The interaction between waterscape nature and sensory design

A case study on enhancing children's well-being and local development in Älvkarleby

Fadi Kreiz

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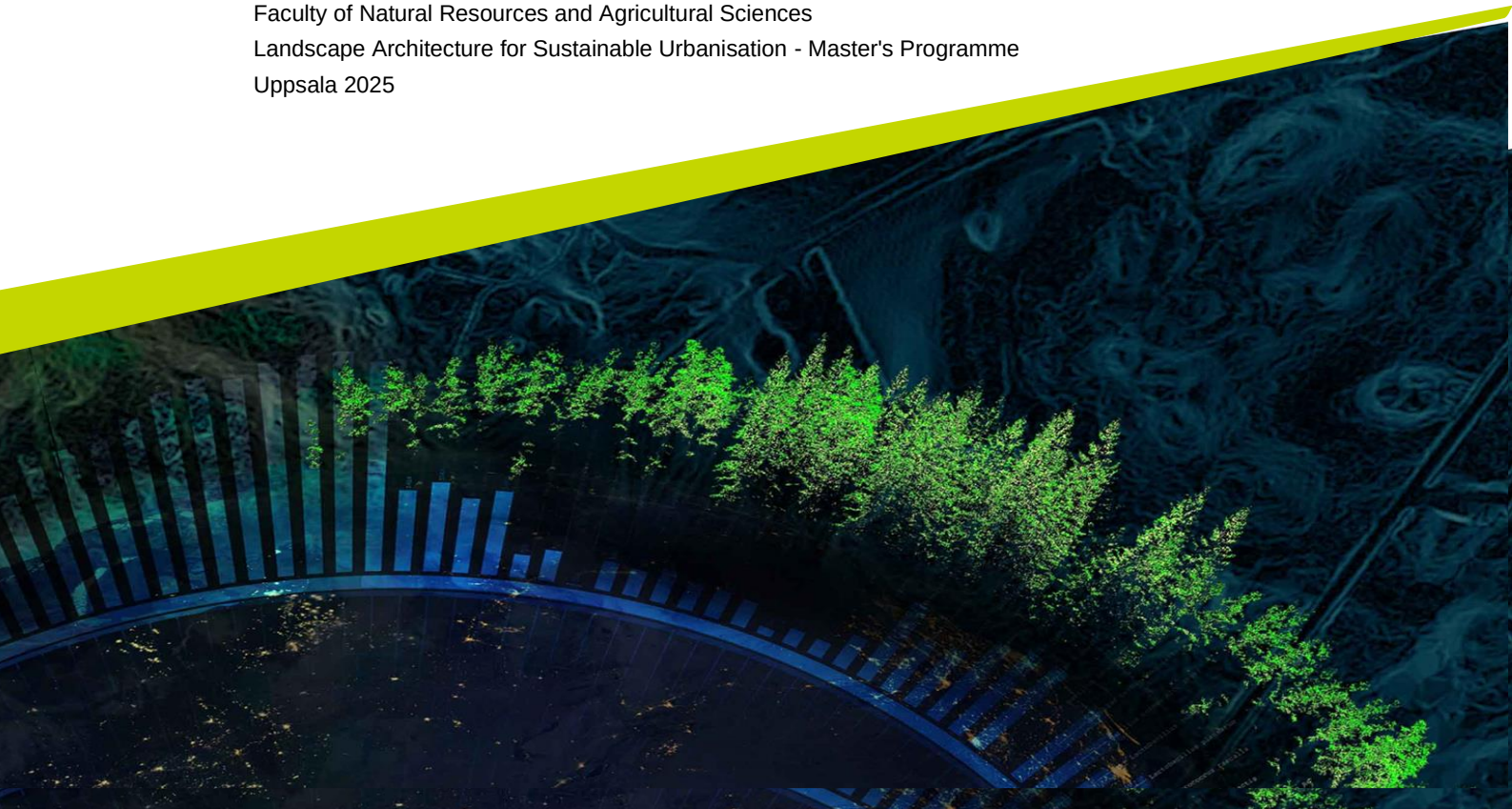

The interaction between waterscape nature and sensory design. A case study on enhancing children's well-being and local development in Älvkarleby

Author of thesis: Fadi Kreiz

Supervisor: Andrew Butler, SLU, Department of Urban and Rural Development
Examiner: Åsa Ahrland, SLU, Department of Urban and Rural Development
Assistant examiner: Carla Cruz, SLU, Department of Urban and Rural Development

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Department of Urban and Rural Development
Division of Landscape Architecture

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Preface

The idea for my master thesis came from my interest in reconnecting children with nature during my master's courses at SLU, which was an excellent opportunity to discover my interest in this topic. My motto was, "Look at the landscape through the eyes of a child."

I have found my interest in creating sensory parks since they play a crucial role in well-being, ecological, psychological, physical health, social interaction, inclusivity, and the aesthetics of the environment.

I want to express my appreciation to the following people for their assistance in finishing my thesis: My supervisor, Andrew's encouragement kept me motivated to research and make a proposal based on what I have learned during my studies in Sweden. Burcu Yigit Turan for leading the course and Lena Steffner for supporting me every time.

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Sincerely
Fadi Kreiz

Abstract

This study explores the potential of child-responsive waterscapes to catalyze growth and revitalization in the municipality of Älvkarleby. With a focus on sustainable development, the research investigates how the design and implementation of waterscapes tailored to children's needs can address demographic challenges and foster a vibrant community. Drawing on insights from the comprehensive plan for Älvkarleby Municipality in 2050, which emphasizes the imperative need for developmental strategies aligned with sustainable progress, this study examines the historical significance of Älvkarleby's relationship with its surrounding blue spaces.

By creating a sensory park incorporating all senses, with a specific emphasis on blue spaces and waterscapes, the research aims to provide practical examples of child-responsive design principles. Through an interdisciplinary approach that combines waterscape architecture and community development, this study seeks to demonstrate how child-responsive waterscapes can enhance play, creativity, social interaction, and inclusivity, thereby attracting families, stimulating economic activity, and fostering well-being. By highlighting the transformative potential of child-responsive design, this research contributes to the broader discourse on sustainable urban development and offers valuable insights for policymakers, urban planners, designers, and community stakeholders seeking to create vibrant and resilient communities.

*Keywords: Waterscape design**,** Angling waterscapes, Sensory Park, Children, well-being, community development.*

Sammandrag

Denna studie undersöker potentialen hos barnanpassade vattenmiljöer som en drivkraft för tillväxt och förnyelse i Älvkarleby kommun. Med fokus på hållbar utveckling analyseras hur utformningen och implementeringen av vattenmiljöer anpassade till barns behov kan möta demografiska utmaningar och bidra till ett levande samhälle. Studien tar avstamp i Älvkarleby kommuns översiktsplan för 2050, som understryker det akuta behovet av utvecklingsstrategier i linje med hållbar samhällsplanering, och belyser samtidigt Älvkarlebys historiska koppling till omgivande blå miljöer.

Genom att skapa en sinnespark som aktiverar alla sinnen – med särskilt fokus på blå miljöer och vattenlandskap – syftar studien till att ge praktiska exempel på barnanpassade designprinciper. Med ett tvärvetenskapligt angreppssätt som förenar vattenlandskapsarkitektur och samhällsutveckling, strävar studien efter att visa hur barnanpassade vattenmiljöer kan främja lek, kreativitet, social interaktion och inkludering. Detta i sin tur kan attrahera familjer, stimulera ekonomisk aktivitet och bidra till ökat välbefinnande.

Genom att lyfta fram den transformativa potentialen i barnfokuserad design bidrar denna forskning till det bredare samtalet om hållbar stadsutveckling, och erbjuder värdefulla insikter för beslutsfattare, stadsplanerare, formgivare och lokala aktörer som strävar efter att skapa livskraftiga och resilienta samhällen.

*Nyckelord**:** Vattenmiljödesign, fiskemiljöer, sinnespark, barn, välbefinnande, samhällsutveckling*

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1. Introduction

In this initial section the thesis topic will be presented along with aim, research questions and a problem statement.

1.1. Background

In the comprehensive plan for the Municipality of Älvkarleby spanning from 2020 to 2050, the need for development strategies within the municipality is underscored in alignment with the goal that it should evolve sustainably; encompassing ecological, social, and economic dimensions while meeting present needs without jeopardizing the ability of future generations to meet their own (Älvkarleby Kommun, 2020). However, the municipality (see Figure 1 for location) faces challenges associated with a declining population, skewed demographic distribution, and the need for local growth. Additionally, the decline in children's contact with natural surroundings poses a significant problem, impacting their sensory experiences, well-being, and holistic development within their families (Älvkarleby Kommun, 2020).

Figure 1. Location of the city of Uppsala in Sweden, Location of the Älvkarleby municipality in Uppsala city and Placement of site of thesis in Älvkarleby municipality. Modified by the author of this thesis, edited by Author. © 2020 Hypothesister : Wikimedia Commons - Uppsala län.svg. All rights reserved. https://creativecommons.org/licenses/by-sa/4.0.

To propose further development strategies, considering the municipality's favorable conditions for water use, this thesis use the locality of Älvkarleby to address these challenges. By focusing on the design and implementation of child-responsive waterscapes[1],

[1]Child-responsive refers to an approach that prioritizes children's needs, experiences, and well-being in design and planning. In the context of waterscapes, it emphasizes creating environments that are safe, engaging, and developmentally beneficial for children by incorporating sensory design, accessibility, and opportunities for

I am not only addressing the developmental needs of children but also helping in creating attractive amenities that can serve as catalysts for local growth. This water park, covering an expansive area of approximately 12,388 square meters, will primarily focus on the role of waterscapes in shaping children's experiences, development, and well-being, with a specific emphasis on transitioning from adult-focused to child-centered approaches within the matter of architecture. This thesis will therefore be structured around three main focal points:

- Deepen the understanding of angling waterscapes and sensory design.[2]
- Formulating child-responsive waterscape-design principles derived from theories, and analysis of the site conducted in the locality of Älvkarleby.
- Implement the findings of my selected case study, the locality of Älvkarleby, in the design of my own proposed park, Älvkarleby Park which will be situated within the locality's district.

The decrease in children's contact with natural surroundings is a rising problem, associated with factors such as fast urbanization, overscheduling, and the widespread use of electronic media (Beery et al., 2023; de Keijzer et al., 2016; Grimm et al., 2008; Soga & Gaston, 2016). Here, blue spaces, such as rivers and lakes, and waterscapes, play a crucial role in children's sensory experiences, well-being, and overall holistic development of the family itself. Yet, as urbanization encroaches, these natural features often face degradation or neglect. Also, as urbanization intensifies, communities face the pressing need to revitalize their environments to both keep their residents and attract new ones. Therefore, reimagining developmental landscapes to incorporate accessible and engaging waterscapes could help reverse the trend of urbanization (Hossain & Hossain, 2021; Hurtado Hurtado et al., 2022). Investing in waterscapes aligns with broader goals of sustainable development and ecological balance, specified by the locality of Älvkarleby (Älvkarleby Kommun, 2020:7). By supporting communities become better at preserving the intrinsic beauty and biodiversity of their natural environments (Hossain & Hossain, 2021; Hurtado Hurtado et al., 2022), this approach will not only help attract new residents but also enhances the overall quality of life for existing community members.

exploration and interaction. This approach shifts the focus from adult-centered designs to child-centered spaces that support children's growth, play, and connection with nature (Li & Li, 2017; Bozkurt & Woolley, 2020; Allahyar & Kazemi, 2021).

[2]Angling waterscapes are aquatic spaces that combine fishing with recreational and sensory experiences, fostering engagement, relaxation, and a deeper connection with nature (Bento & Dias, 2017; Djohari et al., 2018). Sensory design enhances environments by stimulating multiple senses, creating immersive and interactive spaces that influence perception, emotions, and well-being (Hogg & Bryant, 1969).

The locality of Älvkarleby is in need for developmental strategies that align with the goal of sustainable ecological, social, and economic progress, ensuring the fulfillment of present needs while safeguarding opportunities for future generations (Älvkarleby Kommun, 2020:7). This directive forms the nucleus of my focus on Älvkarleby, where challenges abound, particularly evident in the skewed demographic distribution characterized by a significant elderly population. Coupled with the exodus of residents to nearby urban centers, this demographic dynamic has led to a diminutive population base, necessitating a surge in local growth. Furthermore, by focusing on the design and implementation of child-responsive waterscapes, I am not only addressing the developmental needs of children but also creating an attractive amenity that can serve as catalysts for local growth. Local growth being, as explained in the comprehensive plan for the municipality of Älvkarleby, as urgently needed (Älvkarleby kommun, 2020).

1.2. Research problem

Below a summary has been made to outline the problems more clearly to highlight that initiatives must be undertaken to steward natural and cultural assets, while also enhancing recreational amenities to draw in more residents and visitors alike, with a particular emphasis on fostering spaces conducive to children's well-being.

- The rise in urbanization, overscheduling, and increased electronic media usage has led to a decline in children's contact with natural environments, impacting their well-being and holistic development. This problem has negative implications for children's sensory experiences, well-being, and holistic development within their families.
- In some regions, blue spaces such as rivers and lakes have faced degradation or neglect due to industrial development and infrastructure expansion, limiting children's access to sensory experiences and recreational opportunities. While Älvkarleby has not undergone rapid urbanization, the construction of the power plant in the early 20th century significantly altered the landscape, submerging parts of the natural riverbanks and affecting public access to blue spaces.
- Älvkarleby faces challenges related to a skewed demographic distribution, significant elderly population, and an exodus of residents to nearby urban centers, leading to a diminutive population base and the need for local growth.

- Älvkarleby's historical relationship with its blue spaces has undergone significant changes due to factors like the construction of a power plant and military activities, shifting attention away from leisure activities to economic and military objectives.

1.3. Aim

This thesis seeks to explore how child-responsive waterscapes can promote well-being, social interaction, and inclusivity, with a focus on the design and implementation of water play facilities that cater to children's developmental needs and promote their engagement with nature. The research contributes to the field by providing insights into the transformative influence of child-responsive waterscape architecture. Furthermore, the thesis also seeks to explore Älvkarleby's historical relationship with its surrounding blue spaces which will add depth to the exploration of child-responsive waterscapes through a site study orientation. The town's proximity to water bodies has long played a crucial role in its development, fostering communal bonds, facilitating trade, and providing recreational opportunities. This rich history underscores the significance of investigating how child-responsive waterscapes can enhance play, creativity, social interaction, and inclusivity within the locality (Älvkarleby kommun, 2020).

The creation of child-responsive waterscapes aligns well with the imperative for local growth in Älvkarleby. As mentioned earlier, the municipality faces challenges stemming from a dwindling population base, largely due to the migration of residents to nearby urban centers (Älvkarleby kommun, 2020). This demographic trend highlights the urgent need for initiatives that not only attract new residents but also retain existing ones, particularly families with children. Finally, the overall aim is therefore to help Älvkarleby develop as a family-friendly destination.

1.4. Research questions

- How can children's engagement with nature and their overall well-being be enhanced through waterscape design?
- How can water environments contribute to the creation of sensory-rich waterscape designs for children?
- How can research on child-responsive design and multisensory experiences be practically applied to the design and establishment of a waterscape park in Älvkarleby?

2. Methodology

This section provides the methodology concerning how the study has chosen to gain and interpret facts in relation to the thesis aim.

2.1. Literature Review

A review of literature was undertaken to establish a foundational understanding of the thesis topic. I conducted this methodology to understand the topic better, focusing on landscape and waterscape design, sensory aspects, and children's overall interaction with blue spaces. Using keywords like "Waterscape Design" and "Children", among the others, I searched both traditional and electronic resources. After on-site observations, I reviewed scholarly articles to explore the relationship between waterscapes and children, evaluating each for relevance and reliability. I then began by organizing my literature review into three main categories: waterscape design, sensory landscapes, and children's interaction with blue spaces. All categories connecting to the thesis aim. The search process encompassed both traditional library resources and electronic databases, including Google Scholar. I also extended my search, and all literature was found with the help of the following keywords: *Waterscape design, Sensory Park, Blue spaces, Children, Landscape and waterscape design for children, Sensory elements in children's waterscape design, Sensory Stimulation through waterscape designs and impact on children's development, Sensory Landscapes, waterscapes and Well-being, Relationship between waterscapes and children's outdoor activities, Multisensory Perspective in waterscapes, Colorful and Visual Interactions, Acoustics in waterscapes, locality growth, municipality growth.*

Utilizing resources such as the Epsilon Archive for Student Projects at SLU and Google Scholar, relevant literature was identified and thoroughly evaluated for its relevance, reliability, and applicability to the research topic. As a result, the following key sources form the foundation of the theoretical framework: Pallasmaa (2012) on multisensory architecture, Ozyavuz (2012) on color and sensory interactions, Litton (1977) on visual evaluation of waterscapes, Brown and Rutherford (1994) on the role of acoustics in natural environments, Nikolajew (2003) on tactile engagement in environmental design, Wong (2006b) on the role of scent in sensory development, and Jeanes and Magee (2010) on multisensory play and child development.

2.2. Site Analysis

In addition to conducting literature reviews, on-site observations were carried out to gather a comprehensive understanding of Älvkarleby municipality and the rationale behind its selection as the focal location for this study. The data collection process encompassed not only the physical environment but also aspects such as historical context and social dynamics, ensuring a well-rounded perspective on the area's significance within the research.

