

# Land Use Planning for Urban River Margins Based on the Green City Approach (Case Study: *Abshooran* River of Kermanshah)

Mohamadreza Farahnaki <sup>a,\*</sup>, Naser Barakpur <sup>b</sup>

<sup>a</sup> Faculty of Architecture and Urban Planning, University of Art, Tehran, Iran.

<sup>b</sup> Faculty of Architecture and Urban Planning, University of Art, Tehran, Iran.

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## Abstract

Physical development without proper planning has limited ecological capacity and the ability of natural ecosystems. Urban river structure as one of the most important ecological infrastructures in the city provides a variety of ecosystem services, including landscaping, climate change, etc. which is strongly dependent on the structure and functional status of the river. This study was conducted to examine the effects of land use on the vitality and life of urban rivers, and evaluate and analyze various factors involved in this issue. In this study, the study area was the area around the *Abshooran* River in Kermanshah. The data was extracted using important and effective indicators and was analyzed using SPSS and the geographical information system GIS and the role of urban management in this area were examined. In order to do the final and general analysis, the problem tree/solution tree analysis method has also been used. The results of the research indicated that both in terms of standard per capita and in terms of distribution of applications, radius performance and access, there are various deficiencies and issues and the existing uses have many incompatibilities with each other and the river's natural environment. As a result, it can be said that the area of studies differs considerably from the current situation with the indicators of the green city approach. Virtually the principles and concepts of applications relations with nature, especially in the green city approach, are not considered. Finally, in order to achieve the research objectives, in accordance with the principles studied, it is proposed to use land in the area and consider the surrounding as a green area.

**Keywords:** Planning, Land use, Urban river, Green city, Kermanshah

## 1. Introduction

Cities are places of residence to over half of the world's population and as the centers of socio-economic development, they are the source of important environmental issues. Cities are shaped and sustained through human-nature conflicts (Alberti, 2005). Urban river structure as one of the most important ecological infrastructures of the city provides a variety of ecosystem services including clearing, landscaping, climate modification, etc., which is strongly dependent on the structure and performance status of the river structure (XU at el, 2009: 399). The development of ecological rivers is the starting point for ecological reform. Along with social development, big changes in river performance are created, and people's demand for activities such as scenery, leisure and ecology become more and more (Jianxi and Dongying, 2013). Different environmental pollution has become so widespread today, which has found diverse aspects, and examination of different aspects of them is more professional and a large part of the studies is dedicated to them (Sepehrnia et al., 2005).

Urban river corridors can preserve the vanishing natural values of the urban ecosystem to a significant degree. Reviving ecological systems such as riversides and stream buffers will have a significant impact on the creation of a

healthier environment and improve the conditions for recreational activities in these areas (Laghai, 2009).

Human interventions sometimes change the route or characteristics of a river and the river's structure, throughout the world, has undergone massive changes and heavy losses for widespread human use (XU, 2012: 494). Due to the lack of generalization of such spaces in the sustainability of urban life system, paying special attention to these areas and attempting to outline different scientific principles and rules for them is a necessity. The ecological and hydrological value of the riverside land is not well understood and due to the destruction of vegetation, urbanization, and changes of utilization, an important part of these lands is decreasing annually, which causes irreparable damages. Land use in these areas also requires specific study patterns. Considering that the city of Kermanshah is one of the cities that has benefited from these elements of the natural sector, but among it, the rivers have been neglected. The *Abshooran* River, which has been ignored in recent decades, and has caused many social and environmental problems and distress to the residents of the city. It is one of the sources of pollution in the city of Kermanshah, which has made the city ugly. This river has a very tumultuous face with the accumulation of waste and health dangers of the residents of Kermanshah. The main purpose of this study is the land use planning of riversides in the *Abshooran* River of

\*Corresponding author Email address: farahnaki\_mohamad@yahoo.com

Kermanshah with the green city approach. The key questions that the research aimed to answer are:

- 1) Is the riverside use of the *Abshooran* River of Kermanshah compatible with the natural environment and river morphology structure?
- 2) Have the principles and concepts of proper relationship with nature, in relation to the riverside uses of the *Abshooran* River of Kermanshah, been considered in the development plans of Kermanshah?
- 3) Does the *Abshooran* River of Kermanshah have a visual, beauty and memorable attraction for residents?
- 4) Is pollution of the *Abshooran* River of Kermanshah due to inappropriate use of the riverside lands?
- 5) Is it possible to set up compatible applications such as green applications on the riversides of the *Abshooran* River of Kermanshah?

## 2. Theoretical Background

The common traditional approach to land (Comprehensive plans) presents the city's predicted needs by differentiating their use in the form of urban land zoning and through so it also controlled the development of it. The modern approaches define land use planning as "managing land use changes" and in order to provide a performance guarantee for proposed land use plans, the land development process management has been proposed as a final step in this land use planning (Rafiean, 2013: 42).

Around the subject matter of rivers and with more emphasis on urban rivers, the attitudes of managers towards rivers and the development of their basins has been in a way that, nowadays, in many basins, issues such as water crisis, developmental instability and management crisis are somewhat serious challenges. In the purely engineering approach, managers only have to pay for water supply and delivery. In another approach that is the economy, they have tried to find an optimal solution for water resources allocation, or they have tried to justify only the technology of implementing plans by focusing on the hydrological approach. Finally, in the Fourth National Development Policy document in the Netherlands, the Water Management Directorate has introduced a number of functions for the river (Rooyat el,1997:308). By investigating and studying some of the riverside, coastal and linear parks, along with the study of the principles of

ecological design, organization and theoretical theories in Iran and the world, we reached the results of organizing criteria and riverside designing that can be presented in the form of patterns: 1) Natural revival of rivers and their maintenance of natural features and functions 2) Buffer consideration around the river 3) Communication between green and natural spots 4) Revival of marginal and within habitats of the river 5) Promotion of environmental quality 6) Observance of plant arrangement in planting plan (Farzad Behtash, 2010).

The Green Movement began its activities in the mid-1970s. Green City, as defined by the Environmental Protection Organization at the Green City Conference is a city in which people are feeling core responsible for the environment (air, water, soil, plants, animals and humans) and create a safe and peaceful the environment with minimum environmental standards in partnership with civil society organizations and government agencies (Green City Conference, Environmental Protection Organization, 1999). Green Municipal Engineering has an interdisciplinary meaning, and in addition to urban architects and designers have a need for cooperation between landscape architects, engineers, urban planners, ecologists, transportation planning, physicists, psychologists, sociologists and other specialties (Lehmann, 2007: 245).

History of architecture and urbanization illustrates this important issue from past ages, mankind understood the necessity of constructing garden and green space in cities, though primitive at that time, in order not to be separated from its nature and origin. In the context of urban green spaces, various projects have been carried out both globally and at the national level, and this indicates that today, the crucial and determining role of urban designing and planning in maintaining the connection with urban environments, green spaces and nature are emphasized (Klomp maker,2018). Various projects in different parts of the world, including the Guadeloupe Riverside Park, the Chönggy-Chao River in Seoul, the project Vancouver 2020, the plan for organizing the Farahzad river-valley, Baneh river in Baneh in the Kordestan Province, and organizing plan of the Golabdare river-valley has been carried out and in each of these projects, there are some issues that are summarized in Table1below.

