıkesir	Marmara	398	412
Turgut	Village	Marmaris - Muğla	Aegean	577	627
Turgutreis	Town	Bodrum - Muğla	Aegean	5781	16490
Türkali	Village	Centre - Zonguldak	Black Sea	1723	1413
Türkeli	District	Sinop	Black Sea	6977	5457
Türkeli	Village	Marmara - Balıkesir	Avşa Adası	ND	
Türkevleri	Village	Milas - Muğla	Aegean	1333	788
Türkler	Town	Alanya - Antalya	Mediterranean	7240	3524
Turnasuyu	Village	Gülyalı - Ordu	Black Sea	2126	2229
Turunç	Town	Marmaris - Muğla	Aegean	2400	1823
Tuzburgazı	Village	Söke - Aydın	Aegean	1230	862
Tuzla	Village	Erdek - Balıkesir	Paşa Limanı Adası	107	58
Tuzla	Town	Karataş - Adana	Mediterranean	2248	1988
Tuzla	District	Istanbul	Marmara	107883	181658
Uçarı	Village	Anamur - İçel	Mediterranean	351	409
Uçmakdere	Village	ŞarKöy - Tekirdağ	Marmara	287	222
Uğurlu	Village	Cide - Kastamonu	Black Sea	119	136
Uğurlu	Village	Gökçeada - Çanakkale	Aegean	466	438
Ulaşlı	Town	Gölcük - Kocaeli	Marmara	2445	
Ünye	District	Ordu	Black Sea	61552	74806
Ürkmez	Town	Seferihisar - Izmir	Aegean	5206	0
Urla	District	Izmir	Aegean	36579	43386
Üsküdar	District	Istanbul	The Bosphorus - Anatolia	495118	524379
Uzunkaya	Village	Centre - Rize	Black Sea	ND	0
UzunKöy	Village	Centre - Rize	Black Sea	296	255
Uzunyurt	Village	Fethiye - Muğla	Mediterranean	1509	457
Vakfıkebir	District	Trabzon	Black Sea	33394	13936
Vakıf	Village	Enez - Edirne	Aegean	574	332
Yahşibey	Village	Dikili - Izmir	Aegean	250	235
Yakaboyu	Village	İnebolu - Kastamonu	Black Sea	150	148
Yakacık	Village	Gazipaşa - Antalya	Mediterranean	429	356
Yakacık (Payas)	Town	Dörtyol - Hatay	Mediterranean	31131	33265
Yakakent	District	Samsun	Black Sea	4707	5141
Yakaköy	Village	Datça - Muğla	Aegean	520	577

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Yakaören	Village	Bozkurt - Kastamonu	Black Sea	552	534
Yakuplu	Town	Büyükçekmece - Istanbul	Marmara	23878	
Yalıkavak	Town	Bodrum - Muğla	Aegean	8000	10060
YalıKöy	Village	Görele - Giresun	Black Sea	82	76
YalıKöy	Village	Tirebolu - Giresun	Black Sea	469	150
YalıKöy	Village	Centre - Sinop	Black Sea	449	391
YalıKöy	Village	Bulancak - Giresun	Black Sea	634	618
YalıKöy	Village	Çatalca - Istanbul	Black Sea	1687	1485
YalıKöy	Village	Didim - Aydın	Aegean	1107	1761
YalıKöy	Town	Vakfıkebir - Trabzon	Black Sea	2971	2011
Yalıköy	Town	Fatsa - Ordu	Black Sea	3327	2253
Yalova - Centre	Province	Yalova - Centre	Marmara	70118	92166
Yanıklar	Village	Fethiye - Muğla	Mediterranean	2598	1791
Yanıktaş	Village	Derepazarı - Rize	Black Sea	391	361
Yanışlı	Village	Gülnar - İçel	Mediterranean	149	177
Yapraklı	Village	Fatsa - Ordu	Black Sea	79	373
Yayıkdamlar	Village	Yayladağı - Hatay	Mediterranean	447	304
Yaykıl	Village	Gerze - Sinop	Black Sea	937	803
YazıKöy	Village	Datça - Muğla	Aegean	583	545
Yeniay	Town	Sürmene - Trabzon	Black Sea	6207	3300
Yenice	Village	Cide - Kastamonu	Black Sea	363	259
Yenifoça	Town	Foça - Izmir	Aegean	11652	
Yenikale	Village	Centre - Rize	Black Sea	245	140
Yenikaş	Village	Aydıncık - İçel	Mediterranean	989	1121
Yenikent	Town	Gerze - Sinop	Black Sea	1389	968
YeniKöy	Village	Centre - Tekirdağ	Marmara	170	97
YeniKöy	Village	Fındıklı - Rize	Black Sea	231	217
YeniKöy	Village	Ezine - Çanakkale	Aegean	430	378
YeniKöy	Village	Manavgat - Antalya	Mediterranean	603	706
YeniKöy	Village	Gaziosmanpaşa - Istanbul	Black Sea	2338	
Yenişakran	Town	Aliağa - Izmir	Aegean	2987	3630
Yeniyenice	Village	Bandırma - Balıkesir	Marmara	932	852
Yeniyurt	Town	Dörtyol - Hatay	Mediterranean	5048	4415
YeşilKöy	Town	Dörtyol - Hatay	Mediterranean	8868	10527
YeşilKöy	Village	Kaş - Antalya	Mediterranean	ND	3280-Town
YeşilKöy	Village	Alanya - Antalya	Mediterranean	ND	
Yeşilovacık	Town	Silifke - İçel	Mediterranean	5548	2351
Yeşiltepe	Village	Erzin - Hatay	Mediterranean	1310	1071
Yeşilyalı	Town	Arsin - Trabzon	Black Sea	3994	4038
Yiğitler	Village	Marmara - Balıkesir	Avşa Adası	823	
Yıldızlı	Town	Akçaabat - Trabzon	Black Sea	3072	6810

Table F.1 (continued): Coastal Settlements and their Populations in Turkey

Settlement Name	Settlement Type	Province - District	Coast to	Pop. (2000)	Pop. (2009)
Yılgın	Village	Tirebolu - Giresun	Black Sea	302	286
Yolağzı	Village	Keşap - Giresun	Black Sea	566	381
Yomra	District	Trabzon	Black Sea	13346	10977
Yüceler	Village	Ünye - Ordu	Black Sea	980	1680
Yukarıburnaz	Village	Erzin - Hatay	Mediterranean	348	547
Yumurtalık	District	Adana	Mediterranean	4745	5220
Yunus	Village	İnebolu - Kastamonu	Black Sea	209	213
Zeytinada	Village	Gazipaşa - Antalya	Mediterranean	1008	812
Zeytinbağı	Town	Mudanya - Bursa	Marmara	2269	1919
Zeytinburnu	District	Istanbul	Marmara	247669	290147
Zeytineli	Village	Urla - Çeşme	Aegean	366	285
ZeytinKöy	Village	Selçuk - Izmir	Aegean	999	928
Zonguldak	Province	Zonguldak - Centre	Black Sea	106742	108792

Appendix G: Main Groupings for the Classification of Turkish Coastal Settlements

Table G.1: Main Groupings of Turkish Coastal Settlements

Sectoral Dominance	**Population Size**	**Population Density (km^2)**	**Urban Problems**	**Coastal Problems**	**Disastrous Problems**
Agriculture	Less than 10.000	Less than 100	Near shore illegal construction	Coastal water pollution	1st Degree Earthquake Zone
Service	Between 10.000-50.000	Between 100-1.000	Urban sprawl and insufficient infrastructure	Conflicts among different coastal uses	Flood and Storm Surge
Commerce	Between 50.000-100.000	Between 1.000-10.000	Waste management problems	Disappearance of natural resources and species	Industrial Port Activities
Construction	Between 100.000-500.000	More than 10.000	Working places and housing problems	Dominant position of tourism on other sectors	Marine Accidents
Industry	Over 500.000		Land speculations		Development pressure
Mining					Historical tsunami events

* There is no relation between the columns.

Appendix H: UDRM Related Legal Arrangements in Turkey

Table H.1: List of UDRM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	**Law Code / By-law Number / Decree Number and Name**	**Date**	**Scope**	**Relevant Sub-Regulations**	**Situation**	
UDRM	Laws (*Yasa*)	4373 Coded - Law of Protection against Floods	1943	Generally defines the rules of declaring "flood area" and expropriation conditions.		Abolished with the enaction of 7269 Coded law.	
		4623 Coded - Law of Measures taken before and after Earthquakes	1944			Abolished with the enaction of 7269 Coded law.	
		5442 Coded - Provincial Administration Law	1949	Draws up the responsibilities, duties, and authorities of local governors. Mentions local safety requirements in Article 44.	By-law n.710357 (1975)	In operation including the revisions made in 2008.	Ministry of Interrior
		7126 Coded - Civil Defence Law	1958	Mainly draws up the responsibilities of civil defence teams and civil defence required conditions.	By-law n. 12937 (2007), 710357 (1975), and code of rules (*nizamname*) n.411715	In operation including the revisions made in 2008 and 2009.	Ministry of Interrior
		7269 Coded - The Disaster Law	1959	Mainly focuses on aftermath of disaster for immediate reconstruction planning.	By-law n.710357 (1975) and 12777 (1988)	In operation including the revisions made in 1999, 2001, 2002, 2003, 2004, 2005, 2006, and 2008.	Ministry of Public Works and Settlement, Ministry of Finance, Ministry of Interrior
		775/3811/3414 Coded - Squatter Law	1966	Land provision in disaster areas and its fundings are explained in Temporary Article 5.		In operation including the revisions made in 1985, 1988, 2007, and 2008.	Ministry of Interrior, Ministry of Public Works and Settlement, Housing Development Administration (*TOKI*), Municipalities

Table H.1 (continued): List of UDRM Related Legal Arrangements in Turkey

UDRM	Laws (*Yasa*)	2709 Coded - The Constitution of the Republic of Turkey	1982	Article 119 draws up the conditions of declaring state of emergency; such as at the time of disasters, epidemics, recession etc.		In operation.	Grand National Assembly of Turkey
		2935 Coded - State of Emergency Law	1983	Mainly draws up the responsibilities, duties, and authorities of all public institutions and bodies on the time of state of emergency, including during and after disasters.		In operation including the revisions made in 1984, 1986, 1988, 1990,and 2008.	Ministry of Interrior, Ministry of Finance, Governorships
		2942 Coded - Expropriation Law	1983	Refers to "public interest" concept and its decision in Article 5 and 6 by also explaining ratification authorities.		In operation including the revisions made in 2001 and 2004.	Ministry of Public Works and Settlement, and other ministries related to the subject
		2981 Coded - Law on The Procedure Enforced to the Buildings Contradicting to the Development Law	1984	Mainly draws up the conditions, status', exceptions, and fee responsibilities of buildings which are violating the Development Law. Supplementary item (e) in Article 19 exempts the buildings constructed according to the 7269 Coded Law for some fees.	By-law n. 9262 (1986)	In operation including the revisions made in 1985, 1986, 1987, and 2003.	Ministry of Public Works and Settlement, Municipalities.

Table H.1 (continued): List of UDRM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
DRM	Law (*Yasa*)	2985 Coded - Mass Housing Law	1984	Basically draws up the ways, techniques, and fundings of meeting the housing needs; and defines the operation ways of Housing Development Administration in housing and land production.	By-law n.3888 (2002)	In operation including the revisions made in 1985, 1986, 1987, 1989, 1990, 1992, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, and 2010.	Ministry of Public Works and Settlement, Ministry of Finance, Housing Development Administration, and Disaster and Emergency Management Headship (*Afet ve Acil Durum Yönetimi Başkanlığı*)
		3194 Coded - Development Law	1985	Generally draws up the settlement development and construction principles in terms of planning, health, and environment. Article 9 defines plan ratification authority of the Ministry if the subject is disasters. Also Article 42 refers to the sanctions about the buildings which threatens the safety of life and property in the case of disasters; even if they are legally constructed.	By-law n. 4877 (1985), 4880 (1985), 4882 (1985).	In operation including the revisions made in 1987, 1989, 1994, 1997, 1998, 2002, 2003, 2005, 2008, and 2009.	Ministry of Public Works and Settlement, Municipalities.
		4123 Coded - Law of Performing the Services concerning the Damages due to the Natural Disasters	1995	Basically draws up the actions and ways of performing normal life services, and financial aids after disasters.		In operation including the revisions made in 1995 and 2003.	Ministry of Public Works and Settlement, Ministry of Finance, Housing Development Administration, General Directorate of Bank of Provinces (*İller Bankası Genel Müdürlüğü*)