The study process has involved various crucial steps, starting with the identification of a suitable site, Älvkarleby, and conducting exploratory investigations. The selection of the water spaces in Älvkarleby has been purposeful, as the municipality is situated between visually appealing islands, interconnected river systems, and naturally occurring waterfalls, all of which contribute to the intended research aim. I also conducted observations of Älvkarleby, considering its unique geographical features, cultural landmarks, and community dynamics during my site visit. In addition to direct observations, maps and documents played a crucial role in contextualizing the physical and historical aspects of the site.

To ensure a comprehensive understanding of Älvkarleby's landscape, history, and social structure, I analyzed various maps and archival documents. These included topographic maps, which provided insight into elevation changes, water distribution, and land use patterns, as well as historical maps, which helped trace the transformation of the municipality's blue spaces over time. Additionally, I examined urban planning documents and municipal reports, which outlined development strategies, demographic trends, and policies affecting public spaces.

By integrating insights from cartographic sources, municipal archives, and field observations, I was able to formulate a holistic view of Älvkarleby's waterscape dynamics. This multidimensional approach ensured that the study was grounded in both empirical observations and documented historical and policy-driven changes, strengthening the research's foundation and its practical implications for sustainable and child-responsive waterscape design.

2.3. Process of Design Proposal

The process of developing the actual design proposal began by establishing key design principles, which were derived from both the literature review and theoretical framework. These principles served as guiding criteria to ensure that the proposed waterscape park was aligned with the study's overarching goals of sensory-rich, child-responsive design. To explore different design possibilities, I first created initial hand sketches, which allowed for quick conceptualization and iteration of ideas. These sketches helped visualize spatial arrangements,

pathways, water features, and interactive elements that could be incorporated into a functional waterscape park. Hand sketching was particularly useful for experimenting with forms and relationships between spaces, enabling an intuitive and flexible approach in the early stages.

Following the hand-drawn sketches, I transitioned to digital modeling and rendering to refine and develop the proposal further. Using AutoCAD, 3D Max, Revit and Adobe Illustrator, I produced scaled site plans, elevations, and perspective views to create a detailed and accurate representation of the waterscape park's layout. Additionally, visualization tools such as 3D MAX and Photoshop were used to generate realistic renderings, enhancing the ability to communicate material textures, lighting, vegetation, and water interactions within the proposed design. These digital tools allowed for precise adjustments, better spatial planning, and an improved understanding of how the waterscape design would interact with its surroundings.

By integrating hand-drawn sketches, digital modeling, and rendering techniques, I was able to systematically develop, refine, and visualize the final design proposal for the waterscape park in Älvkarleby. This combination of methods ensured that the design was both theoretically grounded and practically viable, merging insights from literature, site observations, and iterative design experimentation into a cohesive and well-informed proposal.

2.4. Declaration of AI use

AI has been utilized in this study to generate images adapted to the research findings and concepts. Additionally, AI-assisted language proofreading has been employed as a complement to the automatic language correction features in Word and Google Translate.

3. Literature review

This section presents relevant literature concerning waterscape architecture and design principles that will be used to be able to analyze the study's findings.

3.1. Waterscapes for growth

3.1.1. Waterscape design for growing municipalities and localities

Çelik's (2017b) research emphasizes the pivotal role of landscape and waterscape design in achieving sustainable development goals. She underscores the importance of integrating ecological, social, cultural, and economic factors into landscape and waterscape design to create environments that protect habitats, manage stormwater, conserve water, and promote other objectives essential for sustainability (Çelik, 2017a). In the context of municipalities and growth, Çelik's (2017b) findings hold significant relevance which is why this research is mentioned here and connected to waterscape design as it is this thesis focus.

Sustainable waterscape design can contribute to the attractiveness of municipalities by enhancing their overall quality of life. Here a parallel can be drawn towards families considering relocation, as factors such as access to blue spaces and recreational areas can play a crucial role for families to do so. Çelik's (2017b) research suggests that well-designed areas can offer opportunities for relaxation, social interaction, and outdoor activities, which *could* all be appealing to families seeking a high quality of life in smaller towns (Çelik, 2017a). Economically, Çelik (2017b) highlights the benefits of sustainable architectural designs in promoting growth and development. Here waterscapes can be a part of these architectural designs. Waterscapes, which involve the integration of water features such as ponds, fountains, waterfalls, and streams, can significantly enhance the aesthetic, environmental, and functional aspects of architectural projects.

Well-designed waterscapes can become attractive public spaces and amenities, which also can stimulate tourism, attract businesses, and encourage investment in local infrastructure, all of which contribute to economic prosperity. For families, these economic opportunities can translate into job availability and improved living standards, making smaller towns more attractive as residential destinations (Çelik, 2017a/b).

3.1.2. Waterscape design and sensory elements to attract families and children

The impact of exposure to green and blue spaces on the physiological and psychological well-being of families, and foremost children has been extensively studied and documented (Aghabozorgi et al., 2023). Empirical evidence substantiates that the inclusion of these natural ingredients exerts a significant tranquilizing influence on the emotional well-being of youngsters, actively promotes engagement in physical activities, and notably mitigates levels of stress. When it comes to blue spaces (waterscapes) they have been found to have a positive correlation with improved cognitive development, as well as more positive social interactions and increased community cohesion (Dadvand, Villanueva et al., 2014; Dadvand, Tischer et al., 2017; Keniger et al., 2013; Miller et al., 2022).

By incorporating features that appeal to multiple senses, such as sound, touch, and sight, designers can enhance the overall experience and interest. For example, the gentle sound of flowing water can create a calming atmosphere, while interactive water features like splash pads provide tactile engagement. One key sensory element is color Hogg and Bryant (1969). Vibrant, colorful water features can captivate children's attention and stimulate their imagination. For instance, fountains illuminated with changing lights can create a dynamic and visually stimulating environment that encourages exploration and play. By thoughtfully integrating colors, designers can further enrich the sensory experience in waterscape designs (Hogg & Bryant; 1969; Berlyne, 1971).

The influential significance of color in influencing human emotions has thus been well acknowledged, as posited by Hogg and Bryant (1969) and supported by the research of Wright and Rainwater (1962). Berlyne (1971) further underscores this viewpoint by emphasizing the major impact of changes in color hues on arousal levels. Warm colors, such as red, are shown to evoke high arousal, in contrast to cool colors like blue and green. By establishing a setting embellished with a diverse range of colors, children are provided with the chance to explore a vast array of emotions and sensory encounters within a caring and encouraging environment (*Figure 2).* In the context of waterscape design, incorporating a rich palette of colors can significantly enhance this experience for children.

Figure 2. The Northwood Sensory Garden demonstrates Strong contrasts in color, all design color in this landscape is arranged beautifully. (designed & photo by Richard Bickler) Copyright © 2025 Arbour Landscape Solutions Ltd

Furthermore, the sensory inputs that individuals experience play a crucial role in shaping their perception of the surrounding environment. These inputs include auditory, visual, and olfactory stimuli, as well as the interplay of natural and artificial light, all of which influence spatial perception and engagement. While waterscape design principles are broadly applicable across various contexts, their impact becomes particularly meaningful when adapted to create structured and engaging environments. This involves the alignment and interplay of formal, linear, and textured elements, among others, which contribute to an aesthetically cohesive and well-balanced design (Wong, 2006a).

According to Wong (2006a), fundamental design concepts such as order and unity, scale and proportion, balance and harmony, and rhythm and repetition play a key role in achieving cohesive landscape compositions. The concept of order refers to the intentional arrangement of elements to create a structured and organized space, while disorder becomes evident when a design lacks coherence. This principle is particularly relevant in waterscape planning, where a sense of organization enhances both aesthetic appeal and functional experience.

In the context of waterscape design, particularly in fountains, the principle of order ensures harmony and visual coherence. A well-designed fountain exemplifies order through its structured layout and deliberate arrangement of elements. For instance, the symmetrical alignment of water jets, proportional scaling of fountain structures, and rhythmic water flow contribute to an organized and balanced aesthetic (Wong, 2006b). See Figure 3.

Figure 3. The Rill Garden in the UK demonstrates order, unity, scale, and proportion. All design elements in this landscape are arranged systematically around water elements (Howard 2014) (CC BY-SA 2.0). ***© David P Howard***

The principles of rhythm and repetition further enhance waterscape aesthetics, reinforcing visual harmony and spatial engagement. Repetition refers to the recurrence of specific design elements, amplifying their impact, while rhythm introduces a dynamic flow, shaping how individuals experience and interact with the space. Though Wong (2006b) discusses these principles broadly in relation to waterscape organization and aesthetics. This becomes important to touch upon for this thesis as these principles would also play a key role in creating visually engaging and interactive spaces that appeal to a diverse audience, including children and families.

3.2. Waterscape design, sensory elements and child-responsive blue spaces

Child-responsive design elements constitutes a focal point in the field of waterscape architecture, with a particular emphasis on creating environments that promote the independent mobility of young individuals. While also addressing issues related to access and safety, child-responsive designs aim to encourage children to engage in outdoor activities autonomously. The design of blue spaces, such as water bodies, plays a crucial role in achieving this objective, as it balances the need to protect children near water while enabling them to explore and play freely in safe environments. Nevertheless, the need for certain restrictions in areas frequented by young children is acknowledged, taking into consideration factors like the child's age and the requisite level of supervision (Li & Li, 2017; Bozkurt & Woolley, 2020; Allahyar & Kazemi, 2021). Furthermore, the presence of blue spaces in landscape settings, which are often designed with a focus on the requirements of adults, may not be optimal for promoting child's

play and ensuring their safety. Annunziata and Garau (2019) raise apprehensions on the erosion of children's autonomy in certain environments that primarily cater to the needs and preferences of adults. Child-responsive design principles has therefore emerged as a potential way to address this imbalance, with the goal of improving children's autonomous mobility. The key issue at hand pertains to the conversion of blue spaces from possible constraints to enablers of children's outdoor activities, hence promoting their inclination to participate in self-directed and spontaneous play.

3.2.1. Waterscape stimulation impact on children's development and well-being

The implementation of waterscapes that stimulate the sensory experiences of children can effectively elicit emotional reactions and make substantial contributions to their psychological and physical growth. Water gardens are widely acknowledged as therapeutic spaces for children, as they combine several sensory elements such as tactile sensations, aquatic sounds, the taste of clean water, natural aromas, and visual water features. This amalgamation of sensory experiences results in the creation of an immersive multimodal playground (Hussein, 2012). Nevertheless, a design approach that exclusively prioritizes visual encounters may unintentionally marginalize people who have visual impairments. To address this constraint, project spaces are designed with inclusive principles, which guarantee the full participation of children with a range of abilities *including* those who are visually impaired. Consequently, the project provides functionalities that accommodate tactile, auditory, and olfactory senses, promoting a comprehensive and immersive multimodal encounter. Hussein's research highlights the capacity of multisensory spaces to be easily accessed, hence making them attractive and inclusive to a wide range of individuals. The primary benefit of incorporating multisensory elements into designs is their commitment to inclusivity and accessibility, which is in line with the main goals of child-responsive designs/architecture (Hussein, 2012). The research conducted by Vitali et al. (2022) emphasizes the favorable influence of being near blue spaces during childhood on mental health outcomes during maturity. This underscores the long-lasting advantages of water-based surroundings in promoting general well-being.

The inclusion of water components in the environment has been found to have a considerable positive impact on the development of children. (Aghabozorgi et al., 2023; Chen et al., 2021). Water functions as a catalyst for stimulating the sensory experiences of children, encompassing auditory, visual, tactile, olfactory, and gustatory sensations. Consequently, it assumes a fundamental role as a constituent of every waterscape. Natural play places consist of

a wide range of components, including vegetation, sand, water, trees, and various other natural attributes. The presence of different natural habitats fosters a wide range of extended play activities (Russell, 2021). In metropolitan environments characterized by a scarcity of green and blue spaces, children may develop sedentary indoor behaviors, which can have detrimental effects on their health, including obesity, cardiovascular diseases, and specific types of cancer (Cheng, 2021). Therefore, the objective of child-responsive design is to develop outdoor environments that actively encourage play among children in urban settings, thereby reducing sedentary habits (Cheng, 2021).

A multitude of studies have emphasized the beneficial impacts of water on human welfare. According to Herzog (1995), there is a tendency for individuals to exhibit a preference for situations that contain water as opposed to those that do not. In a similar vein, Ulrich's (1981) research findings show that water might offer certain psychological healing powers. This project demonstrates the utilization of colors, textures, noises, and scents to create a captivating atmosphere that elicits sensory stimulation. These environments offer a safe setting for children with specific educational needs to regulate their sensory input, facilitating opportunities for relaxation, social interaction, and information exchange among peers (Aghabozorgi et al., 2023; (Hussein, 2010). The integration of auditory and visual environments introduces an element of enchantment and engagement, especially when youngsters interact with tangible play structures by throwing stones, pinecones, sand, or water, resulting in both immediate and cumulative effects. The design technique described in this study utilizes digital mechanisms such as interaction, resource accumulation, interconnection, and sensory experiences, combining them with the intrinsic characteristics of nature play (Mårtensson, Back, Waern, Pysander, 2012).

The research conducted by Kaptan (1999) illuminates the profound impact of early sensory experiences on children's cognitive development, emphasizing the significance of environmental conditions in fostering comprehensive growth. This observed progression, from initial sensory exploration to the development of more complex cognitive processes, underscores the pivotal role of enriched and supportive environments in shaping children's cognitive abilities. Empirical research by Allahyar and Kazemi (2021) further underscores the importance of environmental stimuli, particularly waterscapes, in promoting the overall well-being of children (Allahyar & Kazemi, 2021; Aghabozorgi et al., 2023). Their findings reveal a clear inclination among youngsters towards aquatic habitats, as indicated by extensive surveys where water aspects consistently emerged as their predominant choice.

When it then comes to blue spaces, and more specifically, the investigation of waterscapes as therapeutic environments for children, this is the prominent focus in this current academic

study. According to the findings of Allahyar and Kazemi (2021), it is posited that the presence of these spaces plays a substantial role in facilitating the recuperation process from a range of health conditions, encompassing ailments, physical injuries, psychological disorders, and traumatic experiences. Furthermore, the study conducted by Britton et al. (2020) provides empirical evidence suggesting that participation in activities inside aquatic facilities, rather than the inherent characteristics of the blue space, shows potential for facilitating rehabilitation and promoting mental health in individuals with mental health conditions *(Figure 4).*

Figure 4. The fountain park is a blue play space for children. Fountains are a type of waterscape that plays a role in improving development and well-being. © 2025 Barrington Park District

The active involvement with water is a crucial factor in determining the effectiveness of blue treatment, especially in mental health circumstances. The absence of active engagement in a water environment may not result in significant health advantages for children. Hence, it is crucial to develop facilities that promote and foster active participation, thereby ensuring that children are actively involved in water play endeavors. The available research strongly indicates that the benefits of well-being linked to blue spaces are particularly evident when youngsters engage in active water-related activities, such as fishing.

Furthermore, the construction of waterscapes designed to engage all five senses in children can evoke a range of emotions and sensations. It is important for children to establish

a profound connection with the natural world through direct interaction to cultivate an appreciation for its preservation. The availability of accessible natural environments and green play areas also has a salutogenic effect on children's well-being, regardless of the presence of disability (Aghabozorgi et al., 2023)[3]. Such spaces offer valuable opportunities for children to engage in exploration, use their imagination, express their spontaneity, develop their creativity, and develop their social skills, thereby supporting their physical and psychological development (Aghabozorgi et al., 2023; White, 2008). The concept of fostering a connection between individuals and water is a recurrent theme in the discourse of designers, often framed in terms of the sensory, cooling, or mood-enhancing pleasure that water can elicit (SEÇKİN, 2010). The water element in open spaces holds significant value due to its aesthetic, sensory, social, and psychological benefits, as acknowledged by Duzenli and Özkan (2016). These benefits are not only relevant to architects but also extend to psychologists, sociologists, and the broader community.

The study conducted by Engemann et al. (2020) explores the intricate relationships between the amount of time individuals spend in aquatic environments and the corresponding decreases in symptoms of sadness and anxiety, as well as the subsequent enhancement of self-assurance in children. These findings allude to the possibility of enduring effects on mental well-being during adulthood. The story lays particular emphasis on various forms of waterscapes, with a specific focus on reflecting pools. These pools are highlighted for their ability to offer not just visual stimulation but also a serene atmosphere that promotes children's involvement (Engemann et al., 2020). The recognition of the psychological significance of blue space leads to an examination of various forms of waterscapes and their unique impacts on the well-being of youngsters. One prominent aspect that emerges is the presence of carefully planned fountains, which can generate blue space inside urban surroundings. In contrast to natural bodies of water, fountains possess the unique ability to be effortlessly incorporated into urban environments, hence offering a range of sensory advantages (Engemann et al., 2020). The therapeutic potential of water fountains through sound therapy has also been highlighted in research conducted by Rådsten-Ekman et al. (2015). Within the dynamic urban environment of Stockholm, where the presence of noise pollution constitutes a potential hazard to

[3] The salutogenic effect refers to the positive impact of an environment, activity, or design on health and well-being. Rooted in salutogenesis, a concept introduced by Aaron Antonovsky, it focuses on factors that promote health rather than those that cause disease. In design and planning, a salutogenic effect means creating spaces that reduce stress, enhance resilience, and support overall physical and mental well-being (White, 2008; Aghabozorgi et al., 2023).

individuals' overall welfare, the purpose of these fountains extends beyond their aesthetic value (Rådsten-Ekman et al., 2015; Berdzenishvili, 2019).

They are specifically crafted to provide a source of auditory relief. Stockholm boasts a notable presence of several water fountains (Berdzenishvili, 2019), which actively contribute to the auditory milieu, so augmenting the overall quality of the acoustic waterscape. The incorporation of auditory aesthetics into design is consistent with the concepts of child-responsive design, acknowledging the need of addressing noise-related stressors for children (Rådsten-Ekman et al., 2015; Ozyavuz, 2012).