Table 1  
The Major Constructive Criteria of the Examined Samples

Under Study Samples?	Constructive ecological criteria of riverside
Guadeloupe River in California	Preservation and revival of natural systems, biological vitality, energy efficiency
Chönggy- Chaun River in Seoul	Revival of the natural life of the river, sustainable development
Vancouver 2020: a bright green future design	Achieving a sustainable environment, health recovery
The organizing Plan of Golabdareh River -Valley Route	Maintaining and restoring natural systems, biological vitality
Farahzad River-Valley in Tehran	Sustainable development, creating a green axis, biological vitality
Baneh River in Baneh, Kurdistan Province	Maintaining and creating a green axis, health
Villeurbanne, Lyon, France	Definition of the components of urban green spaces such as trees, shrubs, vegetation, minerals and etc

As mentioned in the table above, these projects have concentrated generally on environmental issues, and do

not pay attention to the issue of land use and the impact on the health of the surrounding area of a river.

### 3. Theoretical Framework

Urban land use planning, the spatial organization of urban activities and functions are based on the needs of the urban community, which forms the main core of urban planning (Saiednia, 1999: 13). In other words, land use planning is the science of dividing land and space for different uses and needs of life (Chapin and Kaiser, 1978); which is designed to make effective use of the land and the proper and efficient spatial discipline. In this planning, attempts are made to determine the patterns of urban landscapes scientifically and locations of various activities in the city are found in accordance and coordination with each other and urban systems (Pourmohammadi, 2010: 3).

#### 3.1. Land use planning targets

One of the most important targets of urban land use planning is the prevention of land degradation, communication between city and nature, conservation of sustainable and non-renewable resources, preservation of the historical and cultural heritage of development of green spaces and optimal location of services (Mahdizadeh, 77: 2000). This is a topic that has been raised at various stages of the process and interest groups, influencers, and urban design experts will decide in relation to various issues (Bahrain, 2013: 200). In general, the purpose of land use planning is divided into two categories: macro and micro goals. Macro goals include environmental, economic, social and physical-spatial. Micro goals include measures such as efficiency, equality, sustainability, and general well-fare and health (Pourmohammadi, 2010; Turner, Meyer, 1994. Bach, Fudge, 2001).

#### 3.2. Three collections of land use values

In change management, local land planners need to connect with three powerful types of land values. The social values of applications represent the value that people give to land use designs for reserving their living. Market values explain the weight people give to land as a

commodity; this view considers land use as a profitable mediator of real estate. Ecological values explain the weight people bring about in natural systems; this view considers land use as a natural environmental threat that must be reduced. These three values are sometimes disconnected, rival, and sometimes mixed and helpful (Godschalk et al, 2006: 50).

#### 3.3. Sustainable urban development and land use

In terms of sustainable development, land, and space are not only an element to meet the city's economic and physical needs but it is the mainstay of all the activities of citizens and the means necessary to fulfill human wants and aspirations. Therefore, how to use urban land plays an essential role in meeting the needs of citizens, the quality of the environment, the health and the comfort of the urban population, the beauty of the urban environment and, ultimately, the sustainable development of the city (Barow, 1995). When decisions are made on land use, the decision-making process involves the public, private

owners, developers, government, and other interest groups (Ferber, Preub, 2008: 4). In other words, one of the most important levers for the development of urban planning and the richness of planning for sustainable urban development is paying attention to the urban land use planning; which should provide citizens with mental and psychological well being in the city along with the development of cities and the sustainability of urban development (Drakasis, 1997). Land use is also one of the key points of Agenda 21 and HBITAT and other international commitments such as climate change and biodiversity (Bach, fudge, 2001: 3).

#### 3.4. Environmental accounting as a prerequisite for sustainable development

It is only by calculating environmental costs that we can restrain economic growth and reduce the speed of degradation of nature (Harison, 1999: 215). Use of environmental assessment for the highest class actions in accordance with EIA law (Environmental Impact Assessment) is required for:

- Policies for sustainable development, especially in energy production, mining, industry, transport, agriculture, forestry and water management
- Documentation of land use planning for residential and district settlements in selected areas, especially the center of a district
- Regulatory Legal Provisions
- The possibility of having a negative impact on the environment (Belcakova, 2003: 65-66)

The importance of the environment: Environmental problems are one of the most important issues in today's city and are the result of conflict and their confrontation to the natural environment; because urban development is inevitably accompanied by the domination of buildings, industries, transportation and economic activities on natural spaces and this dominance as time goes by has been transformed into the dominance of the city on nature, causing widespread urban pollution (Annerstedt van den Bosch et al, 2016).

With the spread of cities, the manifestations, and values of the natural environment are more prone to destruction and erosion, and urbanists are deprived of natural attractions and psychological and social problems have appeared (Ekkel, 2017).

#### 3.5. Sensitive ecosystems

Sensitive and critical areas are usually defined as areas of land or water which are necessary to be identified and protected from the unnecessary and inappropriate development in order to protect the values that affect human life, such as natural areas, the living, and dead environment, or a range of lands in capturing natural resources (APA 2006: 42). Steiner (2000) has proposed a system of classification of sensitive ecosystems based on the experiences of various US states (see table 2). He classified the environmentally sensitive ecosystems into four categories: Critical ecological regions, perceptual and cultural critical regions, critical resource production areas, and critical natural hazards areas (Steiner, 2000: 56).

Therefore, rivers - valleys and rivers are part of sensitive ecosystems, which can be considered as corridors of undeveloped land in urban environments because of their visual and residential value (Jongman, 2003, p. 173-181). Protecting and improving the urban environment is possible through environmental responsibility and liability by reducing reliance on natural resources, minimizing air pollution, avoiding soil pollution, seeking energy efficiency, increasing biodiversity and re-using or clearing the burnt ground, which will eventually lead to improved quality of life (Strong, Hemphill, 2006: 485).

Urban rivers, despite the various constraints, are a valuable resource for developing ecological approaches in the urban setting without removing human presence from this approach. First of all, these corridors provide the connection of single urban greenery to one another, and the green space of the suburbs is transferred into the city (Penteado, 2004). Waterbodies are key parts of urban and suburban land cover and have a significant impact on reducing air pollution through their absorption of air pollutant particles through air deposition (Allegrini, 2018. Guo et al., 2019).

In general, four major reasons which cause the lack of environmentally significant and valuable areas in today's cities include:

1. Unplanned urban development, which tends to surround and restrict natural areas, corridors and natural fragments that are located in distant spots from each other.
2. Disturbance of natural ecosystems in cities such as wetlands, rivers, natural pastures and ... by residents of the region.
3. Overuse of the natural areas and development of recreational facilities in them.

4. The remaining pieces and natural corridors, which are often abandoned as cultural or natural parks because they lack the characteristics required to support native species (Cook, 1991: 7).

In the present century, due to the increasing urbanization and the intensification of changes in the way people think about nature, the long-standing equilibrium of man and nature tends towards human domination over nature. Inter-city natural structures play a key role in creating sustainable urban green spaces (Micarelli et al, 2007: 204).

### 3.6. Revival of urban river

- 1) The river course and its limits when overflowing are important factors. This is because the overflow of the river can cause serious problems for installations and utilities (Khatibi and Haji Najafi, 2015: p60). In the field of urban reviving, guidelines have been developed in cooperation with experts from Poland, the Czech Republic, and Germany, for the revival of the urban river. In order to help planners, decision-makers, executives, and stakeholders, taking into account a wide range of aspects related to urban river life reviving requirements, the following guide is divided into four main groups: Increasing the environmental capabilities of the waterway as an ecosystem.
- 2) Protection against flood
- 3) Increasing residential, cultural and recreational value
- 4) Safe and sustainable use of water basins (Gwarkow, 2012, p178). (Table 2)

Table 2

Success Indicators in terms of Rehabilitation of Urban Rivers (Source: Gwarkow, 2012; Hwang, 2007)

<b>Economical Indicators</b>	<b>Social indicators</b>	<b>Ecological indicators</b>
. Activity to earn money	. A large number of parking lots	. The biological quality of water
. Average value of property	. Public Transportation Stations	. River depth and width diversity of it
. Unemployment	. Access to safe points	. Its acidic condition
	. Water contact areas	. Percentage of flow length with vegetation
	. Anchorages	. Using recycled water
	. River Crossing	. River conjunction
	. Public facilities around the river	. Presence of vegetation
	. Signs, points of view	. The boundary of the riverside
	. Entertainment facilities	. Hydro-morphological conditions
	. Recreational trails	
	. Cultural events	

In general, a major approach to the management of rivers and streams in most Iranian cities have been considered a possibility to beautify the walls of the rivers with the Chinese wall and concrete beds. In addition to providing safety against possible flooding, somehow they improve the quality of facade and urban landscapes, unaware of the fact that, in most cases, changing the structure of the river

and disposing of the walls and its natural bed, not only does not reduce the damaging effects of the flood, but also increases its degradation strength. Nowadays, dealing with such spaces in other countries, in contrast to Iran, is done in the opposite way. In most foreign societies, for the purpose of organizing and rehabilitating city streams and rivers, the walls and concrete beds that were built in the past are destroyed. This helps to restore the status of the river from the state of being a canal to its natural and

primary form (Walls and organic substrates) (Diasalar, 2015: 80).