Table H.1 (continued): List of UDRM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
UDRM	Laws (*Yasa*)	4708 Coded - Building Construction Supervision Law	2001	Draws up basics and techniques on building construction supervision, responsibilities of related person and institutions, and defines enforcement areas. Building Construction Supervision mainly aims to define constructural defects.		In operation in Adana, Ankara, Antalya, Aydın, Balıkesir, Bolu, Bursa, Çanakkale, Denizli, Düzce, Eskişehir, Gaziantep, Hatay, Istanbul, Izmir, Kocaeli, Sakarya, Tekirdağ and Yalova; including the revisions made in 2004 and 2008.	Ministry of Public Works and Settlement, Municipalities, Building Construction Supervision Corporations (*Yapı Denetim Kuruluşları)*
		5216 Coded - Greater Municipalities Law	2004	Article 7 determines the responsibilities and duties of greater municipalities. Preparing disaster related plans and programs and making related controls are among the responsibilities.		In operation including the revisions made in 2004, 2005, 2006, 2007, and 2008.	Ministry of Interrior, State Planning Organization (*Devlet Planlama Teşkilatı Müsteşarlığı*), Greater Municipalities
		5302 Coded - Special Provincial Administration Act	2005	Defines disaster related duties of Special Province Administration in Article 6 and responsibilities in terms of preparation of emergency plans and involved teams in Article 69.		In operation including the revisions made in 2005, 2006, 2007, 2008, and 2009.	Ministry of Interrior, Governorships
		5393 Coded - Municipality Law	2005	Article 14 and Article 53 defines the responsibilities and duties of municipalities in disaster and emergency planning.		In operation including the revisions made in 2006, 2007, 2008, and 2010.	Ministry of Interrior, State Planning Organization, Municipalities
		5366 Coded - Law of Conservation and Use of Old Historical and Cultural Properties by Renovation	2005	Article 1 and Article 3 explains disaster risk areas are also one of the subjects of urban renewal projects.	By-law n. 9668 (2005)	In operation including the revisions made in 2008.	Min. of Interrior, Special Provincial Administration, Min. of Public Works and Settlement, Housing Development Administration, General Directorate of Wakfs (*Vakıflar Genel Müdürlüğü*), Municipalities

Table H.1 (continued): List of UDRM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
UDRM	Laws (*Yasa*)	5902 Coded - Law on Organization and Responsibilities of Disaster and Emergency Management Headship	2009	Draws up duties, responsibilities, and authority of the headship and its sub-units, and financial management issues. Includes pre-during-post disaster phases. This law also defines organization and specialties of the personnel and disaster related terminology.	By-law n. 13619 (2009)	In operation.	Prime Ministry, Ministry of Interrior, Governorships, Special Provincial Administration (*İl Özel İdaresi*).
	By-laws (*Yönetmelik*))	710357 - By-law on measures should be taken against fires on the coast.	1975	Prepared only for fire events and focusing on dense coastal industrial areas which also have continual marine traffic. Draws up responsible units and bodies, their duties, and coordination among them.		In operation.	Ministry of Interrior, Governorships
		4877 - Tip development by-law for planned areas	1985	Article 5 requires following the articles of other disaster related by-laws. Article 23 underlines the unsafe areas in terms of land dividing.		In operation including the revisions made in 2008. Operates with 3194 coded law.	Ministry of Public Works and Settlement, Municipalities
		4880 - By-law on the rules of preparing plans	1985	Article 5 and Article 6 requires obtaining and using disaster related data in plan preparation.		In operation including the revisions made in 1998, 1999, 2000, 2001, and 2005. Operates with 3194 coded law.	Ministry of Public Works and Settlement, Municipalities

Table H.1 (continued): List of UDRM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
UDRM	By-laws (*Yönetmelik*)	4882 - Development by-law for unplanned areas	1985	According to Article 8, the artciles of this by-law which are contradictory to the by-law 11445 are not enforced in disaster areas.		In operation including the revisions made in 1997, 1999, and 2001. Operates with 3194 coded law.	Ministry of Public Works and Settlement, Governorships, Municipalities
		12777 - By-law on emergency assistance organizations for disasters and their planning principles	1988	Basically draws up combination, coordination, organization, duties and responsibilities of emergency assistance units /agencies.		In operation.	Ministry of Public Works and Settlement, Governorships, Boondock Organizations of Public Institutions (*kamu kurum ve kuruluşlarının taşra örgütlenmeleri*)
		968716 - Prime Ministry Crisis Management Center by-law	1997	Draws up and defines operation principles, organizational structure, duties and responsibilities of Prime Ministry Crisis Management Center		In operation.	Prime Ministry, Ministries, Turkish General Staff (*Genelkurmay Başkanlığı*), Secretariat of the National Security Council (*Milli Güvenlik Kurulu Genel Sekreterliği*), Public Institutions
		9668 - By-law on the implementation of the law of conservation and use of old historical and cultural properties by renovation	2005	Section 7, Article 28 and Article 29 draw up determination of disaster risks and house cleaning (tasfiye) conditions in the case of risk conditions.		In operation.	Ministry of Interrior, Ministry of Public Works and Settlement, Special Provincial Administration, Municipalities,

Table H.1 (continued): List of UDRM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
UDRM	By-laws (*Yönetmelik*)	11162 - By-law on structures constructed in earthquake zones.	2007	Prepared for earthquake resistance and defines engineering tasks. These rules are explained in the comprehensive appendix of the by-law.		In operation including revision made in 2007.	Ministry of Public Works and Settlement
		11445 - By-law on structures constructed in disaster areas.	2007	Beside defining the land that should not be constructed on, this by-law also defines general technical conditions of the prevention against flood, fire, and earthquake disasters.		In operation.	Ministry of Public Works and Settlement, Municipalities
		11520 - Technical earthquake by-law on the constructing coastal structures-harbors, railways and airport constructions	2007	This by-law draws up the required rules and minimum conditions of assessing earthquake resistance of harbor-railway-airport constructions.		In operation including revisions made in 2008.	Ministry of Transport and Communication
		12937 - By-law on protection of the buildings against fire	2007	Draws up the rules and isntructions should be followed in order to minimise fire risk, and to interfere immediately in all types of buildings.		In operation.	many

Table H.1 (continued): List of UDRM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements					Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Situation	
UDRM	Decrees (*KHK*)	180 - Decree on the Organization and the Responsibilities of the Ministry of Public Works and Settlement	1983	Generally defines the body's responsibilities, duties, and authorities, and explains its organizational form.	In operation including the revisions made in 1984, 1986, 2003, 2005, and 2009.	Council of the Ministers
		576 - Decree on delaying tax responsibilities and making financial aids at the time of natural disasters	1999	Draws up the principals of delaying tax responsibilities of disadvantaged people due to the 1999 Eastern Marmara Earthquake. It also rules the financial aids that will be given to those people.	In operation including the revisions made in 2000.	Prime Ministry, Ministry of Public Works and Settlement, Ministry of Finance, Governorships
		582 - Decree on eliminating the losses emerged due to the disasters	1999	Draws up the payments of public debts occured at the time of 1999 Eastern Marmara Earthquake, and additional payments for civil cervants who worked in the disaster area before 10.1.1999 for at least three weeks.	In operation	Prime Ministry, Ministry of Interrior
		583 - Decree on founding Turkish Emergency Management Headship	1999	This decree enacts a change in the organization of Prime Ministry and drives foundation of Turkish Emergency Management Headship under the structure of Prime Ministry.	Abolished with the enaction of 5902 coded law.	
		587 - Decree on Compulsory Earthquake Insurance	1999	This decree requires having earthquake insurance in order to get compensation in the case of earthquake damages to the buildings.	In operation including the revisions made in 2007.	Turkish Catastrophe Insurance Pool (*Doğal Afet Sigortaları Kurumu*), Undersecretariat of Treasury (*Hazine Müsteşarlığı*)
		595 - Decree on Building Construction Supervision	2000	Draws up basics and techniques on building construction supervision, responsibilities of related person and institutions, and defines enforcement areas. Building Construction Supervision mainly aims to define constructural defects.	Cancelled by Constitution Court in 2001	
		601 - Decree on Professional Competence	2000	Basically defines the criteria that engineers and architects who will work as a building construction supervisor should have.	Cancelled by Constitution Court in 2001	

Appendix I: ICZM Related Legal Arrangements in Turkey

Table I.1: List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
ICZM	Laws (*Yasa*)	618 Coded - Law on Ports	1341	Draws up some issues on protecting marine environment, marine transportation, maritime navigation, and working conditions of harbor employees.	Terms of references n. 935061, n. 51806, n. 84538, n. 968442, n. 22081, and n. 9811860	In operation including the revisions made in 1935 and 2008.	Ministry of Industry and Trade, Undersecretariat of Maritime Affairs (*Denizcilik Müsteşarlığı*)
		5442 Coded - Provincial Administration Law	1949	Article 11 and Article 32 determine the duties of governors on coastal safety and security.	By-laws n. 710357 (1975), n. 979707 (1997), n. 84018	In operation including the revisions made in 2008.	Ministry of Interrior
		6237 - Law on Construction of Ports	1954	This law is mainly related to the financial resources for the construction of harbors and other marine structures. Additiobally, Supplementary Article 2 assures other construction activities required for economic and technical considerations, protection of coasts against sea erosions and prevention of sand movements and other similar considerations, and study and project of the ship building port, and manufactures and facilities required for their maintenance and repairs as well as maintenance and repair works regarding these services are taken into the scope.		In operation including the revisions made in 1956 and 2008.	Ministry of Public Works and Settlement, Ministry of Transport and Communication, General Directorate of Railways, Harbors and Airports Construction (*DLH - Demiryolları Limanlar ve Havameydanları İnşaatı Genel Müdürlüğü*)
		6831 Coded - Forestry Law	1956	This law has no judgement on coasts, however there are also coastal forests and this law has authority.	By-laws n. 848323 and n. 712520	Revisions made in 1959, 1968, 1971, 1973, 1975, 1982, 1984, 1986, 1987, 1988, 1995, 2000, 2001, 2003, 2004, 2008, 2009.	Ministry of Environment and Forestry

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
ICZM	Laws (*Yasa*)	2565 Coded - Law of Prohibited Military Zoners and Security Zones	1965	This law has no judgement on coasts, however there are 1st degree prohibited military zones on coastal areas and this law has authority.	By-law n. 835949	In operation including the revisions made in 1983, 1987, 1996, 2004, 2005, 2008, and 2009.	Turkish General Staff, Ministry of Interrior, Secretariat General of the National Security
		1380 Coded - Fisheries Law	1971	Mainly draws up the basics of protection, production, and control of fisheries; and defines prohibitions on these issues.		In operation with revisions made in 1986 and 2003.	Ministry of Agriculture
		2634 Coded - Law for the Encouragement of Tourism	1982	Defines the conditions of opening coasts and forests which belongs to the Treasury for tourism and structuring. Articles 3, 6, 8, and Section 4 regulates these issues.	By-laws n. 200915212, n. 836285, n. 20047253, n. 836181, n. 836708	In operation including the revisions made in 1983, 1988, 1991, 1993, 1997, 2001, 2002, 2003, 2004, 2007, and 2008.	Ministry of Culture and Tourism, Ministry of Environment and Forest, Ministry of Public Works and Settlement
		2674 Coded - Act on the Territorial Sea	1982	Defines the limits and special conditions of Turkish territorrial waters and inland waters.	By-law n. 837467	In operation.	Council of the Ministers

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
ICZM	Laws (*Yasa*)	2709 Coded - The Constitution of the Republic of Turkey	1982	Article 43 ensures that coasts are under the decision and authority of the state.		In operation.	Grand National Assembly of Turkey
		2863 Coded - The Law of the Conservation of Cultural and Natural Assets	1983	Article 5 makes the definition of "state-owned property", and coasts are included by this definition according to the constitution.		In operation including the revisions made in 1987, 2001, 2002, 2004, 2007, 2008, and 2009.	Ministry of Culture and Tourism, Ministry of Interrior, Directorate of Wakfs, Ministry of National Defence,
		2872 Coded - Environment Law	1983	Article 2, Article 9, and Article 11 make judgements with reference to the coast.	By-laws n. 12611, n. 12256, n. 7221, n. 12587, n. 9844, n. 9845, n. 5426	In operation including the revisions made in 1984, 1986, 1987,1988, 1990, 1991, 2002, 2004, and 2006.	Ministry of Environment and Forestry,
		2873 Coded - National Parks Law	1983	Since we have national parks on the coast this law has also authority on coasts.		In Operation including the revisions made in 2001, 2004, 2005, and 2008.	Ministry of Environment and Forestry, Ministry of Public Works and Settlement
		2960 Coded - Bosphorus Law	1983	This law has a distinctive place in terms of being prepared for a special coastal area. Defines specific coastal planning areas and rules for the Bosphorus.		In operation including the revisions made in 1984, 1985, and 1986.	Ministry of Publis Works and Settlement, Istanbul Greater Municipality, Bosphorus Development Directorate (*Boğaziçi İmar Müdürlüğü*), Bosphorus Development Administrative Board (*Boğaziçi İmar İdare Heyeti*), Bosphorus Development High Coordinating Committee (*Boğaziçi İmar Yüksek Koordinasyon Kurulu*)