Reflecting pools are a notable type of water feature that possesses the ability to serve as optimal environments for children. The reflective surfaces of pools provide visually captivating encounters, enticing youngsters to engage in observation of the dynamic interaction between light and water, as well as participate in activities such as generating ripples using stones. In addition to their aesthetic appeal, reflecting pools offer a serene and calming environment for children, thereby enhancing their entire state of emotional and mental wellness (Latreille, 2013; Rådsten-Ekman et al., 2015; Ozyavuz, 2012).

It is worth mentioning that the shallow characteristics of reflecting pools serve to reduce potential safety risks, so creating a safe setting for children's recreational activities. The term "reflecting pool" inherently signifies its intended function, which is to exhibit the reflection of sunlight upon the surrounding scenery (Latreille, 2013). The presence of this illumination enhances the aesthetic appeal and allure of gardens. The statement made by Torquil Canning regarding the presence of a reflecting pool as a source of illumination in a garden draws attention to its capacity to augment the overall luminosity of a space, especially in areas that receive minimal sunshine (Latreille, 2013). This characteristic becomes particularly advantageous during periods of reduced daylight or when the sky is overcast, harmonizing with the architectural objective of establishing visually appealing and dynamic recreational spaces.

3.2.2. Child-responsiveness in waterscape design

Waterscapes possess an intrinsic ability to captivate the attention of youngsters and evoke a sense of excitement. The attraction of water in the environment is particularly appealing to children, as demonstrated by research conducted by Yamashita (2002). This study found that waterscapes have a significant ability to capture the attention of young inhabitants, whereas adults tend to perceive them with less prominence. The observed difference in perception highlights the distinct and significant importance of waterscapes for children, hence

establishing their crucial role in the design process that is responsive to the needs of children. The significance of comprehending the unique viewpoint of a child regarding blue space highlights the necessity of customizing waterscapes to cater to their requirements, guaranteeing that the design is aesthetically pleasing and captivating.

The development of aquatic areas within urban settings frequently prioritizes the preferences and requirements of adult individuals, supposing a certain degree of independence in traversing bodies of water. Nonetheless, the focus on adults in this method gives rise to apprehensions regarding the safety and suitability of these aquatic environments for children's involvement. According to Annunziata and Garau (2019), the autonomy of children decreases when urban amenities, including blue spaces, are predominantly tailored to the needs and preferences of adults. This prompts a thorough analysis of the equilibrium between safeguarding children's well-being and promoting their autonomy to engage in recreational activities within aquatic environments.

The current prevalence of adult-oriented design in blue spaces gives rise to noteworthy safety apprehensions about minors. Water environments designed specifically for the preferences and requirements of adults may provide certain hazards and difficulties that are not appropriate for recreational activities involving children. Annunziata and Garau (2019) assert that the approach is deemed undesirable, as it infringes upon the fundamental principle that blue spaces should not impede children's autonomy to investigate and interact with their surroundings. The fundamental issue pertains to the potential constraints imposed by water environments that prioritize the needs and preferences of adults, which may hinder children's autonomy and opportunities for engaging in outdoor pursuits.

The emergence of child-responsive waterscape architecture is proposed as a potential approach to effectively tackle the issues presented by adult-centric blue spaces. The main objective of this initiative is to improve the self-reliant movement of younger demographics through the provision of conditions that prioritize both safety and the facilitation of outdoor pursuits. The core principle of child-responsive design is minimizing limitations and promoting children's inclination to participate in autonomous outdoor activities (Annunziata & Garau, 2019:525). The acknowledgement is made regarding the necessity of establishing habitats that enable children to engage in unrestricted exploration and play within urban settings.

Child-responsive design provides a comprehensive method to effectively managing the balance between safety precautions and encouraging autonomous exploration in aquatic environments. The primary objective is to promote liberty, although there are circumstances in which the imposition of limitations becomes imperative, particularly when considering the

child's age and stage of development. For example, it may be necessary to implement stricter measures for regulating access to bodies of water for young children, given their limited ability to effectively supervise themselves. The acknowledgment highlights the significance of incorporating age-specific design considerations into waterscape architecture that is responsive to the needs of children.

3.2.3. Children's interaction with angling waterscapes

The investigation into blue spaces and their profound impact on children's development sets the stage for a deeper exploration into the significance of angling waterscapes within this context. While blue spaces encompass various aquatic environments, including lakes, rivers, and reflecting pools, the focus now shifts to understanding how angling waterscapes contribute to children's well-being and sensory experiences. Angling waterscapes offer unique opportunities for children to engage with waterscapes, fostering multisensory stimulation and promoting holistic development (Bento & Dias, 2017; Djohari et al., 2018). By incorporating angling waterscapes into waterscapes, designers can cater to children's preferences for water-based activities while providing safe and engaging recreational spaces (Bento & Dias, 2017; Djohari et al., 2018). As the study progresses, this focus will help centre the thesis on elucidating the specific benefits of angling waterscapes and combining them with waterscape design principles to create inclusive and enriching environments for children.

The significance of angling waterscapes within the context of this study requires a reframing to underscore their importance in facilitating physical activities and fostering engagement with nature. It is essential to articulate that such activities offer invaluable opportunities for individuals, particularly children, to interact with their surroundings and engage all their senses (Bento & Dias, 2017; Djohari et al., 2018). Engaging in fishing activities within the context of angling waterscapes greatly boosts children's self-esteem and confidence. Participating in nature-oriented outdoor activities, as emphasized by Bento and Dias (2017), has been demonstrated to be successful in cultivating children's self-assurance and their capacity to interact in natural environments.

Bento and Dias (2017) argue that engaging in open-air relaxation and being exposed to natural stimuli play a significant role in fostering self-assurance in young individuals. Interacting with the natural environment provides children with an immersive experience that allows them to appreciate vibrant sceneries, perceive subtle aural stimuli, encounter unusual smells, and explore various tactile aspects. The presence of natural environments provides

certain stimuli that captivate the attention and curiosity of youngsters, thereby enriching their overall childhood experiences. Creating fishing environments allows youngsters to participate in outdoor leisure activities, fostering their self-assurance by fostering positive connections with the natural world.

Angling waterscapes, which are specifically crafted landscapes for the purpose of angling activities, provide children with a distinctive opportunity for enjoyable escapism. Djohari et al. (2018) study highlights the significance of fishing grounds as habitats that offer young anglers the chance to relieve tensions and pressures linked to their everyday routines. Intentionally designed aquatic environments for fishing serve as vital tools in children's ability to manage stress, providing a haven from the challenges they face. Children view fishing environments as feasible options to their residences and businesses, emphasizing the significant impact these waterscapes have on their leisure preferences. Angling is seen as a method of mitigating anger, tension, and anxiety, offering therapeutic advantages for mental well-being. Djohari et al. (2018) highlights that fishing amenities enhance relaxation and diminish stress levels in young individuals, providing holistic benefits to their well-being through good and calming experiences associated with angling activities *(Figure 5).*

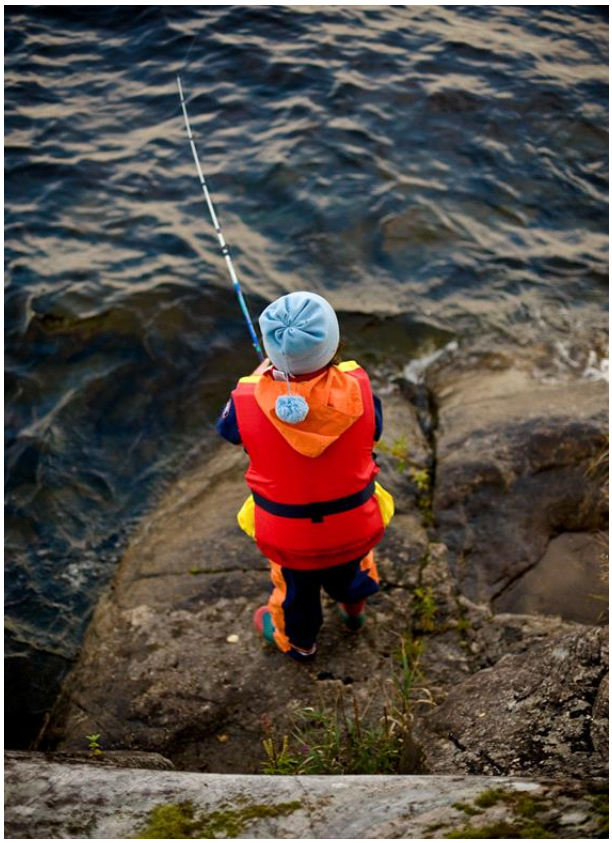


Figure 5. Children need opportunities to play in nature, like angling activities (Sønderland 2008) (CC BY-NC-SA 2.0).

Research consistently demonstrates the positive impact of outdoor activities in natural environments on children's self-esteem (Bento & Dias, 2017). Encouraging children to explore the outdoors is paramount as it fosters self-confidence, aided by their exposure to colorful vistas, subtle sounds, new scents, and diverse textures (Bento & Dias, 2017).

It is evident that the outdoor environment provides children with a rich array of stimuli that captivate their attention and curiosity (Bento & Dias, 2017). Playing outdoors and involving water play are effective ways to foster children's development of self-confidence, motor skills, coordination, mental and physical health (White, 2008). It is particularly helpful if the outdoor space is equipped with a variety of features that allow children to explore and develop their range of motor skills, such as a combination of firm and soft surfaces, even and uneven areas, tunnels, hidey-holes, gradients, curving pathways, steppingstones, different types of walls and more (White, 2008; Fambasayi & Katsidzira, 2022). Therefore, a key aspect in child-responsive design is to create outdoor spaces that encourage urban children to play actively, reducing sedentary behaviors (Cheng, 2021).

3.2.4. Summary of Literature Review

This literature review has underscored the importance of child-responsive design principles in enhancing well-being, social interaction, and inclusivity within communities. However, a significant gap exists in research, particularly regarding the utilization of angling waterscapes to attract families and promote municipal growth. As stated in the initial chapter, this thesis aims to address this gap by fulfilling its aim, ultimately exploring how child-responsive waterscapes can serve as catalysts for community development. By focusing on the design and implementation of water and sensory elements tailored to children's developmental needs, the research seeks to fill this void.

4. Theoretical framework

This section presents the importance of sensory inclusion and its connection to the creation of waterscape architecture.

4.1. Multisensory Perspective in Waterscapes

Juhani Pallasmaa, a Finnish architect, adopts a phenomenological standpoint in his publication "The Eyes of the Skin: Architecture and the Senses" (2012). In this work, Pallasmaa explores the domain of architectural experience, highlighting the significance of employing a multisensory methodology. Pallasmaa offers a critique of the dominant tendency in current architectural practice, which frequently prioritizes visual stimuli to an excessive degree. He argues that it is essential to move away from this visually centered paradigm to cultivate a more profound understanding of the dynamic relationship between the built environment and its inhabitants. Given this viewpoint, the author argues for a shift in blue spaces design that prioritizes the development of deeper and more significant encounters, engaging all human senses rather than only depending on visual stimuli to provide perceptual experiences.

The design methodology discussed here involves the integration of diverse components that address the sensory experiences of individuals, extending beyond the realm of visual perception. These features comprise auditory components, such as the incorporation of relaxing sounds produced by running water, and tactile attributes, such as the integration of varied textures on surfaces, to enhance the experiential dimension within the environment in a more comprehensive and integrated manner. The role of color, specifically, assumes a crucial significance within the domain of child development. According to Pallasmaa (2012), engaging with various forms, sizes, and textures facilitates the cognitive development process by promoting creative thinking and the establishment of connections between colors and specific objects and concepts. The incorporation of color in design functions as a medium through which children can create connections with their surroundings and supports their investigation of the environment in which they are situated. The design presented here adopts a multidimensional approach that is consistent with Pallasmaa's proposition for a comprehensive sensory encounter. This method showcases its relevance in the realm of child development and their engagement with the surrounding environment.

Applying Pallasmaa's (2012) principles to waterscape design involves integrating various sensory components beyond just visual elements. This includes incorporating auditory

features like the sound of flowing water and tactile attributes such as different textures on surfaces. By embracing a multidimensional approach, waterscape design can enhance the experiential dimension within environments, offering richer encounters for individuals. Furthermore, Pallasmaa (2012) highlights the importance of color in child development, suggesting that exposure to diverse forms, sizes, and textures can stimulate creative thinking and cognitive development. Incorporating color into waterscape design provides children with opportunities to connect with their surroundings and explore their environment more deeply. In summary, adopting a multisensory approach to waterscape design, as advocated by Pallasmaa (2012), can enrich experiences within these spaces, particularly for children. By considering auditory, tactile, and visual elements, designers can create environments that promote exploration, creativity, and holistic engagement with nature.

4.1.1. The effect of colorful and visual interactions in waterscape design

Now, in discussing the significance of incorporating colours and sensory aspects, particularly water features, in waterscape design to enhance children's experiences. The first section focuses on the impact of colours on children's emotional responses and engagement with their environment, while the second section delves into the importance of sensory stimulation, including visual and tactile cues, in fostering children's understanding and connection with their surroundings.

The incorporation of a wide range of colors in various settings presents a significant opportunity for youngsters to effectively communicate and convey their emotional states. In a setting characterized by colors, children are afforded an opportunity to engage in the exploration and understanding of their emotional experiences. This is since different hues have the potential to evoke unique emotional responses. In addition, the deliberate utilization of colors can successfully capture the interest of young individuals towards components within the environment, such as recreational areas or walkways, thereby augmenting the simplicity of navigation (Ozyavuz, 2012) (Figure 6).

Figure 6. The sensory garden at the Building and Construction Authority Gallery in Singapore provision of visual, tactile signals and auditory from musical pipes for children. Photo.Chenzw 2009 (CC BY -SA 3.0). © 2009 Hypothesister: Wikimedia Commons - commons.wikimedia.org. All rights reserved.

The aesthetic allure of water transcends its mere physical characteristics, which is a notable observation. The reflecting properties of water surfaces are prominently demonstrated as they effectively capture and refract light, resulting in visually striking and lively exhibitions. The dynamic movement of water droplets in this visual display enhances the sensory perception of youngsters in the surrounding environment. In addition, the acoustic aspect of water features, exemplified by the pleasant noises produced by water splashing, plays a role in establishing a harmonious auditory environment, hence enhancing the liveliness of the surrounding space (Ozyavuz, 2012).

Furthermore, in his seminal work on the visual evaluation of waterscapes, Litton (1977) astutely noted that the presence of water, as a dominant element within these spaces, had considerable sway over visual perception. The extreme conspicuousness of the object is attributed to its visibility, dynamic movement, reflective characteristics, and variable coloring. The dynamic nature of water's movement and its capacity to reflect light give rise to a prominent feature within the natural environment. The juxtaposition of colors and textures present in aquatic environments creates distinct contrasts with the surrounding terrain, so enhancing their visual significance. An example of this may be seen in the dynamic contrast between the vivid

orange tones of the rocks and the tranquil blue hues of the sky and sea, which elicits a captivating visual representation.

To relate these previous research findings to angling waterscapes, it is possible to emphasize how incorporating water features, such as rivers, lakes, or ponds, into waterscape design not only enhances children's sensory experiences but also provides unique opportunities for exploration and connection with nature. Angling waterscapes, which encompass areas where fishing activities take place, offer an additional layer of sensory stimulation and engagement for children. The presence of water bodies in these spaces introduces elements like the sound of flowing water, the sight of rippling waves, and the tactile sensation of dipping hands into the water, all of which contribute to a rich sensory experience. Furthermore, the vibrant colours associated with aquatic environments, such as the blue and green hues of water, can evoke emotions of serenity and excitement, enhancing children's emotional responses and overall engagement. By integrating angling waterscapes combined with sensory design principles, designers can create environments that not only foster sensory exploration but also promote a deeper connection with nature, thereby enriching children's experiences and well-being.

4.1.2. The effect of acoustics in waterscapes

The aural aspect of children's encounters inside waterscape design plays a crucial role in developing their imaginative faculties and enriching their comprehension of their environment. Sound serves as a helpful medium for conveying information pertaining to the relationships of environmental components and a child's sensory experience especially when they taste fruits and drink water. In addition, water, a fundamental element, presents numerous opportunities for generating multisensory effects in these spaces designed for children.

Within the framework of waterscapes, many criteria can be utilized to control the auditory encounter for youngsters. The characteristics discussed in the literature include components such as the strategic placement of water features, the modification of timbre, the control of sound intensity, and the incorporation of rhythmic patterns (Nikolajew, 2003; Halprin, 1973). Moreover, the increasing incorporation of water elements in architectural design, particularly in the context of stormwater retention systems, presents a captivating auditory aspect.

Water features can provide a range of auditory effects, including the calming sound of water trickling and the energetic splashing of fountains. Additionally, these water features

possess the capacity to contribute to the masking of sounds (Brown & Rutherford, 1994). The purposeful utilization of water elements in the environment can effectively reduce external noise problems by introducing soothing sounds. Moreover, the interplay between water sounds and other environmental surfaces, such as grass and trees, can also impact the acoustic characteristics of the surrounds *(Figure 7).*

Figure 7. High Park in Toronto show fountains Water that can provide a range of auditory effects. © 2004 Hypothesister: Wikimedia Commons - commons.wikimedia.org. All rights reserved.