3.7. Green city

Research and scientific centers around the world have considered different criteria and indicators for a green

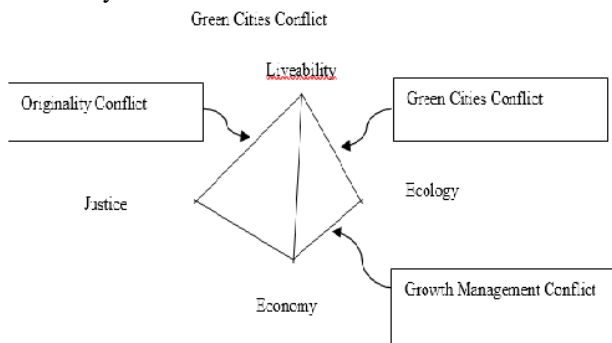
city; although in some cases there are differences, the principles are the same regardless of the geographical area, the economic conditions and social conditions (seeking zero energy, 2009: 7). (Table 3)

Table 3  
Green City Indicators

Indicator	Description
Air quality	Air pollution at acceptable level
Transportation	The use of public transportation (Abbaspour, 1997: 19), the extension of the public transportation systems (Fazzano, 2001, p16), The expansion of green transportation, Hamidi, 2002: 9)
Carbon Dioxide	Reduction of carbon dioxide levels (seeking zero energy, 2009)
Energy	Emphasis on energy production, energy use, renewable energy use, clean and efficient energy policies (Maknon, 2003:11)
The Buildings	Construction of green buildings (California department, 2007:32)
Waste and Waste Recycling	Reduction of urban waste production, increase waste recycling (Bush, 2012:23)
Environmental Monitoring	Emphasis on Green Management (Abbaspour, 1997: 17)

3.8. Green cities conflict

Sustainability charter clarifies the interaction between core values. The main point of this charter represents the primary and major values of justice, economic, ecology, and viability.



Source: (godschalk et al, 2006:38)

Fig. 1. Green cities conflict

This charter not only reminds us that land use planning deals with a three dimensional space, but also provides a structure for identifying and dealing with inherent value conflicts in different perspectives.

The tension between viability and the consequent economic growth in a "growth management conflict" that comes from competing theories in an unmanaged development area, which not only owes to the principles of the market, can provide a high quality of life environment. The focus of this discussion is on the alternatives of the American Dream.

The tension between viability and the environment as a result of the "green cities conflict" comes from competing theories in discussing the priority of nature against the environment. This discussion is wider than the extent to which ecology systems should determine the urban form.

The tensions between viability and justice lead to the formation of conflicting reproduction. This is shaped by the rivalry of ideas for protecting poorer neighborhoods in order to benefit the current population against re-developing and raising the quality to attract and return middle and high-class to the city center. (Godschalk et al., 2006: 40).

Finally, the most important approaches in creating a green city are: dealing with marginalization; coordinating implementation of programs (Beatley, 2012: 72); using the proper technology (California department, 2007: 29); civic participation (Fazzano, 2001: 32); efficient urban management and national laws; the development of a comprehensive and balanced approach (E.Kan, 2006: 76); and paying attention to the green spaces of cities (Hamidi, 2003: 13).

3.9. Urban green spaces

Urban green spaces are vital parts of any city due to their capacity to provide a large number of urban services to a wide range of stakeholders. However, since urban green spaces can consume large areas of the city, where land is both scarce and expensive, planners and managers are usually faced with conflicting challenges. They must endeavor to provide a tremendous amount of urban services (Belmeziti,2018:p2). With current new urban developments, no balance can be found between green spaces and open areas present within urban networks and natural land patterns since urban networks are dominating ecological networks (Yousefi et al, 2016 : p51). Green space could reduce the likelihood of being overweight by offering suitable spaces that encourage physical activity (Klompmaker et al,2018) Despite the importance of urban green spaces and the services they provide, there is still a balance to be found between the grey and green areas within cities. Many existing cities do not have enough

space for the development of new parks and green areas; consequently, they are squeezed into any available space between buildings and roads (Bell et al, 2007). Urban green spaces are very important in cities because of providing people with benefits and to connect them to nature and to each other. Physiologically, connecting with nature has many benefits through reducing stress, enhancing senses, reducing offense and crime and social abnormalities and enhancing experiences. Moreover, in terms of physiological benefits, connecting with nature has a direct benefit to human physical health such as resolving issues relating to obesity (James et al., 2009). Researchers believe that creating urban green spaces, encourages people to walk and increases the value of land and also helps to the development and growth of tourism industry (amy, 2016). Urban green spaces have a lot of positive effects for residents, these spaces generally improve the environmental conditions in cities by eliminating pollution, adjusting temperature and reducing noise (Hofmann 2012, p1).

The concept of green space integration: In recent years, researches have been attempting to apply an integrated method for simplifying the complexities, basic mechanisms and providing more efficient and comprehensive solutions to new emerging issues such as sustainable development, compatibility to climate change, protection of environment and the importance of green space, especially in developed countries (Atiqul Haq,2011). Integrating green space means creating executive and decision-making management, or the so-called unity of command, in order to facilitate and accelerate the conduct of affairs; which these definitions in the analysis of doing the work process can be defined by refining, adapting, matching and integrating urban green spaces with urban built spaces. Means creating spaces without obstacles or facilitating access for everyone (Rajabifard & Williamson, 2006).

In the end, after studying and paying special attention to the natural resources available in urban planning, the case sample was studied and examined. The main criteria and indicators studied in this study are presented in the table below, (Table 4) based on theoretical foundations and framework.

#### 4. Research Methodology

This research is based on the category of applied and practical research, nature, and methodology in the descriptive-analytical, and political category as well. In the present study, the statistical population of this study is the inhabitants of the margins of the *Abshooran* River of Kermanshah in 2016, which are somehow involved in the problems caused by the issues related to the river. In order to determine the sample size, the Cochran formula was used and the sample size number is determined as 320.

Different methods for sampling have been defined. The sampling method used in this study is systematic random sampling.

Information gathering methods were field and documentary studies (Library), and information gathering tool also included a questionnaire using the Place Check technique, interview with beneficiary and influence groups, observations, snapshots, databases and other collection tools including the Internet and satellite networks (Google Earth).

The analysis of the uses has been evaluated using spatial geographic information system (GIS) at two quantitative and qualitative levels. In the quantitative assessment, the available per capita in different study areas is compared and estimated with the standards. For qualitative analysis, after adjustment, the matrix was formed. First adjustments were scored on the basis of neighborhood units and paired comparisons. Then, using the spatial positioning method, their compatibility level was analyzed and evaluated. In order to estimate the distribution pattern of applications, the nearest neighbor method (RN) is used.