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
ICZM	Laws (*Yasa*)	2981 Coded - Law on The Procedure Enforced to the Buildings Contradicting to the Development Law	1984	Article 12 and Article 14 defines the structures constructed on the coast contradictory to the shore law are the exclusion.	By-law n. 9262 (1986)	In operation including the revisions made in 1985, 1986, 1987, and 2003.	Ministry of Public Works and Settlement, Municipalities.
		3194 Coded - Development Law	1985	Article 46, 47, and 48 make statements on Bosphorus Law. Supplementary Article 3 in Section 6 makes statements on Shore Law and Tourism Incentives Law.	By-law n. 4877 (1985), 4880 (1985), 4882 (1985).	In operation including the revisions made in 1987, 1989, 1994, 1997, 1998, 2002, 2003, 2005, 2008, and 2009.	Ministry of Public Works and Settlement, Municipalities.
		3213 Coded - Mining Law	1985	Article 7 draws up permissions for mining activities in coastal areas and similar special areas.	By-law n. 20059013	In operation including the revisions made in 1987, 1999, 2001, 2004, 2006, and 2007.	Ministry of Energy and Natural Resources, Ministry of Environment and Forestry, General Directorate of Mineral Research & Exploration (*Maden Tetkik ve Arama Genel Müdürlüğü*)
		3402 Coded - Cadastre Law	1987	Article 16 excludes public domain, such as coasts, from the decisions of this law.	By-law n. 4730	In operation including the revisions made in 2000, 2005, 2008, and 2009.	Ministry of Public Works and Settlement, Ministry of Finance, General Directorate of Land Registry and Cadastre (*Tapu ve Kadastro Genel Müdürlüğü*)
		3621 Coded - Coast Law	1990	This law covers the arrangements for the sea, natural and artificial lake coasts and the surrounding coast lines and their condition of usage	By-laws n.4897, n. 11118,	In operation with revisions made in 1992, 2003, 2005, and 2008.	Ministry of Public Works and Settlement

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
ICZM	Laws (*Yasa*)	4533 Coded - Law of Gallipoli Peninsula Historical National Park	2000	Draws up managing the whole national park area (includes the coast) by protecting and improving its historical, cultural, and natural values (Article 3 is significant in this respect)	By-law n. 5415	In operation including the revisions made in 2003 and 2004.	Ministry of Environment and Forestry, General Directorate of National Parks (*Milli Parklar Genel Müdürlüğü*)
		4721 Coded - Turksih Civil Law	2001	Article 715 has an implicit mention on coasts.	Terms of reference n. 20035960	In operation including the revisions made in 2003, 2004, 2005, and 2007.	Ministry of Interrior, Ministry of Foreign Affairs
		5312 Coded - Act on Guidelines for Response to Emergencies and Compensation of Losses in case of Pollution of the Marine Environment from Oil and other Harmful Substances	2005	Mainly draws up the intervention types and rules in the case of oil spill and other types of pollution effects in order to fulfill the responsibilities that required by national and international legal rights.		In operation.	Ministry of Environment and Forestry, Ministry of Foreign Affairs, Undersecretariat of Maritime Affairs, Disaster and Emergency Management Headship
		5393 Coded - Municipality Law	2005	Article 79 defines coasts of the municipality under the decision and the authority of the municipality as long as they enforce the decisions of Shore Law.		In operation including the revisions made in 2006, 2007, 2008, and 2010.	Ministry of Interrior, State Planning Organization, Municipalities

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
ICZM	By-laws (*Yönetmelik*)	710357 - By-law on measures should be taken against fires on the coast.	1975	Prepared only for fire events and focusing on dense coastal industrial areas which also have continual marine traffic. Regulates responsible units and bodies, their duties, and coordination among them.		In operation.	Ministry of Interior, Governorships
		4897 - By-law on enforcement of coast law	1990	Determines all the coastal activities and their places, conditions, features; plan intervention types on the coast, and defining the boundaries of special coastal zones.		In operation.	Ministry of Public Works and Settlement
		8132 - By-law on controlling solid wastes	1991	Article 18 forbids dumping solid wastes to seas, lakes, and other similar receiving environments.		In operation.	Ministry of Environment and Forestry
		10848 - By-law of Turkish National Committee on Coastal Zone Management	1993	Determines the principles of founding Turkish National Committee on Coastal Zone Management as being an active actor in coastal issues.		In operation.	METU
		4997 - By-law on shelters	1996	Draws up the construction conditions, operation principles and other features of shelters,		In operation.	Ministry of Agriculture, Ministry of Public Works and Settlement

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	Responsible Bodies
ICZM	By-laws (*Yönetmelik*))	7221 - By-law on water pollution control	2004	Determines prosedures and ways of controlling coastal water quality, gives lower and higher limit values, and also makes some definitions.		In operation.	Ministry of Environment and Forestry.
		6599 - By-law of industrial zones	2004	Article 7 insists on coastline and coastal filling areas in terms of getting required data in order to make threshold analysis.		In operation.	Ministry of Industry and Trade
		5426 - By-law on protection of wetlands	2005	This by-law has no mention on coasts however most of the wetlands are locating on coastal areas. Therefore this by-law may have effect on coastsl areas.		In operation.	Ministry of Environment and Forestry
		7557 - By-law on controlling hazardous wastes	2005	Article 2 enforces applying the decisions of MARPOL to the ships.		In operation.	Ministry of Environment and Forestry
		9844 - By-law on urban waste water treatment	2006	The by-law explains discharge conditions and emphasises coastal waters.		In operation.	Ministry of Environment and Forestry
		9845 - Quality of swimming water by-law	2006	This by-law mostly insists on sea water as swimming water and defines the conditions for its quality.		In operation.	Ministry of Environment and Forestry

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	Responsible Bodies
ICZM	By-laws (*Yönetmelik*))	10043 - By-law on the inspection of port states	2006	According to Article 1, this by-law also provides protecting marine environment.		In operation.	Undersecretariat of Maritime Affairs
		11118 - By-law on the basics of giving enterprice license to coastal installations	2007	The by-law refers to the Coast Law in defining coastal installations and determines the permission conditions for enterprice.		In operation	Ministry of Transport and Communication, Undersecratariat of Maritime Affairs
		11520 - Technical earthquake by-law on the constructing coastal structures-harbors, railways and airport constructions	2007	This by-law draws up the required rules and minimum conditions of assessing earthquake resistance of harbor-railway-airport constructions.		In operation including revisions made in 2008.	Ministry of Transport and Communication
		12256 - By-law on Environmental Impact Assessment (EIA)	2008	Appendix II of the by-law explains "transport, infrastructure, and coastal structures", and Appendix V of the bay-law insists on "coastal areas" as sensitive areas.		In operation.	Ministry of Environment and Forestry
		12290 - By-law on waste oil control	2008	According to Article 5, discharging waste oils to the sea is forbidden.		In operation.	Ministry of Environment and Forestry
		12587 - By-law on 1/50.000 - 1/100.000 scaled master plans for regions and basins	2008	Article 9 emphasises plan revisions without any reasons for the Bosphorus region in order to prevent maritime accidents, environmental pollution, disasters, and damage to natural and historical resources.		In operation.	Ministry of Environment and Forestry
		15212 - By-law of marine tourism	2009	This by-law mainly draws up the required qualifications of marine tourism complexes, services, and facilities.		In operation.	Ministry of Culture and Tourism

Table I.1 (continued): List of ICZM Related Legal Arrangements in Turkey

	Relevant Legal Arrangements						Responsible Bodies
	Type	Law Code / By-law Number / Decree Number and Name	Date	Scope	Relevant Sub-Regulations	Situation	
ICZM	Decrees (*KHK*)	383 - Decree on the establishment of Environmental Protection Agency for Special Areas	1989	Article 13 and Article 19 draws up some main duties and responsibilities of EPASA with reference to coasts and marine activities.		In operation including the revisions made in 1991, 2002, and 2005.	Ministry of Environment and Forestry
		485 - Decree on organization and duties of the Undersecrataríat of Customs	1993	Also draws up the responsibilities of the sub-units of Undersecrataríat of Customs with reference to sea, harbors, and coastal borders.		In operation including the revisions made in 1993, 1994, 1995, 2000, 2005, 2006, 2007, and 2009.	Ministry of Finance
		491 - Decree on organization and duties of the Undersecretariat of Maritime Affairs	1993	Draws up the duties, responsibilities and organization of the undersecrataríat. Huge part of its mission is on providing maritime safety and security.		In operation including the revisions made in 1999, 2000, 2002, 2004, 2005, and 2009.	Ministry of Transport and Communication

Appendix J: CVI Development Methodologies and their Usage

Five different types of CVI development methodologies (their data sets, variables and characteristics) their usage for which kind of disaster risk assessment, CVI formulations, and ranking systems are discussed briefly in the following.

According to the report prepared by Thieler and Hammer-Klose (1999), the CVI was first developed and used by Gornitz et al. (1994), and a similar index was also developed by Shaw et al. (1998) as the sensitivity index. However, a systematic approach to the calculation of CVI is first used by the United States Geological Survey (USGS) for the sea-level rise. The study held by Thieler and Hammer-Klose seeks to objectively determine the relative risks due to future sea-level rise for the U.S. Atlantic, Pacific, and Gulf of Mexico coasts. With this aim, they developed and used CVI which is quantified based on the following criteria: tidal range, wave height, coastal slope, shoreline change, geomorphology, and historical rate of relative sea-level rise. Their approach combines a coastal system's susceptibility to change with its natural ability to adapt to changing environmental conditions, and yields a relative measure of the system's natural vulnerability to the effects of sea-level rise. The results of their studies were published in 1999 and 2000 by the USGS (http://woodshole.er.usgs.gov/project-pages/cvi/ - Access Date: 21.11.2007).

Thieler and Hammer-Klose used geomorphology, shoreline erosion and accretion rates (m/yr), coastal slope (percent), rate of relative sea-level rise (mm/yr), mean tidal range (m), and mean wave height (m) as the physical index variables, and each variable is assigned a relative risk value based on the potential magnitude of its contribution to physical changes on the coast as sea-level rises. Table J.1 summarizes these variables and ranking methodology of Thieler and Hammer-Klose for giving an example. This method yields numerical data that cannot be directly equated with particular physical effects. It does, however, highlight those regions where the various effects of sea-level rise may be the greatest (Thieler and Hammer-Klose, 1999).

Once each section of coastline is assigned a risk value based on each specific data variable, then Thieler and Hammer-Klose calculated the coastal vulnerability index as the square root of the geometric mean, or the square root of the product of the ranked variables divided by the total number of variables. The formula of CVI that used by Thieler and Hammer-Klose was the same as shown in the figure below:

$$CVI = \sqrt{((a*b*c*d*e*f) / 6)}$$

Figure J.1: CVI Formula used by Thieler and Hammer-Klose (1999)

In the formula above, (a) indicates geomorphology, (b) indicates coastal slope, (c) indicates relative sea-level rise rate, (d) indicates shoreline erosion / accretion rate, (e) indicates mean tide range, and (f) indicates mean wave height.

Table J.1: Thieler and Hammer-Klose's Ranking of Coastal Vulnerability Index Variables

	Ranking of Coastal Vulnerability Index				
	Very Low	Low	Moderate	High	Very High
Variable	1	2	3	4	5
Geomorphology (erodibility)	Rocky, cliffed coasts Fjords Fjords	Medium cliffs Intended coasts	Low cliffs Glacial drift Alluvial plains	Cobble beaches Estuary Lagoon	Barrier beaches Sand beaches Salt marsh Mud flats Deltas Mangrove Coral reefs
Coastal Slope (%)	> 0.2	0.2 – 0.07	0.07 – 0.04	0.04 – 0.025	< 0.025
Relative Sea-level Change (mm/yr)	< 1.8	1.8 – 2.5	2.5 – 2.95	2.95 – 3.16	> 3.16
Shoreline Erosion / Accretion (m/yr)	> 2.0	1.0 – 2.0	-1.0 - +1.0	-1.1 - -2.0	< -2,0
	Accretion		Stable	Erosion	
Mean Tide Range (m)	> 6.0	4.1 – 6.0	2.0 – 4.0	1.0 – 1.9	< 1.0
Mean Wave Height (m)	< 0.55	0.55 – 0.85	0.85 – 1.05	1.05 – 1.25	> 1.25

At the end of their study, Thieler and Hammer-Klose (1999) claim that CVI provides insight into the relative potential of coastal change due to future sea-level rise. The results of their study can be viewed in at least two ways:

- as a base for developing a more complete inventory of variables influencing the coastal vulnerability to future sea-level rise to which other elements can be added as they become available; and
- as an example of the potential for assessing coastal vulnerability to future sea-level rise using objective criteria.

About the use of CVI, Thieler and Hammer-Klose (1999) also claim that to best understand where physical changes may occur, large-scale variables must be clearly and accurately mapped, and small-scale variables must be understood on a scale that takes into account their geologic, environmental, and anthropogenic influences.

In another study, Pethick and Crooks (2000) claim that simple and preliminary first order vulnerability index help to identify whether a coastal system is under threat or failure because of human perturbations, or whether the change in coastal configuration of concern is part of a natural or quasi-natural cyclical readjustment and will in time return to a stable and resilient state, and they formulize the index as below:

Vulnerability Index = Relaxation Time / Return Interval

Figure J.2: Vulnerability Index Formula of Pethick and Crooks (2000)

The ratio between relaxation time and the return interval for threshold events explains the vulnerability index and it provides an important measure of the manner in which coastal landforms respond to imposed changes and allow assessment of the potential for long term progressive change in the system (Pethick and Crooks, 2000).

