

Floating Green: Creating Design Guidelines for Artificial Floating Islands as Social Green
Spaces Along Urban Waterfronts

by

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A REPORT

Submitted in partial fulfillment of the requirements for the degree

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College of Architecture, Planning and Design

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ABSTRACT

An artificial floating island (AFI) is a man-made, floating planter installed with aquatic or terrestrial plants. AFIs float by a constructed, buoyant frame or substrate mat, and can be anchored in place via cables or piers. AFIs float on the surface of water, allowing plant roots to be constantly submerged in the water column. Through rhizofiltration, AFIs filter excess nutrients and pollutants from the water. For centuries, AFIs have been used for ecological purposes and have supported agriculture and human habitation. Recently, AFIs have been growing in usage and popularity for their ecological benefits, and some contemporary AFI designs incorporate spaces for social and recreational activities. Although these AFI designs successfully address their primary environmental goals, they may not fully accommodate the social and recreational uses of public open spaces. This research focuses on how AFIs can support social and recreational activities while maintaining their existing ecological services and contextual appropriateness. Through a series of precedent studies, expert interviews, and projective design, the research will inform new guidelines for the design of social and recreational AFIs, and ultimately help develop a new type of public green space.

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Dr. Amir Gohar | Prof. Jessica Canfield | Dr. Stacy Hutchinson

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Abstract

An artificial floating island (AFI) is a man-made, floating planter installed with aquatic or terrestrial plants. AFIs float by a constructed, buoyant frame or substrate mat, and can be anchored in place via cables or piers. AFIs float on the surface of water, allowing plant roots to be constantly submerged in the water column. Through rhizofiltration, AFIs filter excess nutrients and pollutants from the water. For centuries, AFIs have been used for ecological purposes and have supported agriculture and human habitation. Recently, AFIs have been growing in usage and popularity for their ecological benefits, and some contemporary AFI designs incorporate spaces for social and recreational activities. Although these AFI designs successfully address their primary environmental goals, they may not fully accommodate the social and recreational uses of public open spaces. This research focuses on how AFIs can support social and recreational activities while maintaining their existing ecological services and contextual appropriateness. Through a series of precedent studies, expert interviews, and projective design, the research will inform new guidelines for the design of social and recreational AFIs, and ultimately help develop a new type of public green space.

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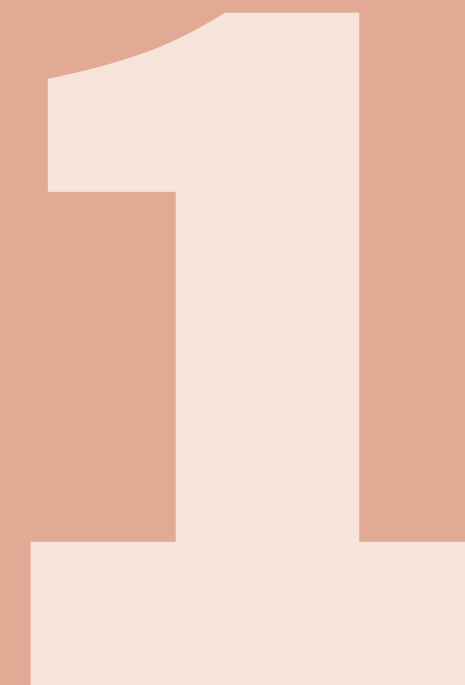
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BACKGROUND

1.1 Introduction

Floating islands, both artificial and natural, have been used by different populations of humans for centuries. In recent decades, artificial floating islands (AFIs) have been developed and implemented for their ecological benefits and are becoming more widely used for ecological restoration. AFIs have also been, and are still being used, by humans for the provision of food and shelter. In Bangladesh, landless, impoverished farmers use AFIs to cultivate crops (Andrews et al. 2013; Irfanullah et al. 2011; “Floating Gardens in Bangladesh” 2017; Li 2013). And, in Peru, the Uros people of Lake Titicaca have built entire villages on AFIs constructed from living reeds (Andrews et al. 2013; Li 2013; Masters 2012) .

AFI design is expanding to incorporate social and recreational activities and serve as public open space. For example, in Singapore’s Punggol Reservoir, a series of AFIs have been implemented both as an ecological strategy and a community space (Andrews et al. 2013; CPG Consultants 2018). And in Rotterdam, the Recycled Park Foundation has created a “floating park” of AFIs using recycled plastic from the Nieuwe Maas river (Neelis 2018). These AFI designs successfully fulfill their environmental goals. And though these designs include spaces for social and recreational activities, it is not their primary goal and they may not be fully accommodated.

This research will answer the question, “How can artificial floating islands (AFIs) along urban waterfronts support human social and recreational activities while maintaining their existing ecological services and contextual appropriateness?” and will look at creating guidelines for AFI design as public space along urban waterfronts.

1.2 Terminology

To begin, it is important to address and understand the many terms used to describe artificial floating islands (AFIs). The terms “floating island” and “floating wetland” are used to refer to the natural phenomenon of a mass of plants growing on the surface of water (Headley and Tanner 2006; Hoeger 1988). “Floating wetland”, along with “floating treatment wetland” (FTW), can also be used to refer to a constructed mat on which plants are installed for ecological purposes (Andrews et al. 2013; Headley and Tanner 2006; Kennen and Kirkwood 2015; MacDonald 2016; Streb 2013). “Floating garden” is used to describe constructed floating islands in Bangladesh used for crop cultivation (Irfanullah et al. 2011; “Floating Gardens in Bangladesh” 2017). The term “bairas” is also used to describe the floating crop technique that has been used in Bangladesh, Myanmar, and China for centuries (Andrews et al. 2013; Li 2013).

Throughout the research, the term “artificial floating island” or “AFI” will refer to a man-made floating planter that allows plants’ roots to be in constant contact with the water column. In addition, the term “social AFI” will refer to an artificial floating island that supports social and recreational activities. Social activities are defined as events that “bring members of the community together” (Nugent 2013) and recreational activities are defined as activities that people choose to partake in their leisure time “to refresh their bodies and minds” (Khasnabis et al. 2010). These interactions enrich communities as well as personal growth.

The term “ecosystem services” will also be used throughout this research. In his article from Britannica Academic (2016), Johnston defines “ecosystem services” as ecological conditions that are directly or indirectly linked to the benefit or profit of human beneficiaries. Johnston (2016) uses the example that an increase in fish in a human-populated area can increase recreational and commercial fishing, which promotes the welfare of humans. The terms “ecological purposes” and “ecological benefits” will be used throughout this paper and refer to the ecosystem services that benefit humans.

1.3 History of AFIs

Human use of AFIs has occurred throughout history in different areas around the world. In between the Tigris and Euphrates lies the ancient Mesopotamian Marshlands, a place surmised to have been the “Garden of Eden” (Andrews et al. 2013). Native Marsh Arabs, the Ma’dan, have built their villages there for thousands of years (Arraf 2016; Andrews et al. 2013). Floating islands made of reeds, buffalo dung, and clay serve as the foundation for these villages (Andrews et al. 2013). Unfortunately, much of the marshlands were drained and villages destroyed due to the political unrest during the 1980’s and 1990’s (Arraf 2016; Andrews et al. 2013). Still, a small portion of the Mesopotamian Marshlands remain (Arraf 2016).

In Asia, water filtration strategies have been used since the 11th century when Chinese and Vietnamese farmers used floating Azolla ferns to filter the water in rice paddies (Masters 2012). Farmers would later harvest the ferns, compost them, and use them as fertilizer (Dodkins and Mendzil 2014; Masters 2012). Since approximately 1700 years ago, Chinese farmers have cultivated entire crop fields on AFIs (Li 2013). This strategy, known as “baira”, has also been used in Bangladesh, and Myanmar (Fig. 1) (Li 2013).



Figure 1: “Baira” agricultural strategy in Myanmar (Schoch 2010).

In South America, the Uros people of Lake Titicaca have built their villages on rafts of living reeds since 1500 CE (Fig. 2) (Andrews et al. 2013; Li 2013; MacDonald 2016). They originally built their villages on Lake Titicaca to defend against attacks from enemies like the Incas (Li 2013). A group of the Uros still inhabit the Bolivian floating islands of Lake Titicaca today (Andrews et al. 2013). These examples from the Middle East, Asia, and South America exemplify the use of AFIs to accommodate human physical needs.



Figure 2: Floating village on Lake Titicaca in Bolivia (Wojtkowski n.d.).

As evidenced by the literature, the ecological benefits of floating wetlands started to be scientifically understood in the early 1900’s, when it was first recommended that water hyacinth be used to treat wastewater in the U.K. and New Zealand (Masters 2012). The first use of floating wetlands in the United States occurred in the 1970’s, when they were used to filter acidic mine wastewater in southeast Missouri (Masters 2012). In the same decade, NASA used water hyacinth to reduce the pollutants in a 16-hectare sewage lagoon (Masters 2012). In the 1980’s Heathrow Airport in the U.K. used floating islands to remove deicing chemicals from the stormwater (Masters 2012). The concept of a manufactured floating base was first conceived in the 1990’s in Taiwan, Japan, and China and was implemented in Japan in 1998 (Masters 2012). Then, in 2005, the first floating planter was commercially produced in Montana by Floating Island International LLC (Masters 2012).

1.4 Advantages and Limitations of AFIs

In order to create relevant and appropriate guidelines for social AFIs, we must first address the advantages and disadvantages of AFIs. It is also important to understand the ecological, educational, psychological, cultural, and practical advantages of AFIs when selling a social AFI design to a client. As previously discussed, AFIs have been used for crop cultivation and human habitation (Section 1.3) and are now primarily used for ecological purposes. AFIs have many other advantages in addition to these.

1.4.1 Advantages of AFIS

AFIs can help remove organic and inorganic pollutants from water such as nitrogen, petroleum, chlorinated solvents, and pesticides (Kennen and Kirkwood 2015). Other pollutants, such as explosives, phosphorus, metals, and POPs (persistent organic pollutants), are not entirely removed, but are held in the plants' roots (Kennen and Kirkwood 2015; Yeh et al. 2015). Phosphorus, nitrogen, and some metals can be extracted from the water over a long period of time via rhizofiltration, if the plants are later harvested (Kennen and Kirkwood 2015; Yeh et al. 2015). The process of AFI rhizofiltration starts when microorganisms attach to the plants' roots. The microorganisms digest excess phosphorus and nitrogen from the water and transfer the nutrients directly to the root system (Fig. 3). The plants then use these excess nutrients to produce biomass that can be fully removed from the system once harvested (Li 2013). The harvested biomass can then be used for fertilizer, animal feed, and food for humans (Li 2013; Zhang et al. 2015).

AFIs can also control algae and phytoplankton levels in the water (Li 2013). The plants' roots absorb excess nutrients from the water column faster than algae can, thus starving the algae (Li 2013). To reduce phytoplankton, AFIs create a shadowing effect in the water, which prevents phytoplankton from receiving adequate sunlight (Li 2013). At the same time, shadowing from AFIs lowers the water temperature, which is healthier for fish and other aquatic species (Andrews et al. 2013). In addition, the plants' roots provide protection and spawning materials for vulnerable fish (Andrews et al. 2013; Dodkins and Mendzil 2014; Hoeger 1988; Li 2013). AFIs also serve as habitat and protection against terrestrial predators for waterfowl, insects, amphibians, reptiles, aquatic mammals, and invertebrates (Fig. 3) (Andrews et al. 2013; Hoeger 1988; Li 2013).

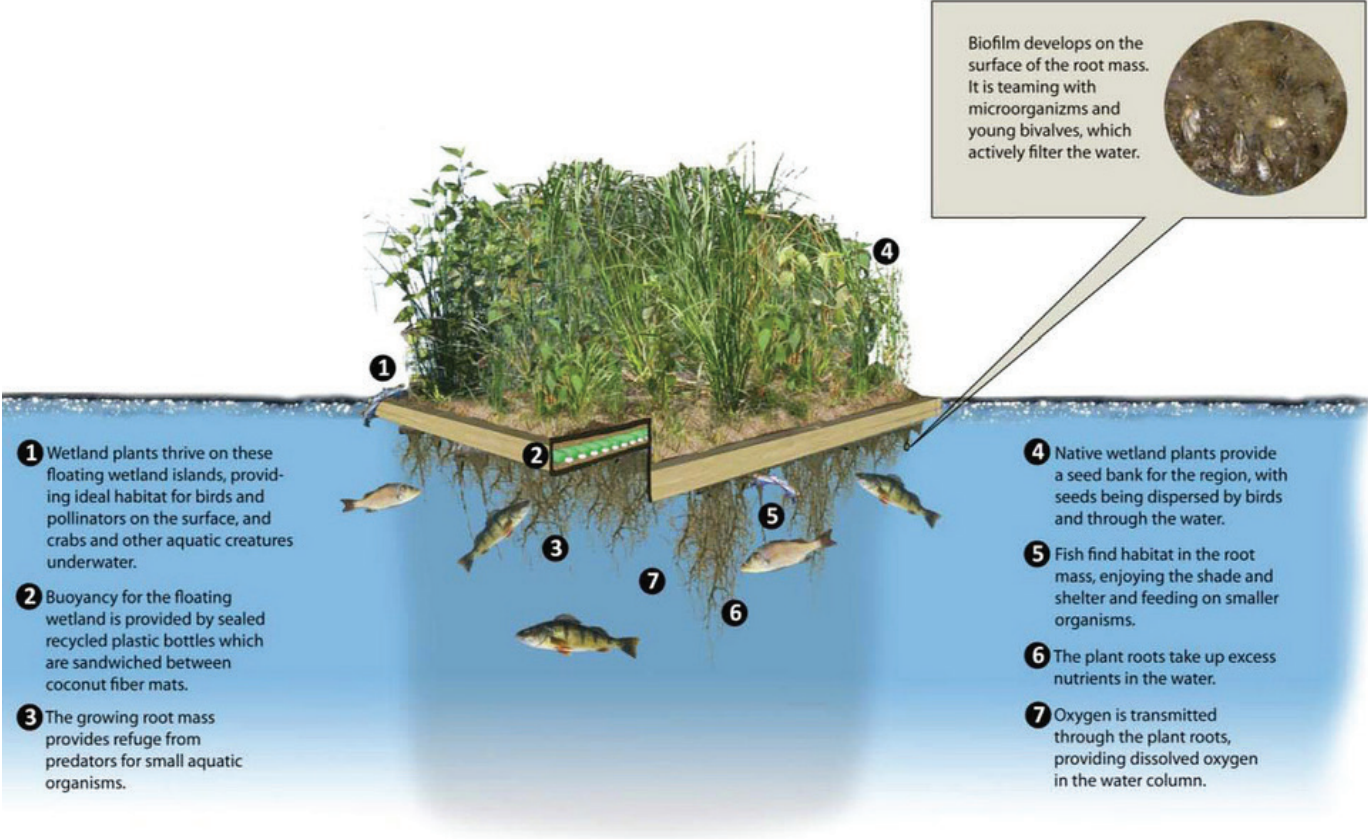


Figure 3: AFIs provide Rhizofiltration and wildlife habitat (Adam 2011).

The presence of native plants and wildlife can attract ecotourism on floating islands with activities such as birdwatching (Dodkins and Mendzil 2014). The presence of flora and fauna also creates opportunities for ecological education (Andrews et al. 2013; Dodkins and Mendzil 2014). The Sengkang Floating Wetland in Singapore and the artificial floating islands along the Chicago Riverwalk are two examples of using floating spaces, native plantings, and informational signage to educate the public about their local ecosystem. (Andrews et al. 2013; Sasaki 2017; CPG Consultants 2018). This ecological education lends to a stronger local identity and even ecotourism.

AFIs can also affect the well-being of a population. In his book “Biophilia” (1986), Edward O. Wilson describes his theory: humans have an innate desire to interact with other living things. And, in “Handbook of Biophilic City Planning & Design,” Beatley (2017, 3) defines a biophilic city as one that supports green spaces and biodiversity. He goes into detail about the impact that nature has on urban areas and argues that biophilic cities are more resilient when it comes to poverty, affordable housing, employment, and sustaining the local economy. In other words, it pays to have a green city. As green spaces, AFIs can help make cities more biophilic and create more enjoyable environments for city-dwellers and visitors.

Today, 54% of the global population lives in urban areas and this number continues to grow with increasing urbanization (Beatley 2017, 3). Impervious surfaces that accompany urbanization lead to more abundant and polluted stormwater runoff (MacDonald 2016). In urban areas, where filtration of stormwater is vital, natural filtration systems, such as wetlands and other green spaces, are limited (MacDonald 2016). Urbanization transforms desirable real-estate along urban waterfronts from soft, permeable edges, to hard and impermeable (MacDonald 2016). Without permeable surfaces, polluted stormwater runs unobstructed to water bodies without natural filtration and inhibits the health of the environment (MacDonald 2016). To mitigate this, AFIs are being implemented in stormwater retention ponds and other urban water bodies to strengthen natural filtration and remediate local ecologies (MacDonald 2016; Wang and Sample 2014). While AFIs improve conditions under the surface of water, they can also protect the shore by abating bank erosion (Hoeger 1988; Li 2013). AFIs can act as wave breaks by absorbing the shock of waves, retarding the gradual process of erosion and, thus, protecting aquatic edges (Hoeger 1988; Li 2013).

