

Urban Riverfront Design: A Study of Karmanasha River

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Abstract

This paper aims to study about the Karmanasha River from the perspective of People, River and City. Furthermore, this study also aims to identify the present condition of the river. This study is conducted on three segments of the river. The study is done by structured and semi structured interviews and by the field observation. The research paradigm that will be used for this research study will be Postpositivist which will accept the theories, background, knowledge and the values of the researcher that can influence what's being observed and constructivist paradigm which is best suited for qualitative research and emphasizes the subjective and socially constructed nature of reality. The study revealed that there are various aspects that hinder the relationship between the river, city and people and how the relationship can be improved in the form of recommendations will be given.

Keywords

Riverfront, Urban River, Floodplain, Karmanasha River, River, City and People

1. Introduction

Rivers have been important to human civilization throughout history, serving as a source of life. However, contemporary socioeconomic developments have threatened rivers due to pollution, overuse and habitat degradation, especially due to human activities. Kathmandu is one of the fastest growing cities in South Asia [1]. To rejuvenate urban rivers, they must act as indicators that they are humane and provide convenient, attractive and safe environments for communities economic development along urban riverbanks should also be considered, to the benefit of residents and tourists alike. Globally, rivers play prominent role in urban formation and affect development, social interaction, and vital functions such as irrigation and water supply.

Rapid urbanization has had impacts on stream water quality, air quality, and energy which they obtain. Urban wetlands and waterfront areas are essential components of urban open spaces, contributing significantly to urban resilience and public health.

The connection between rivers, waterfronts, and open spaces should create a comprehensive recreational space system that benefits both the community and the city as a whole. Human Urban edges are not only important features but also important environmental corridors. They address important environmental functions and form the basis for robust, reliable and sustainable urban development. The crucial factor in riverfront development is the interaction between people and the river. Regardless of the project's scale, the absence of a connection between people and the river, in terms of human interaction, can lead to the failure of the riverfront development. This focuses the significance of human interaction with water as the most critical element in riverfront development.

2. Research Problem

Despite their potential benefits for society and the environment, urban river corridors, particularly the Karmanasha River is currently in a state of degradation. The Karmanasha River has been subjected to unprecedented levels of pollution, primarily resulting from the actions of polluting households, individuals, and a lack of action by the responsible authorities assigned with its protection.

What was once a freshwater river has now degraded into a polluted liquid including suspended and dissolved solid debris, raw sewage, and other contaminants. The haphazard discharge of rubbish into the river corridor has not only reduced its visual and economic worth, but has also had a negative influence on the natural beauty of the riverside. Continuous pollution has had a devastating impact on the riverside.

We are currently living in an era where once-flowing, clean rivers have been transformed into channels for sewage and garbage disposal. In the past, rivers held a central place in everyone's lives, nurturing cultures, sustaining farmlands, teeming with diverse fish, providing children with play areas, and offering solace and joy to people after demanding days of work. However, in today's world, many individuals grow up without ever witnessing a river in its natural, clean and fresh state.

The deep connection between rivers and people has eroded, and there is little motivation to reestablish or even protect what remains of this once-great relationship. The strong bond that once existed between the river and the city's residents has been severed.

3. Need and Importance of Research

Urban populations have a significant interaction with their surroundings. In the case of the Kathmandu Valley, it is

increasingly transforming into a city dominated by concrete and lacking even the essential greenery necessary for its residents. The Valley is fighting to maintain its remaining open and natural spaces, which include agricultural land, trees, and woods. This represents a major issue within the context of the Kathmandu Valley, and it has far-reaching consequences for the climate, environment, and society.

This situation has given rise to a lot of problems, encompassing environmental, social, and economic dimensions. The absence of green spaces in urban area deprives the local population of an aesthetically pleasing urban environment but also of clean air and public spaces for both present and upcoming generations to enjoy. River corridors can serve as a crucial natural link that connects humans, the city, and nature, playing a pivotal role in enhancing the natural characteristics of a city. Introducing green spaces along the Karmanasha River corridors can encourage and foster a more positive relationship with the environment while also providing valuable services. This research aims to explore a concise overview of urban rivers, analyze the distinct issues faced by the river, the city, and its residents independently, and show how these aspects are interconnected in achieving sustainable riverfront development. The findings will aid in the planning and execution of riverfront development projects.