Pethick and Crooks (2000) give an example in their study by a summary table (Table.4.2) which shows some documented estimates of the return intervals and corresponding relaxation times of a range of coastal forms. These data are collected from locations around the world.

Table J.2: Example Vulnerability Indices for a Range of Coastal Features

(*Source:* Pethick and Crooks, 2000).

Coastal Form	Event Frequency (yr)	Relaxation Time (yr)	Vulnerability Index
Cliffs	1-1000	> 1-1000	1
Beaches	1	0,7	1,5
Sand Dunes	8	4	2
Mudflats	2	1	2
Spits	500	50	10
Salt Marshes	33	5	6
Estuaries	100000	10000	10
Shingle Ridges	10-100	1-10	10

On the other hand, Özyurt (2007) also used almost the same variables with the ones in Thieler and Hammer-Klose's study. However, Özyurt (2007) first determined the impacts of sea-level rise (coastal erosion, flooding due to storm surges, inundation, salt water intrusion to ground water resources, salt water intrusion to estuaries and rivers) and then also developed sub-indices of vulnerability by using physical parameters (such as geomorphology, coastal slope, tidal range, rate of sea-level rise, significant wave height, etc.) and human influence parameters (such as river flow regulation, engineered frontage, coastal protection structures, natural protection degradation, land use pattern, ground water consumption, etc.). Following these steps, she calculated CVI's for each impact of sea-level rise. However, the formula she used for the calculation of CVI's is different from the ones Thieler and Hammer-Klose and Pethick and Crooks have used (Figure J.3).

Özyurt ranged the sub-indices of vulnerability for the impacts (CVI_{impact}) between 1 and 5 from least vulnerable to most vulnerable. And finally she summarized all the parameters and impacts with CVI values in a CVI matrix and adopted it in her case study area, Göksu Delta.

Another CVI development made by Boruff, Emrich, and Cutter (2005) for erosion hazard also uses the same formula with the one used by Thieler and Hammer-Klose in 1999. As explained in the previous section, Boruff, Emrich, and Cutter calculated three types of vulnerability indices; place vulnerability index – PVI which represents overall place vulnerability, CVI (coastal vulnerability index) which represents physical vulnerability, and

CSoVI (coastal social vulnerability index) which represents social vulnerability. Their physical vulnerability variables are also the same as the variables of used by Thieler and Hammer-Klose. According to the results of their study, CVI scores range from -1.857 to 2.490, CSoVI scores range from low of -3.727 to 3.304, and PVI scores range from -3.397 to 3.932. They evaluated index values of each research area in their study between these ranges and decided which area is most vulnerable and which area is least.

$$CVI_{impact} = \frac{\left(0.5 * \sum_{1}^{n} PP_n * R_n\right) + \left(0.5 * \sum_{1}^{m} HP_m * R_m\right)}{CVI_{\text{least vulnerable}}}$$

$$CVI(SLR)n = \frac{\sum \text{Parameters of Impacts of the group}}{\sum \text{Least Vulnerable Case of the group}}$$

Figure J.3: The CVI formulas used by Özyurt (2007)[12]

Finally, McLaughlin, McKenna, and Cooper (2002) explored socio-economic data usage in developing CVI's. They analyzed varying types of socio-economic data for the development of a kind of CVI, and ranked them in sub-indices, and developed a simple CVI calculation as shown in the figure below:

For example; land-use vulnerability ranking and socio-economic characteristics vulnerability classification took their place in the study as summarized in Table J.3 and J.4.

[12] In the first formula, PP represents physical parameters, HP represents human influence parameters, R represents corresponding range of the vulnerability parameter, and $CVI_{leastvulnerable}$ represents the value of the summation of the parameters for the least vulnerable case of the given impact (Özyurt, 2007).

Table J.3: Land-use Vulnerability Ranking of McLaughlin, McKenna, and Cooper (2002)

	1	2	3	4	5
Land-use	Bare rocks Sparsely vegetated areas Marsh/bog/moor Water bodies	Coastal areas Natural grasslands	Forest	Agriculture	Urban and industrial Infrastructure

Table J.4: Socio-economic Characteristics Vulnerability Classification Scheme of McLaughlin, McKenna, and Cooper (2002)

Variable	**1**	**2**	**3**	**4**	**5**
Settlement	No settlement	Village	Small Town	Large Town	City
Cultural Heritage	Absent				Present
Roads	Absent				Motorway Dual carriage way
Railway	Absent				
Land-use	Water bodies Marsh/bog and moor Sparsely vegetated areas Bare rocks	Natural grassland Coastal areas	Forest	Agriculture	Urban and industrial Infrastructure
Designated conservation areas	Absent		International		National

Appendix K: Cancelled 1/100.000 scaled Hatay Master Plan

1/100.000 scaled Hatay Master Plan is evaluated only by considering the Iskenderun Coastal Region part. According to this plan, approximately 2 km-width coastal land of Karaağaç is allocated to tourism complexes and secondary housing. There are 2 large parts allocated to military uses between Iskenderun and Denizciler. There are also storage units, industry, housing, urban development areas, settled urban areas, and railway which lie along the coast and ends at the center of Iskenderun city. The plan allocates the area between Denizciler and Sarıseki to settled urban areas and military. Coast of Sarıseki is allocated to OIE, and this area ends by the area of ISDEMİR. There is a limited area allocated for recreation on the north of Sarıseki. Figure 6.19 shows “ICR” part of the 1/100.000 scaled Hatay Master Plan.

This plan orientates and defines the lower scale (1/25.000) planning areas, and “Iskenderun Sub-region” is one of these lower scale planning areas. 1/100.000 scaled Hatay Master Plan defines Iskenderun Sub-region as “*the center of specialization of industry and service*” According to the 2025 year projections of this plan, average population density of Iskenderun city-center is 100 person/hectare. Increase in density is orientated to north and south-east parts of the city.

1/100.000 scaled Hatay Master Plan proposes capacity increase for the port area. However, no more industry areas are proposed by the plan. According to the plan, existing industry should improve itself in terms of technological development. Green belts and more social activity areas are intended by the plan in order to rehabilitate the Iskenderun city. With these intends, the plan recommends increase in the population of people working in service sector. Iskenderun city is expected to expand towards Dörtyol and Belen (in terms of urban expansion), and towards Karaağaç and Arsuz (in terms of secondary housing and tourism). Additionally, the plan puts urgency and necessity forward in terms of having treatment unit for all types of tourism and industry complexes. A solid waste management system is expected to be provided by the coordination of Iskenderun Municipality. These proposals are evaluated positively by the study by taking today’s tendencies into consideration.

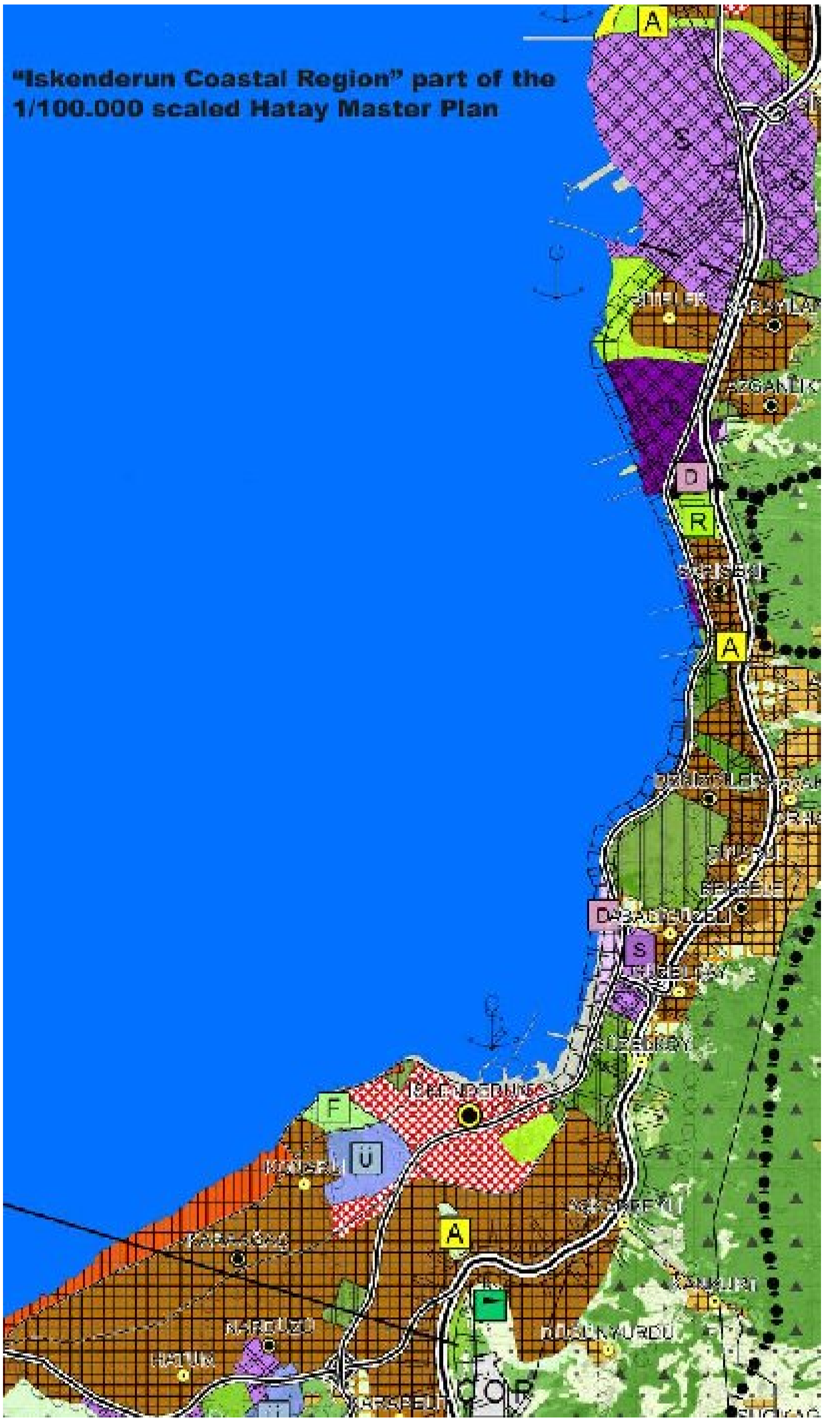

Figure K.1: "Iskenderun Coastal Region" part of the 1/100.000 scaled Hatay Master Plan

1/100.000 scaled Hatay Master Plan also recommends strengthen of the highway through Iskenderun – Arsuz – Çevlik – Samandağ. However, since its possible negative and damaging implications on living environment, ecological balance, settlement expansions and future tendencies, this recommendation is evaluated negatively by the study. Effects and possible results of this recommendation should be investigated and analyzed in detail.

Appendix L: 1/25.000 scaled 1994 Plan of Iskenderun Bay and Near Environs

First of all, the very noticeable point of this 1/25.000 scaled plan is about transportation. Transportation links proposed by the plan do not satisfy the needs and tendencies of the region. In fact, the city needs stronger, definite and certain links with both its newly developing parts and its current transportation system elements (different transportation types).

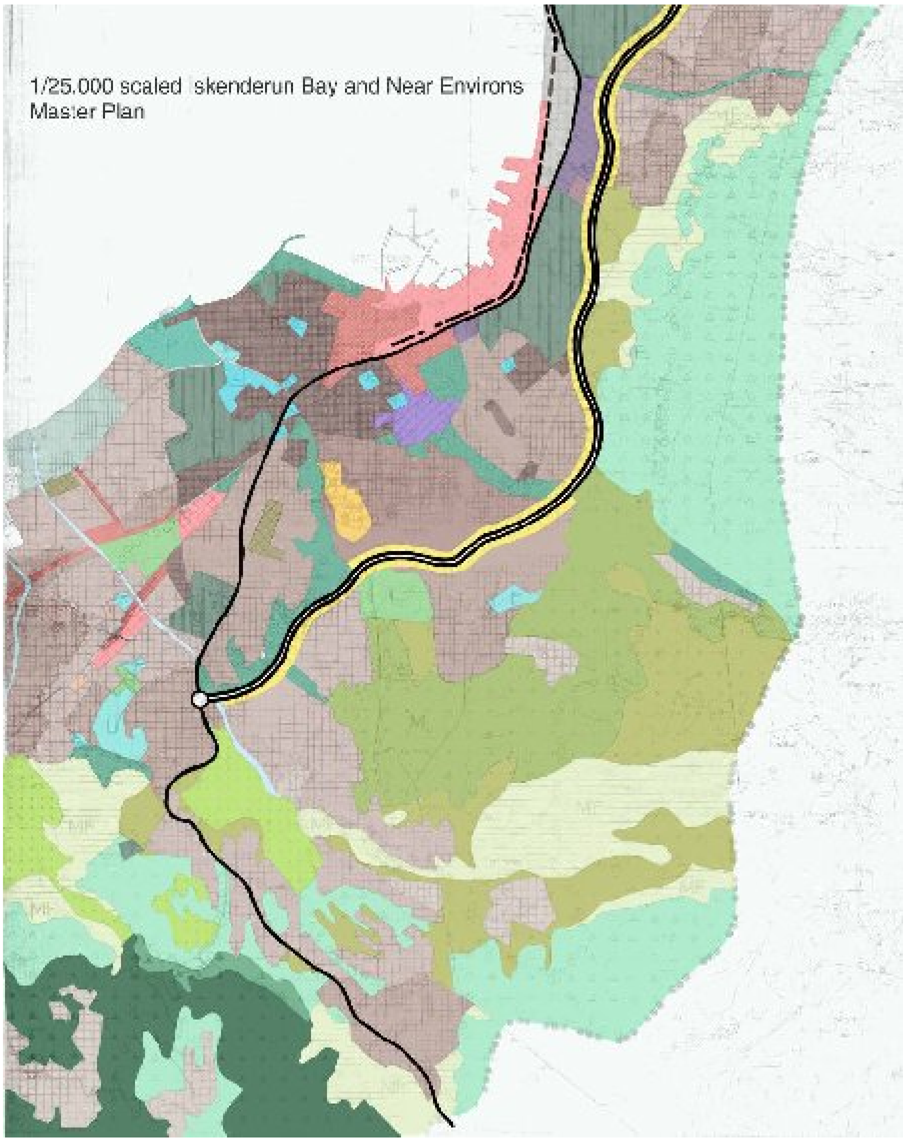

Figure L.1: 1/25.000 scaled 1994 Plan for the Iskenderun Bay and Near Environs

The plan preserves the current development and land-use type on the coastal strip (port activities, CBD, the densest housing areas) housing and proposes secondary housing and recreational uses for developing parts of the coastal strip on the south. According to the plan; northern part of the Iskenderun city is allocated basically for industrial activities (industry, storage, transportation, military, etc.) and the southern part of the Iskenderun city is allocated basically for tourism and recreation (secondary housing, less dense housing areas, agriculture, and conservation, etc.) The plan does not propose an extension for the highway coming from the northern coastline along southern coastline. This approach is evaluated suitable in terms of preserving southern parts more natural and more protected.