In order to analyze the data obtained from the questionnaire, confirmatory the factor analysis was used with SPSS.

Finally, after reviewing and analyzing the various methods, a problem-tree/solution-tree has been used for the final analysis. For this purpose, in the first step, the issue and the main problem that research attempts to resolve was identified and expressed.

In the second step, after identifying and determining the main issue, the involved factors and its effects, which are the main causes and have direct effects, were determined. Hence, proper understanding of the underlying macro, micro and major causes can be obtained.

In the next step, after determining the problem tree, the solution tree is defined and developed by reversing the terms contained in the problem.

In the fourth step, which is a final step in this type of analysis, an appropriate strategy for intervention and problem solving was determined after considering the factors identified in the problem and solution tree. In general, the process of analyzing information is as follows.

#### 5. Identification of the Area

The area of study in this study is the area around the *Abshooran* River, which is part of the central and middle part of Kermanshah, located in the districts 1, 3 and 4 of Kermanshah's municipality. The study area is located between 34 ° 19 'north latitude and 47 ° 7' east longitude from the Greenwich meridian. The study area is 1322 meters above sea level and has a relatively gentle eastern slope from the north to the south. (Figure 2 and 3.)

Table 4  
The Criteria and Indicators Studied in the Research Process

Dimension	Criterion	Index	Reference
Environmental design	Climate adaptation and housing construction	The rate of utilization of indigenous and local sustainable materials in the existing buildings	California department, 2007
	Attention to the needs of residents in housing design	Trading value of land and buildings	Edwards, 2000
		Attention to the inhabitants culture	Fleming, 1985
		The rate of residents' participation in the planning, design and construction of housing	Fazzano, 2001
	Green building	The amount of green technology used in the building	California department, 2007
	Land use	Mixed use	Attention to use capacity in an area
The compatibility of adjacent uses			Municipal, council of California, 2008 Razavian 2002 Renato et al, 2015
Number of different uses in area			Asgharzadeh Yazdi 2010 Pakzad 2007
Prioritizing urban public spaces		Number of mixed uses in area	Jabareen, 2011
		Number of 24-hour and active users	Akalghan 2014
		Area of green and public spaces	Asgharzadeh Yazdi 2011 Belmeziti, 2018
Land use	Neighborhood development	The number of multi -functional and green quality urban spaces	Botequilha, 2002
		Average number of floors in the area	Pourmohammadi 2003 Burgess, 2000
		Population density of area	Azizi 2009
Urban nature	Spatial coherence	Pure residential density	Pourmohammadi 2003 Azizi 2009
		The status of the integrity of the green and open and the public space of neighborhood	Van Kamp et al, 2003 Moutin 2007
	Access rate	The relationship between open and public spaces through the green corridor	Cook, 1991
		The status of footpaths and bicycle routes	Gharib 2004
Access network	Coherence of transportation networks	The amount of access to the public transportation network	Edwards, 2000
		The degree of coherence of transportation networks within the area	Leck, 2006
	Awareness and culture	The ratio of the width of the passage to the height of the adjacent buildings	Azizi 2009
		Awareness and promotion of walking on foot for short trips within the neighborhood	Azizi 2009
Energy	New energies	The rate of personal car use	Pourmohammadi 2003
		The rate of replacement of non-renewable energy with new and renewable energies	Maknoon 2003
		The number of buildings using renewable energy such as sun, wind, water and etc.	Maknoon 2003
Waste Management		Building design based on energy saving	California department, 2007
		The number of garbage collections per week	Farzad Behtash & Others 2010
		The cost of the municipality for waste collection	Vancouver's Greenest City Action Team, 2009

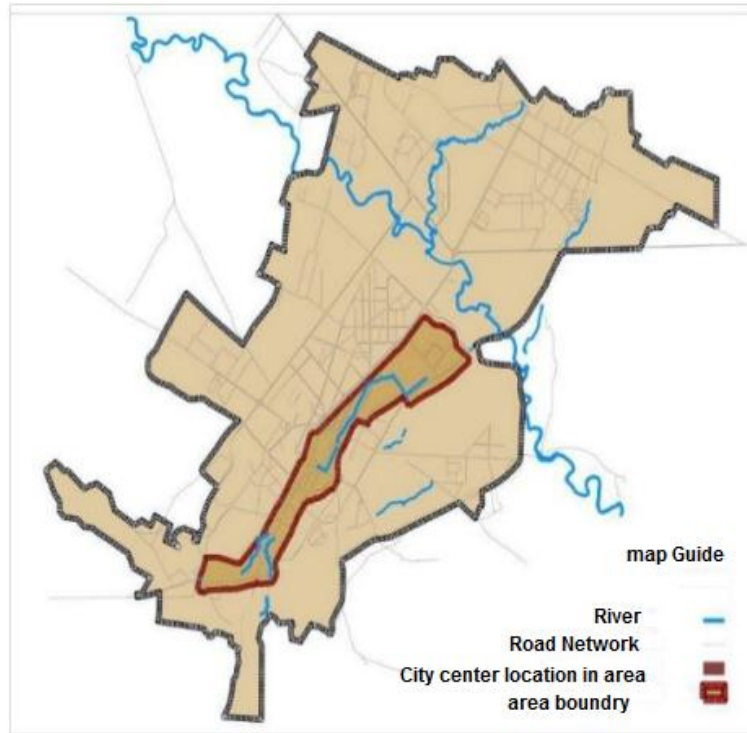


Fig. 2. Location of study area in Kermanshah

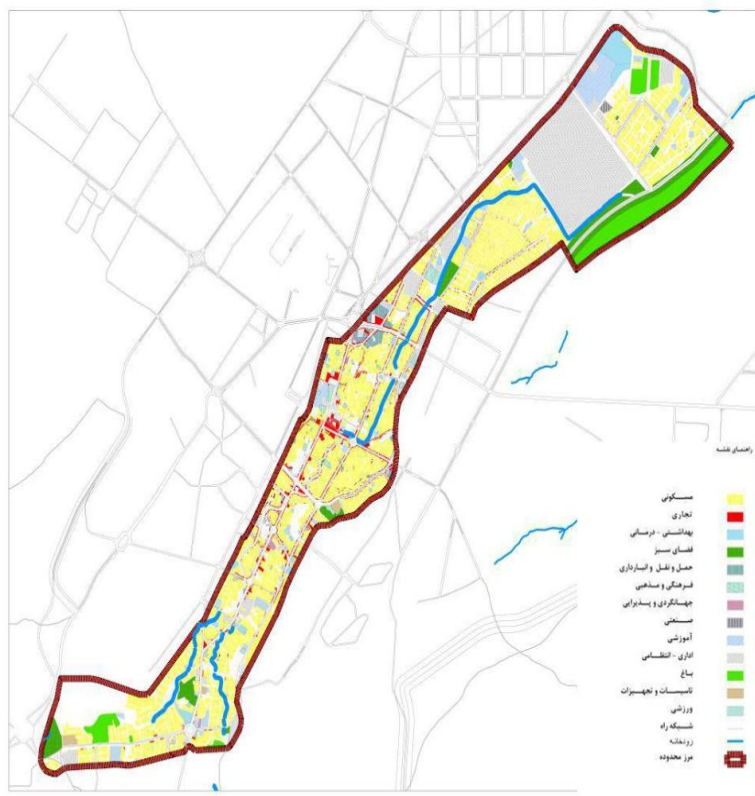


Fig. 3. Land Use Pattern of Study Area in Existing Status

Based on physical studies and calculations, the study area was 726.99 hectares, which is equivalent to 480.588 hectares. About 66.1% is dedicated to pure urban and

surface uses, which is equivalent to 246.4 hectares. About 33.88% is of the impure urban contribution. The detailed results are given in Table 5.