Like other greenspaces, AFIs reduce the heat-island effect in urban areas. In his book, “Handbook of Biophilic City Planning & Design,” Beatley (2017, 42) explains the heat-island effect, a phenomenon where urban areas are significantly hotter than rural areas due to less heat-absorbent surfaces (Fig. 4). The rise in urban temperature can be mitigated with several strategies, the most common being the implementation of more green space. As green space, AFIs can slightly reduce the heat-island effect and help control the immediate microclimate, making the space more enjoyable for visitors.

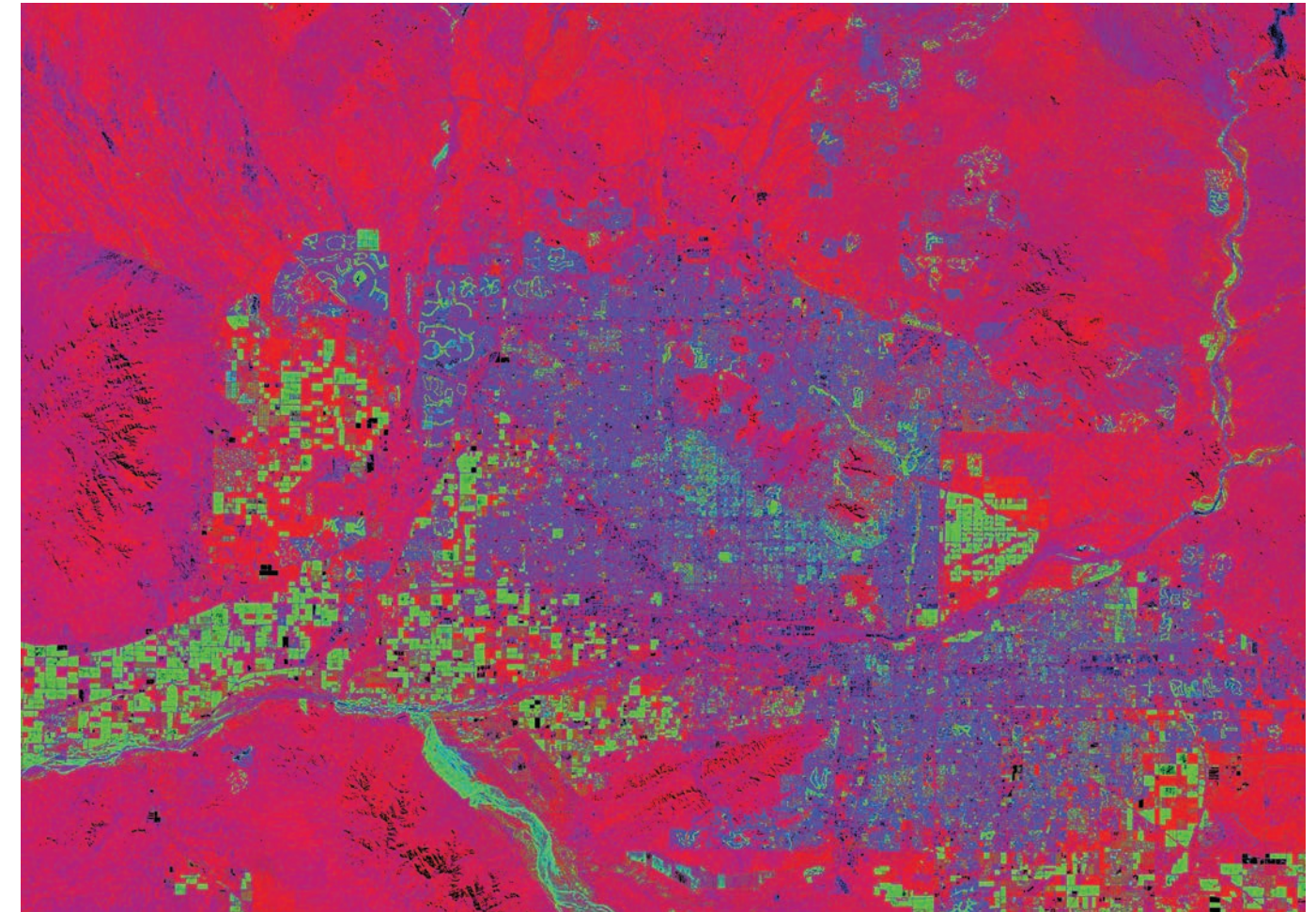


Figure 4: Heat island map of Phoenix Arizona shows pervious surfaces in red, vegetation in green, and impervious land cover in blue (NASA 2000).

Artificial floating islands are also beneficial to cities because they are relatively cost and space effective (Andrews et al. 2013; Olguín et al. 2017). AFIs do not typically require land acquisition (Wang and Sample 2014) and, therefore, can be exempt from land taxes. Because AFIs require little to no land, they are also a space-effective strategy (Andrews et al. 2013; Olguín et al. 2017). The cost of an AFI can be further reduced by using recycled materials (Wang and Sample 2014). For example, plastic bottles are often used to construct the buoyant bases AFIs. Some AFIs such as Spiral Island in Mexico (Fig. 5), Pier 53 on the Delaware River in Philadelphia, and Lake Rotorua Floating Island in New Zealand use as many as 400,000 empty plastic bottles secured in netting to support the floating islands (Andrews et al. 2013).

In addition, AFIs require a limited amount of labor (Wang and Sample 2014; Headley and Tanner 2006; Hoeger 1988, 304) and Headley and Tanner (2006, 80) agree that that artificial floating islands are “virtually maintenance free” (Hoeger 1988, 304) besides occasional inspections. AFIs can simply be pulled to shore and can support the weight of a person for maintenance (Headley and Tanner 2006). Of course, Hoeger, Headly and Tanner were describing the maintenance of highly naturalized AFIs used solely for water filtration and waterfowl habitat. Still, it can be deduced that the amount of labor needed to construct, install, and maintain an AFI is equal to - if not less - than a terrestrial green space.



Figure 5: Spiral Island gained buoyancy from a raft of plastic bottles (McCallum 2000).

1.4.2 Limitations of AFIS

Although AFIs have many benefits, there are other elements that must be addressed. First, the active ecosystem services of an AFI depend on its context. One of the most well-known ecosystem services of AFIs is water filtration. However, AFIs have varying effects on the water quality depending on the volume and flow rate (m³/s) of a body of water (Headley and Tanner 2006). AFIs only treat the volume of the water column that the roots come in contact with (Headley and Tanner 2006). Thus, though they are still beneficial to the environment, AFIs have minimal impact on the water quality in larger bodies of water or those with higher flow rates. AFIs have the most impact on the water quality of small, freshwater water bodies with low flow rates (Headley and Tanner 2006).

Another aspect to consider is that AFIs may require special maintenance. Sediment accumulation on AFIs is common, so dredging may be necessary every several years. The sediment that accumulates on AFIs tend to be high in metals and contaminants and must be handled appropriately as to not agitate and remobilize the pollutants. Maintenance may also require access by boat and may become more difficult in climate extremes (Andrews et al. 2013). For example, AFIs may need special attention or need to be removed during a freeze (Andrews et al. 2013).

Lastly, the balance of an AFI’s size and weight must be considered. Andrews et al. (2013) provide many examples of large AFIs. Rotorua Floating Island measures 68,775 sqft, Sengkang Floating Wetland is roughly 28,800 sqft, and Spiral Island measured 3,564 sqft. Rotorua Floating Island and Sengkang Floating Wetland are made up of multiple AFIs secured together, but Spiral Island was a large, singular AFI. Although these large precedents are, and have been, successful, AFI size and weight are generally limited by their context, purpose, and construction. Headley and Tanner (2006, 76) admit that the size of an ecological-effective AFI cannot be fully determined due to the absence of AFI design guidelines.

1.5 Significance

Urban water bodies possess historical, cultural, and social significance that lends to local identities. However, some urban water bodies have become inaccessible to locals and tourists. In addition, their aquatic ecologies are becoming threatened due to urban development and pollution. AFIs are a way to ecologically restore waterfronts while allowing us to take advantage of them as social and cultural platforms. AFIs have supported ecological purposes and human physical needs. However, they have not been researched for their potential to serve as social and cultural spaces. The research aims to create guidelines for social AFI design in order to create a new design thinking for this type of sustainable urban green space.

2.1 Introduction

The primary question driving this research is, “How can artificial floating islands (AFIs) along urban waterfronts support human social and recreational activities while maintaining their existing ecological services and contextual significance?” To answer this, the following sub-questions must be addressed as well:

- What social and recreational activities have AFI precedents supported?
- How have AFI precedents balanced ecological and recreational uses?
- What other frameworks can inform the guidelines for social AFIs?
- What other important elements must be addressed to make an AFI successful?

Through precedent studies and phone interviews with experts, a set of design guidelines will be developed to inform future social AFIs, create a new design thinking for AFIs, and ultimately help develop a new type of public green space (Fig. 6). Their effectiveness will be demonstrated through the development of design guidelines and projective design. I hypothesize that AFI designs can be developed into a new type of public open space. If this hypothesis is disproved, then AFIs will be evaluated for their ineffectiveness as to perform as public open spaces.

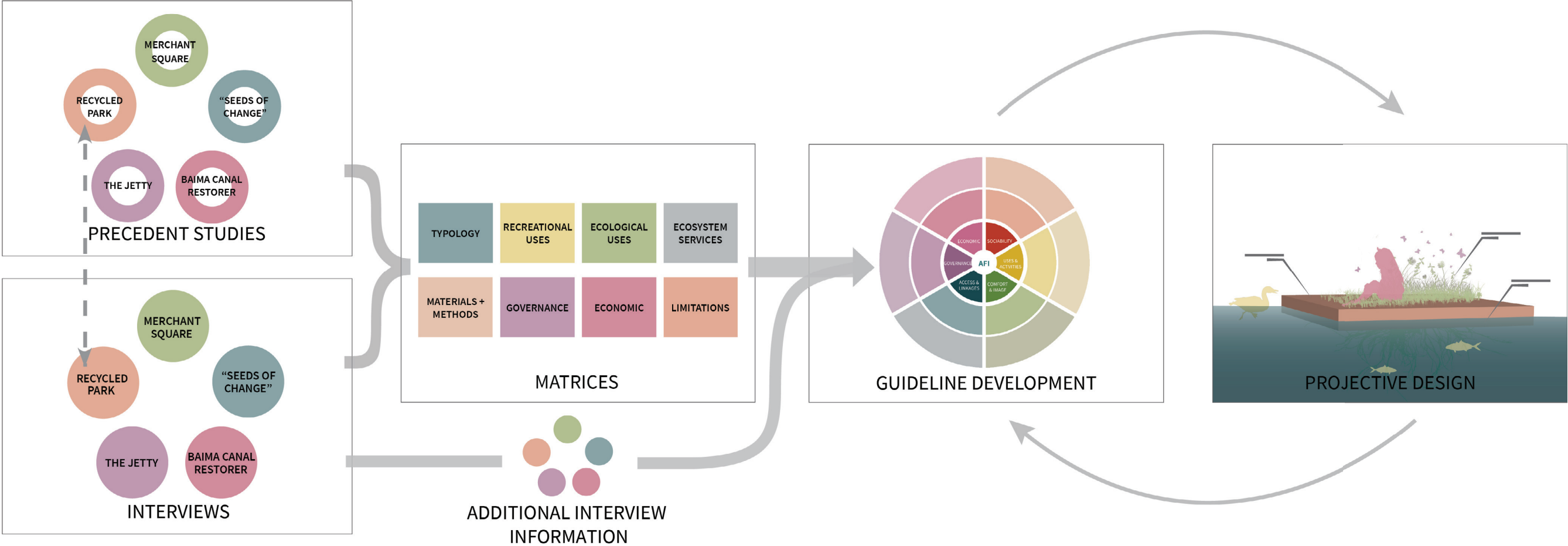


Figure 6: Precedent studies and interviews will inform the iterative process of guideline development and projective design (Borelli2019).

2.2 Precedent Studies

This research will begin with a series of precedent studies. There is a significant research gap regarding the social and recreational uses of AFIs. Therefore, a wide net will be casted for the selection of precedents. Criteria for the selection of precedents are that they must address an ecological goal and have floating vegetation with an adjacent social/ recreational space. The precedents are not restricted to a geological region in order to demonstrate the global relevance and applicability of social AFIs. Each precedent will be evaluated for its design, the goals or issues it addresses, the construction methods and materials used, the parties involved in the design and implementation, and the social, recreational and ecological uses present. These elements will then be compared across all the precedents through a series of matrices, graphs. and charts.

The AFIs that will be investigated are the Recycled Park in Rotterdam, Merchant Square on the Grand Union Canal in London, “Seeds of Change” in Bristol Harbor, “The Jetty” of the Chicago Riverwalk, and the Baima Canal restorer. These precedents all meet the same selection criteria listed above. However, they represent different perspectives regarding the use of AFIs. Some precedents focus more on the ecological use, while others focus more on cultural and social uses. Some precedents are balanced on the social-ecological spectrum, representing both aspects relatively equally. More information about each precedent is listed in the following sections (Sections 2.2.1 – 2.2.5) including their description and why they are relevant to the research.

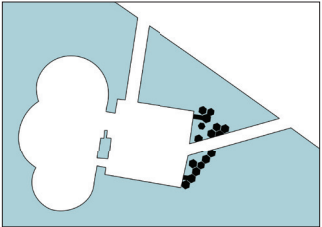


Figure 7: Plan of Recycled Park (Borelli 2018).

2.2.1 Recycled Park

In Rotterdam, plastic debris from the Nieuwe Maas River is being recycled to help build AFIs for “Recycled Park”. The first batch of twenty-eight pods been have recently installed. Most of the pods are vegetated AFIs or floating planters, but two are used for visitor seating. This effort was enacted by Recycled Island Foundation to reduce plastic litter in the Nieuwe Maas River, and the park was designed by WHIM Architecture. This precedent will benefit the research because it includes both ecological goals and recreational uses. (Fig. 7-8) (Neelis 2018; Waste 360 2018)



Figure 8: Recycled Park (Recycled Park Rotterdam July 2018 Courtesy of Recycled Island Foundation).

2.2.2 Merchant Square

The floating park in London’s Merchant Square is part of the Greater London Authority’s green infrastructure initiative. The site includes a pavilion equipped with Wi-Fi, a lawn area, pathways, and places for seating. The design is meant to be an outdoor workplace and recreational space for the community. It includes plants, though their roots are not submerged in the water for rhizofiltration. Instead, the plants are enclosed in soil planters that sit on top of the floating structure. Besides the main structure, there is an independent floating planter that is intended to serve as habitat for waterfowl and other wildlife. This precedent is beneficial to the research because it focuses on the social and recreational use of the space while also striving towards an ecological goal. (Fig. 9-10) (Jewell 2017; Garden Club London n.d.)

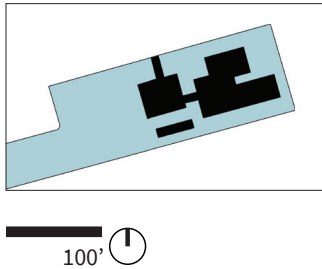


Figure 9: Plan of Merchant Square’s floating park (Borelli 2018).



Figure 10: Merchant Square (©Garden Club London).

2.2.3 Seeds of Change

“Seeds of Change,” in Bristol Harbor, was a collaboration between designer Gitta Gschwendtner and artist Maria Thereza Alves. The pair worked with the University of Bristol Botanic Garden, Arnolfini, and Bristol City Council. In this design, non-native plants are installed on a disused floating barge. The design was inspired by Alves’ research of barges. Alves learned that after barges completed their shipment, they would be loaded with soils and stones native to the area to weigh the barges down for their return journey. The ballast naturally contained plant seeds from the foreign areas and would be dumped into Bristol Harbor upon its return. Alves learned that if the seeds were excavated from the bottom of Bristol Harbor today, they could still be germinated. The possibility of growing these foreign plants from another era inspired the design. The floating garden includes vegetation and spaces for visitor seating and circulation, all on a floating platform, making it an appropriate precedent for social AFIs. (Fig. 11-12) (Chalcraft 2012)

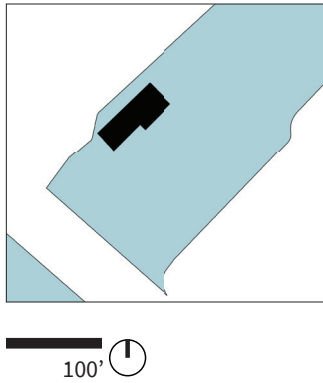


Figure 11: Plan of “Seeds of Change” (Borelli 2018).



Figure 12: “Seeds of Change” in Bristol by Maria Thereza Alves (©McClure 2012-2016).

2.2.4 Chicago Riverwalk

The Chicago Riverwalk by the City of Chicago consists of five main spaces. One of these spaces, “The Jetty”, includes AFIs interspersed between protruding piers. AFIs provide an opportunity for ecological education and wildlife habitat and the piers are often used for photography and fishing. The AFIs are not physically connected to the piers, and cannot support human weight beyond maintenance purposes. However, the proximity of the AFIs to the piers, along with the social value they add to the space make it an appropriate precedent for social AFIs. (Fig. 13-14) (Sasaki 2017)

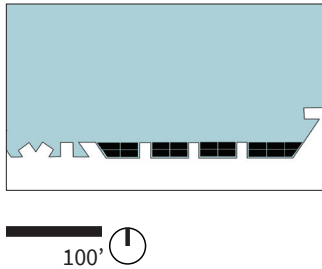


Figure 13: Plan of the Jetty (Borelli 2019).



Figure 14: The Jetty of the Chicago Riverwalk (©Christian Phillips Photography Courtesy of Sasaki).