4. Research Objectives

The research explores the situation of present state of Karmanasha River. The objectives of the research are as follows:

1. To examine and evaluate the present condition of the selected stretch along river and the nearby corridor.
2. To explore the elements that cause degradation and its consequences, and formulate recommendations and suggestions for its enhancement.
3. To explore approaches for successful riverfront development to guarantee the long-term viability of both river and green areas alongside the Karmanasha river corridor on the basis of River, City and People.

5. Research Methodology

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques [2].

5.1 Research Paradigm

The research paradigm adopted for this research study will be post positivist and constructivist paradigm. Post positivist paradigm accepts the theories, background, knowledge and the values of the researcher that can influence what's being observed [3]. Constructivism is a philosophical paradigm that ontologically emphasizes how an individual actively

constructs their own notions of reality through their cognition resulting in the existence of multiple realities [4]. It is best suited for qualitative research which emphasizes the subjective and the socially created character of reality. It is based on the notion that knowledge is not discovered but rather constructed by individuals based on their experiences, perceptions and interpretations of the world around them.

5.1.1 Ontology

The study's ontological premise will be that the current state of the Karmanasha River has an affect on its surrounds and the local people who live nearby. It has experienced a variety of issues and obstacles.

5.1.2 Epistemology

The literature review, information and data gathered from various external sources, local inhabitants, and other engaged organizations will be used to determine the epistemological stance of the research field.

5.1.3 Methodology

Research Type: A qualitative research method will be used to achieve the objectives of the research. The objective of the research is to examine and evaluate the present condition of the Karmanasha River and the variables responsible for the deterioration and its consequences. For which the qualitative research will be the best.

Research Strategy: Case studies are an important qualitative research tool that enables researchers to investigate and comprehend individual situations or "cases" in depth. Case studies, when used to the study of rivers, may give significant insights into numerous elements of river systems, management, and interactions with human and natural settings.

5.2 Research Design

5.2.1 Data Collection

The primary data collections were collected through:

- Site surveys including site observations, personnel observations, knowing historical facts about the rivers, etc.
- Questionnaire survey including close end and open-ended questions
- Interview with local residents, practitioner and ward representative

Secondary data collections were collected through:

- Maps, policies and projects by the government, books, journals.

5.2.2 Field Visit and Questionnaire Survey

Several field visits and observation of the case area to understand about existing condition, different problems and causes related to River, City and People.

5.2.3 Sample Selection for Questionnaire Survey

The questionnaire survey on all three segments employed a random sample approach to learn about local people's perceptions on the Karmanasha river and its growth, as well as their worries and wishes. In all three parts of the case region, from Hattiban Bridge to Gwarko Bridge, 30 participants were interviewed by questionnaire survey.

- Segment-1: 10 (Hattiban Bridge to Little Angles School)
- Segment-2: 10 (Little Angles School to KIST Hospital)
- Segment-3: 10 (KIST Hospital to Gwarko Bridge)

The purpose of selecting these three segments is that the river is mostly affected by the settlements around periphery of the river in these segments so that the study can be made on the basis of River, City and People.

5.2.4 Data Compilations and Analysis

Data compilation and analysis were critical in determining the outcome and drawing conclusions from the research. Following the collection of data from all sources and the questionnaire survey, certain data was examined and other important conclusions were retrieved in order to assess the viability of riverfront development in the Karmanasha River.

6. Limitations

A section of the Karmanasha river will be used for the research. On both sides of the river, the research area will extend from Hattiban Bridge to Gwarko Bridge. Due to time constraints, the research will not explore all of the concerns and challenges of the Karmanasha River's tributaries. However, the research findings, along with study's proposals and recommendations, will be used in other rivers with similar challenges.