Children can associate certain sounds with certain emotions or smells with specific experiences. These helps children develop a more complex understanding of their environment. Children may learn to associate the smell of rain with the sound of thunder or cut grass with the feeling of joy. These connections help children to better recognize and understand the world around them. Continuous exposure to various sounds, smells, and experiences develops their memory. This memory is further associated with the emotions they experienced at the time, helping them form an environmental mental map and its associated emotions. It gives them a complex understanding of the world and helps in recognizing and responding to certain situations meaningfully (Barbara & Perliss, 2006).

4.1.3. The effect of scent on children

The inclusion of smells plays a vital function, especially in the context of children's environment. Through the association of scents with emotions or experiences, children construct a sensory representation of their environment, resulting in a distinct and personalized understanding of the surroundings. Thus, incorporating the sense of smell into waterscape design can serve as a potent means of enhancing children's comprehension of their surroundings on a profound and individualized level. The citation refers to, for example, young people can learn to connect the smell of rain, or for example smell of an ocean breeze (Wong, 2006b). (Figure 8).

Figure 8. Developing scent and visual aspects through water-oriented surroundings. Photo: AI ChatGpt

Furthermore, angling waterscapes often feature an array of natural scents associated with the surrounding blue spaces. As children’s fish along the banks of a river or pond, they may encounter the fresh scent of aquatic plants, the earthy aroma of mud and soil, or the fragrant aroma of wildflowers. These natural scents not only enhance the sensory experience but also deepen children's connection with the natural environment, making fishing a multisensory adventure.

4.1.4. The effect of taste on children

Although general aspects of architecture commonly focus on the visual, auditory, olfactory, and tactile senses, the sense of taste is generally overlooked. However, it is an essential part in children's sensory encounters. While fishing in angling waterscapes, children may have the opportunity to taste fresh water from the stream or pond. The crisp, clean taste of freshwater

adds to the sensory experience, providing a refreshing break during fishing excursions. In addition to enjoying the sensory experience of fishing, children can learn about the culinary aspects of handling fish as food. Educators or guides may demonstrate proper cleaning and filleting techniques, as well as simple recipes for cooking fish. Children can participate in hands-on activities, such as gutting and scaling fish, under supervision, while learning about the nutritional value of fish and the importance of sustainable seafood consumption. This holistic approach to learning engages children's sense of taste and fosters a deeper connection with nature through responsible fishing practices.

4.1.5. The effect of tactile sense on children

Tactile experiences in waterscapes embrace a diverse range of textures and surfaces that enhance interaction with aquatic environments. Integrating elements such as smooth river stones, coarse sand, rippling water, or uneven stream beds creates a multisensory space that stimulates tactile perception. These tactile features encourage exploration, allowing individuals especially children—to develop both fine and gross motor skills as they engage with the dynamic surfaces and materials found in and around water (Nikolajew, 2003). Sensations such as the refreshing touch of cool water along with the comforting warmth of sunlight on a surface can evoke positive feelings and enhance a child's overall state of well-being. Moreover, exposure to diverse tactile sensations in waterscapes fosters sensory curiosity, evoking awe and encouraging exploration (Nikolajew, 2003). Incorporating tactile elements into aquatic features can promote both physical activity and imaginative engagement. Materials like soft sand, smooth driftwood, or textured aquatic plants offer safe and enjoyable tactile experiences. These thoughtful design choices contribute to the creation of inclusive and accessible waterscapes, accommodating the varied sensory needs of all individuals, including those with sensory sensitivities or disabilities. *(Figure 9).*

Figure 9. A sensory waterscape planned area illustrating tactile interactions for children. Photo. AI ChatGPT.

For example, angling waterscapes provide a unique opportunity for children to engage their tactile sense through hands-on interaction with various fishing equipment and natural elements. As children hold fishing rods, bait hooks, and fishing lines, they experience different textures and sensations, which promote sensory exploration and fine motor skill development. Additionally, touching different types of fishing bait, such as worms or artificial lures, introduces children to the diversity of aquatic life and encourages them to appreciate the intricacies of nature. *(Figure 10)*

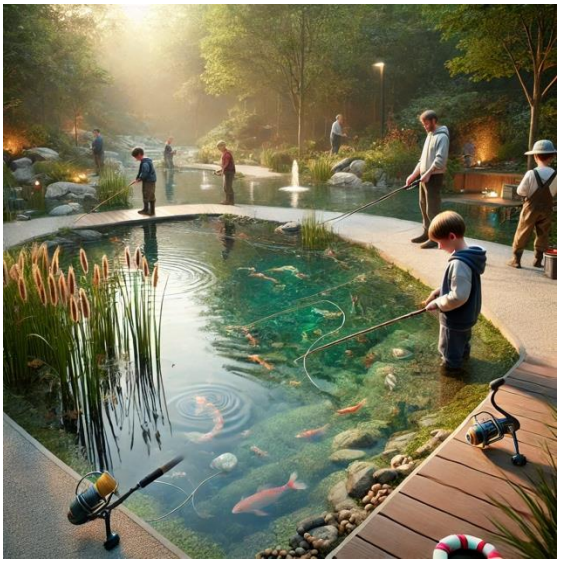


Figure 10. Children exploring the joys of fishing in a serene park waterscape, engaging their tactile senses with fishing rods, bait, and the natural elements around them, while connecting with nature and aquatic life. Photo. AI ChatGPT

4.2. Theoretical Synthesis

With the help of this theoretical framework various design principles concerning the creation of sensory-rich environments, particularly in waterscape design, has been explored. Here, I will now summarize the framework and highlight the upcoming design principles that will use in relation to the upcoming site analysis to form a foundation for the proposal of my new angling waterscape park, which is the aim of this thesis.

- **Sensory Inclusion**: Incorporating sensory elements in waterscape design to provide meaningful experiences for individuals of all ages, with a focus on children. This encompasses visual, tactile, olfactory, gustatory, and auditory experiences (Jeanes & Magee, 2010). In designing angling waterscapes, I aim to apply sensory inclusion by integrating diverse water features, textures, and scents that cater to children's developmental needs.
- **Multisensory Perspective**: Advocating for a shift away from visually centered design paradigms toward a holistic approach engaging all human senses to create deeper connections between individuals and their environment (Pallasmaa, 2012). In designing angling waterscapes, I will employ a multisensory approach, incorporating elements like soundscapes created by flowing water, varied textures for tactile exploration, and aromatic plants to stimulate the sense of smell.
- **Color and Visual Interactions**: Examining the impact of colors on emotional responses and engagement with the environment, as well as the visual appeal of water surfaces contributing to sensory experiences (Ozyavuz, 2012). In designing angling waterscapes, I will feature vibrant, colorful water elements and dynamic water surfaces that capture attention and stimulate emotional and visual engagement.
- **Acoustics in Waterscapes**: Discussing the role of sound in waterscape design, particularly in water-inclusive environments, and how water features provide auditory effects enhancing the overall sensory experience (Brown & Rutherford, 1994). In designing angling waterscapes, I will include strategically placed fountains and streams to create soothing auditory waterscapes, enhancing the park's ambiance and sensory appeal.
- **The Effect of Scent on Children**: Recognizing the importance of incorporating smells into the environment to enhance children's sense of smell and foster deeper connections with their surroundings (Wong, 2006b). In designing angling waterscapes, aromatic plants and flowers will be integrated around water features to provide pleasant olfactory experiences that stimulate and engage children's senses.
- **The Effect of Taste on Children**: Highlighting the often-overlooked sense of taste and its role in children's sensory experiences, especially in waterscape design where edible plants offer interactive experiences (Jeanes & Magee, 2010). In designing angling waterscapes, I will

include areas with edible plants, such as berry bushes and herb gardens, allowing children to safely explore tastes and connect with nature through interactive experiences.

- **The Effect of Tactile Sense on Children**: Emphasizing the significance of tactile experiences and the use of various textures, surfaces, and materials to stimulate children's sensory perception and promote well-being (Nikolajew, 2003). In designing angling waterscapes, water features with different textures, such as smooth pebbles and rough stone surfaces, will be incorporated to enhance tactile exploration and sensory engagement.

All the above principles underscore the importance of creating immersive and inclusive environments catering to the diverse sensory needs of all individuals, particularly children, in waterscape design that can also help municipality and locality growth. This, as inclusive and immersive environments that nurture a deeper appreciation for nature and enhance the well-being of families and children.

5. Site Analysis

In this section the project site Älvkarleby will be given a short presentation corresponding to both demographics, geography, and my own observations. This is of importance as Älvkarleby will serve as the backdrop for the new design of a sensory park that I will later propose.

5.1. The population of Älvkarleby

Among the challenges identified is the uneven demographic distribution, with a significant portion of the population being elderly. This, coupled with outmigration to nearby cities, results in a small population base and low tax revenue. Other demographic challenges include integration issues, low educational attainment, and high unemployment rates in certain groups (Älvkarleby, 2020). Efforts to address these challenges are complicated by the municipality's small size and limited resources. However, discussions emphasized the importance of leveraging the municipality's geographical location near Gävle and Uppsala while mitigating negative effects. Strategies include enhancing the municipality's identity and infrastructure, such as developing housing, tourism, and business sectors, as well as creating meeting places for youth. Strengthening connections between towns within the municipality and to neighboring cities is also crucial (Älvkarleby, 2020).

On December 31, 2022, the population of Älvkarleby municipality was 9,625 residents, representing a decrease of 2 individuals compared to the previous year (Region Uppsala, 2022). In 2022, 613 people moved into the municipality, while 587 people moved out. Notably, the municipality experiences the largest exchange of movers with Gävle, primarily among individuals aged 20-29, who are often at pivotal life stages involving family formation, education, and career changes, all of which frequently coincide with relocation. Looking ahead, population projections for Älvkarleby municipality indicate growth to 11,116 residents by 2050. However, it's noteworthy that the forecast anticipates a negative natural population increase, meaning that migration will be the primary driver of population growth. Specifically, the demographic dependency ratio in Älvkarleby is projected to increase from 92 in 2021 to 95 in 2050, indicating a relatively high burden of dependents (both children and elderly) per 100 working-age individuals, second only to Östhammar municipality in the county (Region Uppsala, 2022)[4].

[4] The demographic dependency ratio is a measure that compares the proportion of dependents (typically children under 15 and adults over 65) to the working-age population (usually ages 15–64). It indicates the economic burden on the working population to support those who are not in the labor force. A higher ratio suggests more dependents per working individual, which can strain social services and economic growth, while a lower ratio indicates a larger workforce relative to dependents (WHO, 2025).

Analysing age distribution, it is to be expected that the population aged 80 and above will increase by 84% by 2050 (Region Uppsala, 2022). Moreover, the municipality is projected to experience negative natural population growth throughout the forecast period. In terms of migration, Älvkarleby is expected to continue attracting individuals, contributing to overall population growth. However, it's important to consider the implications of these demographic trends for future planning and resource allocation within the municipality (Region Uppsala, 2022).

In the context of Älvkarleby municipality's demographic challenges and future development goals, the focus on children emerges as a crucial aspect for several reasons. According to recent data and projections, Älvkarleby faces an aging population, with significant increases expected in the elderly demographic by 2050. However, alongside this trend, there is also a notable exchange of movers, particularly among young adults aged 20-29 (Region Uppsala, 2022), who are often at pivotal life stages involving family formation, education, and career changes. This demographic group represents a key opportunity for the municipality's growth and vitality. By prioritizing children in planning and development efforts, Älvkarleby can address several important objectives. Firstly, investing in amenities and environments that cater to the needs of children can attract and retain young families, thus contributing to the municipality's long-term sustainability and population growth, which is also highlighted in Älvkarleby kommun (2020). Creating family-friendly spaces, such as parks and recreational facilities, not only enhances the quality of life for residents but also fosters a sense of community and belonging. Furthermore, focusing on children's well-being aligns with broader goals of social inclusion and community development. By providing opportunities for social interaction, play, and learning, Älvkarleby can create a supportive environment for children to thrive and develop. This, in turn, contributes to the overall resilience and cohesion of the community, which is described as important (Älvkarleby kommun, 2020). Additionally, considering children's needs in future planning efforts is essential for building a sustainable and vibrant municipality. By addressing challenges (mentioned in Älvkarleby kommun, 2020) such as integration issues and low educational attainment from an early age, Älvkarleby can lay the groundwork for positive social outcomes and economic prosperity in the years to come.

5.1.1. Älvkarleby geographical position

The geographical positioning of Älvkarleby is at around 80 kilometers north of Uppsala. Located adjacent to the Dalälven River, it is situated amidst the abundant forests of the region and in a beautiful environment with cultural value *(Figure 1).* Covering an expansive area of approximately 12,388 square meters, the site boasts a considerable waterfront expanse.

The landscape of Älvkarleby is a vital factor in establishing the community's identity and has rich resources with forests, wetlands, rivers, coasts and arable land, and the topography of the region is characterised by level terrain. Coniferous forests and deciduous forests cover most of the land. There is aquatic vegetation interspersed with deciduous woodland along the shoreline edge, forming little islands. The area's soil types are primarily clay-silt and sandy moraine, and the shoreline has clean edges and a seamless transition to the water *(Figure 11).*

Figure 11. The shoreline in Älvkarleby. Photo by Author2023

The height difference between the land and the water is minimal, going beyond just its visual appeal to become a fundamental component of its whole character. To fully grasp the recreational and environmental context of the municipality, it is crucial to have a clear understanding of the unique features of the landscape, such as the vast forests, agricultural districts, or industrial sectors (Schäfer et al., 2018).

For example, the abundance of extensive forested regions that contain many rare plants, animal species and a well-established fishing culture. may indicate potential for establishing natural recreational places, but zones designated for industrial purposes may necessitate careful strategizing to guarantee the seamless incorporation of outdoor spaces. These observations have a direct impact on the necessity for a variety of outdoor spaces that meet the expectations and

preferences of the community. Within the municipality, significant developments have taken place over the years, with notable mention of the hydropower station constructed during the twentieth century (Ye, 2022). This station plays a pivotal role in the energy supply for neighboring industries, while simultaneously impacting the ecological balance of the Nedre Dalälven region. Given its geographical location on the border between Norrland and Svealand, Älvkarleby has acquired distinct characteristics and has become a hub for diverse interests. These encompass sporting activities, tourism, hydropower production, and cultural heritage (Schäfer et al., 2018). Moreover, the presence of the Dalälven River carries immense significance for the municipality, offering a myriad of opportunities and challenges that warrant exploration.

5.1.2. The historical Railway Park and perspectives on waterscape transformation, infrastructure, and development of child-responsive spaces

Historically the town of Älvkarleby has a deep-rooted relationship with their surrounding blue spaces, which has played a crucial role in facilitating trade, transit, and fostering communal bonds (Holmström, u.å.; Nyström, 2007). The riverbanks were previously a flourishing area where children could engage in play and locals could congregate, cultivating a feeling of community and recreation along its picturesque coastlines. Nevertheless, the physical features of the country experienced substantial modifications during the early 20th century. In the 1910s, the construction of a power plant resulted in the submersion of the original park located along the riverbanks (Holmström, u.å.; Nyström, 2007).

The park was then repurposed for military activities and then modified to accommodate the infrastructure of the power plant (Rohde & Kendle, 1994; Holmström, u.å.; Nyström, 2007). This alteration had a profound impact on the town's relationship with the river, redirecting its attention from leisure activities to economic and military objectives. Älvkarleby saw a new phase in its interaction with the Dalälven River in the 1980s, after the military presence left. The region had a revival as a popular tourist spot, mostly focused on the scenic Älvkarleby Falls (Holmström, u.å.; Malone & Tranter, 2003; Nyström, 2007).

In this part of the section, I will further mention the Railway Park situated in Älvkarleby, as an example of a park lacking vital elements that would classify it as a sensory park encompassing all senses and thus making it inclusive and attractive to all types of people. However, as the Railway Park contains several blue spaces and angling waterscapes it is a good

reference example showing how improvements can be made. The park is no longer operational due to unique circumstances that will be discussed below.

The presence of the Railway Park in Älvkarleby's landscape and in the core protected zone for in-depth planning and design (Fish nature park) narrative is essential for comprehending the progression of public spaces and the influence of infrastructure advancements, cultural protection, and rural development on recreational locations (Holmström, u.å.; Rohde & Kendle, 1994; Malone & Tranter, 2003; Nyström, 2007). The historical importance of the old railway park is emphasized by its conversion into the fish nature park. The former railway park, located on the western bank of the Nedre Dalälven river, possesses significant cultural and historical significance (Holmström, u.å.; Rohde & Kendle, 1994; Malone & Tranter, 2003; Nyström, 2007). It formerly served as a crucial link between the two banks of the Nedre Dalälven river. Nevertheless, the installation of the hydroelectric power station significantly transformed the terrain. The increase in water level upstream caused a significant portion of the historic railway park to be submerged. This development is a result of the substantial infrastructural overhaul in the region *(Figure 12)*.