2.2.5 Urban Municipal Canal Restorer

The Baima Canal, in Fuzhou, China was once polluted with commercial waste and untreated domestic sewage. It inhibited the quality of life of the adjacent neighborhoods and polluted the MinJiang River downstream. In 2002, John Todd Ecological Design, in collaboration with Ocean Arks International, created and installed the canal restorer. The design is a floating walkway, flanked by AFIs of native plants. At one end of the bridge is a water recycling treatment system which aerates the water. Since its installation, the canal restorer has significantly improved the water quality and quality of life in the surrounding neighborhoods. (Fig. 15-16) (Andrews et al. 2013; World Unwrapped 2015)

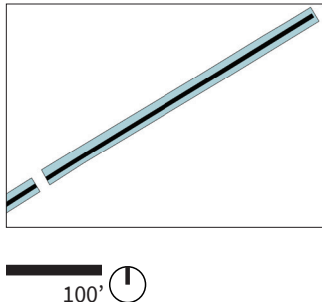


Figure 15: Plan of the Baima Canal restorer (Borelli 2018).



Figure 16: Baima Canal restorer (©John Todd Ecological Design).

2.3 Interviews

To supplement the precedent studies, I will conduct phone interviews or video conferences with the precedents' experts. The interview subjects are from the U.S., Singapore, the U.K., and the Netherlands. If phone and video conference interviews are not possible due to certain limitations such as Wi-Fi access, conflicting time zones, and schedule coordination, emailed interview questions will be used instead. Through the interviews, the inspiration, goals and services of the design, the governance and maintenance of the site, and the overall success of the space will be addressed. The information gathered from the interviews will supplement the information found through the precedent studies and will help develop the guidelines.

2.3.1 Recycled Park – Ramon Knoester

Ramon Knoester is the founder and coordinator of the Recycled Island Foundation which supports Recycled Park and its related litter cleanup proposals. Knoester is also the founder of WHIM Architecture in Rotterdam which is responsible for the design of Recycled Island.

2.3.2 Merchant Square – Ben Dewhirst

Ben Dewhirst is a landscape architect Garden Club London, which is one of the lead design and build studios in London, and the firm responsible for designing and constructing Merchant Square's floating garden. Dewhirst was the lead landscape architect on the project, responsible for design development and technical detail of Merchant Square's floating park. Garden Club London has won the BALI Principal Award for Communities and Schools category, the BALI Special Award for Design and Build, the Canal and River Trust 2018 Living Waterways Award and recently the SGD Award for best public or commercial outdoor space with the floating park design.

2.3.3 Seeds of Change – Maria Thereza Alves with supplementary information from Aldo Rinaldi and Nicholas Wray

Maria Thereza Alves is a Brazilian artist, author, and activist who has been featured in many international exhibits and biennials since the 1980's. Through research-based work, Alves strives to unveil lost histories of localities where she has lived or visited. Alves has also won many awards for her work such as the Vera List Center Prize for Art and Politics. Alves started "Seeds of Change" in 1999 in Marseille, France and has since produced "Seeds of Change" work for Reposaari, Finland; Liverpool, Bristol, Exeter and Topsham in England; Dunkirk, Germany; Antwerp, Belgium; and Manhattan, New York.

Aldo Rinaldi was the Senior Public Art Officer for the City of Bristol from 2003 to 2017. Rinaldi is the curator and commissioner of public projects - especially those with an ecological aspect - and commissioned Alves for the floating ballast garden. Nicholas Wray is the curator of the University of Bristol Botanic Garden and the "Seeds of Change" ballast garden in Bristol.

2.3.4 Chicago Riverwalk – Steven Walz

Steven Walz is an associate landscape architect at Sasaki. Walz was also the project manager for the Implementation of Phase III of the Chicago Riverwalk which included the Jetty.

2.3.5 Urban Municipal Canal Restorer – Dr. David Benjamin

Dr. David Benjamin is a senior advisor at John Todd Ecological Design, which is responsible for the design of the Baima Canal restorer. Dr. Benjamin has been practicing architecture in the U.S. and Norway since 1985.

2.4 Guideline Development

Using the precedent studies and interview results, I will develop a set of design guidelines for social AFIs along urban waterfronts. The resulting AFIs will accommodate social and recreational activities, while maintaining ecological services and contextual appropriateness. The guidelines will also catalyze a new perspective on AFIs as public green space. The design guidelines are meant to be applied along urban waterfronts but may be applicable in other contexts if deemed appropriate by the guidelines and judgement of the designer.

2.4.1 Existing Frameworks

General design guidelines for social AFIs have hardly been researched, if at all. In order to create effective design guidelines, it is useful to look at other well-recognized frameworks.

AFIs can be effectively evaluated through the lens of ecosystem services. Ecosystem services are divided into four categories: supporting, provisioning, regulating, and cultural services (Fig. 17) (Johnston, 2016). Supporting, provisioning, and regulating are all quantitative, have been thoroughly researched, and are well-understood. These categories include aspects such as photosynthesis, climate regulation, and provision of medicinal resources.

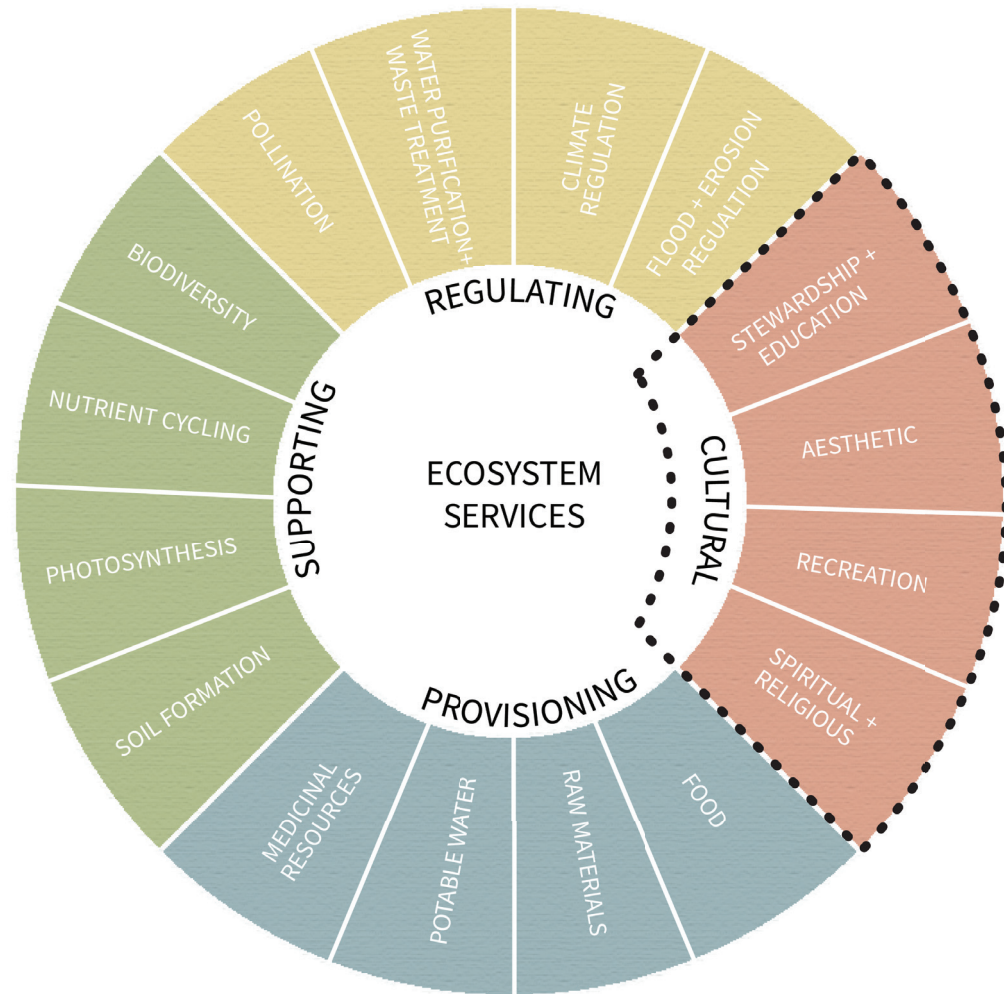


Figure 17: Ecosystem Services (Borelli 2018 adapted from The Economics of Ecosystems and Biodiversity (TEEB) Europe n.d.).

WHAT MAKES A GREAT PLACE?

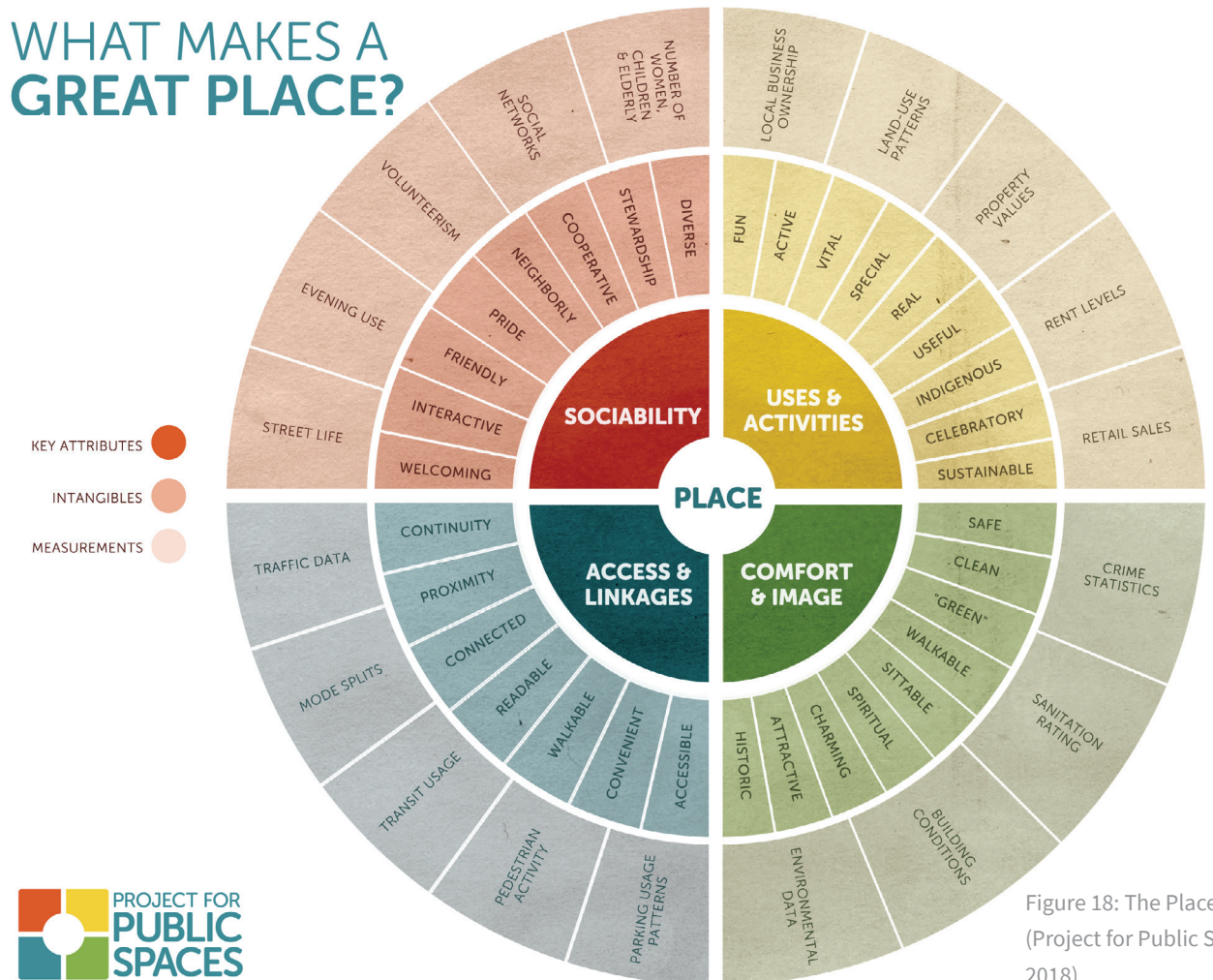


Figure 18: The Place Diagram (Project for Public Spaces 2018).

Cultural, though, is a qualitative value and has hardly been researched, if at all, in terms of AFIs. This category includes the recreational, educational, spiritual, and aesthetic value that ecosystems provide. The cultural portion encompasses the social and recreational use of AFIs, which is the focus of this research.

Project for Public Spaces (PPS) is a non-profit organization that has developed a framework outlining criteria for successful public spaces. “The Place Diagram” is divided into four quadrants representing key attributes of good public spaces: sociability, uses and activities, access and linkages, and comfort and image (Fig. 18). Two layers radiate out from the key attributes. The inner ring identifies “intangibles,” while the outer ring identifies “measurements” (Project for Public Spaces 2018). “Intangibles” represent intuitive qualities of a space such as “welcoming” and “walkable,” while “measurements,” include quantitative variables such as property values and crime statistics (Project for Public Spaces 2018).

The Place Diagram has given clarity to a topic that once seemed intangible. It provides a clear, organized way to evaluate public open space and can help inform the structure of the proposed AFI design guidelines. This diagram covers many important variables that affect the quality of a space. And although the Place Diagram shows some aspects of governance and finance, they serve a greater role in the success of a public space, especially for justifying the implementation of a social AFI.

The framework for sustainable development supplements the elements of economy and governance. The framework for sustainable development illustrates that sustainability is achieved through a balance of ecology, equity, and economy. Ecology is intrinsic to AFIs and is addressed in the ecosystem services framework. Equity would ideally be achieved through social AFIs and is addressed through the Place Diagram. Lastly, economic support is essential to the success of any public open space, including social AFIs, and is addressed in the sustainable development framework. El Hour et al. (2016) argue that effective governance is inherent of sustainable development in addition to ecology, equity, and economy, making it an overarching principle of sustainable development and a necessary part of the proposed AFI design guidelines (Fig. 19).

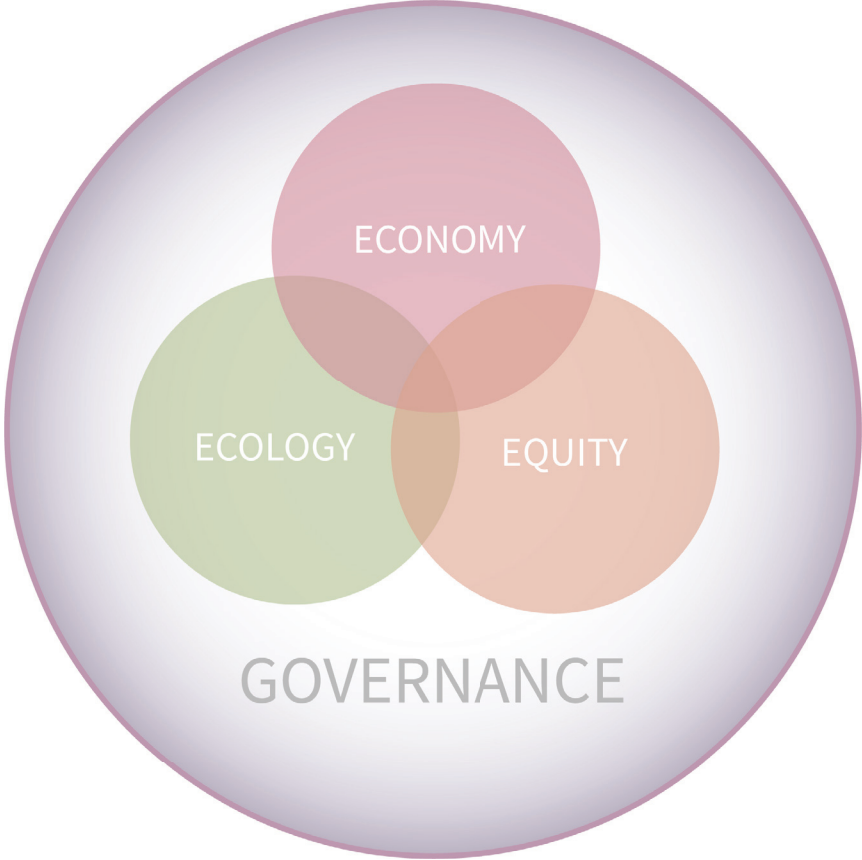


Figure 19: Sustainable development framework with governance (Borelli 2018 adapted from The Siam Cement Public Company Limited 2008).