However this plan does not consider problematic parts of the city seriously. Approach of the plan to the flood and landslide areas is not satisfying. In fact, the plan totally ignores the canal passing throughout the city. New plans and new plan approaches should approach this issue much more seriously.

On the other hand, preparation works of 1/25.000 scaled Master Plan of Hatay Province is still going on and a draft plan was prepared for Iskenderun city within these works. Figure 6.21 shows this draft. This draft, within this form, introduces much more described functions and activities than previously discussed 1/25.000 scaled master plan. The plan relocates dense housing areas from city center to the outer parts of the settlement and recommends a decrease in density in the city center. However, the plan consumes the areas that previously were defined as urban open-green space in order to provide decrease in density in the city center. Previously existing high density housing areas are described as CBD by the plan. Denser housing areas are mostly located along the transportation lines. Coastal strip is basically allocated for open spaces and daily recreation except the port area; and certain approaches seems to be developed to the canal and protection areas as well as coastal strip. The highway passing throughout the city center seems as a separator dividing the city into two parts one of which has very limited ability in reaching to the coast. In other words, the highway divides the city into two parts; one’s function is business and recreation, and the other’s is housing.

Appendix M: Plans and Plan Evaluations of Denizciler, Sarıseki, Karayılan and Karaağaç Districts

The one and only approved plan of Denizciler is prepared in 1990 by the municipality. Almost Approximately 75 % of the municipal area is in between Mediterranean Sea and Ceyhan – Iskenderun Motorway and 20 % of the municipal area of Denizciler is military area. Coastal strip of the municipal area is utilized for railway and highway. Except these functions, the municipality has a very narrow and limited shore for other uses on the coastal strip.

The plan is in fact very detailed and well designed. However, according the preparation works of the 1/25.000 scaled Master Plan of the Hatay Province; this plan of Denizciler is inadequate today. The municipality has some projects (such as mass housing, sport complexes, and a treatment unit) nowadays and these projects should take their places in the master plan. Figure 6.23 shows 1/5000 scaled Master Plan of Denizciler Municipality.

1/5000 scaled Master Plan of Sarıseki Municipality is prepared by Öner Mersinligil in 1992, and some revisions related to Organized Industrial Estate was made in 2008. Likewise Denizciler, Sarıseki also jams in between Mediterranean Sea and Ceyhan – Iskenderun Motorway.

Sarıseki was taking place as “Sarıseki Village” in the 1981 plan of Iskenderun. After the establishment of Organized Industrial Estate in 1980, plans were prepared for the area including OIE. There are also revisions for the filling areas locating on the coast of OIE. The critical point here is that Sarıseki Organized Industrial Estate comprises both the “industry zone” determined in 1981 plan and its adjacent area which was defined as “water source protection area” in 1981 plan.

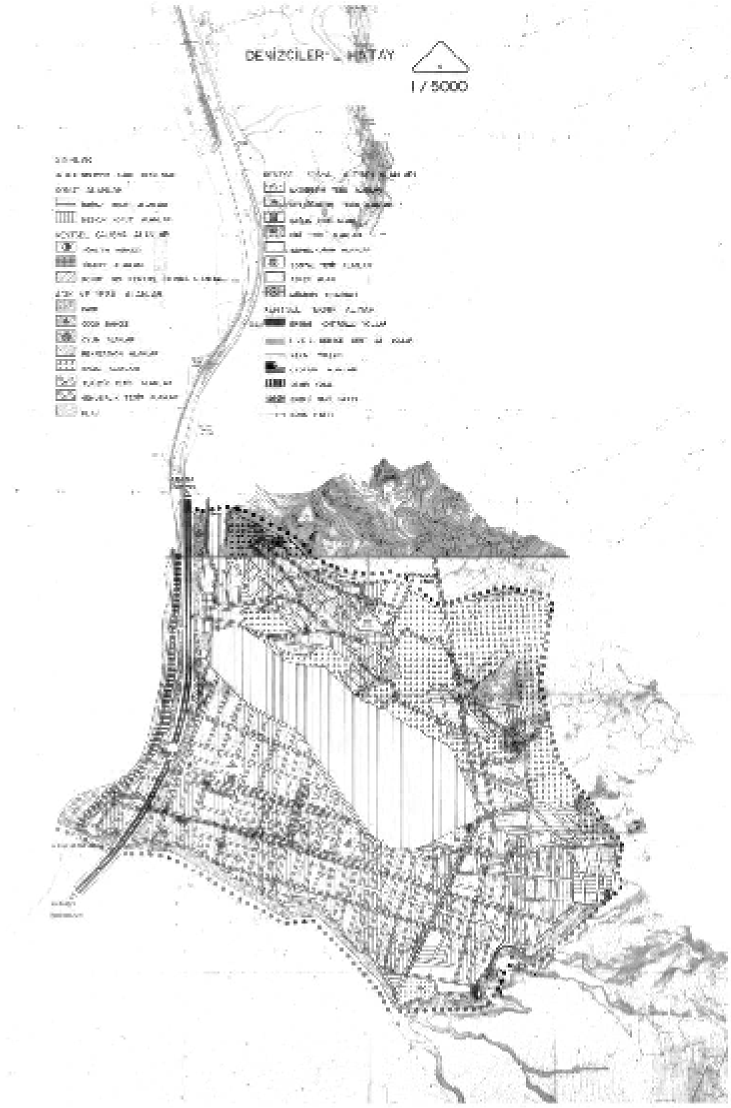

Figure M.1: 1/5000 scaled Master Plan of Denizciler Municipality

Organized Industrial Estate constitutes a large part of Sarıseki Municipality. Coast of Sarıseki is almost totally utilized by the Organized Industrial Estate. Piers, storage units, landing areas and also the railway line locate on the Sarıseki coast. People of Sarıseki could only use about 700 m part of the coast for recreational activities. Figure 6.24 shows the latest plan of Sarıseki Municipality. However, there are some development projects about Organized Industrial Estate on the agenda nowadays. Therefore, the municipality needs a new plan.

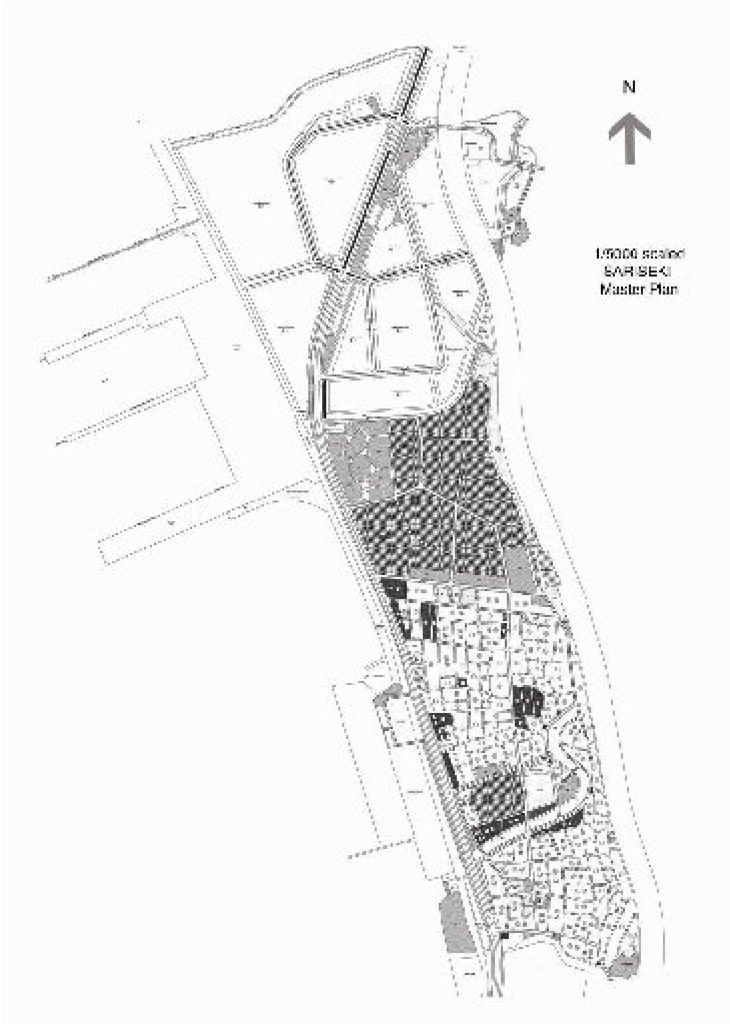

Figure M.2: 1/5000 scaled Master Plan of Sarıseki Municipality

The first and latest ratified plan of Karayılan was prepared by Bülent Berksan in 1996. There are also revisions prepared for the different parts of ISDEMİR. Likewise Sarıseki, a huge part of Karayılan Municipality is utilized by industry; a huge part of the municipality is composed by the land of ISDEMİR. Figure 6.25 shows existing situation map of Karayılan Municipality including ISDEMİR. The master plan of Karayılan Municipality, which also covers outer parts of ISDEMİR, could not be obtained.

Coastal part of the Karayılan Municipality is totally utilized by ISDEMİR, and people of Karayılan could not access to the coast within the Karayılan Municipality borders.

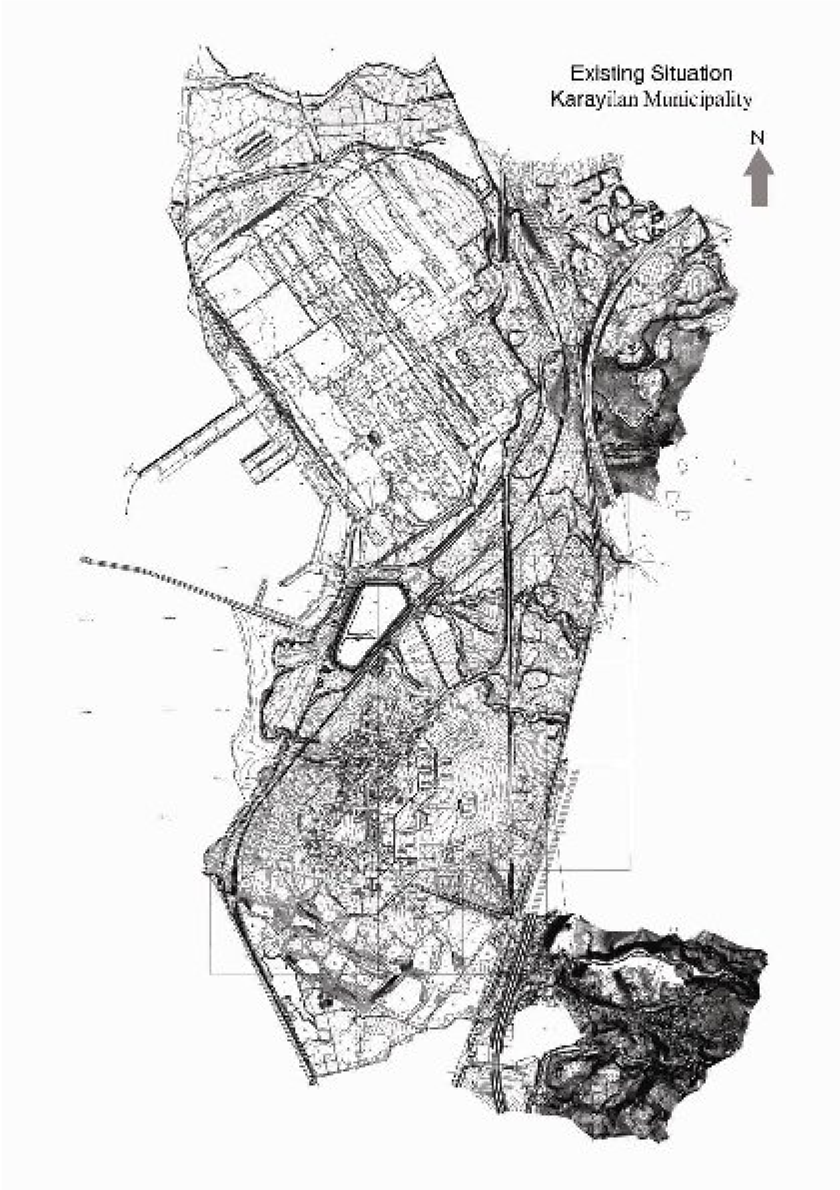

Figure M.3: Existing Situation of Karayılan Municipality

Latest ratified plan of Karaağaç Municipality is prepared by Cemal Atakan in 1990, and some revisions made in 1996.