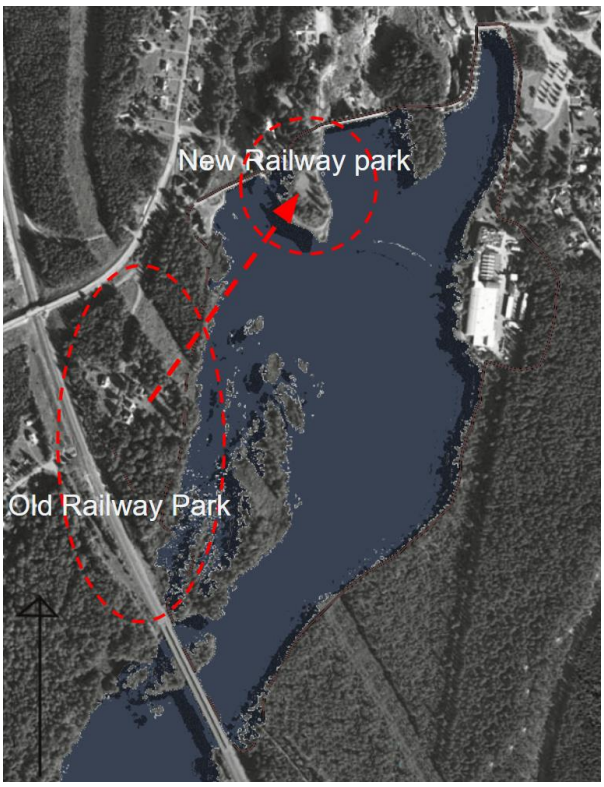


Figure 12. The location of old railway park and new railway park in Älvkarleby, © Google Map data 2023, edited by Author

The fish nature park exemplifies adaptive reuse and the incorporation of natural components into the built environment, as it emerges from the remains of the former railway

park. The map depicts the arrangement of the fish nature park, showcasing how it leverages the previous railway park land to create a larger public river space. Älvkarleby's dedication to conserving historical and cultural assets while adjusting to evolving environmental and infrastructural circumstances (Älvkarleby kommun, 2020), is evident in this change. This shows the potential for repurposing areas to create sensory parks. Furthermore, the effects of the built railway may be clearly observed in the removal of numerous public structures in the former railway park. Despite these alterations, Stora Hallen remains a durable testament to the region's past (Holmström, u.å.), functioning as the sole surviving structure and a notable historical and cultural monument in Älvkarleby (Figure 13).

Figure 13. The location in Stora Hallen. Photo by Author2023

Tragically, the Railway Park's history is marred by its eventual destruction due to floods resulting from the construction of a new hydropower station. The alteration of river levels led to irrevocable damage, illustrating how modernization adversely affected the landscape (Älvkarleby kommun, 2025). Consequently, Älvkarleby found itself bereft of this cherished park, leaving a void that endures to this day. Despite this loss, fishing has emerged as a prominent recreational activity along the Dalälven River in Älvkarleby, given its reputation for an abundance of fish species (Ye, 2022; Älvkarleby kommun, 2025).

The aesthetic and sensory attributes of the Railway Park are embedded in its historical significance and environmental context. and due to the thick vegetation covering the region by forest, it feels somewhat enclosed, but there is a big open water space located around the area and a few outside amenities like benches and kid-sized slides. There are several islands where

visitors can enjoy the serene, expansive view of the Nedre Dalälven river up close (Älvkarleby kommun, 2025).

The characteristics of the Railway Park in Älvkarleby, including its historical significance, dense vegetation, open water spaces, amenities like benches and slides, and islands offering expansive views of the Nedre Dalälven river, collectively contribute to its sensory experiences and aesthetic elements. The park's historical context adds depth and connection to the past, while the surrounding dense vegetation creates a sense of immersion in nature, enhancing the overall aesthetic appeal (Älvkarleby kommun, 2022; Älvkarleby kommun, 2025). The presence of open water spaces and amenities provides opportunities for relaxation and play, while the islands offer unique vantage points for appreciating the natural beauty of the surroundings. These characteristics not only shape the collective memory of Älvkarleby's residents but also offer valuable insights for the design of contemporary waterscape within the municipality that are responsive to the needs of children and visitors alike.

5.2. Älvkarleby site assessment

In response to the site analysis and its findings, I am now motivated to propose the development of Älvkarleby Park, a novel facility designed to accommodate residents, tourists, and children, fostering relaxation in a natural setting, exploration of waterscapes, and recreation along the Dalälven River. Public transport is well connected to Älvkarleby by train and bus, and accessibility is further enhanced with a 15-minute walk to the park *(Figure 14)*.

Figure 14. Älvkarleby site and surrounding area. On the right, the Älvkarleby site (photo: Google Maps), and on the left, the site analysis showing access paths, connectivity to the neighborhood, and entrances to the park. Edited by Author, 2023.

In response to these findings, the text proposes the development of Älvkarleby Park, aimed at providing residents, tourists, and children with opportunities for relaxation, exploration of waterscapes, and recreational activities along the Dalälven River. The park's design seeks to leverage the natural beauty of the area and provide amenities that cater to various interests, fostering a sense of connection with nature. Moreover, the text highlights the importance of accessibility, noting that Älvkarleby is well-connected by public transport via train and bus, with the park being within a 15-minute walking distance. This emphasis on accessibility ensures that the park can be enjoyed by a wide range of individuals, including families, tourists, and locals. From an angling waterscape perspective, the proposed Älvkarleby Park presents an opportunity to enhance the recreational aspects of the area, particularly for those interested in fishing. By providing access to the Dalälven River and creating spaces for relaxation and exploration, the park can attract fishing enthusiasts and contribute to the overall experience of fishing in Älvkarleby. Additionally, the park can serve as a hub for community engagement and education about the local aquatic ecosystem, further promoting sustainable fishing practices and environmental stewardship. In relation to the literature review it can be assumed that children, specifically, could be the main recipients of the multi-sensory encounter, such as the one provided by the Dalälven River. In this riverfront environment, children are to be fully engaged through their senses, experiencing a range of sensations from touching the textures of the water to listening to the rhythmic sound of running water. The confirmation of sensory cues inside carefully crafted aquatic landscapes is essential for achieving a truly immersive sensory experience.

Essentially, and in relation to the literature review, children use their five senses - sight, sound, touch, taste, and smell - while enjoying play in aquatic situations. Therefore, my proposal for the waterscape design is to prioritize the creation of significant experiences by incorporating several waterscape components that engage all the senses, as viewed in the diagram depicted in (Figure 15). From Figure 15 I made my own sketch, see Figure 23 incorporating geometric patterns as a design consideration.

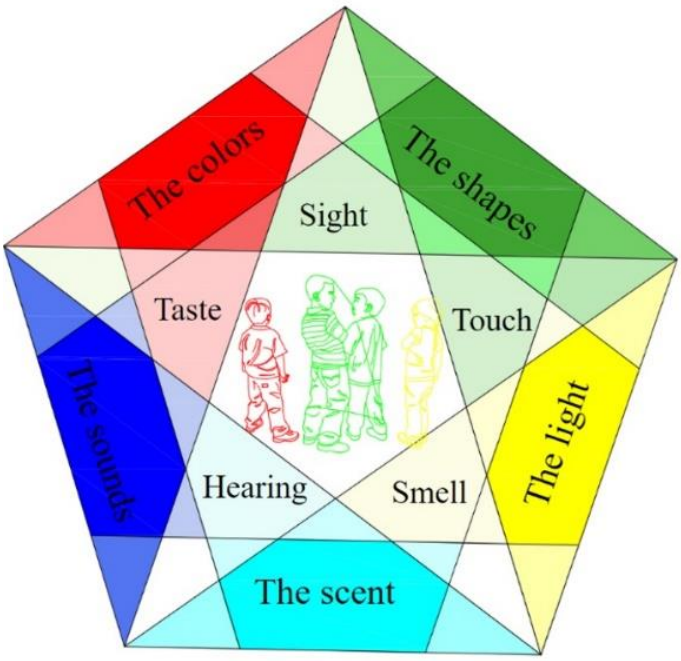


Figure 15. Waterscape elements and sensory analysis focused on creating meaningful experiences by engaging all the senses. The design incorporates colors, shapes, light, sounds, and scents to enhance play in aquatic environments, allowing children to use their five senses—sight, sound, touch, taste, and smell—while interacting with the waterscape. Edited by Author, 2023.

5.3. Surroundings and natural elements analysis

This section is representing an analysis that is done with the help of previous research, which will help the study's contribution by giving a comprehensive understanding of the study area. The analysis not only rests on previous literature, but also extends to on-site visits to the project site.

The observations and analysis of the park is done from an adult perspective, which is paramount to clarify, especially when it comes to the notion of grasping vital sensory experiences for children. The on-site visits expose the picturesque attributes of the Dalälven River in Älvkarleby, featuring splendid bays, majestic meadows, charming lakes, ancient forests, and breathtaking shorelines. While these elements make Älvkarleby an ideal site for sightseeing due to its extraordinary scenery, it is disappointing to observe the dearth of nature-based facilities, especially after the closure of Älvkarleö Railway Park. This comprehensive analysis underscores the inadequacy or nonexistence of such facilities, even though children were previously endowed with ample play spaces when Älvkarleö was operational (Holmström, u.å.).

The study positions Älvkarleby as an ideal project site owing to its natural assets, including a river and forested areas. However, it is evident that outdoor facilities catering to residents, tourists, and children have dwindled following the cessation of Älvkarleö Railway Park's operations (Älvkarleby kommun, 2020). Through meticulous site visits, the researcher gains

insight into Älvkarleby's splendid natural environment and concurrently, its insufficient landscape and waterscape provisions for recreation, tourism, and play, post-closure of Älvkarleö Railway Park. This exploration of the site unveils the topographical influence of the Dalälven River, shaping the surroundings with expansive grasslands, picturesque boglands, splendid marshlands, and striking swamplands (Schäfer et al., 2018). These findings corroborate Älvkarleby's potential to emerge as a tourist attraction, given its diverse, versatile, and remarkable features of green and blue spaces. The chosen site, situated within Älvkarleby and its immediate environs, bears the hallmark of a diverse and vibrant landscape. It is encompassed by the Dalälven River, which delineates a significant portion of the scenic panorama. In addition to the river's presence, the site enjoys a proximate relationship with adjacent residential areas and a constellation of islands. These geographical elements collectively conspire to render the site amenable to an array of visual perspectives.

The choice of Älvkarleby as the location for this autonomous project is based on its ability to stimulate all sensory modalities while utilizing the surrounding Dalälven River. The scenery of Älvkarleby exemplifies the abundance of sensory experiences that not only provide a break from city life but also enhance the general welfare of persons. This relationship not only helps reduce stress but also significantly contributes to improving health and increasing happiness, mostly through sensory development (Figure 16).

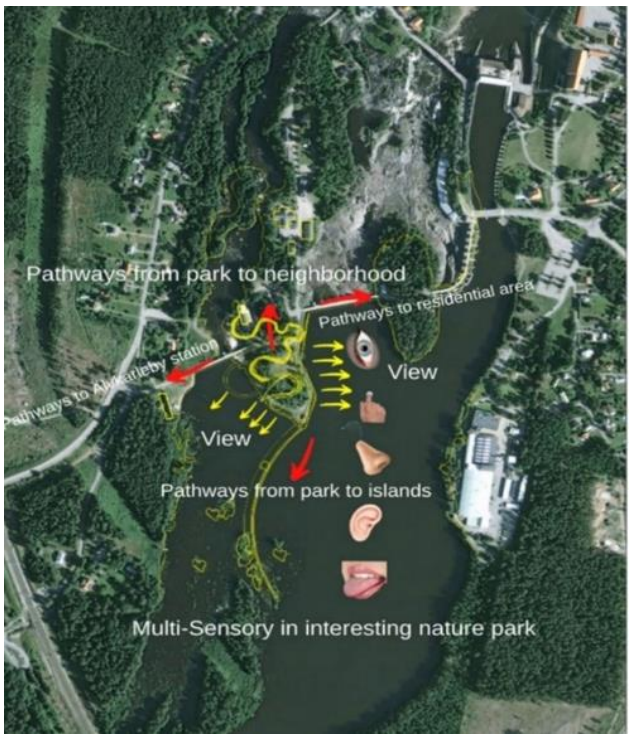


Figure 16. Älvkarleby pathways to neighborhood and inspiring the sensors site, analyses the site from a sensory perspective © Google Map data 2023, edited by Author.

In the context of the proposed park, it becomes pertinent to examine how river facilities are designed to optimize environmental benefits while addressing ecological challenges. River design, as a component of waterway management in the built environment, is a multifaceted endeavor requiring a delicate balance among societal water usage, ecological enhancements, physical sustainability, cost considerations, and public perceptions of the idealized aesthetics of river landscapes (Schwindt et al., 2020). It is imperative to underscore the lack of aesthetic solutions and pathways in Älvkarleby, a factor that holds significance, not only for tourism but also for the general well-being of the region and its inhabitants. These pathways are integral for fostering tourism and necessitate only minimal services to sustain them as education, recreation, and tourist sites. The location of the project site is strategically situated between the water and forested areas, in proximity to green spaces and the more distant residential zones characterized by villas (Figure 17).

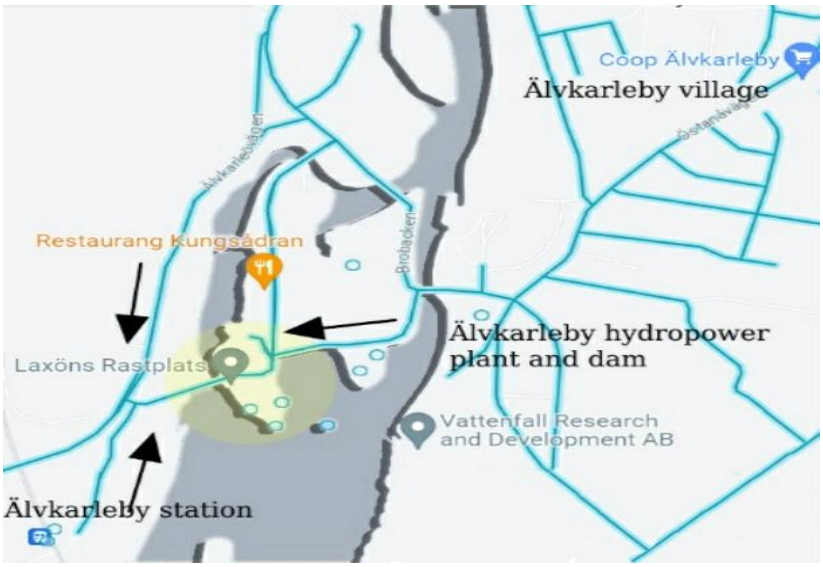


Figure 17. Connectivity access ways map to the site © Google Map data 2023, edited by Author.

The empirical findings derived from the series of site visits underscored the viability of investing in fishing-related amenities in Älvkarleby. The decision to center the waterscape design around fishing was strategically grounded, with the Dalälven River teeming with a rich aquatic ecosystem, featuring the likes of trout, asp, and salmon (Älvkarleby kommun, 2020; Ye, 2022). This project's emphasis on fishing was not intended to import foreign ideas into the municipality; instead, it was a purposeful endeavor to fashion waterscape facilities that harmoniously meld with the existing cultural fabric of Älvkarleby. The resonance of this decision can be discerned in the pivotal role that angling occupies as a quintessential recreational pursuit for the residents living alongside the Dalälven River.

Subsequent site explorations illuminated that Älvkarleby doesn't merely host designated angling spots but rather, it boasts entire ‘angling waterscapes,' denoting the deliberate design of waterscapes that cater explicitly to angling (Ye, 2022). The coining of the ‘angling waterscapes’ concept underscores the notion that a waterscape can be intricately tailored to the pursuit of angling, encapsulating both the culture and the significance of fishing in Älvkarleby. These revelations align with Djohari et al. (2018) assertion that angling venues constitute integral 'blue spaces' that profoundly influence local communities. It was demonstrated that fishing facilities hold significant sway over the well-being of young individuals, serving as a constructive alternative to conventional daily routines.

Notably, the research emphasized that such venues offer a secure gateway for children to access water bodies, not only endowing them with vital mental health benefits but also affording the opportunity to engage in recreational activities within 'blue space' (Djohari et al., 2018). The Älvkarleby area, featuring a Nature Reserve (fish nature park) and the Fisheries Research Station of SLU, offers a captivating environment for outdoor activities, specifically fishing (Älvkarleby kommun, 2020). It is this confluence of cultural resonance, recreational significance, and the well-being of children that propelled the design of a fishing shelter and an accompanying park along the picturesque shores of the Dalälven River. (Figure 18).

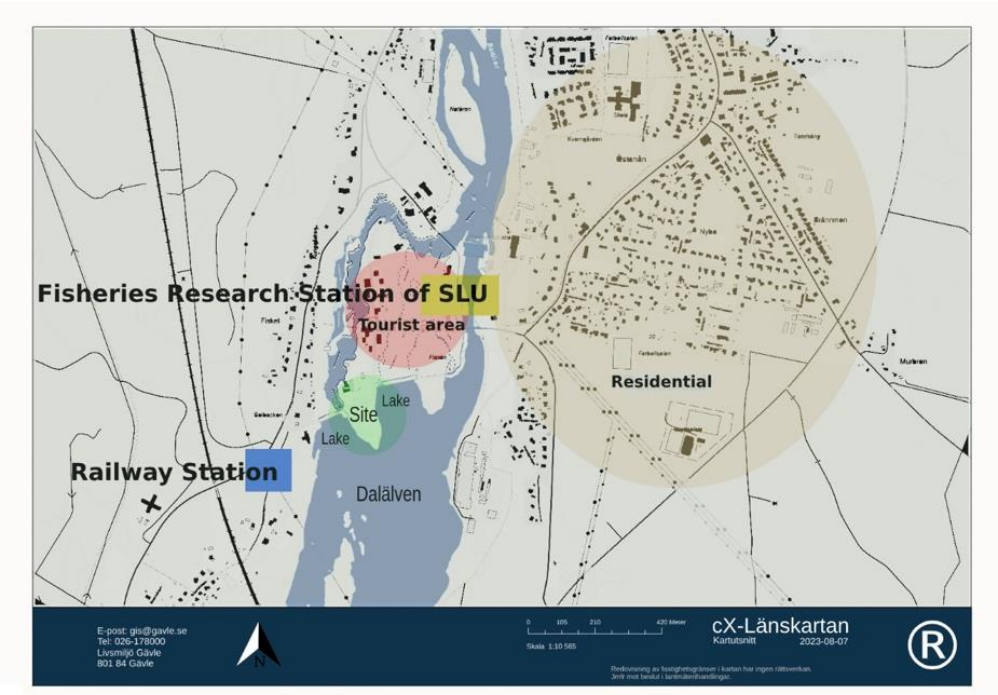


Figure 18. The location in the Älvkarleby area, neighborhood, railway station, and Fisheries research station of SLU, © CX-Länskartan, edited by Author2023.