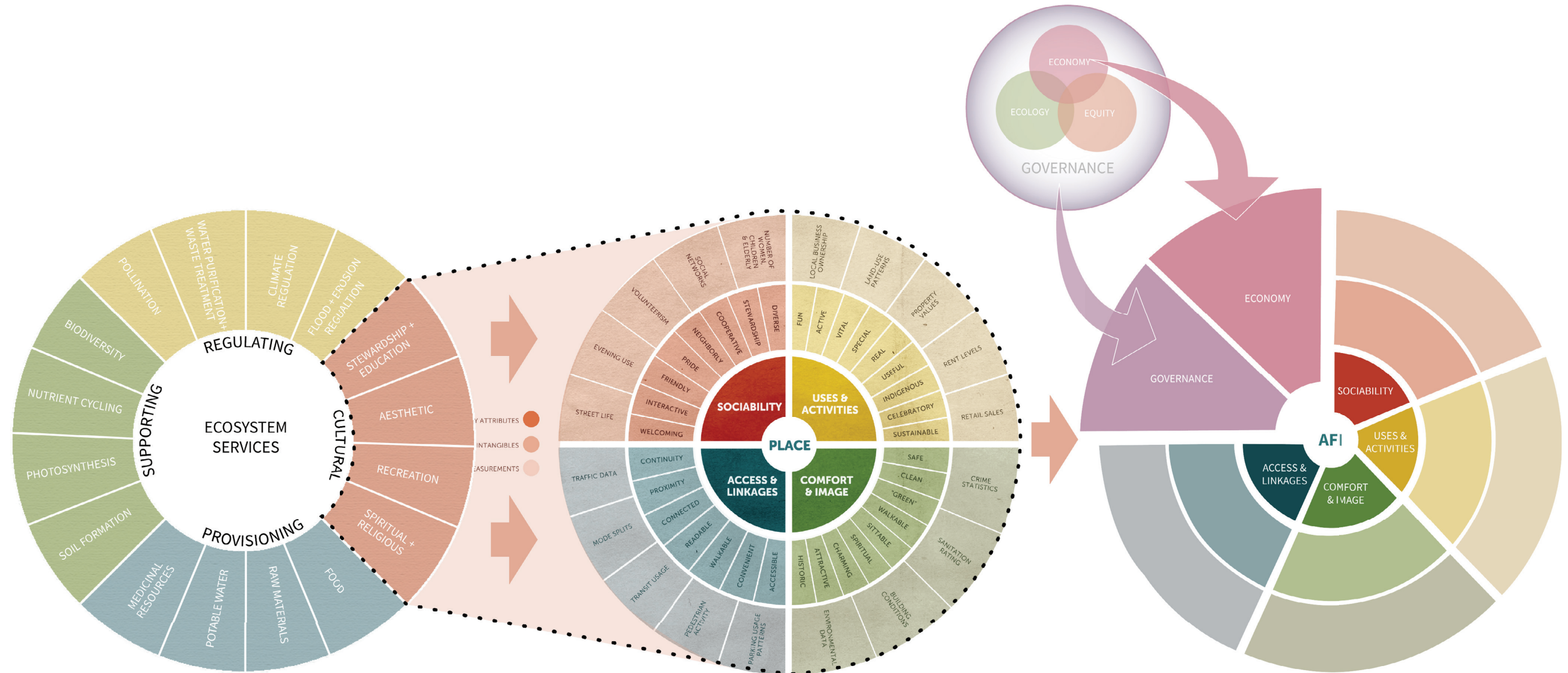


Figure 20: Guideline framework development (Borelli 2018).

2.4.2 Developed Framework

This research will use the ecosystem services framework, the Place Diagram, and the sustainable development framework to develop an outline for the design guidelines of social AFIs (Fig. 20). In summary, the ecosystem services framework focuses on the ecological systems of a green space that benefit humans, some of which are cultural. This reflects the research and nature of AFIs in that, even though they are used primarily for ecological reasons, they also provide an opportunity for cultural activities. The Place Diagram will also be included because it thoroughly covers which aspects make a good public space, with an emphasis on social qualities. Lastly, the sustainable development framework will be integrated because it is a well-known and respected framework that addresses the importance of governance and economy in sustainable development.

Using these three frameworks, a fourth framework will be created to help form the guidelines for social AFI design. The six overarching categories of the proposed guidelines will include sociability, uses and activities, comfort and images, access and linkages, governance, and economy (Fig. 21).

2.5 Projective Design

After developing the design guidelines, they will be used to create a projective design for one of the many waterways in downtown Rotterdam.

2.5.1 Rotterdam

Rotterdam is known for being a major European port, situated in the delta of three major rivers: the Maas, the Rotte, and the Schie. (Goossens et al. 1995). Rotterdam is also known for its traditional flood management systems and creative contemporary sea level rise solutions. One such example is the Rijnhaven’s floating pavilion, which is made out of lightweight material and rises and falls with the water level (“Eco Architecture” 2009). Rotterdam is also the setting for the research precedent, “Recycle Park,” located directly adjacent to the floating pavilion. Many other floating designs have been conceptualized for the Rotterdam area, aiming to fill the demand for flood-resilient urban expansion (Casanova and Hernández 2014; Metz and van den Heuvel 2012). Rotterdam also holds a high standard for its public spaces as demonstrated by their many public open space policy plans throughout the past three decades (Van Melik and Lawton 2011). AFIs could help meet the demand for both flood-resilient spaces, and quality public green spaces. Using the developed guidelines, a social AFI design will be generated for waterway in downtown Rotterdam. One of the anticipated categories of the developed guidelines is site selection. Thus, the developed guidelines will also inform the specific site location of the social AFI.

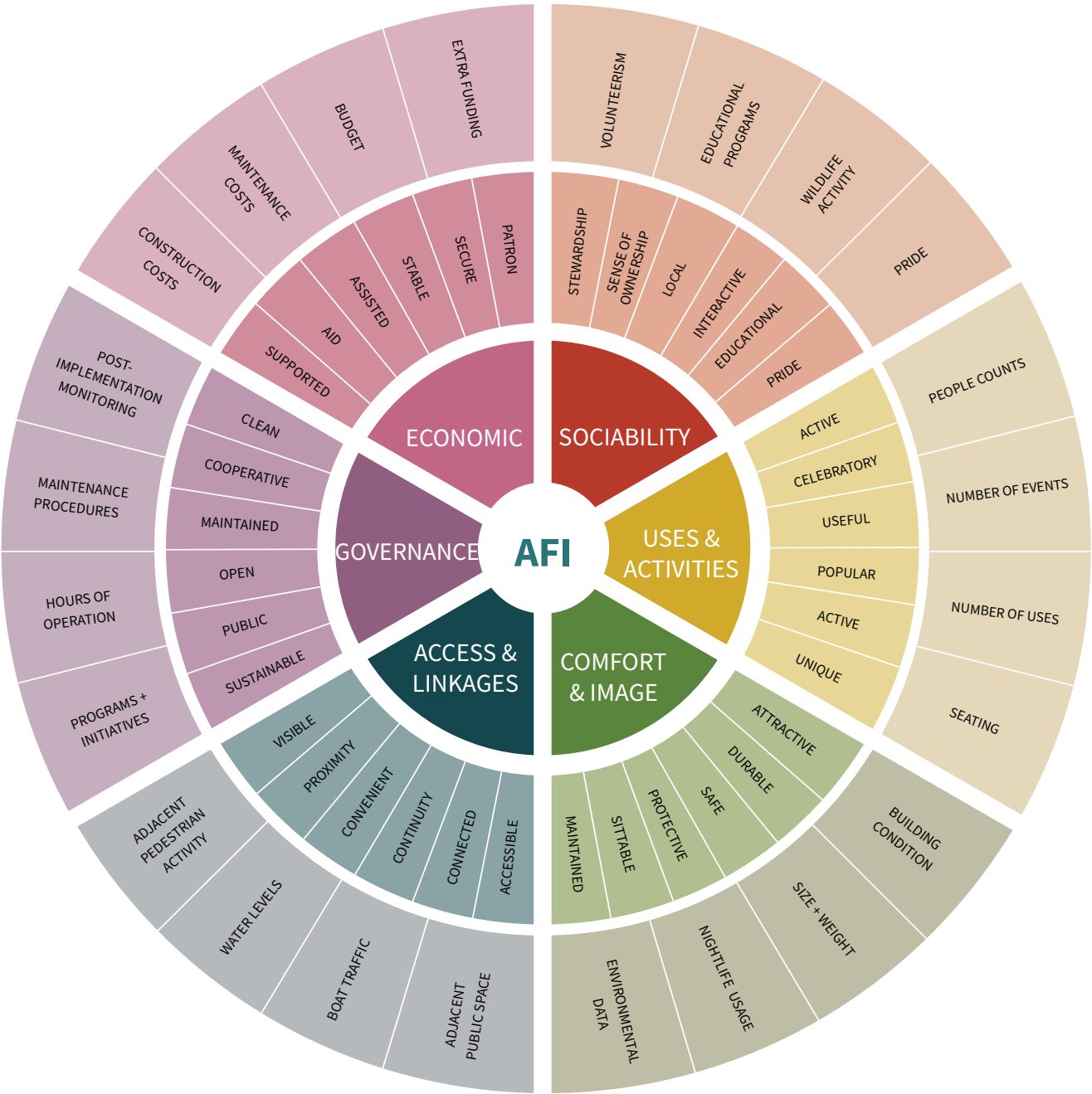


Figure 21: Social AFI design guideline framework (Borelli 2019).



0' 3950' 

Figure 22: Downtown Rotterdam (Borelli 2019).

0' 2.5 miles 

Figure 24: Rotterdam city limits (Borelli 2019).



Figure 23: The Netherlands (Borelli 2019).



3

3

FINDINGS

3.1 Introduction

Through the synthesis of precedent studies and interviews, I developed a set of design guidelines for social AFIs along urban waterfronts. To demonstrate their validity, I used the developed guidelines to produce a projective design for one of Rotterdam’s many harbors.

3.2 Precedent Studies

Using the information found in the precedent studies (See Appendix A), and supplementary information gathered from interviews, I have created a series of eight matrices evaluating each precedent on different themes:

1. Typology – Classifying the type of AFI.
2. Recreational Uses – Identifying the recreational uses of a precedent.
3. Ecological Uses – Identifying the main ecological goals and benefits of a precedent
4. Ecosystem Services – Distinguishing how a precedent benefits the welfare of the users.
5. Materials and Methods – Cataloguing the materials and methods used to construct a precedent.
6. Governance – Identifying who owns the site and how it is managed.
7. Economic – Identifying who paid for a precedent’s implementation and maintenance.
8. Limitations –Distinguishing what could be improved upon to make a precedent more successful.

This synthesis can help identify variables of AFIs that should either be included in the social AFI lexicon or needs to be avoided. However, even though some variables of the precedents are less-common than others, does not suggest that they are less valuable or should be avoided in social AFI design. For example, even though litter cleanup is the least-common ecological use (See Section 6.3.5), does not entail that social AFI designers should avoid it. It is simply less common and an extra initiative that can be taken towards a “greener” design.

First, I will describe the different components of the matrices to provide an understanding of how they work. The y-axis on each matrix list the five precedents, while the x-axis at the top list the different variables dependent the matrix’s theme. The variables were chosen based off the literature review, precedent studies, and my own judgement.

The very top row, above the variables, designates the “rank” of each variable, showing how important it is for the success of a social AFI. The rank is on a scale from 1 to 3, 1 being a “less desirable” variable, 2 being “somewhat desirable,” and 3 being the “most desirable.” Then, within the body of the matrices, the variables for are ranked on the same scale, from 1 to 3, based on how relevant or affective they are for each precedent. A blank cell indicates that a certain variable is nonexistent in a precedent.

The three right-most columns show the “number of observations,” “points,” and “score” of each precedent. The “number of observations” show how many variables apply to each precedent. This column is not present in the Typology, Governance, and Economic matrices as it does not add any descriptive information for those themes. The next column to the right shows how many “points” each precedent has for the given theme. This number is the sum of the rank of all the variables existent in a precedent. The last column on the right shows the “score” that each precedent has for the given theme. The “score” takes the total points of a precedent and divides it by the highest number of points of all the precedents. In the example matrix (Table 1) Recycled Park’s score is its own points (3) divided by the number of points “Seeds of Change” has (10) because “seeds of Change” has the most points. The resulting score of Recycled Park for that theme is 0.3. The scores are on a scale of 0.1 – 1.0 and allow us to compare the success of the precedents for each theme.

The two bottom-most rows are “total” and “value.” The “total” is the sum of all a variable’s ranks in relation to its existence in different precedents. In the example matrix, “Variable A” was used in 4 precedents. The ranks for its existence in each precedent are 1, 3, 1, and 2, which adds up to a “total” of 7. Then, the bottom row shows each variable’s “value.” The “value” is a variable’s “total” multiplied by its overall “rank”.

These matrices allow us to compare the relevant variables of each precedent and see what makes each precedent successful. In the following sections, I will explain the trends of each of the matrices (See Appendix C for the full matrices).

3.2.1 Typology

Using the information gathered from the precedent studies, I Identified four types of social AFI precedents.

The first type, Unintegrated, Submerged Roots (UISR) (Fig. 25) includes precedents in which the floating vegetation is separated from the social space, either spatially or by a physical barrier. In these precedents, the floating vegetation – with its roots fully submerged in the water – is treated as an aesthetic and ecological addition to the social space, and not

Table 1: Example of precedent study and interview analysis matrix (Borelli 2019).

Rank	2	1	3		10	1.0
	Variable A	Variable B	Variable C	# of Observations	Points	Score
Recycled Park	1		2	2	3	0.3
Merchant Square	3	2	1	3	9	0.9
Seeds of Change	1	3	3	3	10	1.0
The Jetty		1		1	1	0.1
Baima Canal Restorer	2		3	2	5	0.5
Total	7	6	9			
Value	14	6	27			

intended for public access. The adjacent social space may be floating, terrestrial, or may be a pier. UISR is generally the most common type of precedent. The AFIs of the Jetty are considered UISR AFIs.

(opposite page, from top left to bottom right)

Figure 25: Plan and section of an Unintegrated, Submerged Roots (UISR) AFI (Borelli 2019).

Figure 26: Plan and section of a Semi-Integrated, Submerged Roots (SISR) AFI (Borelli 2019).

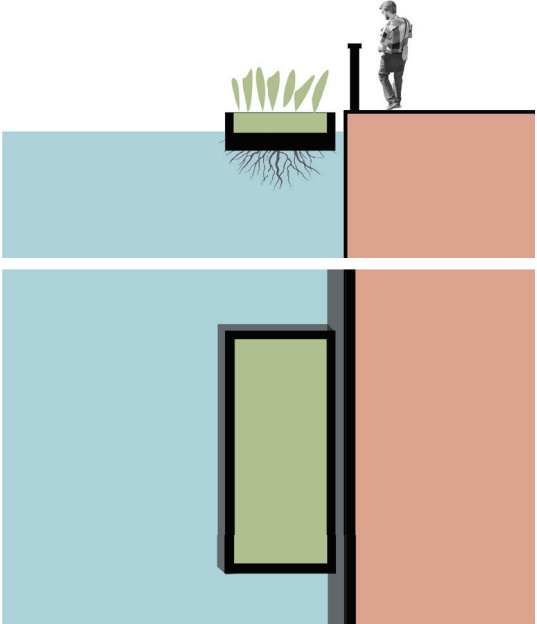
Figure 27: Plan and section of a Fully Integrated, Unsubmerged Roots (FIUR) AFI (Borelli 2019).

Figure 28: Plan and section of a Fully Integrated, Submerged Roots (FISR) AFI (Borelli 2019).

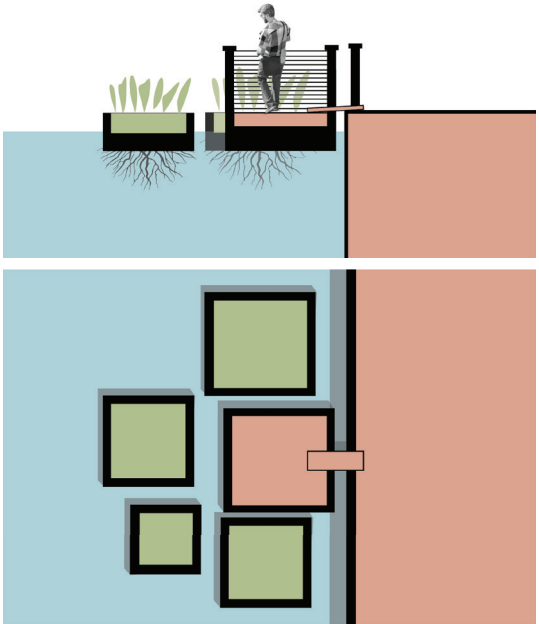
Semi-Integrated, Submerged Roots (SISR) AFIs (Fig. 26) include vegetation with fully-submerged roots as well as adjacent floating social spaces. Although the social spaces float amongst the vegetation, they are still spatially or physically separated, and the vegetation is out of reach of the users. Recycled Park is an example of a SISR AFI.

Fully Integrated, Unsubmerged Roots (FIUR) AFIs (Fig. 27) have vegetation and social space fully integrated on a floating structure. The vegetation is fully accessible to users, but the roots are not submerged in the water. Rather, the vegetation occupies soil planters that are simply placed on the surface of the floating platform. Merchant Square’s floating park and “Seeds of Change” are both FIUR precedents.

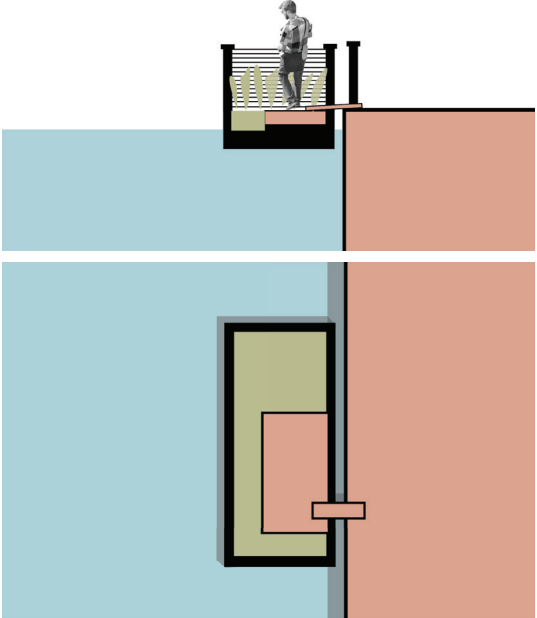
The last type of AFI precedent is Fully Integrated, Submerged Roots (FISR) (Fig. 28). This type has vegetation and social space fully integrated on a floating structure. The roots are fully submerged in the water, and there are no physical or spatial barriers between the vegetation and social spaces. This allows users to come physical contact with the plants. The Baima Canal restorer is the only FISR precedent focused on in this study and is the type of AFI that this research aims to create through design guidelines.