7. Literature Review

7.1 Urban Riverfront

An urban riverfront, part of the waterfront where a city is in direct contact with water, refers to a transition area taking the river's edge as a reference and creating occasions and space for the interactions between citizens and water [5].

7.2 Flood Plain Spaces

A floodplain is a distinctively dynamic environment situated at the aquatic-terrestrial interface [6]. Floodplain spaces offer various activities, and spontaneous uses are common. Riparian zones have subclasses based on river channel accessibility.

7.3 Upland Spaces

They are open areas in urban hill environments which are situated in valleys with terraced plains and steep cliffs and are naturally located along riverbanks, avoiding flood-prone areas. Parks and pathways are typically connected to riparian areas yet distinct from the water by varying distances due to terrain

or steep slopes, attracting people for recreational activities away from the river due to their natural beauty.

7.4 Raised Spaces

They are situated on dry, artificially elevated terrain. Greenways along levees can be distinguished from parks and trails on large embankments and refilled banks. This type of open space is a stroll along a substantial concrete wall that was previously constructed to prevent Floods. Aside from the design, the way it interacts with the river and how it is used is similar to how levee greenways are used.

7.5 Characteristics of Urban Riverfront

- It features the riverside as the foreground door, showcase river's history and activate riverfront.
- It limits obstacles and engages people with river.
- It repair and enhance the environment.
- It employs high-quality architectural materials and sustainable engineering practices.

7.6 Riverfront as Public Space Potential

The functions of riverfront as a public space, within a typology is defined by Maxmilian Wittman into the following categories:

- Transport (road transport, rail transport, walking and cycling) [7]
- Social (linked with public facilities) [7]
- Function additional to housing and housing itself [7]
- Recreation. [7]
- Industrial use and as complementary functions [7]

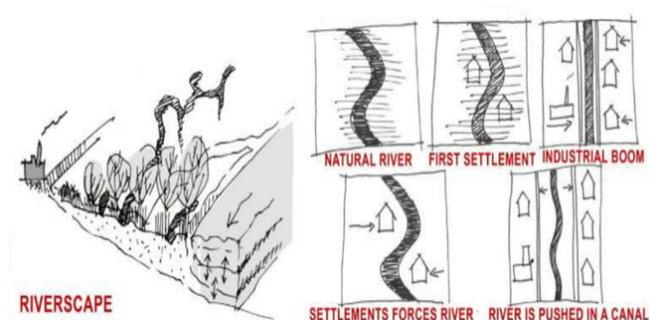


Figure 1: The potential of settlements at the river banks
Source: A Guide to Riverfront Development

7.6.1 Vertical connections towards Riverfront

Aiming the vertical connections can be related to the function of connecting people to the place within the roads, pavements, ways, and much more [8].



Figure 2: Vertical connections
 Source: *A Guide to Riverfront Development*

7.6.2 Parallel connections towards Riverfront

This connection is relatively conducted within the bringing the public space to be aligned within the river corridor in a coherent way, that can reflect the beauty of the nature and the use of the place within a safe access [8].

7.7 History of Urban Riverfront Development

- First riverfront settlement (2000BC- 100 AD)
- Middle ages (100 AD-1600AD)
- Renaissance (1600AD -1800AD)
- Industrialization (1800AD -1975)
- Decline of Riverfront (1975 -1990)

7.8 History of Riverfront Development in Nepal

The riverfront was developed in Nepal by creating ghats in river embankments which also protected land from flooding. The Bagmati The river is regarded as the source of Nepalese civilization and urbanization. Nepali culture is closely related to rivers and water. Most of the sacred places are located along the bank of the big rivers [9].

7.8.1 River Culture in Nepal

The river is significant to Nepalese culture. The majority of our religious institutions are located along the river's banks. As a result, rivers are revered as sacred sites in our culture [9]. Water and culture or human life is inextricably linked as water and fish [10] . For us water has relation with the Creation and universal knowledge (brahmgyaan).