Karaağaç is the best site which people of the region could reach to the coast without any barrier. This site is allocated for tourism, recreation and secondary housing. Building density in the site is much lower than other municipalities in the region, especially with reference to Iskenderun city-center. Besides, its location (closeness to the Iskenderun city-center) is an advantage for the people who lives in Iskenderun city-center and wants to use the area for recreational activities.

Figure M.4: 1/5000 scaled Master Plan of Karaağaç Municipality

Plan approach to the canal is appreciated. Plan requires rehabilitation of the canal in order to minimize flood risk. Also the plan does not permit multi-storey buildings since the ground type of the area is not reliable. Open area system that the plan introduces is sufficient.

Appendix N: Iskenderun Bay Integrated Coastal Planning and Management Project

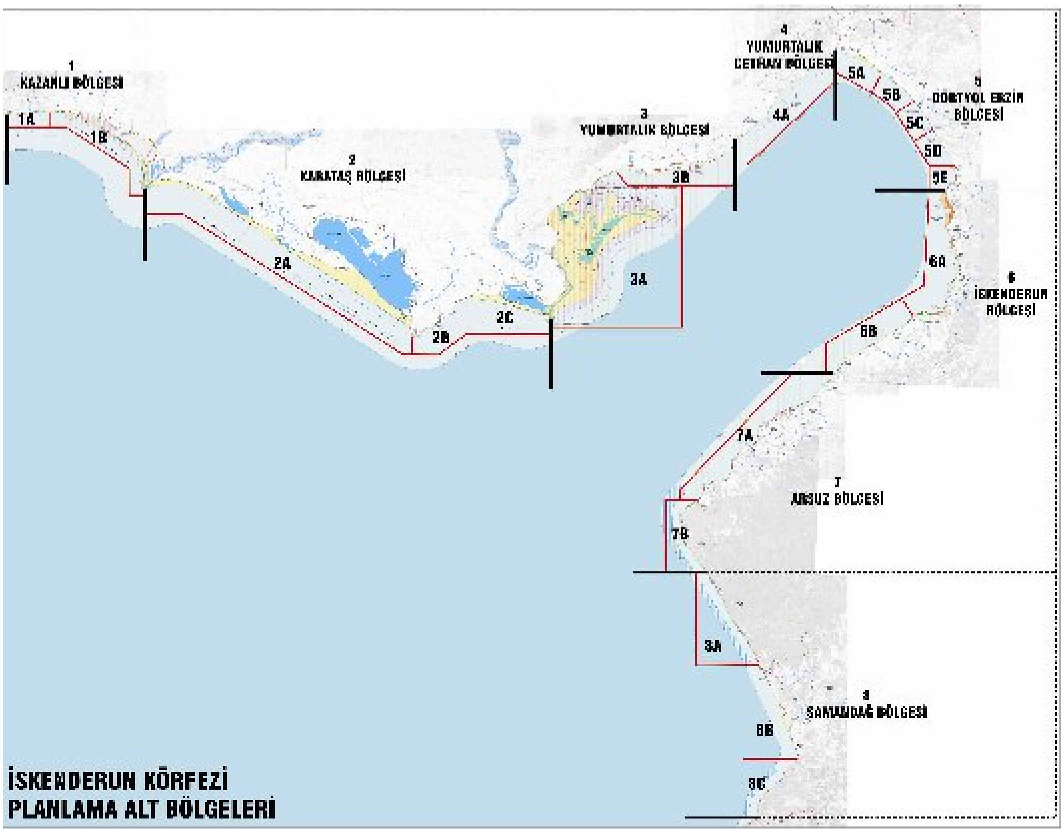

Figure N.1: Planning Areas of Iskenderun Bay Coastal Planning and Management Project (*Source:* Ministry of Public Works and Settlement, 2007)