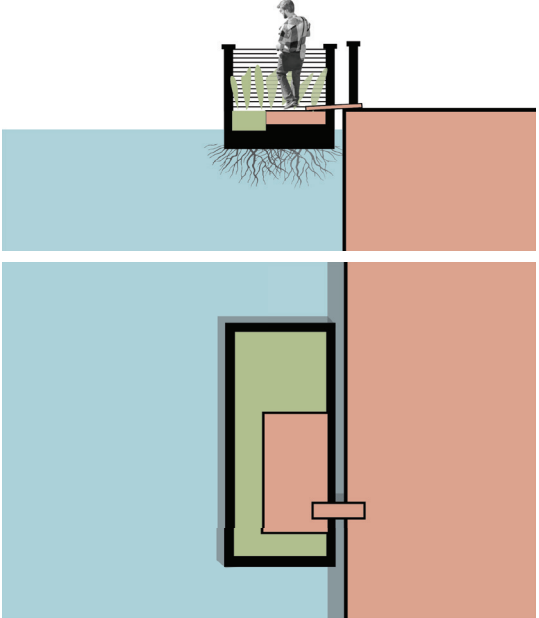
Unintegrated, Submerged Roots (UISR)



Semi-Integrated, Submerged Roots (SISR)



Fully Integrated, Unsubmerged Roots (FIUR)



Fully Integrated, Submerged Roots (FISR)

3.2.2 Recreational Uses

Next, I looked at the recreational uses of the precedents. Most of the recreational uses I focused on are uses that the organizations and companies of the precedents explicitly mentioned. However, some of the identified uses are inferred. For example, I deduced that the Jetty has the “biking” and “walking/ jogging” uses because it is part of a river walk trail where such uses are typical.

Out of all the precedents, The Jetty has the most recreational uses due to its connection to a larger network of social space, the Chicago Riverwalk. It also has opportunities for various social activities such as fishing events for children, and ecological education.

On the other end of the spectrum, the Baima Canal restorer only has three evident recreational uses: sitting, walking/ jogging, and children’s play. This is due to the fact that the restorer’s goals are mostly ecological, and the social space is simply a narrow floating walkway.

Among the recreational uses, the most prominent one used by all five of the precedents is sitting, as this is a common use of social spaces in general.

The least common recreational uses are fishing, biking, and working/studying. All these uses only occur in one precedent each. First, fishing only occurs at The Jetty. The Jetty’s AFIs are marketed as “fish hotels” (Martin Ecosystems 2017). So, while the AFIs protect fish and provide them with habitat, they also attract the fish for recreational fishers. Other precedents either prohibit fishing or are not fruitful fishing environments. For example, fishing is not explicitly prohibited in Recycled Park, but the seating elements do not provide enough space for casting. The Jetty is also the only precedent where biking occurs because it is the only one that provides enough space without disrupting pedestrian traffic.

Another one of the least-common recreational uses is working/ studying. The use is only existent at the floating park in Merchant Square. The surrounding neighborhood is filled with residences and offices buildings. European Land and Property, the property owners, wanted this floating park to be a place where office employees could come and work on their laptops outside. To support this use, the floating park has a pavilion equipped with WIFI. Although working/ studying is not recreational in a conventional sense, I included it as a recreational use. To the workers, coming to work in the outdoor floating office is a relatively recreational choice compared to going to work in a nearby office building.

3.2.3 Ecological Uses

The uses featured in the ecological matrix (See Section 6.3.5) are those gleaned from company and organization descriptions of their precedents. Recycled Park and the Jetty have the most ecological uses. They both have fully-submerged roots, serve as wildlife habitat, and use eco-friendly materials.

The precedent with the least amount of ecological uses is the floating garden at Merchant Square. Its only ecological benefit is that it serves as wildlife habitat to birds and other animals. The floating garden is not an AFI and does not use eco-friendly materials, sustainable man-made systems, or solely native plants. The floating garden is mostly focused on the social aspects of the space.

The most popular ecological use that occurs in all the precedents is “other wildlife habitat.” “Other wildlife” can mean anything that lies outside the classifications of bird and fish. This could mean anything from beavers to pollinators. Recycled Park, Merchant Square, and the Baima Canal restorer all serve as habitat for crustacea. Then, all the precedents have insects and pollinators. Insects are inevitably attracted to vegetation, which is present on all the precedents

The least-prevalent ecological use litter clean-up. The only instance of this is at Recycled Park. The Recycled Island Foundation not only implemented the floating park, it also has employed multiple litter traps. The plastic litter found in the traps is then recycled to create the floating modules of the park.

3.2.4 Ecosystem Services

To support the ecological uses, I studied and synthesized the ecosystem services of each precedent. Ecosystem services are not limited to what is shown in in the matrix (See Section 6.3.4). However, I tailored them to this list of sixteen ecosystem services that are most relevant to AFIs.

The Jetty has the most amounts of ecosystem services. It is marketed as strategies for water purification and has strong stewardship and educational aspects. The Jetty likely has little impact on the water quality, given its size and the flow rate of the Chicago River. Still, it promotes awareness that may lead to more water-purifying initiatives later on.

The Baima Canal Restorer is the only precedent with evidence that it has significantly improved the water quality. The Baima Canal restorer is confined to a narrow canal which

is a more closed system. It also has an aeration system that moves water through the cycle twice before it is released to the Minjiang River. The restorer has been able to reduce the chemical oxygen demand (COD) and the biochemical oxygen demand (BOD) influent by 92% and the water clarity improved by several feet (Andrews et al. 2013).

The Jetty is the only precedent with the supporting ecosystem service of food. The Chicago river is populated by bacteria from raw sewage due to the city’s combined sewer system (Garcia 2016). Still, some fishermen eat the fish they catch in the Chicago River. The Jetty is a popular fishing spot, so the “fish hotels” are technically food source.

On the other end, Merchant Square has the least amount of ecosystem services. This correlates to its limited ecological goals and use.

As for the ecosystem services themselves, pollination, climate regulation, aesthetic, recreation, photosynthesis, and biodiversity are shared amongst all the precedents because they are typical of recreational green spaces. None of the precedents have erosion regulation as they are either too far from the water’s edge to effectively diminish the effects of erosion, or they are located near hard edges with negligible erosion problems. None of the precedents have the soil formation ecosystem service because their roots are submerged in the water or contained in soil planters and are not part of a soil system. And none of the precedents have the spiritual or religious ecosystem service. Of course, this use is deeply personal and may be serendipitous. Therefore, it is not mentioned in the literature or interviews. However, just because there are no advertised spiritual or religious events that take place within the precedents, doesn’t mean that people don’t have spiritual or religious moments there.

Lastly, an obvious hole in the ecosystem service matrix is the “supporting” category with only one marks. The precedents are not largely used for food production, raw materials, potable water, and medicinal resources. They are recreational spaces, after all. However, the supporting ecosystem services are mostly covered in the historic precedents with AFIs providing raw materials and platforms for agriculture and dwellings (See Section 1.3). Possible future research could explore how AFIs in contemporary design can be used for supporting ecosystem services.

3.2.5 Materials and Methods

The variables in the Materials and Methods matrix are taken from the precedent studies and interviews. The most commonly used material amongst the precedents is decking. This

is present in Merchant Square, “Seeds of Change,” and the Baima Canal restorer. “Seeds of Change” and the restorer both use real wood decking. “Seeds of Change” specifically has sustainable pine decking stained with an environmentally-friendly oil stain. Merchant Square, on the other hand, uses lightweight composite decking.

The most common construction method amongst all the precedents is the use of prefabricated elements. This method is useful when constructing at build sites with a lot of pedestrian traffic. Recycled Park, Merchant Square, and the Jetty all used this method.

The least common, materials/ methods are BioHaven Floating Wetland Technology, plastic cube buoyancy modules, concrete block counter-weights, artificial turf, and constructing on a disused barge. First, I would like to point out that while the Jetty is the only precedent to use BioHaven Floating Wetland Technology, the literature has shown that it is actually one of the most popular AFI systems used. Merchant Square is evidently of unique construction as it is the only precedent that uses plastic cube buoyancy modules, concrete block anchors to prevent lateral movement, and artificial turf. Lastly, “Seeds of Change” is the only precedent constructed on a disused barge.

The precedent with the most materials and methods used is Merchant Square. Again, this is due to its unique construction. The precedents with the least amount of used materials and methods are Recycled Park, “Seeds of Change,” and the Baima Canal Restorer. These three precedents have relatively simple designs, though this is not a limitation.

3.2.6 Governance

Through the precedent studies, most of the precedents stemmed from a desire of the government to improve water quality or add to the city’s green space. Many of these precedents have been funded by different corporations. A precedent’s owner sometimes differs from the client because the client may be leasing out the land from the actual land owner. Many times, the owner or client is affiliated with a municipality. These precedents include “Seeds of Change,” The Jetty, and the Baima Canal restorer. Recycled Park is owned by the Recycled Island Foundation but was a result of a collaboration with the City of Rotterdam. Merchant Square’s floating park was commissioned by European Land & Property, a private real estate company and developer.

More than half of the precedents are part of a larger program or initiative. Recycled Island is part of the Rotterdam Area Program; Merchant Square is part of Greater London Authority’s green infrastructure initiative; and “Seeds of Change” is part of the Port City Project. The Jetty also follows some specific guidelines. Sasaki had to meet the safety standards of the

U.S. Coast Guard and the Army Corps of Engineers to prevent vessels collision. For maintenance, the client usually pays for a hired staff, which usually entails keeping up the plants and picking up litter. However, Recycle Park is the only precedent that uses volunteer maintenance, as it is maintain by the Recycled Island Foundation itself. Another very important aspect of governance is access. Most of the precedents are open to the public year-round except “Seeds of Changes”. “Seeds of Change” is only open by appointment through the Arnolfini Museum year-round.

3.2.7 Economic Framework

Most of the precedents are paid for by government-affiliated owners or clients. However, Merchant Square’s floating park which was paid for by European Land & Property. Some of these precedents have been funded by different organizations or have received donations. Recycled Park received funding from the Audi Environmental Foundation and a donation of about \$5,730 USD from Ecorys, a research and consulting company. Ocean Arks International, a non-profit research and education organization, donated to the Baima Canal restorer. Lastly, The Jetty received grant funding from Friends of the Chicago River for the floating wetlands.

3.2.8 Limitations

In order to create effective design guidelines for social AFIs, it is also beneficial to learn from the limitations of the precedents. The six limitations that I identified are limited social/recreational goals, limited ecological goals, limited public access, limited physical integration of AFI vegetation, limited size, and limited funding. The precedent with the most limitations is “Seeds of Change.” It has limited access for the public, limited ecological goals, limited size, and limited funding.

The most common limitations amongst the precedents limited social/recreational uses, limited ecological goals, and limited size. It’s clear that integrating all these factors is not the aim for most of the precedents. The Jetty is the only precedent without these three limitations. However, it does have limited physical integration with vegetation. The proposed design guidelines aim to create social AFIs without these limitations: a FISR AFI (Fully Integrated, Submerged Roots) with ecological goals that is large enough to accommodate various recreational uses.

3.2.9 Findings and Conclusion of Precedent Studies

The precedent studies have revealed which elements contribute the most to a social AFI’s success. Using the matrices, I have developed a radial graph for each precedent, and a bar chart for the variables represented in each matrix. The radial graphs of each precedent allow us to visually compare the precedents and identify what makes them successful. Meanwhile, the bar charts allow us to see which variables of each matrix are most popular and valued across all seven precedents. Studying the radial graphs, bar charts, and interviews with experts will form the social AFI design guidelines.

The radial graphs allow us to visualize how the precedents compare to each other and pinpoint what contributes the most to each design’s success as social AFIs. The eight matrix themes translate to eight sections on the radial graphs. The radial graphs show what each precedent scored in each matrix on a scale from 0.1 to 1.0 (Fig. 29). However, “Limitations” is a negative value and is measured on a scale of -0.1 to -1.0. I set a 60% threshold for all the themes except “Limitations” (Fig. 29). If a theme meets or surpasses this threshold, it is integral to a precedent’s success and will be considered when forming the design guidelines.

For the “Limitations” sector, I set a 40% threshold (Fig. 29). Precedents that meet or surpass this threshold have considerable limitations that hinder the success of a precedent as a social AFI. The limitations will also be considered when forming the design guidelines. I chose to use these 60% and 40% thresholds because, after testing out several different options, they seemed to be the most effective at highlighting the precedents’ relative strengths and weaknesses.

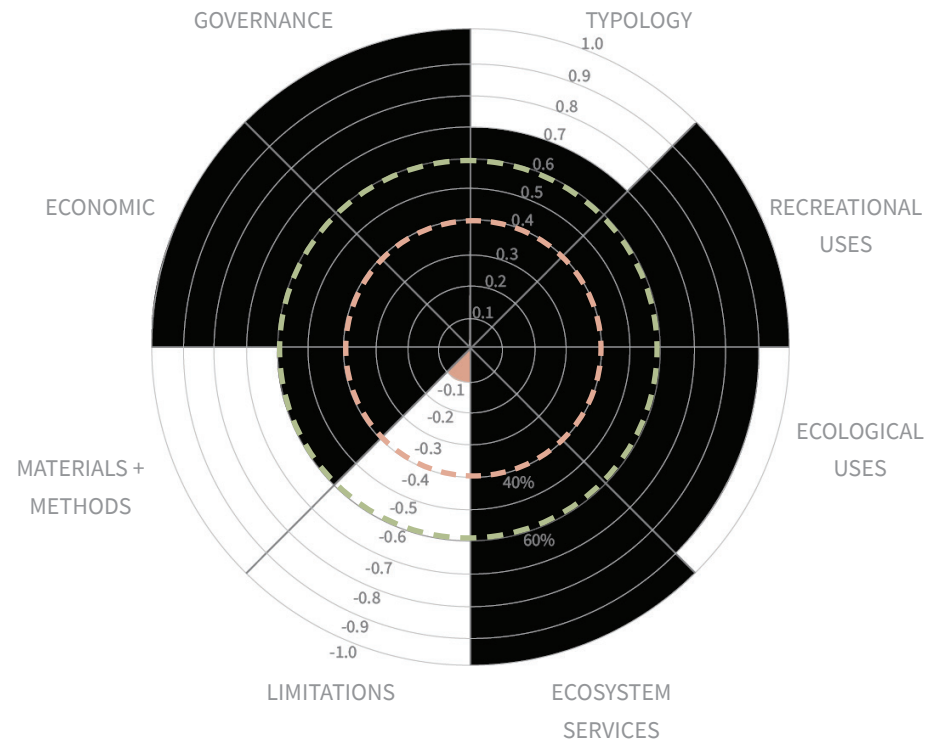


Figure 29: Example showing the scores of the radial graphs (Borelli 2019).

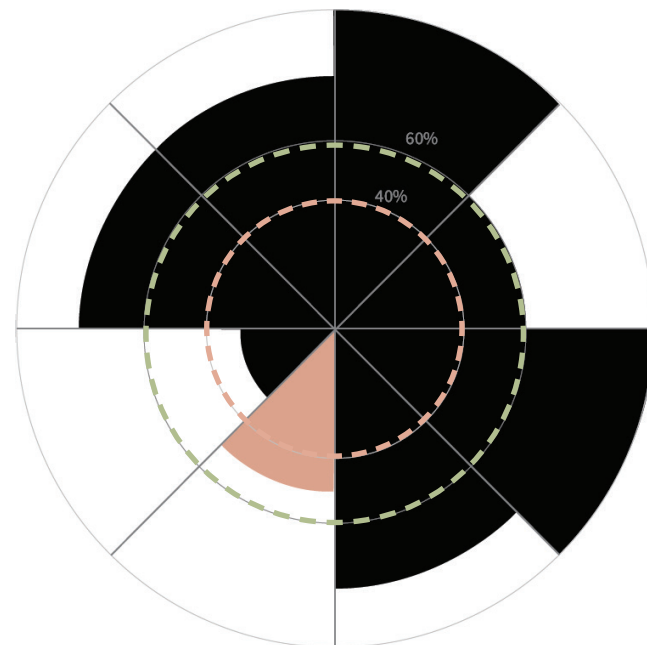


Figure 30: Recycle Park radial diagram (Borelli 2019).



Figure 31: Merchant Square radial diagram (Borelli 2019).

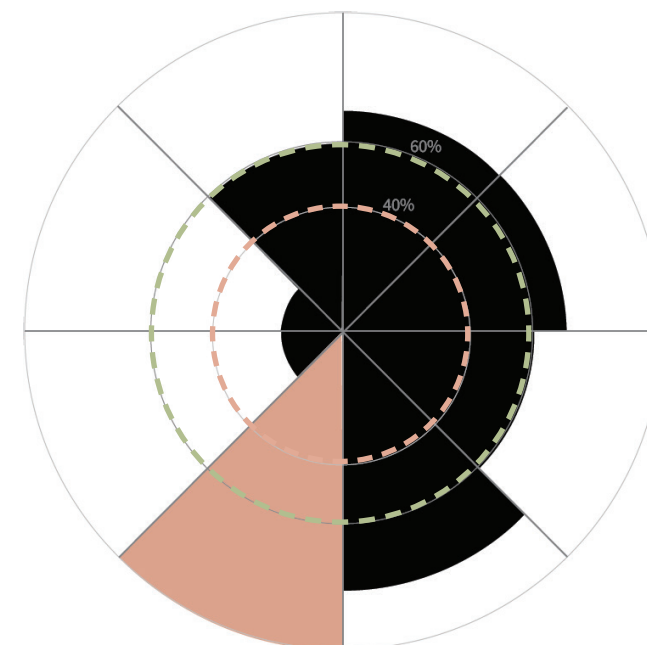


Figure 32: "Seeds of Change" radial diagram (Borelli 2019).