7.8.2 River and Nepalese Culture

Rivers, symbolized by the sacred Ganga, are universally revered for their power to purify, heal, and offer spiritual solace to all living beings. Immersing in their waters is believed to bring a heavenly sensation, and people seek redemption by touching and drinking from rivers, with the ultimate aspiration of merging their souls with these sacred water bodies after their earthly life ends.

7.9 Concept of River City and People

The three worlds of Habermas served as inspiration for river city-people's three-dimensional strategy. In this context, the river can be defined as the physical and biological world, the city can be viewed as the social and humanized world and the people can perform the place of individual emotions and perceptions [3].



Figure 3: River–City–People’ framework
 Source: *‘Three worlds’ of Habermas (1984)*

8. Case Area: Karmanasha River

8.1 Background

The Karmanasha River, located in Lalitpur District, Nepal, flows unusually from south to north for approximately 12 kilometers. It is a river with spring flow mostly during the wet season from June to September. Nagdaha, a large stagnant body of water in the Kathmandu Valley, is one of the sources of this river. Finally, the Karmanasha River joins the Manohara River to form the Bagmati River, the unique river of the Kathmandu Valley. Unfortunately, due to human activity and chemicals from the textile industry, the river has become increasingly polluted, creating a river filled with rocks, gravel, plastic and rare aquatic plants. But as the population grew, so did the demand for land, leading to more settlements along the river. This urban expansion, coupled with direct drainage

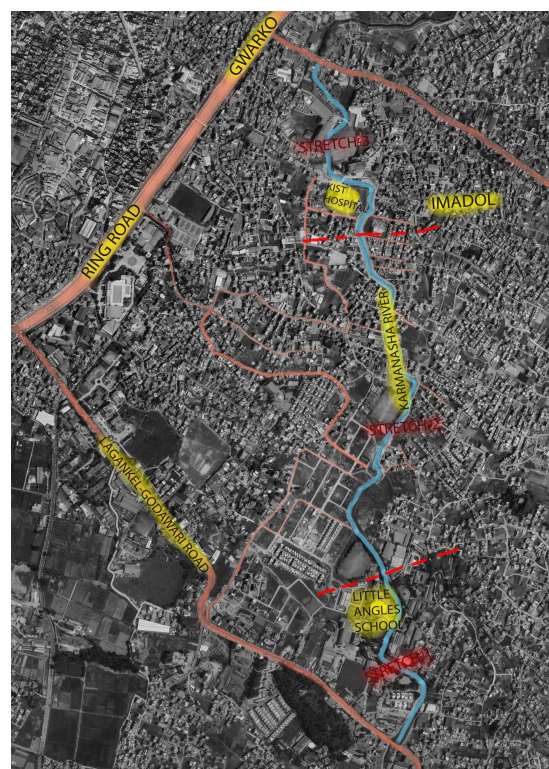


Figure 4: Study Area
 Source: *Google Earth*

into the river, has led to severe water degradation. In addition, the land has been prepared abruptly, creating uneven development and exposing residents to natural disasters. Minimum pre-construction buffer requirements are often ignored, causing problems during the rainy season when the river overflows. Additionally, land near the river bank has been encroached upon, complicating the development of public land.

The research case study area was chosen to be 2.5 kilometers long, from Hattiban Bridge to Gwarko Bridge. For the research, the entire stretch was chosen and divided into three sections.

- Segment 1: Hattiban Bridge to Little Angles School
- Segment 2: Little Angles School to KIST Hospital
- Segment 3: KIST Hospital to Gwarko Bridge

9. Findings

Each segment was explored and different parameters were identified.

9.1 Existing scenario of River

9.1.1 Pollution and solid waste

- Segment-1: Sewerage and drainage were the primary issues in this area, where water quality was deteriorating.
- Segment-2: There was presence of solid waste in this segment and the color of the River water has changed significantly due to the sewerage.
- Segment-3: The most polluted segment of the river is the third segment from Kist hospital to Gwarko Bridge where the household wastages were directly mixed into the river and the bones of buffaloes and the package of wastages were found along the edge of river.