Table 5  
Land Use Pattern of Study Area in the Existing Status

Row	Use type	Population 90729			
		Area (m <sup>2</sup> )	Percentage to area		Per capita (m <sup>2</sup> )
			Net	Total	
1	Residential	2603917.6	54.18	35.8	28.7
2	Educational	269892.4	5.61	3.71	2.97
3	Health care	120115.3	2.49	1.65	1.32
4	Facilities and equipment	23178.1	0.48	0.31	0.25
5	Commercial	167163.5	3.47	2.3	1.84
6	Sportive	10999.5	0.22	0.15	0.12
7	Green space	262480.4	5.46	3.61	2.89
8	Administrative-police	958185.8	19.93	13.18	10.56
9	Cultural-Religious	69387.8	1.44	0.95	0.76
10	Tourism and Catering	10782.3	0.22	0.14	0.11
11	Industrial-workshop	14455.8	-	0.19	0.16
12	Service	233212.6	4.85	3.2	2.57
13	Warehousing and storage	2112376.04			23.28
14	Gardens	370391.7	-	5.09	4.08

Environmental studies in this research are of great importance due to the presence of the *Abshooran* River in a wide range of areas and its issues and problems.

The *Abshooran* River has caused many environmental problems for its surroundings due to various reasons such as the sewage entrainment in the river, the discharge of construction debris at the edge of the river in many places and etc. At present, the discharge of sewage and surface water from the tunnels to the canal is widely spread across the entire covered waterway. This has depleted sediments and garbage through the canal over time, causing serious health and environmental problems. This issue endangers the health of residents around the canal and reduces the city's welfare and public health.

In existing available plans such as the comprehensive plan, a specific strategy for this issue was not considered. In the detailed design, the 8 meter limit for this river is merely considered, which cannot solve the problems and hence the major environmental problems surrounding it.

## 6. Findings

### 6.1. Quantitative analysis of urban land use

Quantitative assessment of the levels and per capita of the study area in view of the studies carried out in the

comprehensive plan of Kermanshah were a range of different uses at the level of the area, the spatial distribution, and location of the applications. Here, the choice of per capita and space allocation of each item was examined. The shortcomings and requirements of each application were estimated. In order to better understand the status quo of the study area and carry out the required analyses, examinations were carried out at different scales (zoning). Hence the division of the study area was classified into 4 sections or regions as follows.

The below table the analyzed comparison of per capita utilization requirements at the level of study areas and in each region was presented, and the deficiencies of each one were determined.

#### 6.1.1. Study area of district number 1 (shariati)

As can be seen from the table above, according to calculations and perceptions in district 1 of the study area, there are some deficits in some applications such as commercial, green space, and education but there is no deficit in healthcare and is even more than the suggested per capita.

Table 6  
Per Capita and Level of Current Situation in comparison with Standards in District 1

Use type	Current status		Recommended		Shortcomings	
	Per capita	Area (m <sup>2</sup> )	Recommended per capita (m <sup>2</sup> )	Area		
1	Commercial	0.38	9583.3	1.4	34552	24968.7
2	Health care	0.6	14885.6	0.2	4936	-
3	Green space	2.9	72696	5	123400	50704
4	Educational	1.14	28255	1.2	29616	1361

6.1.2. Study area of district number 2 (Market)

The significant point in this area that can be seen from the table is the available commercial per capita which is much different from the suggested per capita for the urban area. It should be noted that this area and region are somehow

the economic heart of the city, thus, the per capita of commercial use in this area is expected to be higher than the standard per capita. There is no lack of per capita in health and medical applications, but the use of green space has a deficit of 106504 square meters.

Table 7  
Per Capita and Level of Status Quo and the comparison with Standards in district 2

	Use type	Current status		Recommended		Shortcomings
		Per capita	Area (m <sup>2</sup> )	Recommended per capita (m <sup>2</sup> )	Area	
1	Commercial	6.2	116178.2	1.4	26006.4	-
2	Health care	0.8	15118.6	0.2	3715.2	-
3	Green space	0.9	16896	5	92880	75984
4	Educational	1.9	36851.1	1.2	22291.2	-

6.1.3. Study area of district number 3

In this area, as can be seen; there isn't a deficiency in

commercial and health-care applications, but there are deficiencies in terms of green and educational use.

Table 8  
Per Capita and Level of Status Que and Comparison with Standards in District 3

	Use type	Current status		Recommended		Shortcomings
		Per capita	Area (m <sup>2</sup> )	Recommended per capita (m <sup>2</sup> )	Area	
1	Commercial	1.4	36937.2	1.4	36026.2	-
2	Health care	0.37	9591.5	0.2	5146.6	-
3	Green space	0.85	22263.8	5	128665	106401.2
4	Educational	0.07	19130.4	1.2	30879.6	11749.2

6.1.4. Study area of district number 4 (hafeziyeh)

In this area, there is only a lack of space for commercial use. The health-care the system in the current status has a higher level than the suggested per capita which is due to the placement of Shohada and Taleghani hospitals in this area, which are part of a utility not only with a functionality level of the city but also the metropolitan city. Of course, due to the military presence (Corps), which has a relatively high level, the per capita of other uses are affected in the area, too.

Most usages with surplus levels, such as commercial-services, healthcare, and etc. are required in this area due to urban and metropolitan performance; therefore, in analyzing and planning such applications, the functional scale or classification of physical function of the city and the study area should always be considered.

Statistical analysis of applications indicated that the per capita of status que used in study area with standard per capita is different in some cases. Conclusion and analysis of this table represented the following points:

The use of green space is confronted with a shortage of per capita due to the presence of the natural element of the Abhooran River in the study area. The provision and expansion of cultural spaces, and recreational leisure activities should be the first priority of land use planning.

Table 9  
Per Capita and Level of Status Que and Comparison with Standards in the District 4

	Use type	Current status		Recommended		Shortcomings
		Per capita	Area (m <sup>2</sup> )	Recommended per capita (m <sup>2</sup> )	Area	
1	Commercial	0.16	3597.6	1.4	30436	26838.4
2	Health care	3.7	80519.5	0.2	4348	-
3	Green space	6.8	148203.3	5	108700	-
4	Educational	5.2	114944.6	1.2	30879.6	-

6.2. Neighborhood model assessment (compatibility analysis)

Available usages at the level of the desired study area are influenced by the location of the area; the historical formation process and the existence of river basins in the boundaries of the area and etc. and have incompatibility in the neighborhood model. The information of table 10 and figure 4 below illustrates the incompatibility between

applications in several cases, some of which are given below:

- . Non-standard distribution of user-specific applications, in particular workshop-industry-level within the area
- . Inappropriate location of some medical units, such as hospitals within the study area, which has a metropolitan and city scale in the city's main communication path and range due to high noise and crowd in this route.
- . Construction crash with the *Abshooran* River frontage
- . Location of barracks among residential buildings and...