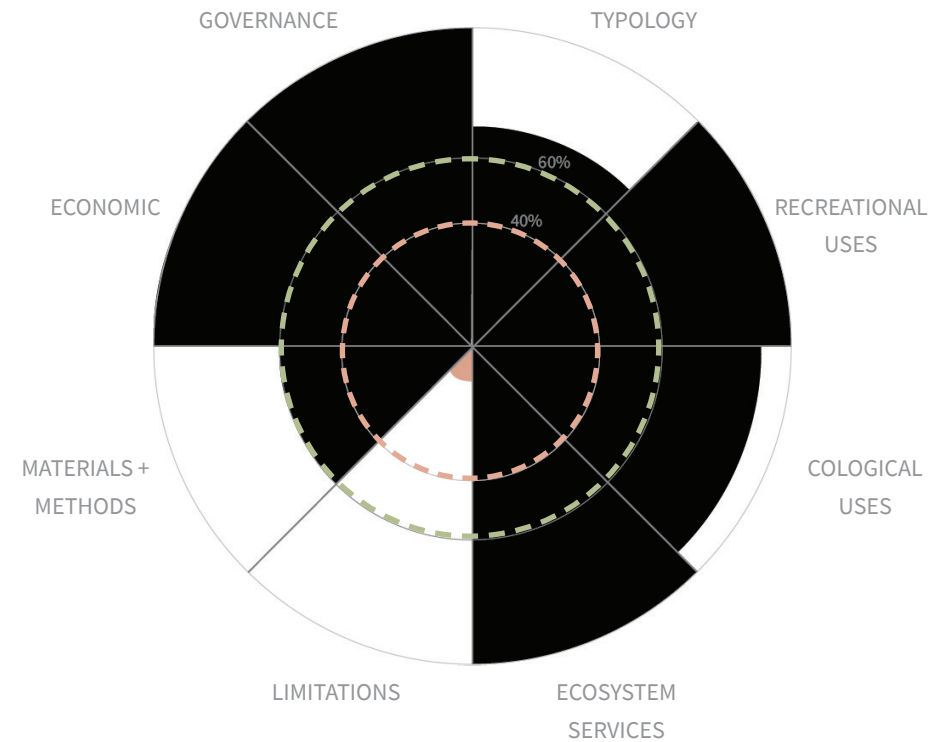


Figure 33: The Jetty radial diagram (Borelli 2019).

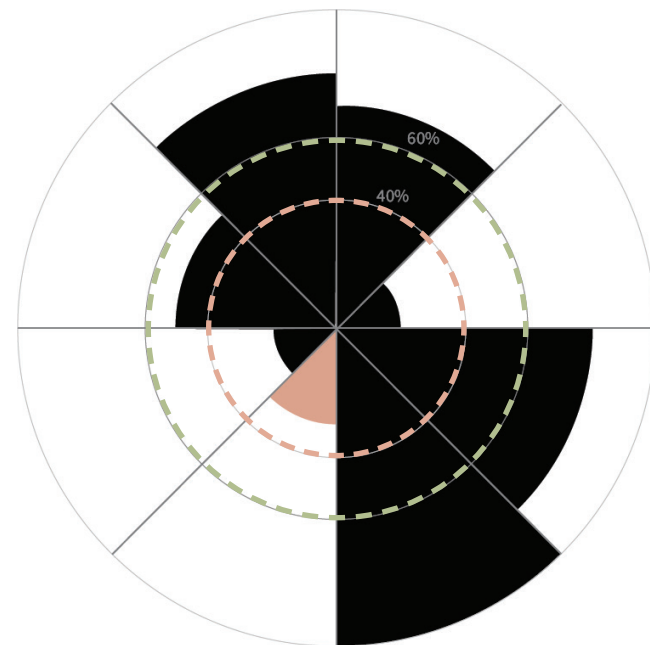


Figure 34: Baima Canal Restorer radial diagram (Borelli 2019).

Using the matrices, I have also developed a series of bar charts. These bar charts help identify which variables from each matrix are most popular and valued. A variable that passes a 40% threshold is used and valued enough to influence the design guidelines. For example, the highest value reach on the “Recreational” chart is 30 (Fig. 35). Forty percent of 30 is 12. Therefore, a value must be greater than or equal to 12 to cross the 40% threshold and be used to form the design guidelines. In this case, community engagement, special events, bird and wildlife watching, walking/jogging, sitting, photography, viewing scenery, ecological education, and other education would be used to inform design guidelines. Variables that do not cross the threshold such as fishing, biking, children’s play, working/ studying, and dining will not inform the guidelines. However, just because these variables do not reach the 40% threshold does not mean that they aren’t valuable.

As with the radial graphs, I chose to use a 40% threshold for the bar charts because, after testing out several different options, they seemed to be the most effective at highlighting which variables are most valued and used amongst all the precedents.

The “Limitations” bar chart is a special case. Instead of showing the positive value of each variable like the other charts, “Limitations” shows the severity of each variable. Variables that reach or surpass the 40% threshold should be taken into account and remedied through the design guidelines. Thus, Figure 42 indicates that “limited physical integration with vegetation” is not as severe as limited funding, size, public access, ecological goals, and recreational uses.

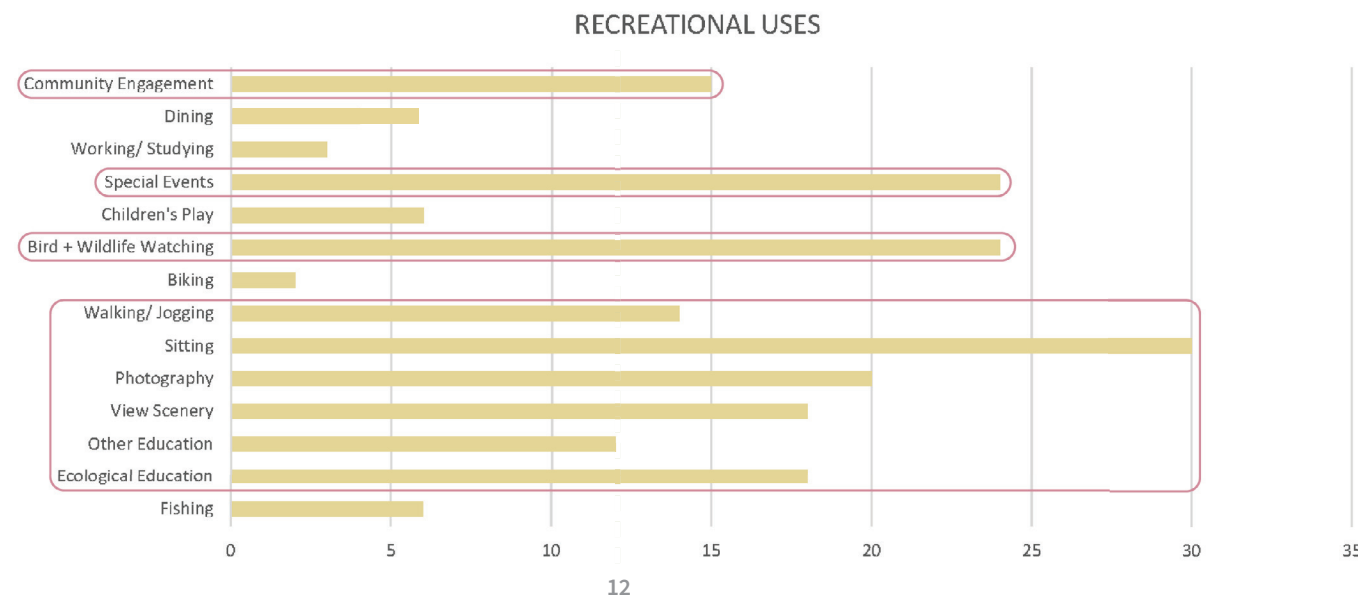


Figure 35: A 40% threshold shows which recreational variables are most valued and used (Borelli 2019).

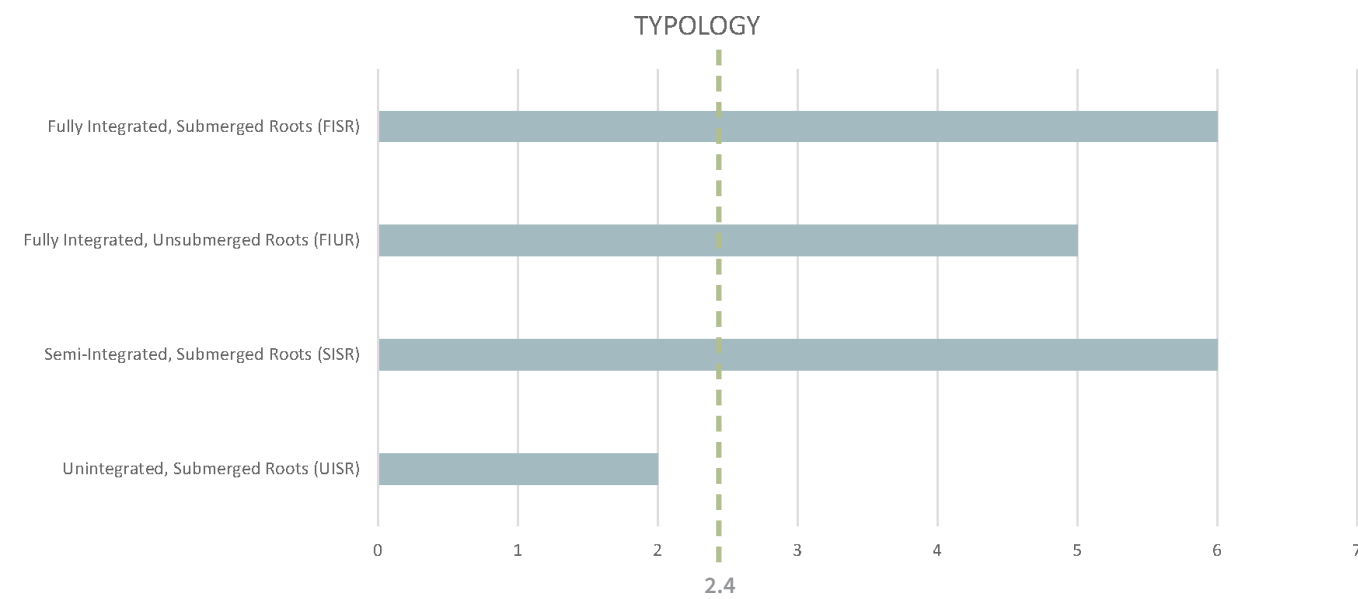


Figure 36: Value of typology variables (Borelli 2019).

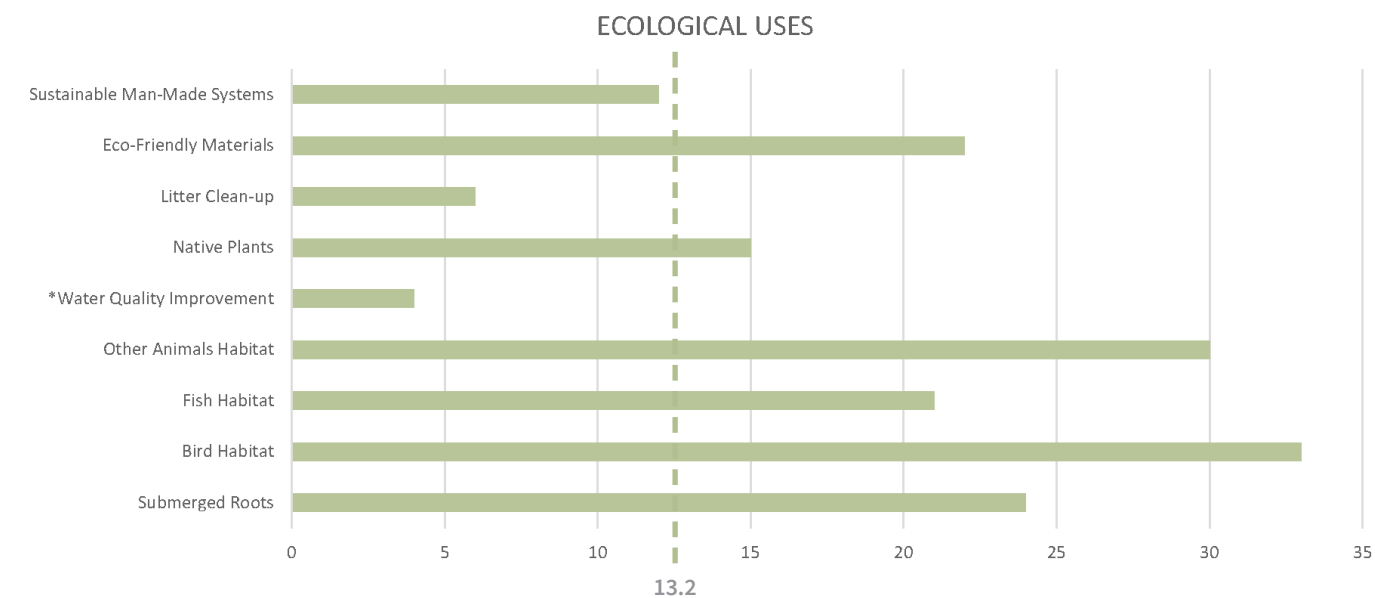


Figure 37: Value of ecological variables (Borelli 2019).

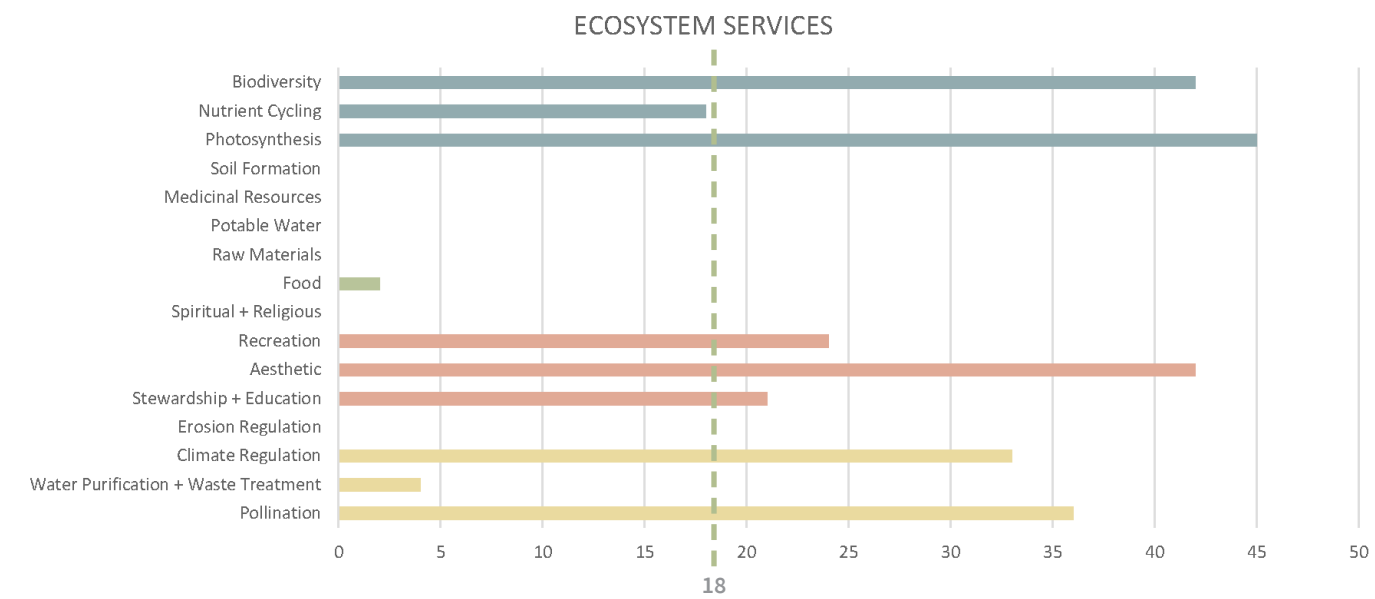


Figure 38: Value of ecosystem services (Borelli 2019).