Figure 5: Polluted water at Segment-1
Source: Author



Figure 6: Polluted water at Segment-2
Source: Author



Figure 7: Direct drainage water at Segment-2
Source: Author



Figure 8: Solid Waste Deposition at Segment-3
Source: Author

9.1.2 Accessibility

- Segment-1: This segment of the river was inaccessible in all the parts.
- Segment-2: One third of this segment was accessible and the remaining parts are not accessible.
- Segment-3: This segment is completely inaccessible from any point.

9.1.3 Public utility

- Segment-1: people use the corridor section of this segment for the mode of walking and transportation.
- Segment-2: The open spaces along the corridor of the section are used by the people for morning and evening walk and different types of sports are played here.
- Segment-3: This segment is used by the people for dumping the different types of wastages and some encroachment can be seen.

9.1.4 Vegetation and Green Cover

- Segment-1: There is lack of green spaces in this segment as there is only road corridor along the edge of river.
- Segment-2: There is plenty of open spaces in this segment which has potential to be developed as the parks. People are already using these open spaces for morning and evening walks as well as playgrounds for different games.
- Segment-3: There is lack of open spaces in this segment which has the potential to be developed as the parks. There is the presence of only corridor road along the edge of river in one side at most of the parts.

9.2 Existing scenario of City

9.2.1 Land Use Pattern

Residential, Institutional, commercial and open spaces.

9.2.2 Function

Functionality and role of the river has been greatly decreasing day by day. The aquatic habitat and the natural functional use have been disturbed due to pollution and degraded river condition. Having the potential of development as recreational spaces the river's potential is not used properly.

9.2.3 Open spaces

- Segment-1: No public and open spaces are present in this segment.
- Segment-2: There is the presence of open spaces in this segment and unofficially people are benefited from this space by using this space as the playground and for exercise purposes.
- Segment-3: No public and open spaces are present in this segment.

9.2.4 Visual Identity

- Segment-1: There is no particular visual identity and there is lack of connection to the river.
- Segment-2: Though there is no official park in this segment but people from all three segments are found to visit this park in the morning.
- Segment-3: There is no particular visual identity and there is lack of connection to the river.

9.2.5 Road and its Infrastructures

The road and its infrastructures are important criterion for any type of riverfront development since they help to link the river with the people. The condition of the road in all segments is unsatisfactory especially in segment-1 and segment-3. There is no provision of pedestrian footpath and greenery. There is lack of railings along the edge of river for the safety of people. Some sections are in critical condition, posing a hazard to pedestrians and passers-by and resulting in muddy roads during the rainy season.

9.2.6 Pollution

River and its landscapes are greatly affected by the pollutions which causes the bad odors to the environment and the deposition of the garbage along the edge of river hinder the beautification of the city.

9.3 Existing scenario of People

Some specific questions were prepared to obtain local people's perceptions regarding the river and riverfront and their uses. It was determined to speak with locals who had lived near the river's banks for a long time, or native residents. Several questions were posed about the river's former health and history, which played an important part in this research in comprehending the backdrop of the present and future. The questions included a variety of topics about the Karmanasha

river and its corridor, including natural and physical factors connected to the river and its scenery, socio-cultural features, economic aspects, changing scenarios, and its growth.

Four factors are significant in the context of river city and people:

- Place of identity: Relationship and connection between the site and its surroundings. A site should have personal and cultural significance. A location must fulfill an individual's requirement. A locale should inherit cultural norms and values.
- Social Connection: Because humans are social beings, a place should allow for social interaction amongst them.
- Place Potential: Visual artistic qualities (appealing appearance, strong personality) Making spaces quality (accessibility, inclusivity, upkeep) social usage quality (connections, functions, safety)
- Responsive characters: Comfort, relaxation, and vitality, as well as passive and active engagement etc.