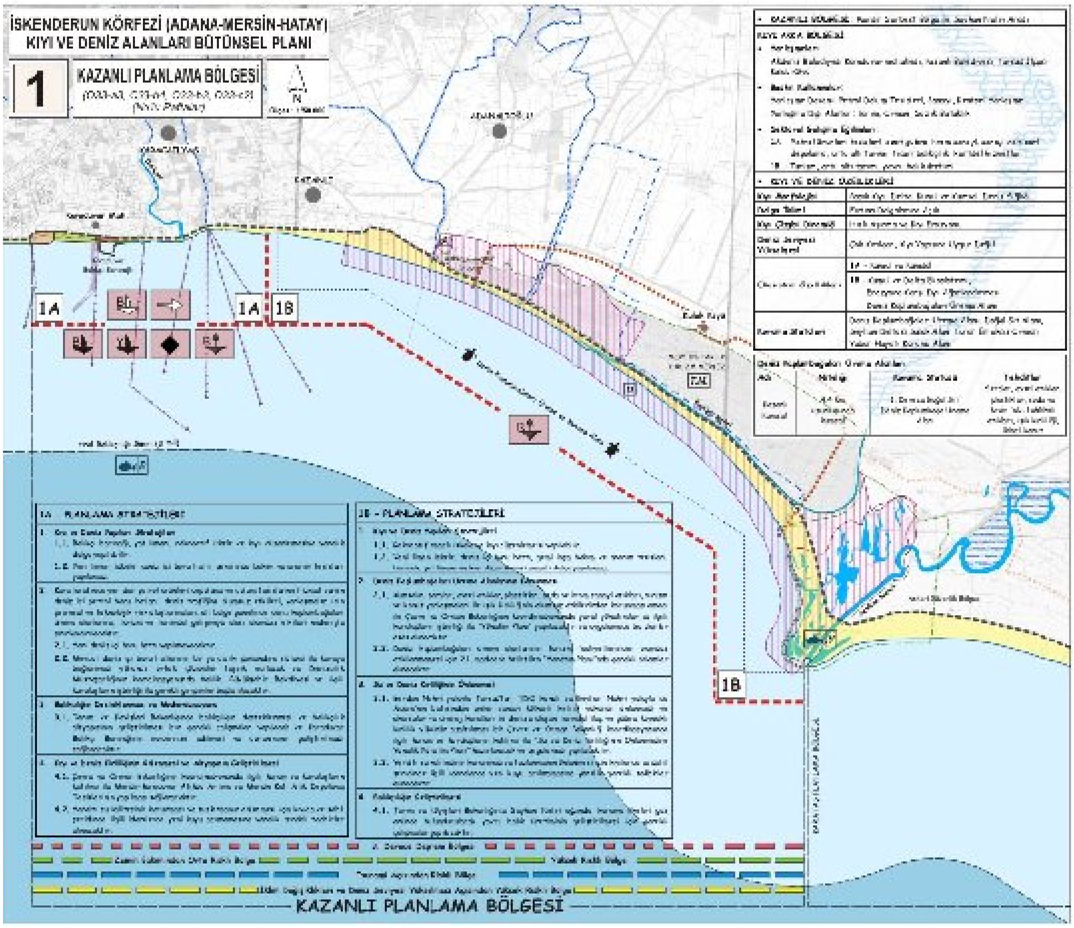

Figure N.2: Kazanlı Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

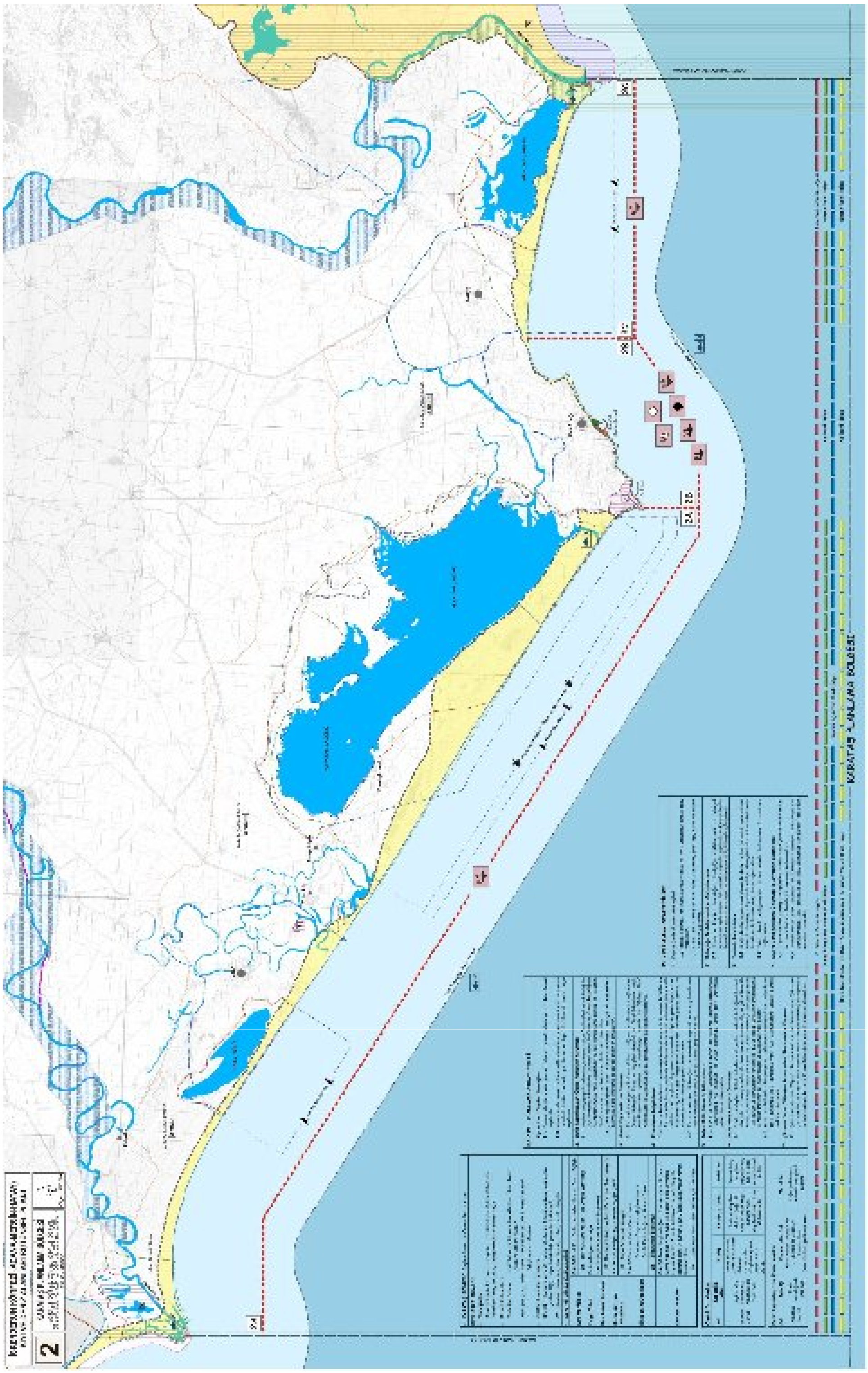

Figure N.3: Karataş Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

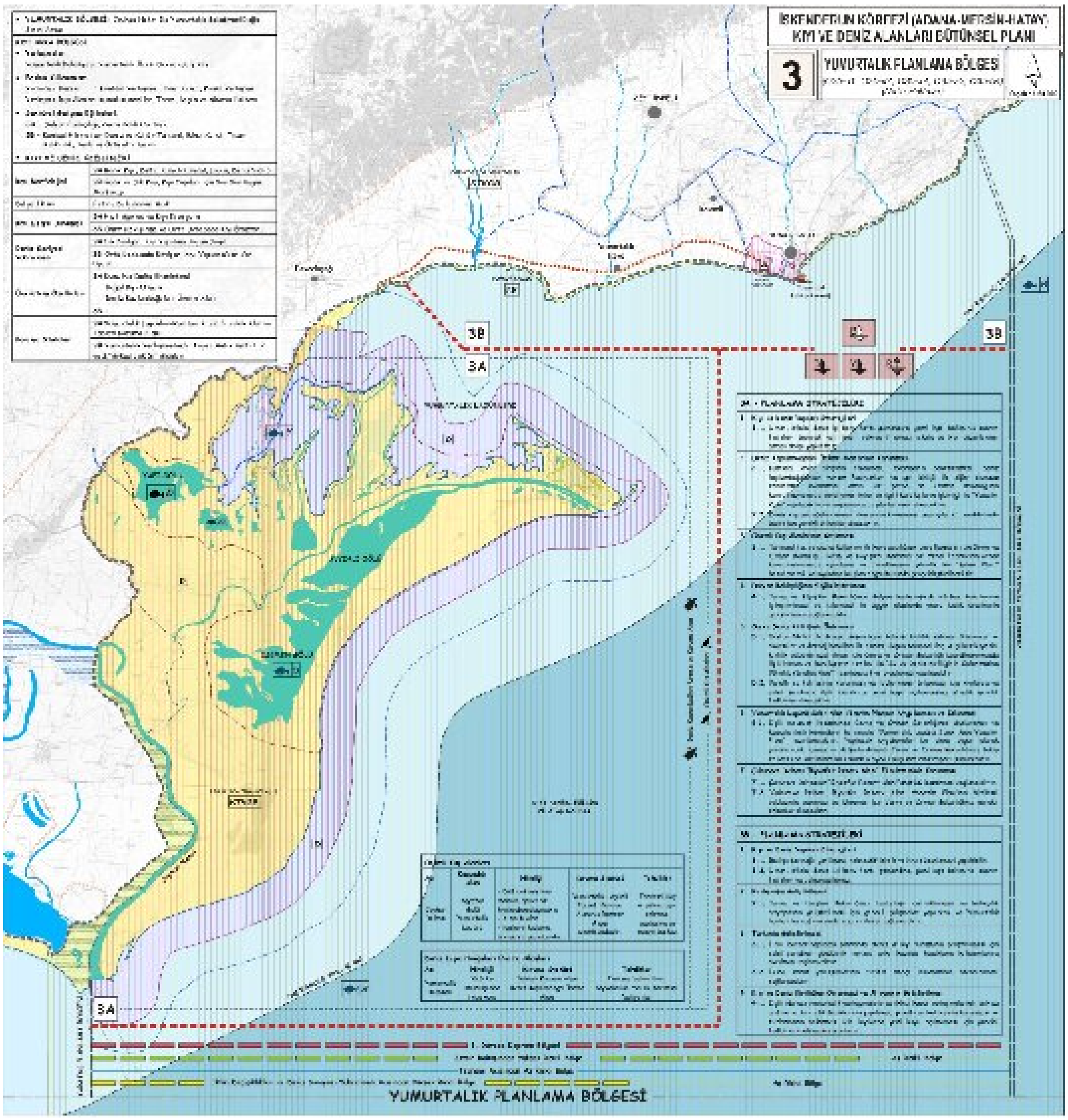

Figure N.4: Yumurtalık Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

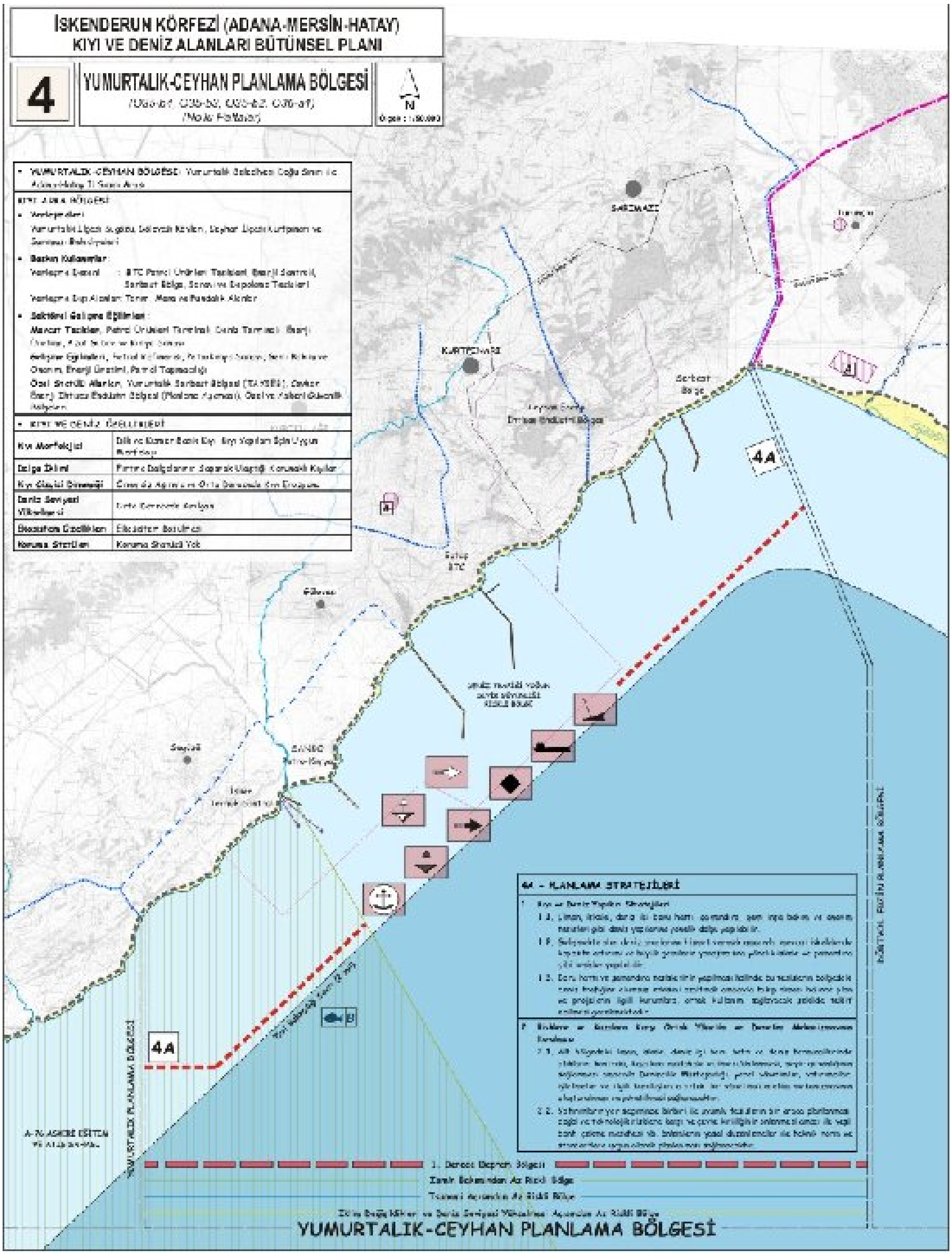

Figure N.5: Yumurtalık – Ceyhan Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