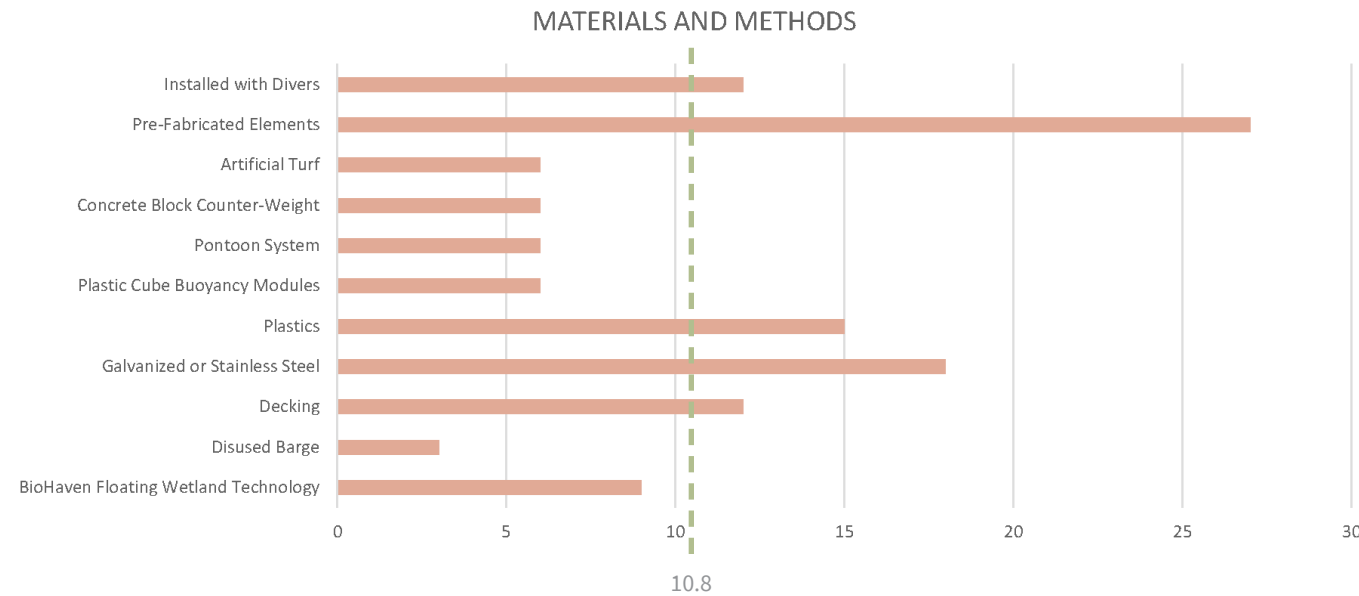


Figure 39: Value of materials and methods (Borelli 2019).

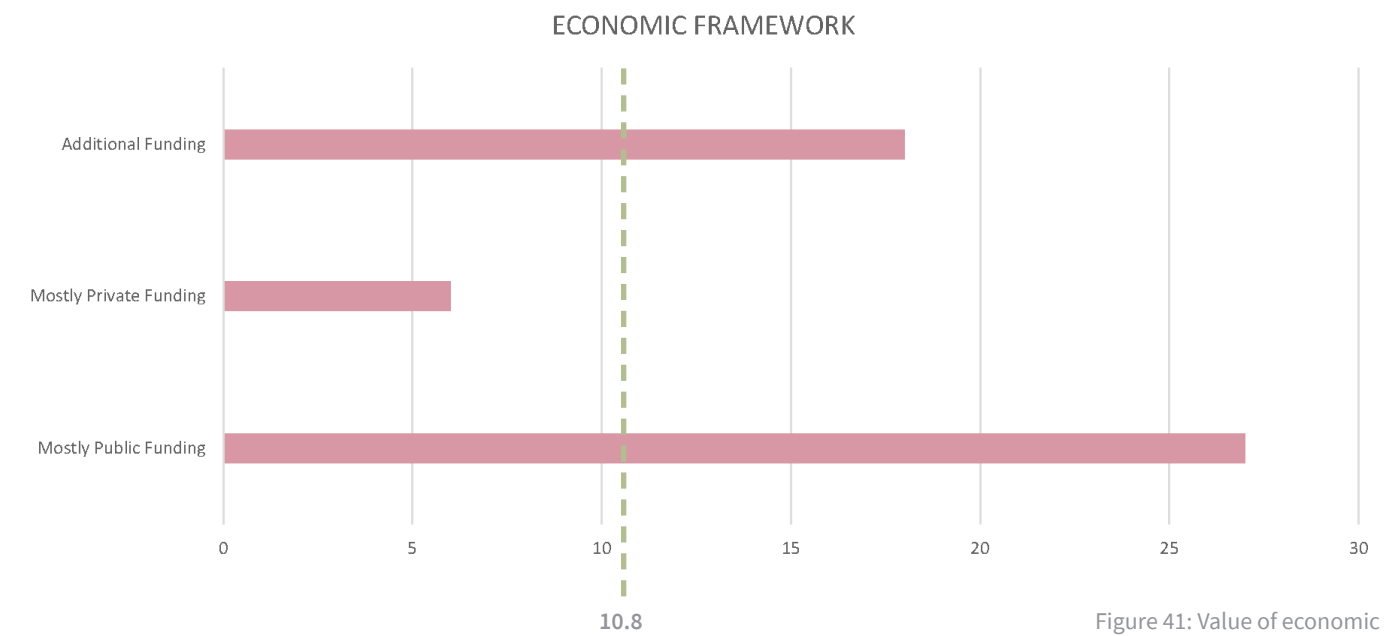


Figure 41: Value of economic variables (Borelli 2019).

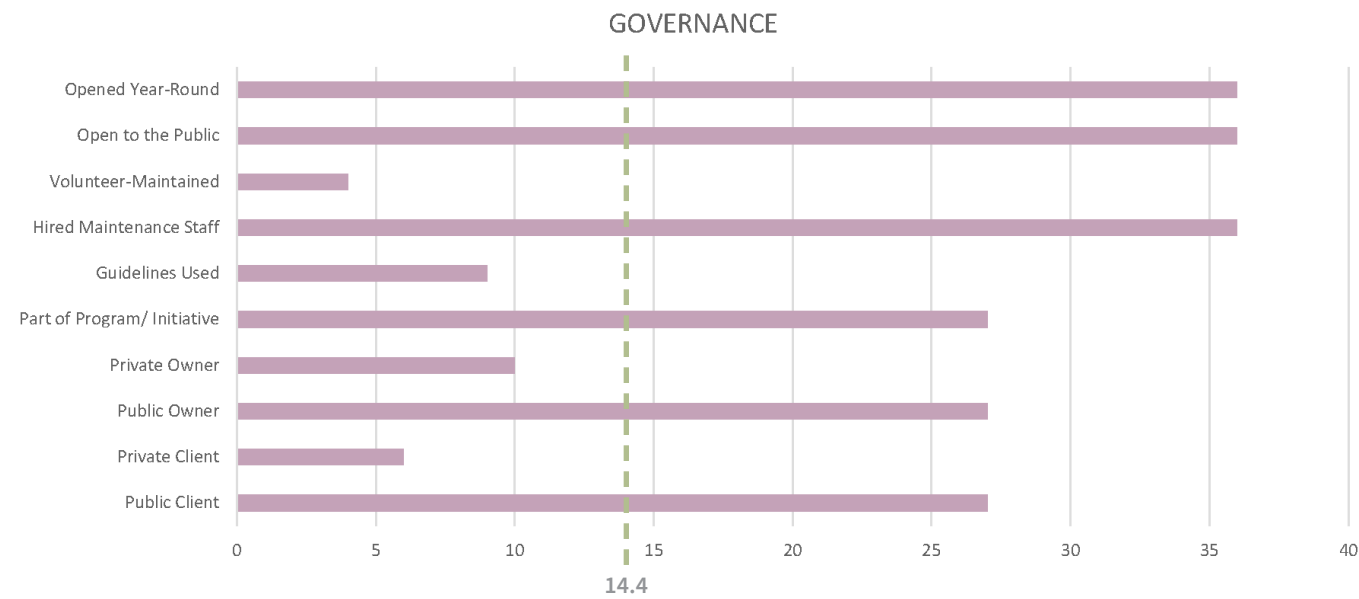


Figure 40: Value of governance variables (Borelli 2019).

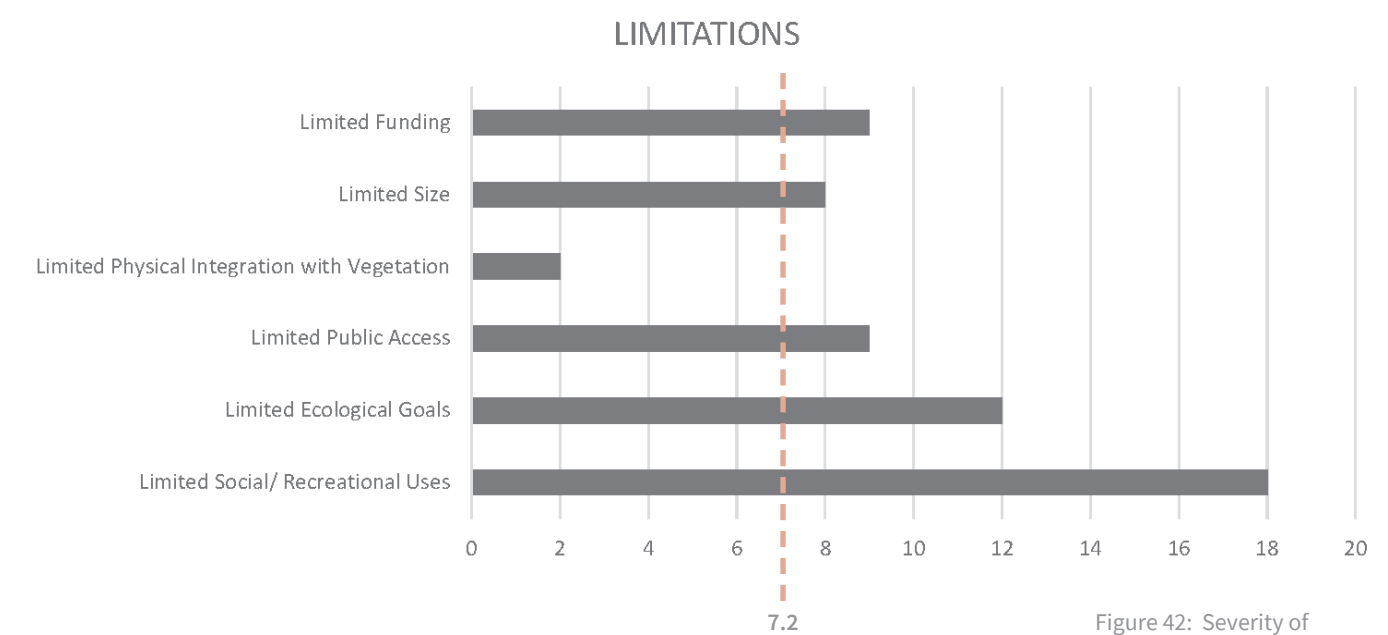


Figure 42: Severity of limitations (Borelli 2019).

3.3 Interviews

To supplement the precedent studies, I have conducted a series of interviews with precedent experts. See Section 2.3 for interviewee profiles. In addition to informing the matrices discussed in Section 3.2, I have also studied the interviews and extracted key takeaways from each. See Appendix B for the full transcripts of each interview.

3.3.1 Recycled Park – Ramon Knoester from the Recycled Island Foundation

The interview with Ramon Knoester interview taught me that was unique from the other interviews. Knoester explained that there has been a good response to Recycled Park from both humans and animals. Knoester listed several species including fish and birds that like to visit the park and how it engages human users. “...You see that really draws a lot of enthusiasm from the people that visit the park.”

Recycled Park has drawn a lot of attention both for its abundance of wildlife and construction. People from recycling industries, schools, and other cities and countries come to see the park, seeing how plastic was recycled to create the modules, and wondering if they can implement a floating park in their own cities. Recycled Park was funded by local and national government subsidies. Extra financial help was provided through donations and discounted materials and services. Knoester had to apply for a building permit, especially because the park would be accessible to the public. When I asked if the seating elements are accessible in high water Knoester replied, “Oh, yes. Of course.”

Knoester talks more about the modules themselves. While some of the modules allow plants’ roots to be fully submerged in the water, some of the modules are enclosed and filled with soil, keeping the roots contained in the floating planters. Recycled Island Foundation maintains the park themselves. They go out to the site about once a month to maintain the vegetation and remove plastic litter. Knoester says that for the past year they have been able to let the plants grow without irrigation. However, the first summer the park was installed there was a drought. For long-term drought conditions there is a water buffering system inside the park to irrigate the plants.

When I asked Knoester what feedback he has received for Recycled Park, he responded that it was very positive, “...and also the general response is that people would like to have it bigger.” Knoester adds, “...We’re still depending on funding and collaboration from the city of Rotterdam.”

The main takeaways from this interview are:

- Users respond well to seeing wildlife.
- There are many different potential sources of funding for social AFIs
- It is possible to have a combination of fully-submerged and unsubmerged roots.
- Water buffering systems provide effective irrigation and are especially beneficial in drought conditions.
- The size of the social space should be large enough to accommodate uses other than sitting and visiting.

3.3.2 Merchant Square – Ben Dewhirst from Garden Club London

During the phone interview with Dewhirst, I realized how critical the structural aspects are for a completely free-floating design. Dewhirst implied several times during the interview that this was certainly the greatest challenge for this design and most of our conversation was focused on the construction materials and methods. Dewhirst described the buoyancy strategy that they used, “The buoyancy modules we ended up using were these little plastic cubes...” Dewhirst explained that since the modules were small (about 19.5” x 19” x 15”) they offered more flexibility for the layout of the footprint. The modules are stacked in varying layers across the structure with divers assisting for precise module placement ensuring a level finish. Dewhirst explained that for this reason, and because the site was so busy with pedestrian traffic, that they tried to prefabricate as much as possible off-site, “...but to the size where we can still move it through site safely and with minimal risk to general public people and minimal costs to the client... We had to manually move all the materials through the site between the busiest hours.”

Dewhirst described some other challenges of the plastic modules, “If it gets really hot, the modules expand and push up certain corners up a little bit.” Regardless of these challenges, the plastic modules have been successful in guaranteeing appropriate buoyancy. In addition to making the pocket park float, Garden Club London also had to figure out how to balance and distribute the weight of the planters, site furniture, and visitors moving across it. Dewhirst says “...when it gets really wet, they sink because of the weight of the soil or the water storing in the planters.” But on the other hand, Garden Club London tried to reduce the amount of heavy soil as much as possible, “We’re certainly only operating with about 400 millimeters of topsoil. And then the rest is a drainage layer, then lightweight void former.” They also installed artificial turf to minimize build-up and weight, in addition to maintenance and aesthetic reasons. Dewhirst expressed that with this design-build

project, the underlying goal was to “...be light-weight, low maintenance...” In addition to the light-weight, buoyant design, the builders also tethered the floating park to a couple of one-ton concrete blocks that rest at the bottom of the canal to anchor the park and keep it in place. Garden Club London has the plant maintenance contract for the site, and Dewhirst says that he frequently measures the water levels around the edges of the park to monitor how it sits in the canal.

Dewhirst also described some of the ecological aspects of the floating park. He pointed out that they designed an AFI that floats independently from the rest of the park and is designated for waterfowl and other birds. In addition to this, even though the plants’ roots are contained in planters and are not submerged in the water, a habitat under the floating park has emerged. “The modules actually have started to moss up underneath and creating a little environment under there.” Dewhirst also says that he has seen crawfish around the site and an increased number of fish. When asked what he thought could have been done to improve the design, he said, “I think we could have investigated beneath the water more to see what could be done under there, or if we could set up a camera to monitor underneath it now that it’s grown up a bit of moss.”

The main takeaways from this interview are:

- Plastic buoyancy modules are appropriate for a social AFI floating base.
- Pre-fabricated elements are favorable for a busy site. Divers may be needed for installation.
- Sunlight (or lack thereof) and wind should be considered in social AFI designs. The presence of adjacent tall buildings will significantly affect this.
- When choosing materials, opt for those that are lightweight and low-maintenance.
- Post-implementation monitoring is critical to ensure the design is holding steady.
- Although AFI vegetation may be fully integrated with social space, there are ecological benefits to having an AFI for wildlife that floats independently from the rest of the design but is still close enough to offer educational value.

3.3.3 “Seeds of Change” – Maria Thereza Alves

The interview with Maria Thereza Alves exhibited why funding is so important for a social AFI. When I asked Alves if there had been any post-implementation studies done, she

expressed that, “These questions are not very applicable if you’re an artist because you don’t get any post production monies to be able to do that.” Alves disclosed that because, of the lack of funds, the installation has been converted into an area for bee pollination. The area has been closed to the public and maintenance of the site has ceased. In addition to pollinators, Alves says that birds are also keen to the floating garden, “They like it because it’s higher from the water, but a duck can fly onto it, a seagull can fly onto it. It’s like a landing pad and they’re near the water and away from people.”

However, back when “Seeds of Change” was open to humans, it was very popular. “The feedback I have is that it is the most visited public work in Bristol.” As an exhibit for the Arnolfini Centre for the Contemporary Arts, “Seeds of Change” was the site of lectures, tours, school visits, and concerts. “It was something very simple that was about celebrating the garden and that would have comfortable seating for people.”

Part of its success can be attributed to its accessibility and visibility. Alves recounted, “... somebody from the city council called me and they had a proposition which was a barge in the center of town, which was perfect. I really liked the idea because you could look at the garden from on top a public pathway that is very well used.” She also expressed that she liked the barge because its position made it virtually vandalism-proof. This is something that cannot be completely avoided without limiting the public’s access, but it is a consideration for social AFI portions that are designated for wildlife.

At the end of the interview I asked Alves what she thought could have been done to make the design more successful. She expressed that a covered area and protection from the wind and the rain would have been helpful. “If we had a bigger space, a little covered area would have been nice.”

The main takeaways from this interview are:

- Readily available funding is key to keeping a site well-maintained and accessible to the public.
- Special events are an effective way to draw in users.
- Clear visibility from adjacent public spaces lends to a social AFIs accessibility.
- In some contexts, overhead structures should be used for shelter from the elements.