Table 10  
Determining the degree of compatibility of the study areas uses with respect to neighborhoods units and paired comparisons

Row	Type of use	Educational	Administrative- Disciplinary	Health- Health care	Installations and Equipment	Commercial and Services	Entertaining And Tourism	Transportation and warehouse	Industrial- Workshop	Cultural- Religious	Sport	Green space	Residential	Total
1	Educational	9	3	3	3	5	5	3	3	5	5	7	7	58
2	Administrative- Disciplinary	3	9	7	1	5	3	7	1	5	5	3	3	52
3	Health- Health care	3	7	9	1	5	3	3	1	3	3	1	3	46
4	Installations and Equipment	3	1	1	9	3	1	3	1	1	1	1	3	28
5	Commercial and Services	5	5	5	3	9	5	7	3	5	5	5	7	64
6	Entertaining-Tourism	5	3	3	1	5	9	3	3	5	5	7	5	54
7	Transportation and warehouse	3	7	3	3	7	3	9	7	3	5	3	3	56
8	Industrial- Workshop	3	1	1	1	3	3	7	9	1	1	1	3	34
9	Cultural- Religious	5	5	3	1	5	5	3	1	9	5	9	5	56
10	Sport	5	5	3	1	5	5	5	1	5	9	7	5	56
11	Green space	7	3	3	1	5	7	3	1	9	7	9	9	64
12	Residential	7	3	5	3	7	5	3	3	5	5	9	5	64
13	Total	58	52	46	28	64	54	56	34	56	56	64	64	

The mentioned issues above are the inconsistent spots that are indicated in figure 4 below. The level of compatibility of the existing area with regard to neighborhoods and paired comparisons in the study area represent 726 hectares of the study area, in which 81.8 hectares

(15.82%) were completely incompatible, 253.3 hectares (49.7%) were relatively incompatible, 121.85 hectares (23.54%) were indifferent, 36.26 hectares (7%) were relatively compatible, and 20.4 hectares (3.94%) were perfectly compatible (Figure 4 and Table 11).

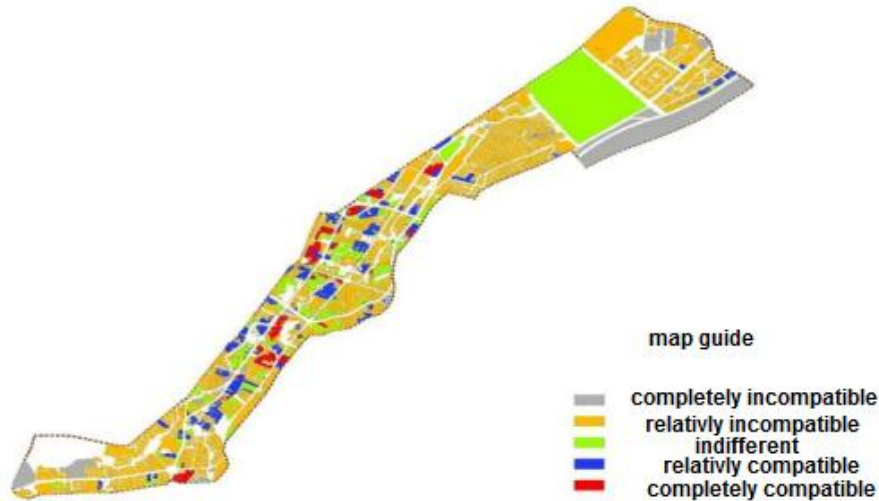


Fig. 4. The Degree of Compatibility and Incompatibility of Applications at the Level of the Study Area

Table 11

The Degree of Compatibility and Incompatibility of Applications at the Level of the Study Area

Description	Area (Hectares)	Compatibility percentage
Completely Compatible	20.4	3.94
Relatively Compatible	36.2	7
Indifferent	121.85	23.54
Relatively Incompatible	257.3	49.7
Completely Incompatible	81.8	15.82
<b>Sum</b>	<b>517.55</b>	<b>100</b>

### 6.3. Evaluation of the distribution pattern of applications

Based on the approach of the nearest neighbors, the distribution pattern is presented at the level of the study area. As shown in Table 12 below, the RN fluctuates between 0.3 and 1, indicating a random and clustered pattern in applications distribution.

Among the limited usages educational, workshop, sports, facilities, urban facilities, green areas, and health care's, have a random pattern; because these applications are appropriate for the needs of the citizens and have been developed over time in the neighborhood. Therefore, they have not followed a particular order and are distributed randomly in most neighborhoods. In contrast to administrative: police, cultural-religious, health-therapeutic, transportation, warehouse, and tourism-

catering services follow a cluster pattern. A cluster pattern means that the accumulation and concentration of some uses in one place is more than other locations. One of the most important reasons for the accumulation and concentration of uses is its historical background and superior social, political and economic status in the urban system, which focuses many economic activities and demographic commuting on the location of this area. The application of the cluster pattern in the study area can be seen in the cultural-religious use, which has the highest level in old context; the administrative-police use, located at a neighborhood level; and location of warehouses and terminals, along the main road. In general, the distribution of applications in the studied area does not have a regular pattern. table12

Table 12

Distribution Model of Applications Based on the Method of Nearest Neighborhood

Application type	RN	Distribution pattern	Application type	RN	Distribution pattern
Educational	1	Random	Sportive	1	Random
Administrative-police	0.4	Cluster	Health care	0.5	Random
Cultural-religious	0.3	Cluster	Greene space	1	Random
Industrial-workshop	0.7	Random	Transportation and warehouse	0.4	Cluster
Facilities and equipment	0.7	Random	Tourism and Catering	0.4	Cluster

6.4. Analysis of the questionnaire

The status of the indicators studied in the area of the *Abshooran* River regarding the characteristics of lighting, urban amenities, physical, user compatibility, social security, recreational-cultural use, socio-cultural functions, green space, public health, environment, quality

of road network, accessibility, are not in good condition and is less than the moderate level.

The status of performance indicators is moderate, and the status of communications, business activities and a mixture of applications are higher than average.

Table 13  
The Status of Examined Indicators Involved in the Area of the *Abshooran* River

Features reviewed	Number	Average	Standard Deviation	t	Df	Sig	Interpretation
Lighting	320	2.3	0.82	-16.09	319	0.0001	Less than average
Municipal facilities	320	2.11	0.51	-33.32	319	0.0001	Less than average
Physical	320	2.21	0.54	-27.63	319	0.0001	Less than average
Use compatibility	320	2.18	0.79	-16.43	319	0.0001	Less than average
Use mixing	320	3.1	0.87	2.24	319	0.025	More than average
Operational	320	3.02	0.7	0.64	319	0.52	Average
Social Security	320	1.76	0.73	-32.22	319	0.0001	Less than average
Recreational cultural	320	1.87	0.81	-26.65	319	0.0001	Less than average
Sociocultural	320	0.82	0.61	-37.22	319	0.0001	Less than average
Green space	320	1.97	0.81	-20.95	319	0.0001	Less than average
Health care	320	2.56	0.65	-12.84	319	0.0001	Less than average
Environmental	320	2.26	0.64	-21.83	319	0.0001	Less than average
Quality of passage	320	2.12	0.66	-25.26	319	0.0001	Less than average
Communications	320	3.51	0.66	8.69	319	0.0001	Less than average
Access	320	2.82	0.45	-4.49	319	0.0001	Less than average

Finally, with the results of field observations, and conducted analyses and interviews, for the final analysis of the subject, the problem tree method has been used. First, the problem and the main problem were identified. In the next step, the causes and factors involved in the main subject matter were identified and analyzed as a tree

species. Then, according to the problem tree, a solution tree was suggested for solving the problem and finally, with the mentioned process, the final strategies were suggested.