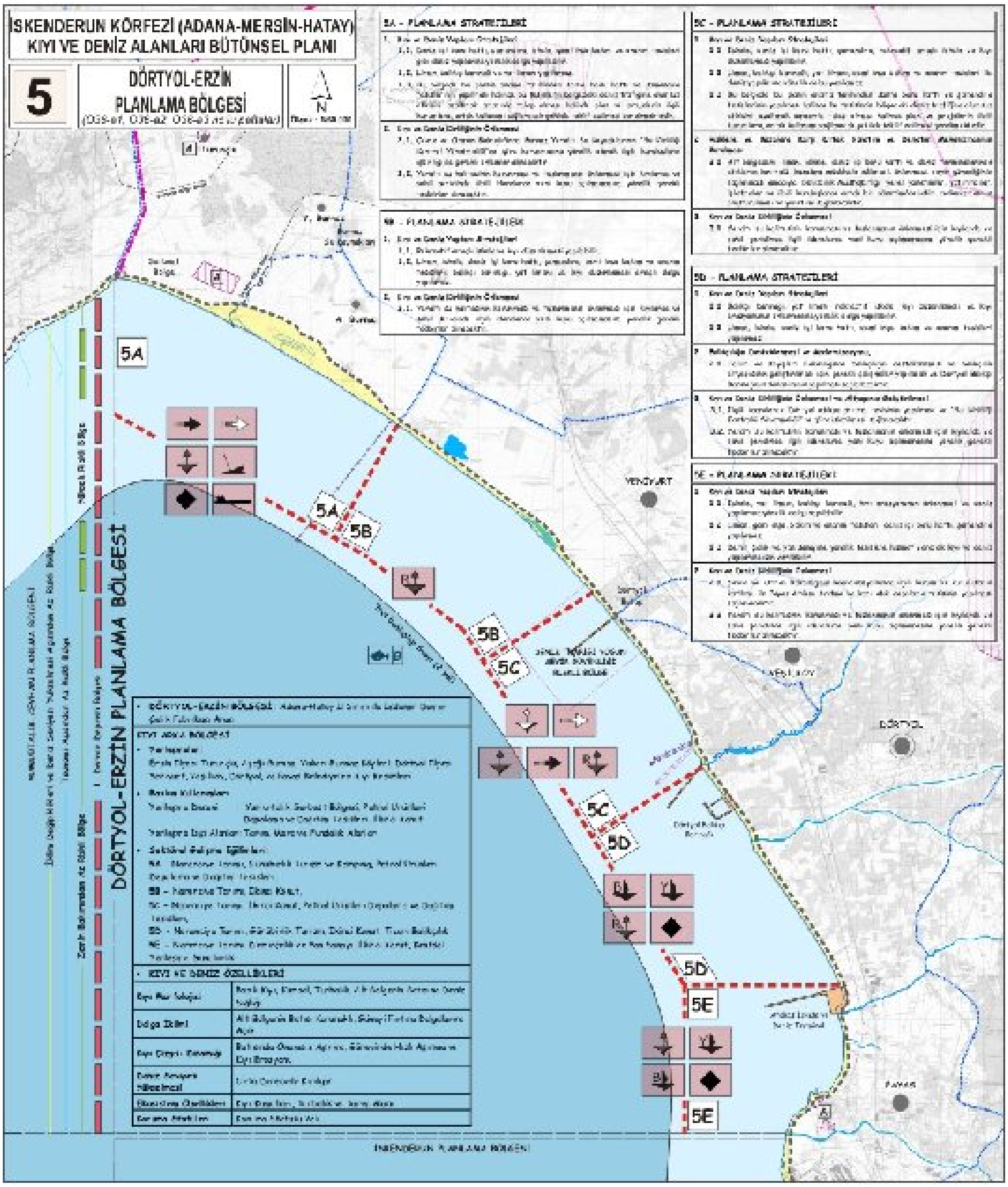

Figure N.6: Dörtyol – Erzin Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

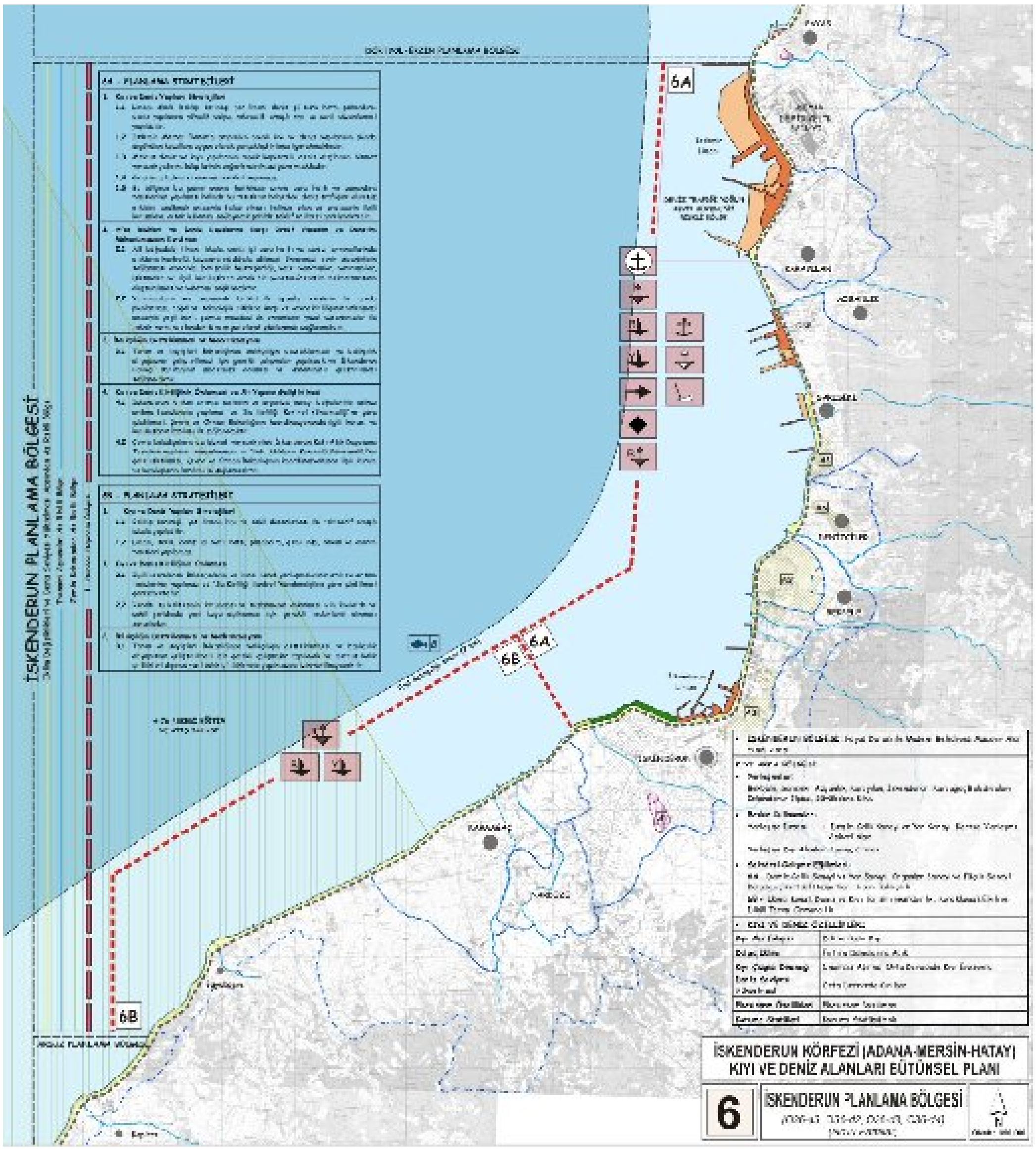

Figure N.7: Iskenderun Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

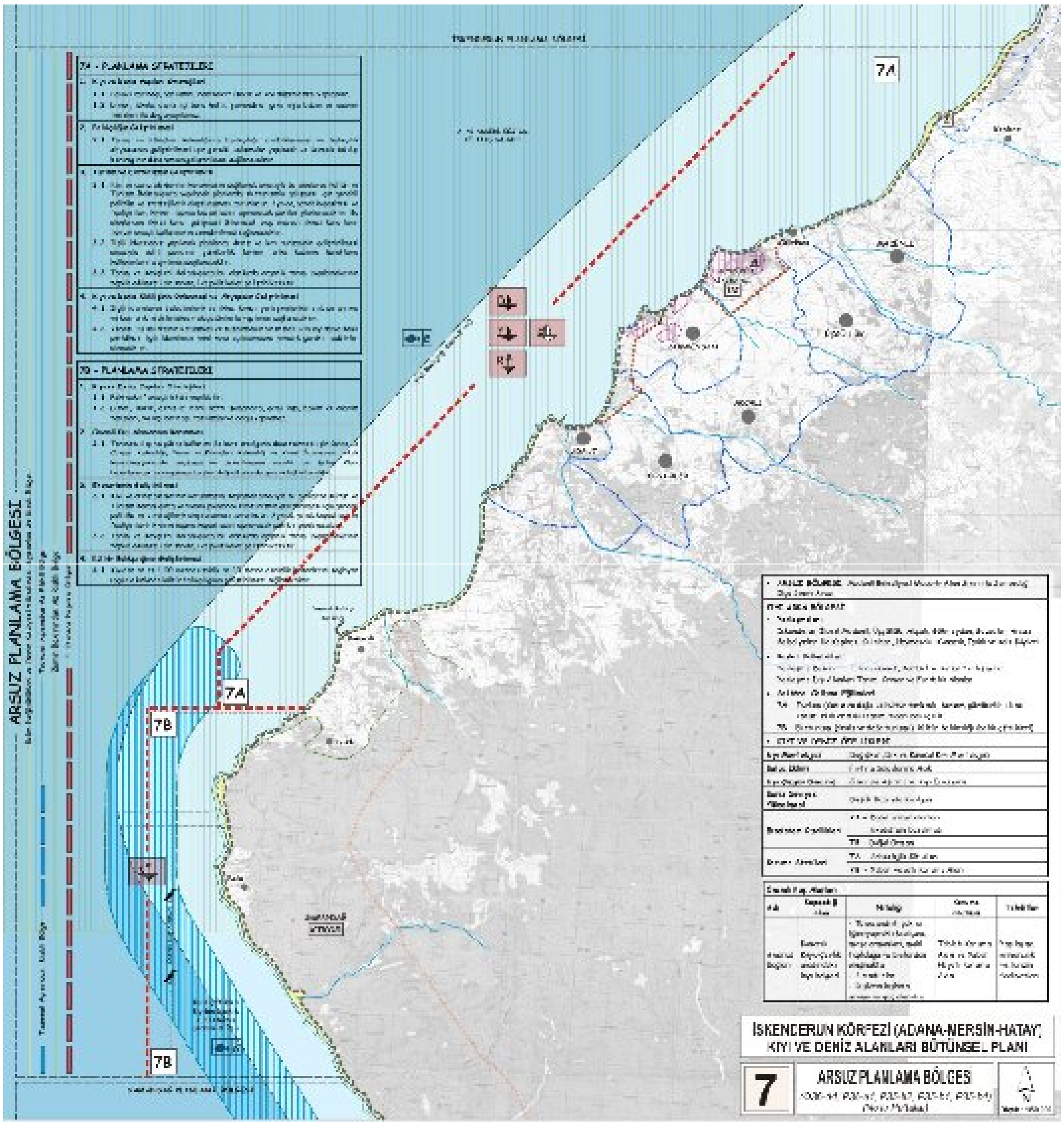

Figure N.8: Arsuz Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

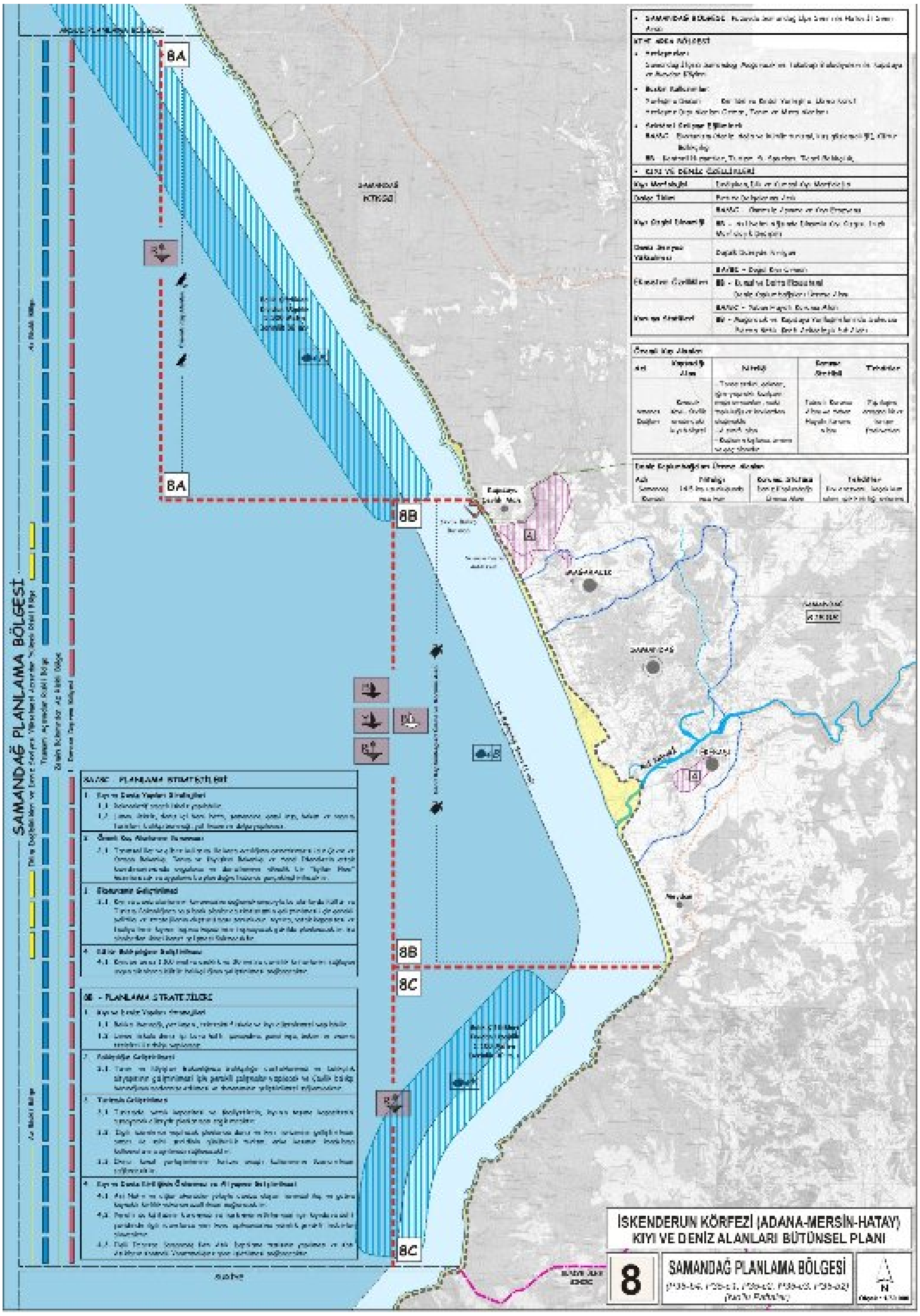

Figure N.9: Samandağ Planning Area

(*Source:* Ministry of Public Works and Settlement, 2007)

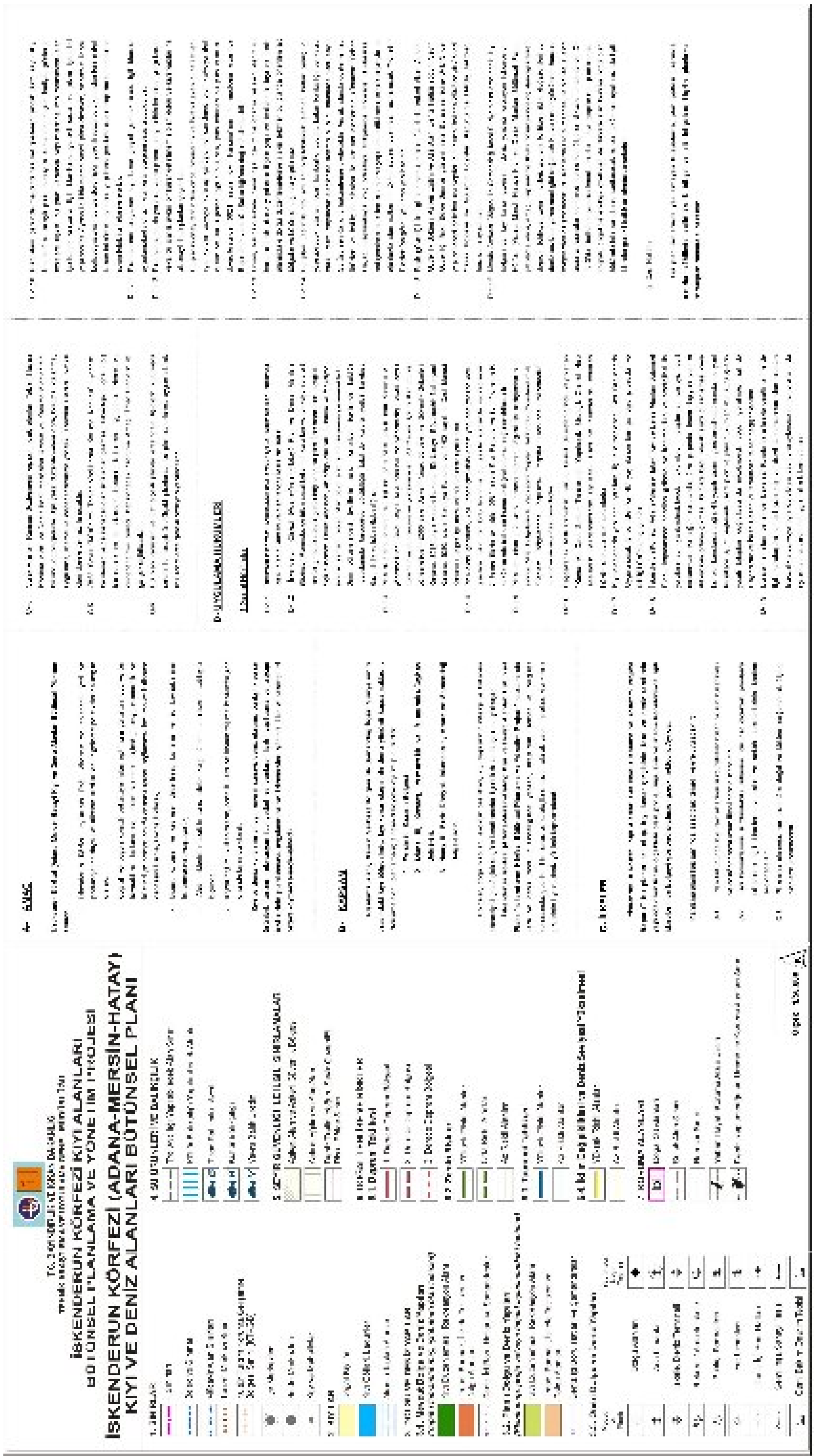

Figure N.10: Legend of the Project

(*Source:* Ministry of Public Works and Settlement, 2007)

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PUBLICATIONS

1. Arslan, B., 2005, "Evaluating the Effects of Natural Disasters on Coastal Zone: Proposal for Re-establishment of Coastal Zone Management Politics" in Proceedings of the 5th National Symposium of Coastal Engineering, held by the Chamber of Civil Engineers in Bodrum in 5-7 May 2005, Volume 2, pp: 557 – 570, edited by A.C. Yalçıner, Ankara (in Turkish)

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