Comparing all three segments the open spaces in the segment-2 has created a place of identity where people from all three segments visit there for the morning and evening walks and playing games. It has given people an opportunity for various functions from social interacting space and playing games for children. Talking about the segment-1 and segment-3 there is the lacks of such open spaces which makes it difficult and disconnect the relation between people and river. Similarly encroachment can be seen in the river edges in the segment-1 and segment-3. As river has cultural values for the people they use the river for flowing away the pindas that are made during the sradhha.

10. Analysis

10.1 Analysis of three segments: Segment-1, Segment-2 and Segment-3

10.1.1 Segment-1: Hattiban Bridge to Little Angles School

One the major findings in this segment are the river corridor road in only one side of the river. There is improper settlement on other edge of the river and sewerage are directly mixed into the river causing the river to be polluted. This polluted river has given bad aesthetics to the city and affects the urban environment. There is the lack of proper open spaces in this segment so no parks can be developed there but the corridor road can be developed in way that it would help pedestrians to walk comfortably and greenery can be provided along the river edge which would cause the beautification of the river. Similarly handrails should be provided along the retaining wall of the river which would provide safety to the people. Some of the major problems associated with this segment are as follows:

- Lack of recreational spaces
- Solid wastages on the river and direct sewerage into the river.
- Bad condition of the road without considering the pedestrian safety and lack of handrails along the edge of river.

As a result of these factors, there is a gap between the river, the people, and the city.

10.1.2 Segment-2: Little Angles School to Kist Hospital

In this segment there is the presence of open spaces which is used by the people for morning and evening walks and playgrounds. We can call this space as informal park which has created a place making for people. But the quality of water is deteriorated as the color of water is black and gives the bad smell. Similarly there is the presence of retaining wall on the edge of river but there are no handrails in order to ensure the safety of people. The road corridor along the river has no considerations for the pedestrians and there is no pitch on the road which causes the road to be muddy during the rainy season. The following are some of the significant issues linked with this segment:

- Polluted water of river causing the bad smell.
- Bad quality of road along the river corridor and no considerations for pedestrians.

In comparisons to other segments this segment has the open space for the social interaction of people which has potential to be developed as park in future. Due to this reason it has shown some sort of connection between river city and people.

10.1.3 Segment-3: Kist Hospital to Gwarko Bridge

In this segment there is the lack of open spaces for social interaction and the river corridor roads has no consideration for pedestrians. The corridor roads are damaged and needs maintenance. Solid wastages are deposited on the edge of river. Similarly there is absence of hand railings along the edge of river which causes no safety. Some of the major problems associated with this segment are as follows:

- Lack of recreational spaces
- Solid wastages on the river and direct sewerage into the river.
- Bad condition of the road without considering the pedestrian safety and lack of handrails near the perimeter of river.

Because of these factors, there is a gap between the river, city and people.

10.2 Analysis of River, City and People connection in each Segment and its importance

Human activities, including the improper disposal of solid waste from various sources, the connection of sewage and drainage systems to the river, and a general lack of awareness, are significantly contributing to the ongoing pollution of the Karmanasha River. As a result, the river has lost its natural beauty, become contaminated, and is no longer functioning as it should. A river can only combat pollution effectively and maintain its quality when it functions in a healthy and proper manner. In many sections, particularly in segments 1 and 2, the river remains largely inaccessible to the public, leading to disconnection between people and the river. This disconnection has detrimental effects on the urban

environment of the city. The utilization of the river and its surrounding area by the public has steadily declined over time. Unless we focus on creating spaces to enhance the riverbank's aesthetics and development, the condition of both the river and its banks will deteriorate further in the future. It's crucial to give equal consideration to the development of all three elements for a holistic improvement.

The challenges and concerns associated with the river have a direct impact on the city, thus influencing the overall urban environment and the residents' quality of life. These three factors form a critical interconnected cycle of existence, and they are interdependent. Each component holds equal significance, and the absence of any one of them hinders development and existence of the other two. Consequently, in any riverfront development project, these three elements play a crucial role in determining its success.