5.4. Sensory design analysis for the park

In the context of developing environments conducive to child-responsive outdoor learning, it becomes imperative to define the essential characteristics of the chosen natural settings and their maintenance conditions. With the help of the chapter incorporating literature review, I will use selected ideas from previous research into my project idea as a nuanced interplay of waterscape elements. The ambition is that these will significantly influence the overall learning and play experiences of children.

Natural Elements

The incorporation of green elements, encompassing trees, shrubs, and ground covers, introduces an array of opportunities that cater to the innate curiosity and imaginative faculties of children. These natural components provide dynamic settings for sociodramatic performances, fostering a realm of exploratory play and learning prospects. Within this encompassing the outdoors, one encounters the prevalence of blue elements, notably the presence of a natural water body.

This environment features river segments, water ponds, and aquatic life forms. These constituents engender multiple affordances that underpin dramatic and exploratory play. Moreover, this watery expanse serves as an invaluable domain for learning, elucidating concepts encompassing the water cycle, the life cycles of aquatic flora, and the fundamental nuances of fishing *(Figure 19).*

Figure 19. The Natural elements in location, surrounding the water pictured, Photo by Author2023

- **Trees in Waterscapes:** Strategically placed near water features, trees with robust trunks and flexible limbs offer opportunities for climbing and imaginative play. Overhanging branches can frame a stream or pond, providing shade and a tactile connection to nature while encouraging sociodramatic play near the water.
- **Shrubs and Natural Hiding Spots:** Evergreen shrubs, integrated around water elements, create soft and voluminous green spaces that double as enticing hiding spots. These areas inspire games of concealment and exploration, enhancing the sense of discovery in the waterscape environment.
- **Flowering Plants by Water:** Flowering plants around the edges of streams, ponds, or fountains add aesthetic beauty and introduce pleasing fragrances. Their blooms attract birds and insects, creating opportunities for children to observe and engage with the natural ecosystem surrounding the water.
- **Water Features as Sensory Stimuli:** Dynamic water features, such as streams, fountains, or reflective pools, offer multisensory experiences. The sound of flowing water, the sight of shimmering surfaces, and the feel of cool liquid engage children's senses, fostering exploration and connection with nature (Sihes, 2018).
- **Sand Areas in Waterscapes:** Sand patches near water elements, such as a small beach by a pond or a play area, provide tactile experiences that help children develop their sense of touch while encouraging creative play with natural materials.
- **Landscape Mounds by Water:** Gently sloping mounds surrounding a water feature invite children to run, climb, and explore. These mounds can also be used to create vantage points for observing aquatic life or hidden areas for imaginative adventures.
- **Dynamic fountains:** Digital fountains curtains and circular water spaces, Participants in the Nature Play Enhanced with Digital Elements workshop discussed how play areas may be enhanced with digital technology to get youngsters outside to play. *"It is necessary to design the digital components in a way that incorporates kid-friendly natural resources, such as water, that are entertaining for kids."* (Mårtensson, Back, Waern, Pysander 2012) This is as the children's water playgrounds are designed in a dynamic and ever-changing range. The main goals would then be to support physical engagement, promote social interaction, and encourage imaginative and recreational activities as well as

sensory exploration in a range of areas, including cognitive, emotional, social, and physical aspects. (Isenberg & Quisenberry, 2002) (Figure 20).

Figure 20. Dancing fountains. From my experience, Photo by Author2023

5.5. Analysis summary

The site analysis of Älvkarleby provides valuable insights that are directly relevant to the aim of your thesis, which focuses on proposing the establishment of Älvkarleby Park as a child-centered water park. Key findings from this site analysis are that Älvkarleby faces demographic challenges such as an aging population and outmigration of young adults. However, there's also an influx of movers, particularly young adults aged 20-29, who represent an opportunity for the municipality's growth. By prioritizing children in planning and development efforts, Älvkarleby can attract and retain young families, contributing to long-term sustainability and population growth.

Furthermore, Älvkarleby's geographical positioning near the Dalälven River and its rich natural environment offer opportunities for outdoor recreation and tourism. The proposed park can leverage these assets to provide residents, tourists, and children with opportunities for relaxation, exploration, and recreation along the river. The design of Älvkarleby Park should also prioritize creating meaningful experiences for children by incorporating various sensory

elements. This includes integrating natural elements like trees, water bodies, and sand, as well as industrial elements such as shaded areas, seating, and pathways. By offering diverse sensory experiences, the park can enhance children's well-being and provide opportunities for outdoor learning and play.

Finally, the proposed park should align with broader objectives of sustainable development, considering factors such as accessibility, environmental conservation, and community engagement. By creating a park that caters to the needs of children while promoting environmental stewardship and community cohesion, Älvkarleby can build a more inclusive, resilient, and thriving municipality for future generations.

6. The Proposal

In this section, I will present my proposal for the sensory waterscape park. The development of this idea has been informed by both regulatory examinations and on-site observations conducted in Älvkarleby. These site visits provided valuable insights into the current state of children's play areas, the characteristics of water elements, and sensory experiences. However, it is important to acknowledge that these observations were made from an adult perspective. Additionally, this section integrates key takeaways from the literature review, ensuring that the principles derived from theoretical research are reflected in the park's conceptual design. Each of these principles emphasizes the importance of inclusive environments, which is particularly relevant in angling waterscapes, as proposed in this thesis. Sensory elements are essential in strengthening connections with nature, thereby enriching experiences for all ages, particularly children. To develop the park concept in Älvkarleby, I have formulated the following program, which is derived from the theoretical framework and serves as a guiding structure for the proposal. This program, now explicitly defined, establishes the key principles upon which the park's design is based (Table 1, and Figure 21).

Table 1: Program: Key design principles for a sensory waterscape park

Key Principle	Description & Design Application
Sensory Inclusion	Designing with a variety of sensory elements to create an engaging and inclusive environment for diverse age groups, particularly children. Sensory rich landscapes promote interaction and accessibility.
Multisensory Perspective	Moving beyond visually dominant design to engage all senses, fostering deeper environmental connections through auditory, tactile, olfactory, and gustatory experiences.
Color and Visual Interactions	Exploring the psychological and emotional impact of color in design, particularly in water-based environments. Using vibrant, natural colors to create stimulating and calming experiences.
Acoustics in Waterscapes	Understanding the role of sound in sensory perception, particularly in water settings, to enhance engagement, comfort, and atmosphere. Designing spaces that incorporate the natural sounds of water movement to create relaxing yet stimulating environments.
Effect of Scent, Taste, and Tactile Sense on Children	Recognizing how smell, taste, and touch contribute to spatial understanding, sensory exploration, and a deeper bond with nature. Integrating elements such as textured surfaces,

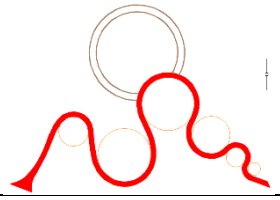
	aromatic plants, and edible landscaping to promote multisensory learning.

These principles act as the foundation of the proposed park, ensuring that sensory engagement, inclusivity, and ecological integration are central to the design. In the next section, the application of this program is demonstrated through the development of the actual park concept.

6.1. Connecting theory to proposal

When conducting a literature review to build knowledge for a master's thesis, it is crucial to establish a clear connection between the theoretical framework and the final proposal. A structured way to achieve this is by formulating a design programme—typically presented as key principles that guide the proposal's development. In this thesis, the section outlining key principles (Figure 21) serves as the design programme, synthesizing insights from the theoretical framework and literature review. These principles form the foundation for the proposed waterscape park, ensuring that the design aligns with research-based findings on child-responsive and sensory-rich environments.

Waterscape Design elements based on sensory inclusion and multisensory perspective.	Incorporating Natural Elements in the angling Waterscape Design	Incorporating Industrial Elements in the angling Waterscape Design
Color and Visual interactions	River, Waterfall, Lake. Ditch, Stream, Forest, Natural lighting 	Fountains Colorful Pathway, Artificial illuminated pathways, Artificial illuminated fountains and colours, textures, shapes, Line and curves 

		
The acoustics in Angling Waterscapes	The sound of waterfalls, river, trees wind and birds 	The sound of Fountains, Artificial Music sculptures 
The scent	The smell of rain on Trees, Grass, flowers 	Aromatic plants and Flowers Pathways 

The taste	Fishing 	The healthy trees and edible such as fruit, water drinking, Edible vegetation dependent on waterscape 
The tactile	Natural Flowers, fishing places, swim place, Agricultural, waterscape 	Wooden twigs to build, Wood pathway beams, Interactive playful Learning, different types of plant materials, pavements, textures to interact with environment by touch and touch waterscape 

Figure 21. Criteria for the project taken from the theoretical framework used in the park idea design to collectively invite children and families to engage their senses and discover the natural surroundings within the angling waterscape.

Regarding Figure 14, and Älvkarleby, the selected site is uniquely situated, encircled by water on three of its sides, while a thoroughfare connects it to the residential districts and the train station. This strategic location ensures convenient accessibility for visitors from neighboring

cities. There are dual entry points from the northeast and northwest, coupled with an exit leading to the nearby islands in the southwest. The pathways interconnecting this entry and exit points are meticulously designed, offering flexibility, and featuring picturesque viewpoints that serve to enhance the sensory experiences of children *(Figure 21).*

The terrain of the site exhibits a series of modest elevation changes, resulting in various small levels. These undulating topographies are thoughtfully planned to incorporate elegant and adaptable lines, designed to facilitate the effective collection and diversion of rainwater towards the adjacent river. Additionally, the site's organization incorporates a stratified layout, dividing it into distinct circular levels, each aligned with specific activities and their intended benefits *(Figure 24).* The site is in Älvkarleby and is designated as a public waterscape park. It is open to the public during the period spanning from April to October. As a precautionary measure for the safety and well-being of visiting children, it is imperative that parents accompany their children during their visit. In my design *(Figure 24)* I have used a harmonious blend of nature and innovation within the enchanting waterscape of the proposed Älvkarleby Park. Each element of the park's design has been meticulously crafted to engage the senses of children and inspire a profound connection with the surrounding environment.

6.2. Älvkarleby Park Design Idea

As the design parameters for the proposed Älvkarleby Park site evolve, it is strategically envisaged to occupy a central locus within a radial layout. This orientation harnesses the potential of lines and curves to craft geometric configurations that incorporate curvilinear aspects, thereby accentuating the perceived softness and malleability attributed to these forms (Silvia & Barona, 2009) (Figure 22).

The main inspiration behind the park's design concept stems from the natural properties of water and its movement. The drop shape became a guiding form in the design process, symbolizing both the flow of the Dalälven River and the central role of water in Älvkarleby's historical and ecological identity. The drop-inspired layout is reflected in the organization of pathways, water features, and play areas, ensuring that the park embodies the fluidity and organic nature of water. During the design development, I explored how water behaves when it interacts with different surfaces—whether still, rippling, or cascading—and sought to

integrate these variations into different zones within the park. The circular resting areas and curved pathways mirror the way ripples expand when a drop hits the water, reinforcing a dynamic yet harmonious spatial composition.

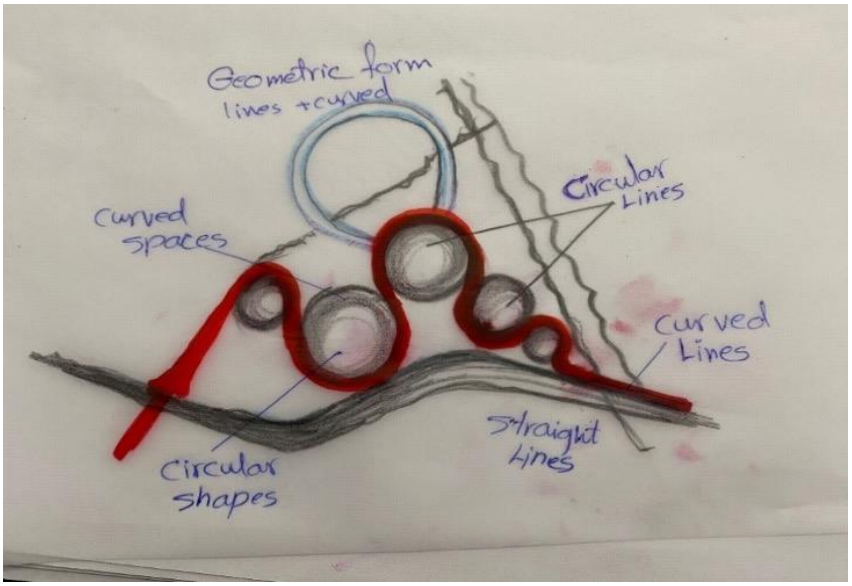


Figure 22. Sketch illustrating the creation of geometric patterns, including curves, circular, and straight lines. The design strategically positions these elements to provide a multi-sensory experience for users. By focusing on the softness and flexibility of lines and curves, the layout engages children with its dynamic and inviting shapes, fostering extended interaction. The geometric configurations incorporate curvilinear aspects and a radial layout to enhance the sensory experience. Sketch by Author, 2023

The sensory qualities of the site are richly layered, shaped by the olfactory, auditory, and tactile interactions between visitors and the natural environment. The flowing waters of the Dalälven River, the rustling leaves, and the chirping of birds all contribute to a harmonious sensory waterscape, enhancing children's engagement with nature. This interaction between natural elements and human experience serves as a foundation for the park's design.

Building on this multisensory approach, the proposed park is designed to seamlessly integrate water, air, vegetation, and sky, inviting engagement through sight, smell, sound, taste, and touch. The waterscape flora serves a dual function—providing shade for comfort while also fostering a sense of privacy and security. Similarly, the materials used in the hardscape are carefully selected to enhance both functionality and aesthetics, ensuring a harmonious relationship between sensory interaction and the natural environment (Children's Play Council, 2002).

To enhance accessibility and encourage exploration, a network of curved pathways gracefully weaves through the park, connecting different play zones and harmonizing with the

natural contours of the waterscape. These pathways are designed to be inclusive, ensuring a safe and engaging experience for all visitors, including children with disabilities. Alongside these routes, circular rest areas and interactive green spaces invite further engagement, fostering social interaction and a connection with nature. The design also maximizes views of the Dalälven River, offering varied vantage points to experience the landscape in dynamic ways.

Recognizing that sensory gardens are not just beneficial for typically developing children but also for those with disabilities, the park is envisioned as a multisensory space where all children can experience outdoor recreation freely. By integrating tactile elements, varying ground textures, water features, and aromatic plants, the design ensures an inclusive and enriching environment for a diverse group of users.

Furthermore, the spatial composition of the park follows fundamental waterscape design principles, integrating both straight and curved elements to enhance movement and perception. The interplay of geometric lines—whether circular, horizontal, or vertical—forms the foundation of the visual experience. Research suggests that curved spaces are inherently more inviting, particularly for children, as they evoke a sense of safety, curiosity, and playfulness (Jeanes & Magee, 2010; Pallasmaa, 2012) (Figure 23). This principle informs the placement of key features within the park, ensuring that the natural and built elements work in unison to create a cohesive and engaging sensory landscape.