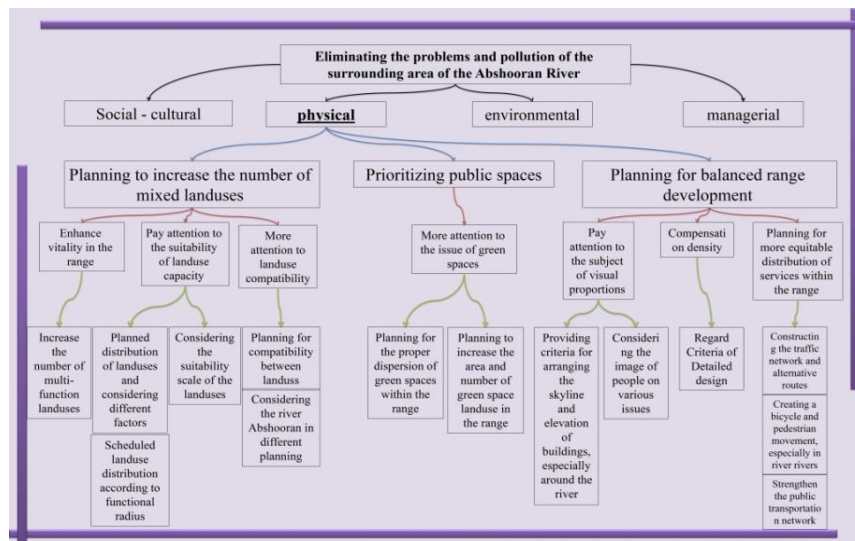


Fig. 5. Solution Tree in the Physical Dimension

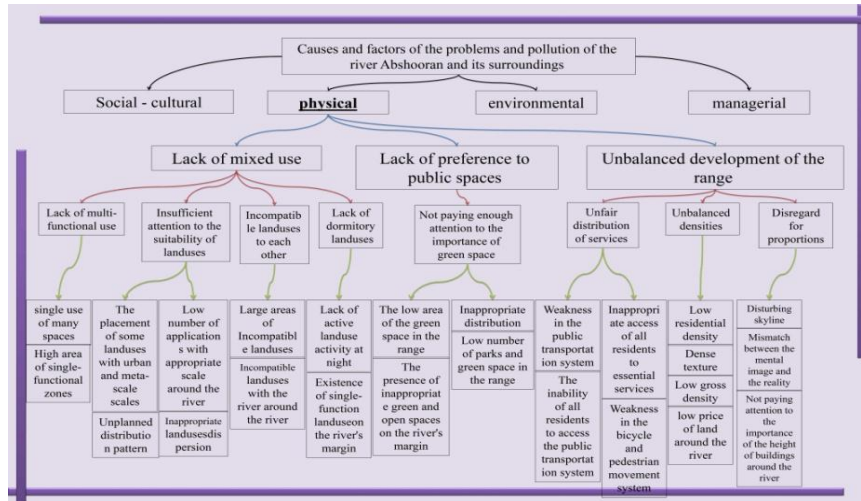


Fig. 6. Problem Tree in the Physical Dimension

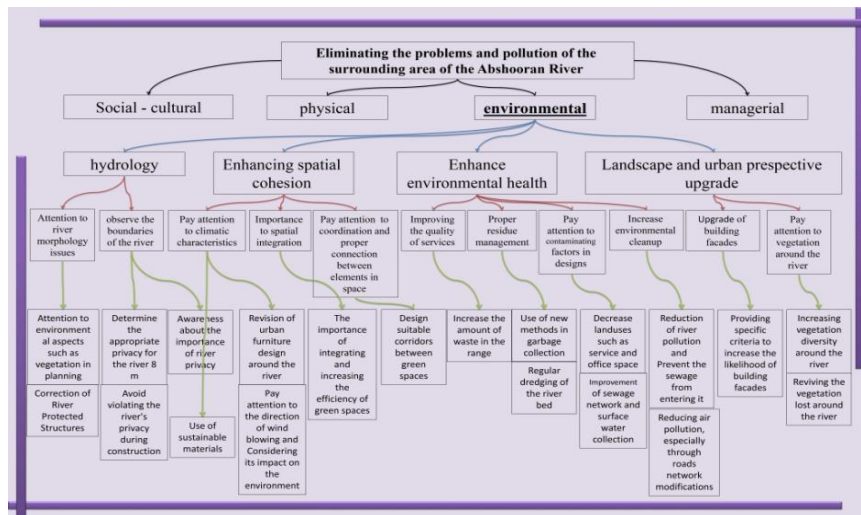


Fig. 7. Solution Tree in the Environmental Dimension

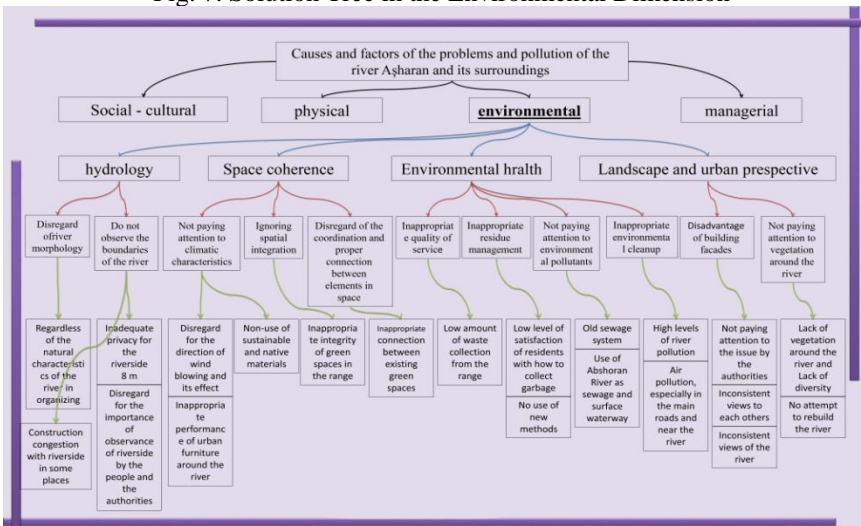


Fig. 8. Problem Tree in the Environmental Dimension

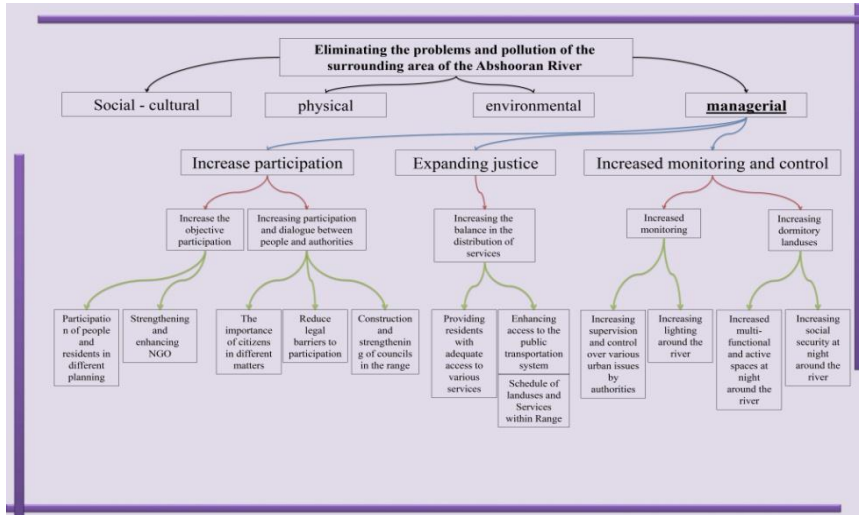


Fig. 9. Solution Tree in the Management Dimension

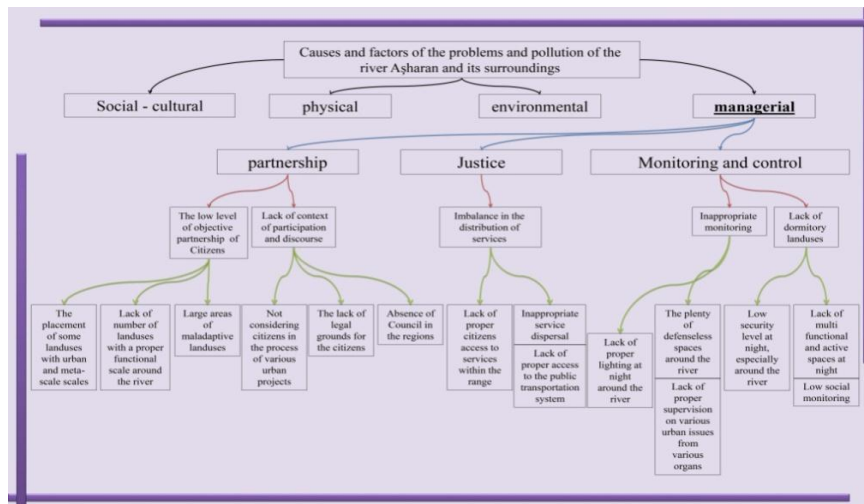


Fig. 10. Problem tree in the Management Dimension

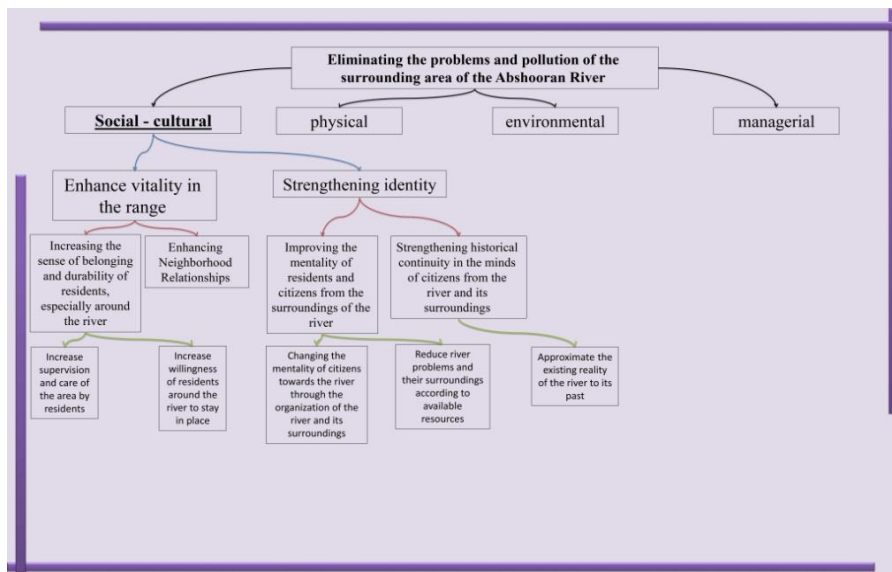


Fig. 11. Solution Tree in the Socio-Cultural Dimension

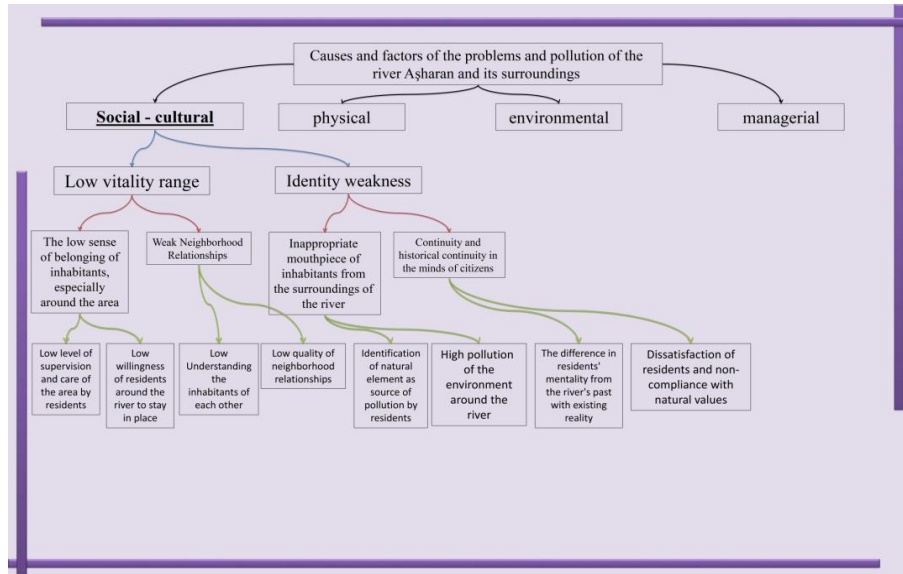


Fig. 12. Problem Tree in the Socio-Cultural Dimension

As mentioned at the beginning of this study, this research was aimed at providing solutions to solve the issues and problems of the *Abshooran* River in Kermanshah and its surroundings. An emphasis is put on criticizing the standard levels and per capita, and the features of this river and its surroundings. This is observed in various shapes and surveys and is different from what is seen in reality. Thus, it has caused a lot of problems for citizens and residents as well as for the surrounding area of the river.

The analysis of the status of the study area in this research shows suffering from many problems. It is due to insufficient attention of authorities and people, which is affected by the effects of urban development over many years. The surrounding area has been affected by these problems and has caused dissatisfaction with residents and citizens, too. One of the important factors that have a particular impact on this subject is the land use of the *Abshooran* River surroundings. According to the studies and analyses carried out in this study, both in terms of standard per capita and in terms of the distribution of use and operating radius and access, there are various shortcomings and issues. In order to balance this issue, the need for planning and balancing the use of green spaces and leisure-time spaces should be taken into consideration.

## 7. Conclusions

Looking again at the purpose of the present study, the development of a framework for evaluating urban riverside uses are based on the principles of Green City. Studying the indicators obtained in the case study of the *Abshooran* River of Kermanshah, a total of 28 indicators were evaluated in the form of 4 physicals, managerial, environmental and socio-cultural dimensions. Each of these dimensions was examined and identified in 3 levels in order to properly identify the causes and factors of the problems surrounding the *Abshooran* River. The results of

the research indicate that there are many problems in the study area and in each category of dimensions.