11. Discussion

One of the most significant findings of the research is that the open spaces available in segment-2 are mostly used by the people of all segments for exercising, playing games and interaction. Thus in terms of social interaction segment-2 stands out than other segments 1 and 3. The River-City-People trio is intricately interconnected and plays a pivotal role in the development of waterfront areas anywhere. The presence and development of one of these components are contingent upon the existence of the other two. To attain sustainable waterfront development, issues within each dimension and region should be addressed concurrently. In this research, an analysis of the Karmanasha River has been conducted, considering the River's natural and physical attributes, the City, and its urban inhabitants. This analysis provides a concise overview of the landscape at the site, offering insights into the current state of the Karmanasha River and its surrounding areas, along with the challenges faced by the river, city, and its residents.

While the condition and challenges within each segment of the river and its surrounding corridor may appear similar at first glance, they are, in fact, distinct from one another. The problems and issues concerning the river, the city, and its inhabitants are intricately intertwined. The river's challenges directly impact the city, thereby influencing the overall urban environment and, ultimately, the well-being of the city's residents. This interconnectedness functions like a continuous cycle, where the significance of these three components is equal, and the absence of any one of them hinders both existence and development.

Any kind of riverfront development projects consist of two things. They are:

- Pollution free and functional river
- Recreational riverfronts: social gathering space with greenery and multi-functional making the river and river front lively connecting people with it.

The poor water quality of the Karmanasha River has left a detrimental impression on the general public. Consequently, they are not interested to spend their free time in proximity to the river or its banks. Moreover, there is a notable absence of

recreational areas, particularly in segments 1 and 3 of the area. This lack of recreational spaces gives people little desire to visit the river and its surroundings, resulting in a gradual decline in the relationship between river and the people.

Creating interaction, social and recreational spaces in all sections is essential, as they play a significant role in fostering a connection between the river and the city's residents. Moreover, they enhance the beauty of both the river and the city while actively contributing to urban development.

12. Conclusion

The study discovered that in three different parts of the river (Segment 1, 2, and 3), the river's condition was pretty much the same, although there were differences in what caused pollution and whether there were nice green areas by the river for people to gather. In the part with green areas close to the river, it had a really good impact, making it better than the other two parts. Segment 2 had a connection, but the other two didn't. These green riverfront areas seem to be good for people's mental health and for them to feel closer to nature.

Eco-friendly riverfronts provide natural spaces in cities, places to relax, and help the environment. They also provide chances for transportation and learning about nature. Having plants by the river helps keep it clean and healthy for the people who live nearby.

This research underscores the vital connection between the River, City, and People in shaping waterfront areas. It focuses on the importance of considering human and social aspects in river projects, emphasizing that addressing river issues without accounting for residents' perspectives can lead to a loss of place identity and a sense of belonging. To achieve sustainable waterfront development, a comprehensive exploration of each dimension - river, city, and people - is essential. The study examined riverfronts along urban rivers Karmanasha riverbanks, aiming for sustainable urban development by analyzing various dimensions and indicators. Ultimately, the research highlights the need to concurrently address the issues of River, City, and People to achieve sustainable development for the Karmanasha River's waterfront.

13. Recommendations

13.1 RIVER: Restoring river natural appearance

Environment: Developing a rigorous waste management strategy, particularly for the river corridor, is crucial and should be promptly put into action to effectively manage and curb the disposal of waste along the riverbanks.

Sewage and drain management: Sewage and drainage systems must be properly controlled to prevent their direct discharge into the river. The sewer currently flowing through the river should be rerouted to separate treatment facilities to enhance water quality.

13.2 CITY: River and Riverbank Beautification and Development

The riverfront development beautification can be done by providing the different interaction spaces and recreational spaces for social gathering. During the research of all three segments of Karmanasha River, most of the open spaces was available that can be developed into the parks. However there is the lack of such open spaces in segments 1 and 3. Thus for the beautification of the riverfront the park is proposed in the segment-2 whereas there is no proper conditions of roads in all segments. Thus considering the pedestrian footpath, greenery and the railings on the edge of the retaining wall of the river is proposed as the recommendations.