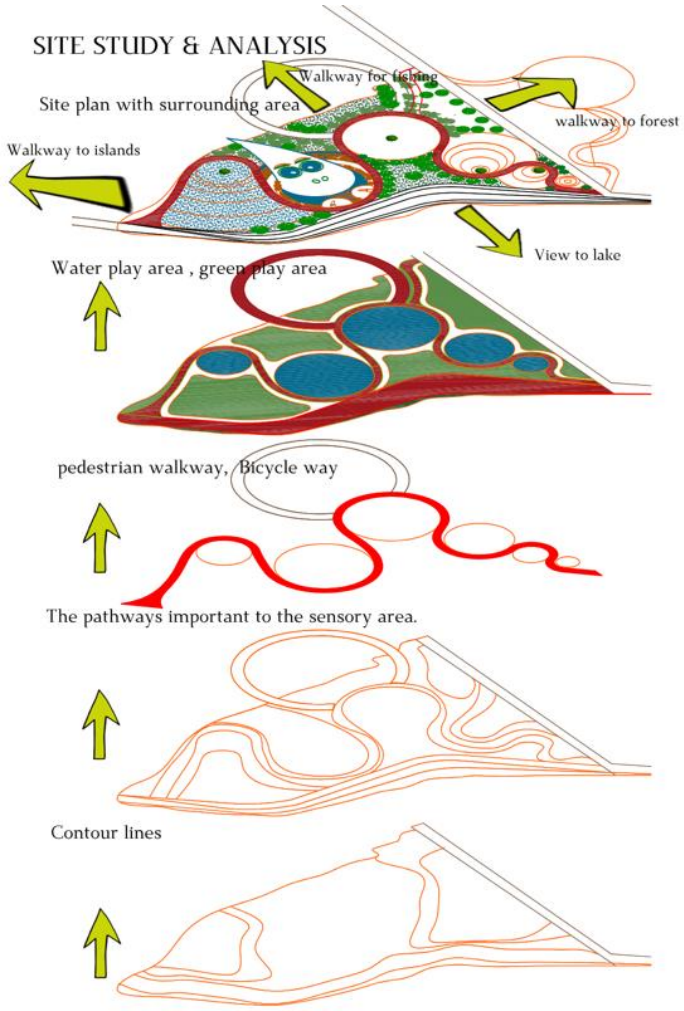
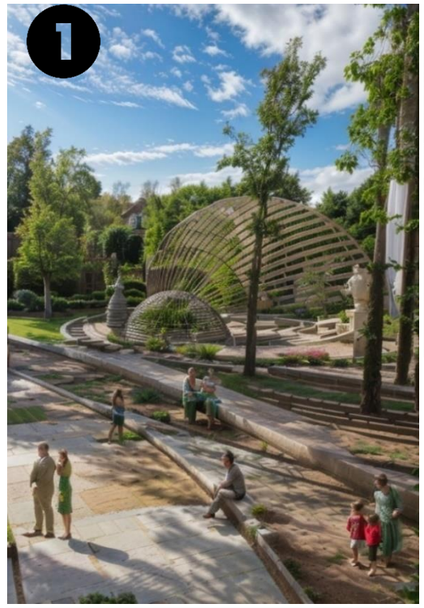


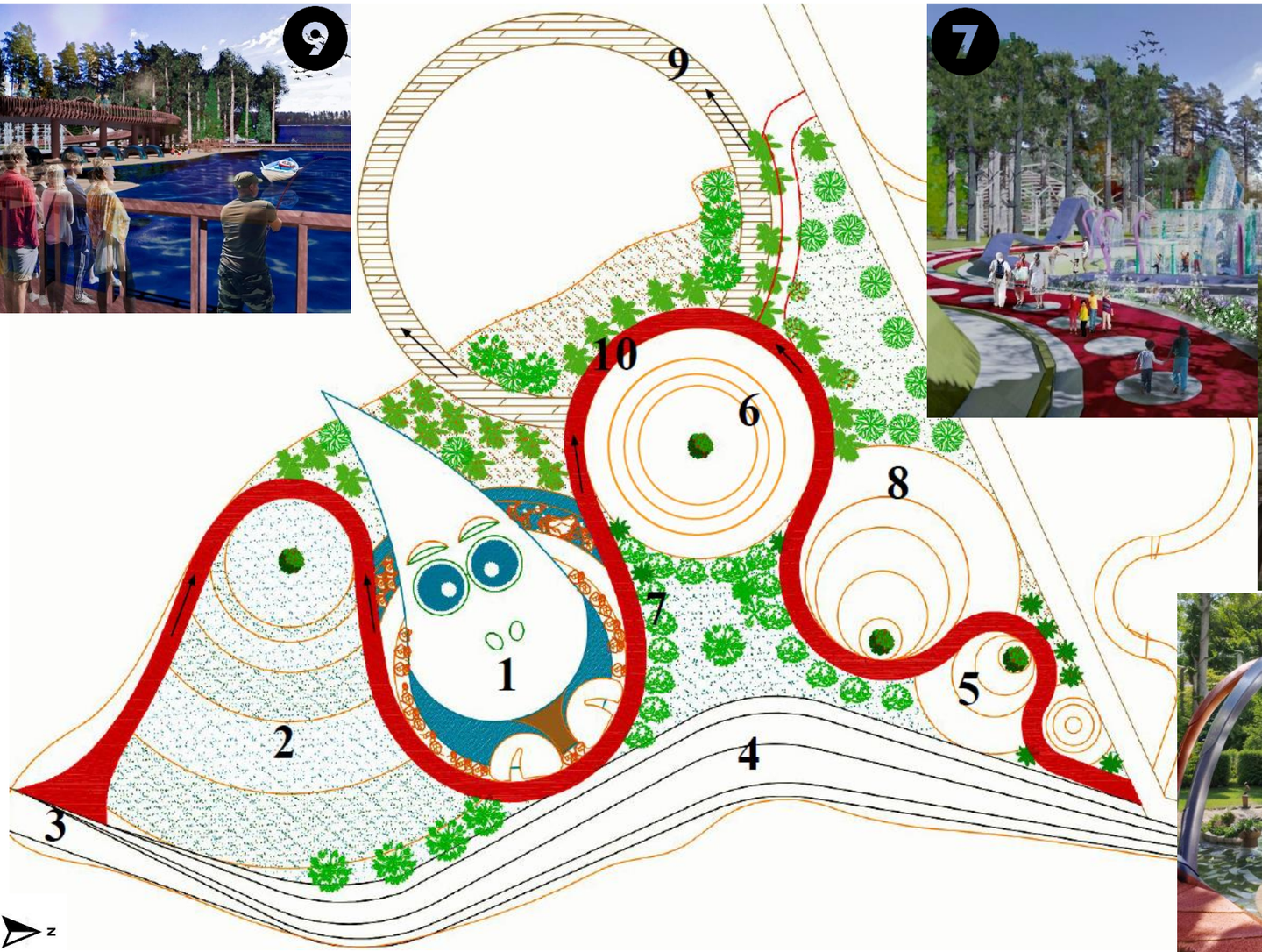
Figure 23. Design stages of the sensory park in Älvkarleby. This diagram illustrates the initial analysis of the site, starting from the contour lines and progressing through the design stages. It outlines how the park's various components were drawn and integrated, considering its relationship with the surrounding neighborhood to create a cohesive sensory park experience. Sketch by Author, 2023.

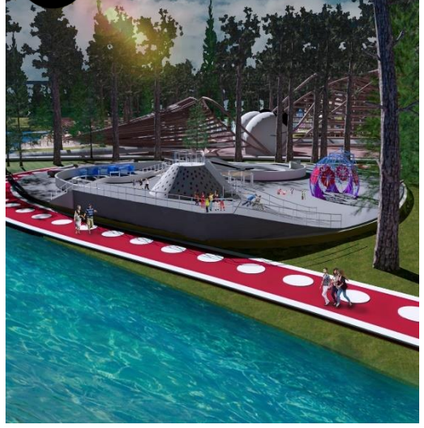
Extensive research suggests that the preference for curvilinear forms may be deeply rooted in human perception. Studies indicate that children are naturally drawn to curved shapes, engaging with them for extended periods due to their perceived softness and flexibility (Silvia & Barona, 2009). This insight into human spatial perception plays a crucial role in shaping the park's design, reinforcing the idea that environments that integrate organic, flowing forms can create a more inviting and engaging experience for younger visitors. Building on this foundation, the project extends beyond a conventional approach to landscape architecture; it aspires to become an interactive and enriching experience for a diverse range of visitors, including locals and children alike. The design is guided by principles of attractiveness, functionality, and sustainability, balancing the needs of residents, municipal objectives, and stakeholder interests.

Central to this endeavor is the seamless integration of existing ecological elements with innovative design, ensuring that the park remains deeply rooted in the identity of Älvkarleby. Key natural features—the Dalälven River, the lake, the interconnected islands, the surrounding forests, and the diverse soil compositions—are preserved and harmonized with the newly introduced design elements, reinforcing a strong sense of place and continuity.

The final outcome of this independent project is the creation of a new park, strategically positioned near the train station on the banks of the Dalälven River. This location is not merely aesthetic but also functional, reflecting the transformative role of water in shaping Älvkarleby's landscape. Over time, the aquatic environment has actively influenced the region's topography, contributing to the formation of marshlands, the redistribution of rocks, and the accumulation of mud deposits. These natural processes, in turn, have sculpted a dynamic and evolving environment, reinforcing the intrinsic connection between water, land, and human interaction within the park's design.







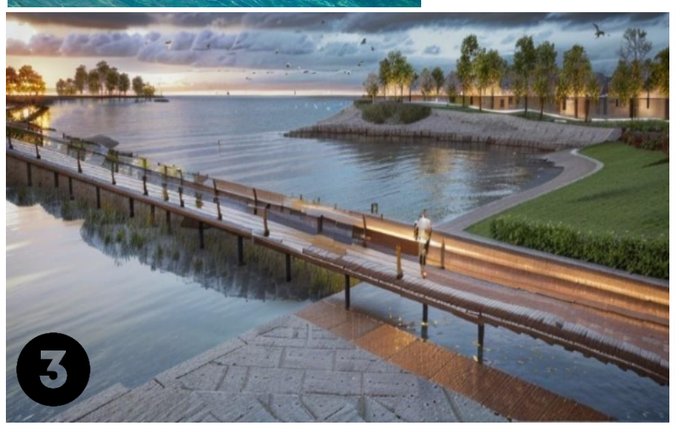


Figure 24. Site plan of the project with 10 Sketches for every place in Älvkarleby Park to show you the sensory stimulation elements, All Designs by Author 2023.

1. Älvkarleby Naturum: Serving as a gateway to nature, Älvkarleby Naturum integrates seamlessly with its waterscape surroundings. The building, inspired by the form of a water droplet—a familiar and captivating shape for children—resonates with the theme of water. Constructed from rustic twigs and wood, it reflects organic architecture while harmonizing with the natural elements of the waterscape. Positioned near water features like streams or ponds, the design enhances the sensory experience by playing with light and shadow, which shift throughout the day and interact with the reflective qualities of the water. This dynamic interplay engages the sense of sight, inviting visitors to explore and connect with the aquatic environment on a deeper level.
2. Green Pathways in Waterscape Design: Winding pathways connect the waterscape with lush green spaces and play areas, guiding visitors through varying elevations and materials such as grass, sand, flower beds, and wooden boardwalks near water features. These pathways not only lead to playgrounds but also weave through interactive zones around ponds, streams, or fountains, encouraging exploration and adventure. The sensory-rich journey engages sight with vibrant plant life and flowing water, smell with fragrant flowers and fresh aquatic aromas, sound with the soothing trickle of water and rustling foliage, and touch with diverse textures underfoot and along the path. This immersive design enhances the multisensory experience for visitors of all ages, seamlessly blending recreation with nature.
3. lsland Bridges in Waterscape Design: Wooden traverse bridges, crafted with diverse designs and materials, create pathways that connect to enchanting islands within the waterscape. These bridges allow children to run across, observe the flowing water below, and track the movement of waves, fostering a sense of wonder and freedom. The islands themselves provide safe spaces for play and exploration, surrounded by the soothing sounds of water and the natural scents of the aquatic environment. The bridges and islands engage sight with rippling reflections and dynamic surroundings, smell with fresh water and nearby vegetation, sound with splashing waves and rustling reeds, and touch with textured wood and cool breezes. This interactive design invites sensory exploration and adventure within the waterscape.
4. Outdoor Stage in Waterscape Design: The outdoor stage, positioned beside a tranquil lake, complements the waterscape by offering unobstructed views of the shimmering water. Supported by varying slopes and a fence for accessibility, the

stage seamlessly blends into its aquatic surroundings, enhancing the natural connection between land and water. As visitors relax on the stage, they are immersed in the peaceful sounds of lapping waves and the scent of fresh water and surrounding flora. The visual experience is enriched by the reflections on the water, while the varied textures of the stage and its natural materials invite tactile exploration. This design creates a harmonious space where water, sound, and light converge, encouraging both relaxation and sensory engagement with the waterscape.

5. Sculptural Mounds in Waterscape Design: Sculptural mounds, rising naturally from grass and sand, create playful landscapes that encourage children to climb, roll, and explore. These mounds, integrated into the waterscape, can be shaped to echo natural forms, or have an industrial design, blending seamlessly with the surrounding water features. As children engage with the mounds, they interact with the natural textures of the earth, the cool touch of nearby water, and the sounds of flowing streams or rippling lakes. The visual impact of these sculptural forms is enhanced by their reflections in the water, while the sounds of movement and water add depth to the sensory experience. This design fosters tactile, auditory, and visual exploration, encouraging children to connect with the landscape and water in new ways.
6. Fountain Circle: Invigorate your kids' senses with the sound and movements of fountains in the five fountains encircling the circle. These dynamic water features invite guests to dance and engage with the water's rhythmic flow through a series of effects and choreography that are designed to time the water's movements and the lighting's changes to the beat of the music, inspiring the fountain running and dancing that is so characteristic of the area. it effects of the sight, sound, and touch senses.
7. Sensory Pathway: Take a trip through pathways adorned with vivid colour elements and guided movements indicated by markings on a floor seamlessly integrated with flowing water surrounding it. This will enhance the park experience for kids and help them develop their gross motor skills as they follow the colour pathway, which also supports them in using their senses to connect with nature, it effects of the sight, sound, and touch senses.
8. Dancing Fountain: Be amazed by the spectacular show of the Dancing Fountain that has different elements of colour, where water jets dance in unison and create

a variety of effects along with light changes that match the beat of the music, enthralling spectators of all ages, it effects of the sight, sound, and touch senses.

9. Water Walkway (Fishingscapes): It is a bridge called the Water Walkway. Beginning at the sensory pathway and going in a circle on the water's various levels where there are fishing spots. Take in the excitement of crossing the water on the Fishing Area Walkway, which offers a distinctive viewpoint of the park's aquatic attractions, it has effects on the sight, sound, taste, smell, and touch.
10. Ramp bridge for children with disabilities: Cross the Playground Bridge for a panoramic and high view of the park, offering a vantage point to appreciate and immerse oneself in the beauty and wonder of Älvkarleby Park, with a focus on the waterscape effects on the sight, sound, and smell senses.

The principles used in the design of Älvkarleby park, and its waterscape have been carefully selected to create a harmonious and stimulating environment. By incorporating elements such as fishing bridges and reflective water features, along with playful forms of natural elements, a welcoming space is created for both children and other visitors to explore, play, and experience the beauty of nature in new ways. The combination of water and natural materials enhances the experience, engaging all the senses through sound, scent, sight, and tactile sensations (Jeanes & Magee, 2010; Älvkarleby kommun, 2020).

6.3. Proposing Älvkarleby Park

The site's comprehensive analysis underscores the organization into three distinct zones, each meticulously designed to cater to specific activities and sensory experiences. These zones serve as functional demarcations that contribute to the overall sensory richness of the site, encompassing the "Blue Zone," dedicated to water-related activities such as the fountain and the waterwheel, the "Red Zone," tailored to educational pursuits, particularly focused on fishing activities for children, and the "Green Zone," artfully embracing the harmony of nature within its precinct, replete with trees, shrubs, flowers, and ground covers (*Figure 24*). Adopting a multisensory perspective, the site is further delineated into five discrete sensory domains, each designed to engage and stimulate the human senses: sight, hearing, taste, touch, and smell from a visual standpoint, the design prioritizes the optimization of the visual experience for children through the incorporation of diverse shapes, topographies, and architectural features various elements collectively contribute to this endeavor, including iconic architectural structures such as bridges and towers, meandering mazes nestled amidst the verdant trees, and a vibrant color

palette thoughtfully integrated within the park's design. The encircling lake enhances the visual panorama, seamlessly melding aesthetic, and natural elements (Jeanes and Magee, 2010; Ozyavuz, 2012; Älvkarleby kommun, 2020).

The auditory dimension of the site, a vital component of the sensory experience, is artfully incorporated through the strategic placement of loudspeaker announcements. These announcements harmoniously blend with the ambient sounds of rustling leaves, the gentle cadence of flowing water, and the cheerful footfalls of children traversing the wooden pathways, effectively capturing the auditory senses and attuning children to the auditory intricacies of the site (Brown & Rutherford, 1994). Taste, another integral aspect of sensory engagement, is meticulously attended to through well-positioned drinking water stations thoughtfully interspersed throughout the site. Additionally, the site's culinary offerings are presented via food kiosks that present a diverse array of fruits, skillfully titillating the sense of taste and enhancing the gastronomic dimension of the sensory experience. The tactile senses of children are sensitively addressed through a judicious selection of design elements incorporated into the waterscape. This sensory canvas includes the textural diversity offered by trees, plants, water features, sand, pebbles, and the application of wooden pathways. These elements collectively invite children to engage tactilely with their surroundings, nurturing their tactile perceptions (Nikolajew, 2003; Wong, 2006b; Pallasmaa, 2012).

Finally, the sense of smell is masterfully interwoven into the site through the presence of an array of fragrant elements. These encompass the introduction of 68 scented trees and bushes, the delicate aroma of blossoming flowers, and the invigorating inhalation of pure, untainted forest air. This aromatic tapestry significantly enriches the site's olfactory dimension, contributing to an immersive multisensory experience. This meticulous zoning strategy, accompanied by the conscientious consideration of each sensory modality, epitomizes an environment that is purposefully designed to provide children with a comprehensive and multifaceted sensory journey (Pallasmaa, 2012). Importantly, this design approach resonates harmoniously with the tenets of child-responsive waterscape architecture, symbolizing a commitment to crafting an environment that profoundly nurtures the sensory development of young visitors. This confluence of aromatic elements contributes to a multifaceted sensory experience, offering children olfactory delight (Litton, 1977; Pallasmaa, 2012).

The findings brought to light the remarkable potential of child-responsiveness in addressing the specific requirements and well-being of young individuals in waterscape design (Birch, 2007). The research aptly demonstrated that child-responsiveness embodies a design methodology meticulously attuned to the welfare of children, reflecting a significant departure

from designs primarily oriented toward adults. Moreover, the research identified a notable discrepancy wherein existing urban design paradigms often privilege facilities and waterscapes tailored for adult preferences, thereby inadvertently marginalizing the needs and desires of children (Lueder, 2007). This imbalance in focus underscores the need to shift the perspective through which urban design is approached. Specifically, it necessitates a transition away from adult-centric models of waterscape creation to more child-centric approaches. In light of these findings, it becomes evident that the voices and perspectives of children have been historically underrepresented within the realm of waterscape design.