According to the carried out studies and analyses, especially in the field of appearance and landscape around the river, in response to the first question, it became clear that the majority of applications within the study area had a lot of incompatibility with each other and with the natural element of the river. It can be stated that in a way, the river was not considered in city planning and design. Investigations were carried out on the comprehensive plan of Kermanshah, and the result was that in the process of preparing these plans, enough attention was not paid to the *Abshooran* River and the importance and organization. Only the 8-meter limit was taken into account, which has been subject to constructions at various locations for various reasons, including administrative problems.

In this research, we tried to find the proper knowledge of the river and its surroundings, the results of various surveys of this issue indicate that the *Abshooran* River lacks a visual attraction and aesthetics for residents and citizens for reasons such as weaknesses in the Kermanshah sewage system, weakness in decision making that the river is considered as a discharge vessel for wastewater and surface waters, and not paying attention to the potentials of this river and etc.. But after analyzing the results of the questionnaire, it became clear that the river still has some remarkable memories from some people, especially the old ones, as a beautiful element.

In relation to the issue of pollution of the *Abshooran* River, various factors, including management and planning weaknesses, sewage entering the river, etc., are involved. One of these factors is the land use around the river. According to the results of the surveys and analyses, it was found that land use planning for the city of Kermanshah did not pay attention to the compatibility of utilization, especially with the natural river. So that the main use around the river is residential areas that are virtually localized for disposing garbage and applications



including green space and leisure time and etc.. These have a good compatibility with the river, and were not considered. Hence, it can be said that the use of water around the *Abshooran* River has a great impact on pollution issue.

According to studies and examinations and also the main approach that is the green city approach, major suggestions in the field of applications toward green space, which are within the study area, are confronted with a lack of per capita, as well as inappropriate dispersion, and its complementary uses. Therefore, considering the boundaries of the surrounding area as a protective green area, not only improves the condition of the greenery (both quantitatively and qualitatively), but also organizes and improves the status of the river as well. It has also been attempted to replace existing incompatible uses, (in particular industrial-workshop) and employ wildlife utilities with river environment-compatible applications instead. Thus, by reducing the disturbing and distracting uses around the river, somehow shortages and deficiencies are compensated for.

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