Segment-1 (Karmanasha to Little Angles School):



Figure 9: Satellite image(left), present situation of river and corridor(Right)

Source: Author

This segment consists of road corridor along the edge of river but there are no proper considerations for pedestrian and greenery and there are no enough spaces available for developing the parks. Therefore a proper road section is recommended which considers the walkway for pedestrians, greenery, street lamps and handrails for the safety of people. The road section consist of 0.5m greenery, 2m for pedestrian and 7.5m of carriage way.



Figure 10: Proposed road

Source: Author

Segment-2 (Little Angles School to Kist Hospital):



Figure 11: Satellite image(left), present situation of open space (Right)

Source: Author

This segment consists of plenty of open spaces that have the potential to be developed as parks. After the research the proper space has been allocated which will be developed into parks considering the riparian zone 10m setback is left from the edge of river and another 10m setback is left for the development of the park. Along the edge of the river different platforms are given so that people can interact with water causing the relation between river and people to prosper. Mainly there are three levels of the space starting from riparian zone to park where the park is situated at the uppermost position so that it would not be hampered by the flood. Similarly, there are plenty of seating spaces as well as the morning and evening walk tracks for the people. These parks and spaces enhance the quality of interaction spaces which is already used by people informally. Similarly for the purpose of Shraddha different patis are provided and landings are developed in circular forms for the recital purpose.

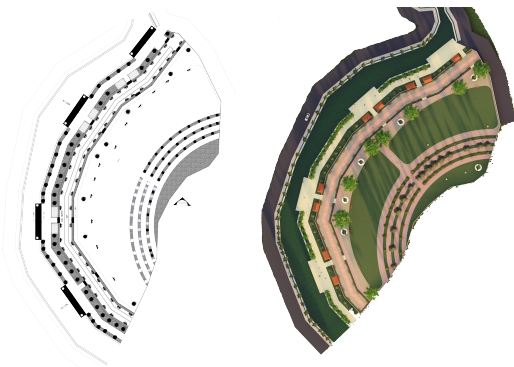


Figure 12: Master plan of the park
Source: Author



Figure 13: Section of the park
Source: Author



Figure 14: View of the park from opposite edge of the river (Left) and view of platform (Right)
Source: Author

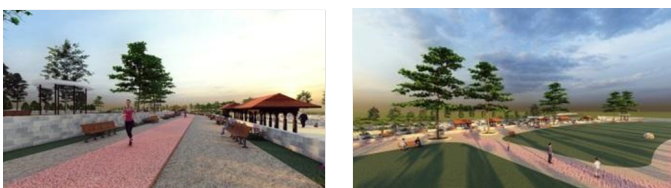


Figure 15: Morning Walk Trails (Left) and park view (Right)
Source: Author

Segment-3 (Kist Hospital to Gwarko Bridge)



Figure 16: Satellite image (left), present situation of river and Corridor (Right)

Source: Author

This segment consists of road corridor along the edge of river but there are no proper considerations for pedestrian and greenery and there are no enough spaces available for developing the parks. Therefore a proper road section is recommended which considers the walkway for pedestrians, greenery, street lamps and handrails for the safety of people. The road section consist of 0.5m greenery, 2m for pedestrian and 7.5m of carriage way.



Figure 17: Proposed Road
Source: Author

13.3 PEOPLE: Development centered on the community

Awareness programs regarding the importance of river, solid waste management, etc should be done in the community level with participation of maximum number of people. Timely surveys should be carried out by the government in order to know about the public's reactions regarding the proposed actions or policies [11].

Apart from that, the lack of laws and standards for waterfront development is one of the primary causes of urban riverfront deterioration. As a result, insufficient legislation and guidelines to manage waterfront development in Nepal, as well as poor enforcement by policymakers, have resulted in unsustainable riverside development in Nepal. Therefore, sufficient regulations and guidelines should be formulated for Riverfront regeneration which would could have a significant impact upon Riverfront and enhance riverfront areas.

Similarly, the findings and recommendations that are made from the study will be helpful in other rivers and tributaries with similar problems.

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