It has been well-documented that environments primarily crafted with adults in mind significantly curtail children's capacity to move about freely and engage independently (Annunziata & Garau, 2019). The very essence of child-responsive design is rooted in the belief that children's perspectives, requirements, and desires should hold a prominent place in the conceptualization and creation of these environments. A fundamental shift in design methodology is called for, one that duly acknowledges the unique vantage point of children and aligns waterscape design principles to these perspectives. In essence, the preferences, needs, and activities that resonate with young people should be intrinsically integrated into the design and planning processes of facilities and waterscapes.

7. Discussion

In this section, I will now discuss my main findings and then draw a conclusion that in parallel also answers the research questions of this thesis.

7.1. Interpretation of Main Findings and Theoretical Anchoring

In interpreting the results from the onsite visits and the knowledge I have gathered concerning Älvkarleby's unique situation, in relation to the literature review and theoretical framework, I believe it becomes evident that the proposed Älvkarleby Park embodies many principles and concepts discussed in existing literature while also introducing innovative approaches to address the needs of children and the Älvkarleby community specifically.

Firstly, the conceptualization of Älvkarleby Park aligns with the principles of child-responsive waterscape architecture, discussed by authors such as Birch (2007) and Lueder (2007). These principles prioritize the welfare and developmental needs of children in waterscape design, advocating for environments that facilitate active engagement and sensory stimulation. The

emphasis on sensory experiences, as evidenced by the incorporation of water elements, wooden structures, and diverse pathways, resonates with the theoretical framework of child-responsive design. This aligns with the broader discourse on the importance of experiential learning environments in landscape architecture, which suggests that physical environments significantly impact cognitive and emotional development in children (Jeanes & Magee, 2010).

However, while the park design aims to enhance sensory engagement and promote children's cognitive, emotional, and physical growth, it is crucial to consider potential drawbacks or limitations. One concern raised by previous research by Annunziata and Garau (2019) is the potential exclusion of certain groups of children, particularly those with disabilities. While the park's design incorporates features like wooden pathways for tactile stimulation, there may be additional accessibility considerations needed to ensure equitable access for all children, as discussed by Annunziata and Garau (2019). This reflects ongoing challenges in urban and landscape design, where ensuring universal accessibility remains a critical issue.

Moreover, the emphasis on water-related activities, such as fishing and water play, may present safety concerns for children, especially those who are unsupervised or inexperienced around water. This concern aligns with research in risk perception and child safety, where Spencer & Blades (2006) discuss how designed environments should balance stimulation with precautionary measures to mitigate potential hazards. Risk-taking is a crucial element in children's play and development (Sandseter, 2010); however, safe play environments should still incorporate clear visibility, accessible supervision points, and hazard-reducing measures.

The significance of soft lines in waterscape design is discussed by Silvia and Barona (2009). They explore how curved shapes and lines tend to be more appealing and inviting, particularly to children, compared to angular or straight lines. This preference for curved spaces is suggested to be innate in human perception, and it has implications for the design of environments aimed at children's enjoyment and engagement. The thought process regarding Älvkarleby Park has taken this into serious consideration with its drop shape and full use of curving lines, as it appeals both to adults and children while at the same time specifically catering to the children. This aligns with Pallasmaa's (2012) argument that curved and organic forms evoke a sense of comfort and connection in architectural spaces, facilitating deeper spatial engagement and interaction.

Furthermore, another factor that I have considered, which is not present in Silvia and Barona's (2009) study, is that curved architecture and plentiful walkways will make the park more accessible to a wider range of users, as it will be more wheelchair-accessible than a park

that utilizes hard lines and platforms to divide up specific sections. This integrates inclusive design principles discussed by Nikolajew (2003), who highlights how spatial fluidity and openness in landscape design contribute to accessibility and user-friendly environments for individuals with disabilities.

Despite efforts to create a safe and stimulating environment, this can never be done fully due to the presence of water features, which necessitate careful supervision and risk management to prevent accidents or injuries. As Jeanes & Magee (2010) emphasize, designing waterscapes for children requires striking a balance between providing enriching natural play opportunities and incorporating protective design elements that minimize unintended risks.

In considering the broader impact of Älvkarleby Park on population decline, it is important to recognize its potential as a community gathering space and recreational hub. By providing residents and tourists with opportunities for leisure, social interaction, and engagement with nature, the park may contribute to a sense of belonging and community cohesion, mitigating feelings of isolation and disconnection that can contribute to population decline. This aligns with the findings of Djohari et al. (2018), who emphasized the role of community spaces, such as fishing venues, in fostering social connections and well-being.

I have tried to create a park that encompasses many of the previous activities and experiences that were lost when the railway park was flooded. The previous existence of the railway park provides valuable insight into how Älvkarleby Park could be received. This historical perspective is crucial in landscape design, as argued by Rohde & Kendle (1994), who highlight the importance of integrating local cultural narratives into new urban development projects to enhance public reception and engagement.

In relation to research by the author, it is evident that the railway park was a significant source of attraction for both locals and tourists alike. Public space regeneration strategies often look at historical precedents to restore lost socio-cultural value in a contemporary setting.

Additionally, the park's focus on nature-based activities and environmental education may instill a sense of stewardship and appreciation for the natural world among children and adults alike. This aligns with broader efforts to promote sustainable practices and environmental conservation, as discussed in the context of the European Water Framework policies. Water-sensitive urban design (WSUD) principles, discussed by Wong (2006b), emphasize that successful integration of ecological elements in urban spaces can contribute to long-term environmental stewardship among community members.

However, it is essential to acknowledge that the success of Älvkarleby Park in addressing population decline will depend on various factors, including its accessibility,

affordability, and cultural relevance to diverse demographic groups. As indicated in studies on rural migration and urban attraction (Champion & Hugo, 2004), the revitalization of public spaces can contribute to community resilience, but it must be accompanied by broader municipal strategies to sustain long-term growth.

While the park's design may cater to the needs and preferences of a wide variety of segments of the population, it is crucial to consider that Älvkarleby as a community needs to implement a wide variety of interventions to attract new residents. Hopefully, Älvkarleby Park can be one of the foundational building blocks in shifting the trend towards population growth—demonstrating that Älvkarleby is a place that actively invests in its residents and develops sustainable environments that positively impact children, adults, and the elderly alike.

7.2. Strength and limitation of thesis

The significance of this study lies in its dual objectives of addressing the challenges of local growth and enhancing children's well-being through the creation of a proposed park centered around child-responsive waterscapes in Älvkarleby municipality.

Firstly, by focusing on the municipality's need for growth, particularly in the face of demographic challenges such as a diminishing population base and an exodus of residents to urban centers, this study offers a strategic approach to stimulate local development. The proposed park serves as a tangible intervention that can attract families, residents, and tourists alike, thereby bolstering the municipality's economy and revitalizing the community. By leveraging Älvkarleby's historical relationship with its surrounding blue spaces, the park becomes not only a recreational asset but also a cultural and environmental landmark that enhances the municipality's appeal as a desirable place to live, work, and visit. Secondly, the emphasis on children's well-being underscores the importance of creating inclusive and engaging outdoor spaces that cater to the developmental needs of young residents. By prioritizing child-responsive design principles, the proposed park becomes a catalyst for promoting physical activity, social interaction, and sensory exploration among children. By enhancing children's well-being, the park contributes to the overall quality of life in Älvkarleby and fosters a sense of community pride and cohesion.

The study's limitations stem from several factors. Firstly, the local context specificity may limit the generalizability of findings to other urban environments with different geographical, cultural, or socio-economic contexts. Secondly, the thesis focus is on waterscapes which means that other perspectives on waterscapes, and green spaces, for example are secondary. As stated,

the study focuses on the design and implementation of a single park, which may not fully address the diverse needs of the entire municipality. The effectiveness of the proposed interventions may vary depending on factors such as location, scale, and local context. While the study aims to contribute to the long-term sustainability of Älvkarleby municipality, the actual impact of the proposed park on local growth and children's well-being may take time to materialize. Long-term monitoring and evaluation efforts will be necessary to assess the park's effectiveness and address any emerging challenges. The success of the proposed interventions relies heavily on community engagement and participation. Limited community involvement may impede the implementation process and undermine the park's potential to serve as a catalyst for social cohesion and community development.

7.3. Practical implications

It is my thoughts that this thesis on the conceptualization and design of Älvkarleby Park holds several practical implications that can positively impact both the local community and the broader field of waterscape architecture and urban planning. Firstly, the development of Älvkarleby Park addresses a significant need for accessible and engaging outdoor spaces within both urban and suburban environments. By creating a multifaceted park that caters to the sensory experiences and recreational needs of children, families, and visitors, it is my hope that this thesis contributes to enhancing the quality of life for residents in Älvkarleby and surrounding areas. The park provides a safe and inclusive environment where people of all ages and abilities can connect with nature, engage in recreational activities, and foster a sense of community.

Moreover, the emphasis on sensory design principles and child-responsive waterscape architecture sets a valuable precedent for future park developments. By prioritizing the sensory experiences of children and incorporating elements that stimulate all five senses, Älvkarleby Park not only promotes cognitive, emotional, and physical development in young visitors but also serves as a model for creating engaging and inclusive outdoor spaces in other settings. This approach to park design aligns with contemporary research and best practices in child-friendly urban planning, highlighting the importance of considering children's perspectives in shaping the built environment. Additionally, a hope is that the significance of sustainability and environmental stewardship in park design and management has been significantly underscored, serving as a model for other parks. By integrating natural elements, such as water features, native vegetation, and eco-friendly materials, Älvkarleby Park promotes ecological resilience

and conservation while providing educational opportunities for visitors to learn about local ecosystems and environmental sustainability. This aligns with broader efforts to create green infrastructure and resilient urban waterscapes that mitigates the impacts of climate change and supports biodiversity. Furthermore, Älvkarleby Park has the potential to stimulate economic growth and tourism in the region. As a well-designed and attractive destination, the park can attract visitors from neighboring cities and regions, boosting local businesses and supporting the hospitality industry. The park's amenities, such as outdoor stages, playgrounds, and recreational facilities, offer opportunities for cultural events, festivals, and outdoor recreation, further enhancing its appeal as a tourist destination and giving locals enjoyment and sense of community.

In terms of population decline, Älvkarleby Park can play a role in revitalizing the community and attracting new residents, particularly families with children. By providing attractive outdoor spaces and recreational opportunities, the park contributes to creating a vibrant and livable community that appeals to potential residents. Additionally, the park's emphasis on sustainability and environmental stewardship reflects a commitment to long-term community resilience and well-being, which can help retain existing residents and attract newcomers seeking a high quality of life.

7.4. Evaluating Research Method

The methodological approach in this study combined qualitative research methods, including literature review, on-site observations, and sketch-based design development. Evaluating the effectiveness of these methods in answering the research questions provides insight into the study’s strengths and limitations. Looking at the strengths of the methodology Bryman (2018) says that a literature review has a theoretical foundation. The comprehensive literature review provided a robust framework for understanding sensory waterscapes, child-responsive design, and accessibility considerations. The selection of key sources (Pallasmaa, Jeanes & Magee, Silvia & Barona, and others) ensured an interdisciplinary approach, integrating insights from architecture, environmental psychology, and landscape design. Along with processing literature to establish the context and theoretical framework of the thesis, on-site observations were made, and empirical data was collected. The site visits to Älvkarleby provided first-hand insights into the existing environmental conditions, community interactions, and potential design challenges.

The decision to observe sensory qualities such as sound, texture, and movement rather than relying solely on maps and technical reports strengthened the study's empirical foundation (Bryman, 2018). Furthermore, a design-based research approach was used as an iterative design process, which included hand sketching, computer modeling, and conceptual visualization, allowed for flexibility in refining the proposal based on both theoretical and empirical findings. The use of visual representation helped bridge the gap between theoretical discussions and practical implementation.

Looking to the limitations of the methodology it is important to mention the perspective of bias in observations (Bryman, 2018). Also, while this thesis presents a replicable model for integrating waterscape architecture into community planning, it is essential to acknowledge potential challenges in its implementation. Context is crucial in any design proposal, and there remains some uncertainty about whether this relatively man-made waterscape fully aligns with the specific needs and preferences of children in Älvkarleby. Conducting interviews with local families and children could have provided deeper insights into how the design might better respond to the community's expectations.

Another key consideration is the intensity of sensory stimuli within the park. The design intentionally embraces the relative nature of sensory experiences, recognizing that different children interact with and process their surroundings in unique ways. While some may find the variety of textures, water movements, and sounds enriching, others may experience sensory overload. Balancing stimulating and calming zones remains an area for further refinement, but the intent is to challenge conventional notions of waterscape design and provide spaces that engage multiple senses in a meaningful way.

Additionally, the practical aspects of maintaining the waterscape must be considered. Features such as interactive water elements and diverse landscape materials may require consistent upkeep, which could pose financial and logistical challenges for the municipality. However, this reality also highlights the importance of advancing the profession, ensuring that landscape architects and planners continue to innovate sustainable, cost-effective solutions for interactive public spaces.

Despite these considerations, the proposed Älvkarleby Park remains a strong concept that responds to the need for child-responsive, nature-integrated play environments. By pushing the boundaries of conventional play design, it offers an opportunity to explore how waterscapes can foster curiosity, adaptability, and engagement with nature. While refinements may be necessary to optimize sensory balance and long-term sustainability, the core vision of the park as an inclusive, enriching, and community-driven space remains highly relevant.

Lastly, this thesis process has been both challenging and rewarding. As someone who is not accustomed to conducting academic research at this level, I have encountered obstacles along the way, but each challenge has provided valuable learning experiences. From navigating complex theoretical frameworks to refining my methodological approach, this journey has deepened my understanding of both the research process and the subject matter. While it has been demanding, it has also been incredibly fulfilling to see how my ideas have developed and taken shape. This thesis has not only expanded my knowledge but also strengthened my ability to critically analyze, synthesize information, and apply research in a practical context.

7.5. Conclusion

The proposed Älvkarleby Park exemplifies how child-responsive waterscape design ultimately can serve as a catalyst for children's well-being, local revitalization, and development, fostering both social engagement and economic sustainability. This thesis especially highlights how interactive water play features, such as shallow streams, stepping stones, and sculptural mounds, enhance children's connection with nature. By incorporating varied water depths, natural materials, and tactile surfaces, the design encourages exploratory play, physical activity, and cognitive stimulation. Additionally, access to blue spaces has been linked to psychological well-being, reducing stress and fostering emotional resilience, reinforcing the argument that well-designed waterscapes can support holistic child development.

To answer how water environments contribute to sensory-rich design, the study emphasizes the role of multisensory engagement. Elements such as flowing water, textural diversity, and auditory stimuli ensure accessibility for children with varying sensory needs. Features like wooden bridges, interactive fountains, and soft sand areas create opportunities for inclusive play by offering different ways for children to engage—whether by touch, movement, or sound. These design choices enhance the sensory experience while ensuring the space is accessible for children of all abilities.

By bridging theoretical research with practical implementation, this study presents a replicable framework for designing waterscapes that are both child-centered and community-driven. The findings illustrate how well-planned waterscape architecture can enhance play, social interaction, and inclusivity while contributing to urban revitalization. Ultimately, the research underscores the transformative potential of waterscape design in shaping sustainable, engaging, and resilient public spaces for current and future generations.

7.6. Further studies

Further studies on the topic of child-responsive waterscape architecture and the design of sensory parks like Älvkarleby Park could explore several avenues to deepen our understanding and enhance practical applications. Many of the suggested avenues for further studies are within the realm of longitudinal studies to assess the long-term impacts of sensory parks on children's development, well-being, and social behavior. By tracking participants over time, researchers can gain insights into how exposure to nature-rich environments influences cognitive, emotional, and physical development throughout childhood and adolescence.

Conducting comparative analyses of sensory parks in different geographical locations and cultural contexts to identify common design principles, cultural variations, and best practices would be of interest. By studying a diverse range of parks, researchers can gain a more comprehensive understanding of how sensory design elements impact visitor experiences and community engagement, while also comparing similarities and differences regarding local contexts. Exploring strategies for involving local communities, children, and stakeholders in the co-design process of sensory parks is another valuable avenue for study. By fostering participatory design approaches, researchers can empower community members to contribute their perspectives, preferences, and needs, leading to more inclusive and culturally relevant park designs.

Investigating ways to enhance accessibility and inclusivity in sensory parks to accommodate individuals with disabilities, sensory sensitivities, and diverse cultural backgrounds. This could involve research into universal design principles, inclusive play equipment, and sensory-friendly programming to ensure that parks are welcoming and accessible to all members of the community. Another exciting area of research is examining the role of sensory parks as outdoor learning environments for environmental education and sustainability awareness.

Researchers could develop curriculum-based programs, interpretive signage, and interactive exhibits that engage visitors in learning about local ecosystems, conservation practices, and environmental stewardship. This could be coupled with investigating the health benefits of spending time in sensory parks, including stress reduction, improved mental health, and increased physical activity. Researchers could employ methodologies such as physiological measurements, self-report surveys, and qualitative interviews to assess the impact of park visits on visitors' well-being while at the same time exploring the integration of technology, such as augmented reality, interactive displays, and mobile applications, into sensory park experiences.

Researchers could investigate how digital technologies can enhance visitor engagement, learning outcomes, and accessibility while preserving the natural beauty and sensory richness of the park environment. Since the creation of a sensory park like Älvkarleby Park is a large undertaking requiring the commitment of several stakeholders, examining the role of government policies, urban planning regulations, and funding mechanisms in promoting the development of sensory parks and child-responsive urban environments is essential. Further research could lead to changes that advocate for policy changes that prioritize investments in green infrastructure, public spaces, and community amenities that benefit children and families. By pursuing these avenues of research, scholars and practitioners can advance our understanding of child-responsive waterscape architecture and contribute to the creation of more inclusive, engaging, and sustainable outdoor environments for future generations.

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