3.3.4 Chicago Riverwalk – Steven Walz from Sasaki

During my interview with Steven Walz I learned how the design and construction underneath social AFIs can be used to enhance its ecological aspect. Walz started off the interview by identifying the design team’s underlying inspiration and goals. They wanted to emulate the ecology of the Chicago River before it was affected by urbanization and the Industrial Revolution and, ultimately, bring back fish and mammal species back into the river. Secondly, they wanted the Jetty to become an outdoor classroom where people could learn about the local ecology.

The floating wetlands of the Jetty are planted with an all-native palette. In addition to this, Sasaki developed a couple of construction strategies that enhanced the design as a wildlife habitat. The first strategy is to install “lunkers” around the underwater structural piers, or “caissons”. These steel lunkers have holes punched out of them big enough for fish to fit through. This provides a place for fish to be protected from predators. The second strategy is to hang nylon rope underneath the structure. This allows more surface area for helpful biofilm to form like it would on the plants’ roots. These nylon ropes are installed around the caissons and under the walkway.

Walz says that he has not noticed increased fish population in the river, but the University of Michigan is conducting a case study that will show what impacts the Jetty has had on the water quality and fish population. In the meantime, Walz says that there has been a noticeable increase in other wildlife, “...I have definitely seen ducks and geese sitting on top of the floating gardens or around them...There’s also a ton of butterflies and birds that otherwise wouldn’t be down here without these floating gardens or the planting improvements that were made along the river in general.”

Walz explained some other design strategies in the Jetty. The Jetty was designed to be flood-resilient, as the water levels can vary in 8 feet. “...you also need to account for the lateral forces of ice flows and wave action from boats when it’s in the summertime.” He discloses that this was the reason for the stainless-steel frames around each floating wetland. “[The water] has all these salts and solids that are discharged into the river. So, we use marine-grade stainless steel to promote its longevity in the water... Everything’s precast granite for hardscape, 316 marine-grade stainless steel, and hardy hardwood species. Everything is meant to be able to be washed down with either a light power washing or minor scrubbing after a flood event. There is silt material that accumulates on the walking surfaces and, sometimes, on the seat walls, depending on how flooded it gets.”

BioHaven planting matrix floats independently with in the steel frames. However, after their implementation, Sasaki noticed that the lateral wave action was washing out the first three rows of planting. “...I think the lessons learned was we didn’t have wave action studies that were done.” To remedy this design problem, they installed a fiberglass fin along the waterfront edge of the floating gardens. Walz said that the wave action also loosened the screws that held the stainless-steel link of each frame. This problem was solved by simply tack welding the connections into place.

The Chicago Riverwalk was a high-profile public project. During the interview, Walz described some of the different funds they received for the project and some of the guidelines Sasaki had to follow with the design. “...there were over 20 regulatory agencies involved with the permitting of the Chicago Riverwalk...” Walz explicitly mentions the United States Coast Guard, the Army Corps of Engineers, the Illinois Department of Natural Resources (IDNR), the Chicago Department of Transportation (CDOT), and the City of Chicago Mayor’s Office for People with Disabilities (MOPD). The U.S. Department of Transportation, USDOT provided a loan for the entire Chicago Riverwalk. But additional funding from the National Fish and Wildlife Foundation was given specifically for the lunkers and nylon rope “pole hulas” and “lonetic curtains.”

The main takeaways from this interview are:

- Strategies constructed underneath the social AFI base can provide extra habitat and add to the ecological value of the design.
- Select durable materials that can be easily maintained.
- Make sure that the design is resilient against any lateral forces such as waves or ice.
- High-profile public projects may be well-funded.

3.3.5 Urban Canal Restorer – Dr. David Benjamin from John Todd Ecological Design

During my interview with Dr. David Benjamin, I learned more about how AFIs can be designed and used to significantly improve water quality. Benjamin started off the interview by describing the different gradations of artificial floating islands. At one end of the spectrum is an AFI that is constructed out of fiberglass, media mesh, or metal, and either has plants, an artificial remediation system, or another treatment system. At the more natural end of the spectrum is an AFI that is constructed out of more natural materials like jute or soy fiber in addition to media mesh or fiberglass. According to Benjamin, the more natural version of an AFI is planted with plants and inoculated with beneficial bacteria and mycorrhizae.

In most cases, AFIs are implemented more with the intention of benefiting wildlife or bringing native species back into the area. Water treatment is often seen as a side-benefit. However, Baima Canal and other John Todd Ecological Design projects aim to noticeably change the water quality of a system. And, in the case of Baima Canal, they successfully reduced pollutant levels and increased the water clarity. John Todd Ecological design did this by inoculating the AFIs with beneficial bacteria and cycling the water twice through an aeration system before releasing it to the Minjiang River. Benjamin says that before the Baima Canal restorer, people could have gotten sick from contact with the canal water. During the interview, Benjamin stressed the importance of knowing what kind of affluents are coming into the water system over time so that they can be treated properly through the AFI design.

Benjamin also highlighted the importance of funding, saying that if he could improve upon the design, he would conduct a post-implementation evaluation. Unfortunately, the government will not fund it. However, they’ve received good feedback on the restorer. The smell of the canal is gone, people aren’t getting sick from the water, and the restorer is being used as a sort of public park. Benjamin also wishes that the community would start a community service organization for the restorer.

Animals have start using the restorer too. Benjamin mused, “I would probably guess that there’s crustacea and maybe even fish, waterfowl maybe, but I’m not sure about that”. Overall, the project has significantly improved the water quality, re-introduced some species into the system, and improved the quality of life in the surrounding neighborhoods.

The main takeaways from this interview are:

- Be aware of the context and what you’re working with before designing an AFI.
- There are different strategies that can be used to increase water remediation.
- There is a gradient of how artificial or naturalized an AFI is. This is dependent on its materials and remediation strategies used.

3.3.6 Overall Interview Themes

The three main things that I learned through the interviews were about construction materials and methods, ecological strategies, and funding. First, I learned the most about construction materials and methods. This was very beneficial because I had trouble finding literature on it for the precedent studies. I learned the most about materials and methods from Walz and Dewhirst, as they were both leads/managers of their projects and overlooked the construction. Through the interviews I learned what to consider when selecting a site, what kind of materials are appropriate for an AFI design, and how to make the AFI installation go more smoothly.

Second, I learned about various ecological strategies through the interviews. All five of the interviewees discussed different ecological strategies. Users respond well to seeing wildlife and I learned different ways to maximize wildlife habitat while keeping the human users comfortable, and the animals safe.

Lastly, I learned about the importance of funding for an AFI site. This was evident through all the interviews, but Knoester, Alves and Dr. Benjamin spoke specifically about how their designs would improve if there was more funding available. Of course, this is an issue when designing any public space, but it is more critical for a social AFI. Funding is especially critical for a social AFI site to sponsor its maintenance and post-implementation monitoring. This ensures that the structure remains stable and usable. Walz and Dewhirst also spoke of funding, though not about a deficit. The Jetty and Merchant Square are both very high-profile projects and were able to obtain sufficient funding for their installation and upkeep.

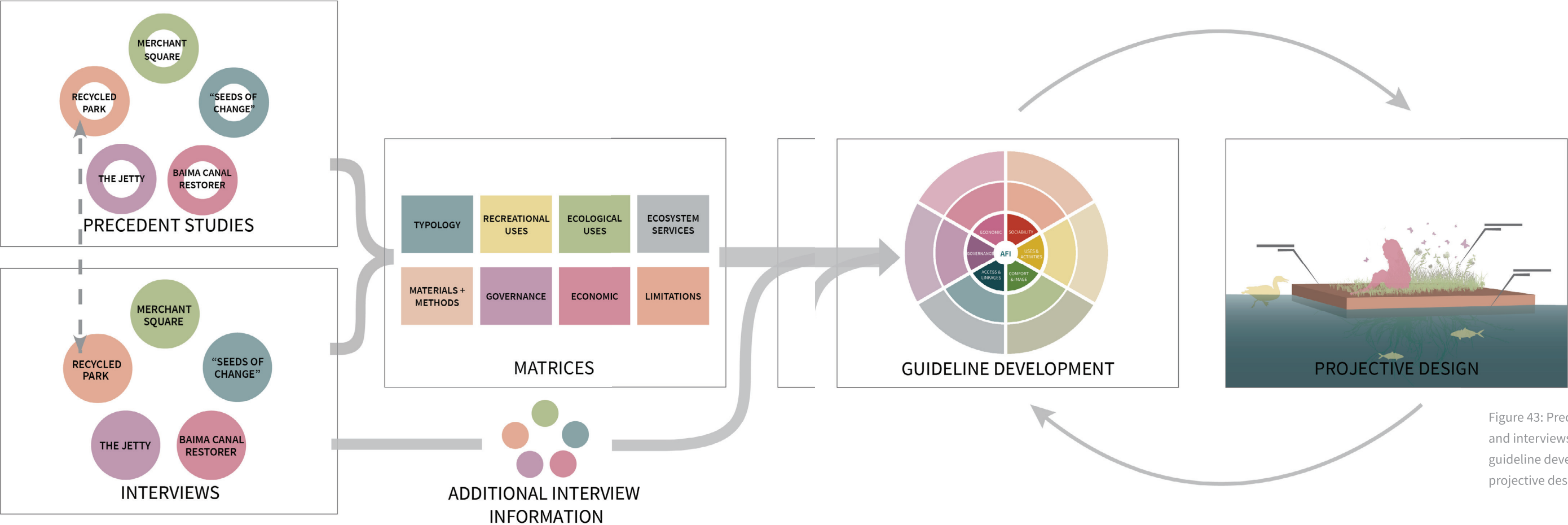


Figure 43: Precedent studies and interviews contribute to guideline development and projective design (Borelli 2019).

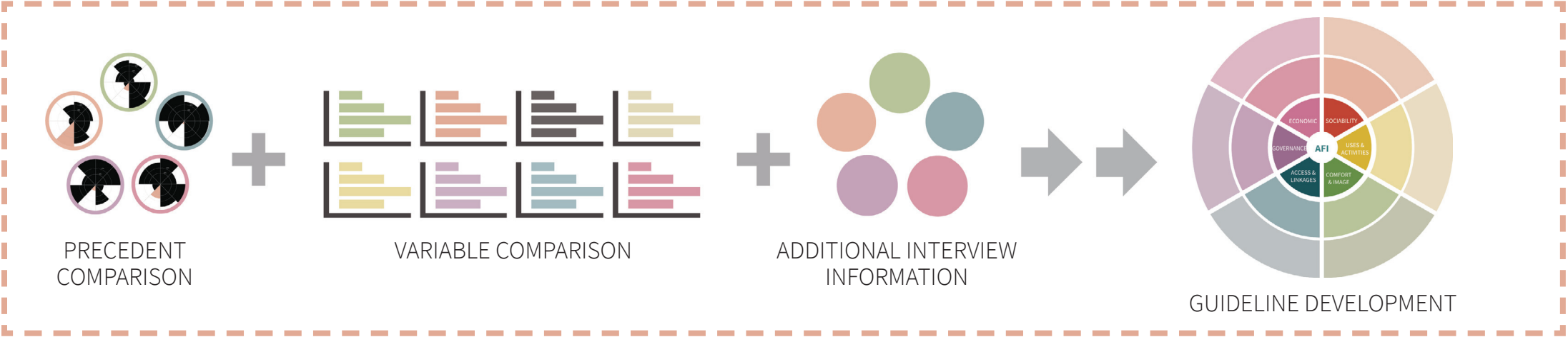


Figure 44: Precedent comparison radial graphs, variable comparison bar charts, and additional information from Interviews will help develop the design guidelines (Borelli 2019).

3.4 Guideline Development

The next step in my research is guideline development. The guidelines are informed by the precedent studies, interviews, and an iterative process of projective design. I have analyzed the precedent studies and interviews through matrices, radial graphs, and bar charts. These three things, along with additional interview takeaways have informed the design guidelines for social AFIs.

3.4.1 Design Guideline Development

To create the design guidelines, I have used the scores from the precedent comparison radial diagrams, the most-valued variables from the variable comparison bar charts, and the most relevant pieces of information from the interviews. I have synthesized these three elements, grouped together the findings from all, and distilled them into draft guidelines (Fig. 46). Then, an iterative process of projective design and guideline development has helped finalize the design guidelines for social AFIs (Fig. 45) (See Section 3.5 for projective designs).

3.4.2 Resulting Guidelines

The following are the final design guidelines for social AFIs. Some of the guidelines have stipulations. For example, a guideline may say that a certain material is appropriate in a certain context, but not another one. The following guidelines are not set rules. Rather, they are simply meant to inform social AFI design with judgement from the designer. The guidelines are organized into different sections derived from the framework (see Section 2.4). The sections are Sociability, Uses + Activities, Comfort + Image, Access + Linkages, Governance, and Economy.

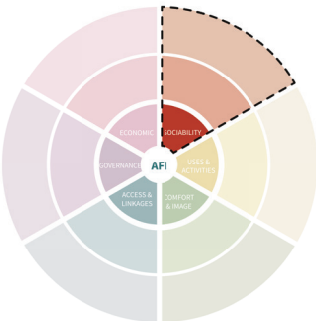


Figure 45a

3.4.3.1 Sociability

“Sociability,” pertains to the sense of ownership of a social AFI. This section of the guidelines includes community engagement, stewardship of the place, education, and inclusion of the local culture.

- Integrate native plants and wildlife habitat wherever possible. Visual access to wildlife increases stewardship, community engagement, and the educational value of a social AFI. However, be conscious that in some cases, the proximity of wildlife may be uncomfortable for the users.
- Although these guidelines encourage the physical integration of AFI vegetation and social space, it is beneficial to have a wildlife AFI separate from the main, social AFI. Position the wildlife AFI close enough for the users to observe wildlife, but far

enough away to provide more comfort to both the wildlife and users.

- For more effective fish habitat, maximize the space under the AFI with man-made strategies, such as nylon ropes that gather biofilm in the water like plant roots and offer more habitat for vulnerable fish. These man-made strategies will also add to the educational value of the AFI.
- Where possible, attempt to integrate food production into the AFI. Such provision may include plants, fish, or mollusks. This can engage the community and encourage stewardship of the AFI. However, be aware of the waterbody’s contaminant levels. A high level of pollutants can contaminate the food and be potentially harmful to humans.
- Install educational signage to inform users of the local ecology, the AFI’s systems, and any other relevant information such as aquaculture or local history.

3.4.3.2 Uses + Activities

“Uses + Activities” pertains to the active use of a social AFI. This section of the guidelines includes the day-to-day use of the AFI, as well as special organized events.

- Integrate unique features into the social AFI, such as art installations or interesting lighting. This will create more opportunities for photography and attract more users.
- Work to encourage organized, special events on the social AFI, as it will draw in users and garner public support. Such special events include but are not limited to:
 - Concerts
 - Community socials
 - Lectures and talks\
 - Yoga classes
 - Happy hours
 - Fishing events
- Provide comfortable and varied seating that can accommodate special events, as well as a myriad of day-to-day recreational activities.

3.4.3.3 Comfort + Image

“Comfort and Image” pertains to the physical design and perceived image of a social AFI. This section of the guidelines includes materials used, maintenance procedures, and creation of a safe, comfortable AFI.

- The social AFI must be large enough to accommodate different recreational uses. However, it is critical to consider the contextual limitations when determining the

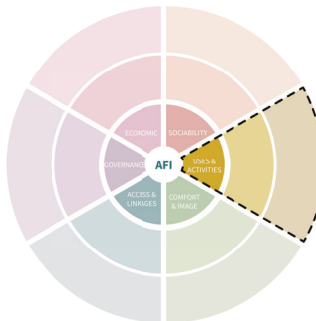


Figure 45b

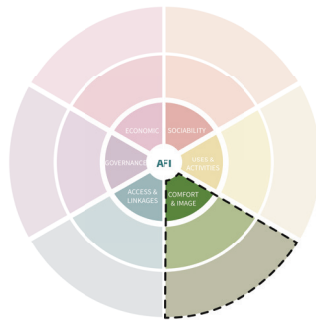


Figure 45c

size of a social AIF. Some limitations include wave action, available space, and local regulations.

- Materials should be attractive, lightweight, durable, and low-maintenance. In addition, make an effort to specify recycled and eco-friendly materials. Appropriate materials for social AFIs include but are not limited to:
 - Light- weight composite decking
 - Galvanized or stainless-steel for edging
 - Floating wetland matrix like BioHaven mats for plantings
 - Recycled, non-toxic plastics
 - Artificial turf for lawn areas

These materials can create a self-buoyant system. If the system is not self-buoyant, then use additional buoyancy materials such as a pontoon system or plastic buoyancy blocks. Calculate the weight of the AFI - taking into account visitor occupancy - to determine what buoyancy strategy is best for the design.

- Materials must be easy to clean, as silt and other build-up may occur.
- Materials must be able to hold up against lateral forces from wave action and ice, and other weathering.
- Pre-fabricated elements are favorable for a busy site.
- Consider using divers when installing the AFI.
- Balance the weight of site elements on the AFI.
- Strive to establish post-implementation monitoring. It is critical to ensure that the design remains stable.
- Where applicable, include overhead structures to shelter visitors from the elements. The structure must be stabilized, should not impede views, and its weight must be accounted for.
- Provide adequate lighting to promote night-life usage.

3.4.3.4 Access + Linkages

“Access and Linkages” pertains to the accessibility... both physical and visual... of a social AFI. This section of the guidelines includes site selection and different strategies for access.

- Social AFIs must be held in place close the water’s edge to maintain accessibility. Different options for keeping the AFI stationary include:
 - Tether the AFI to multiple vertical piers inserted into the bottom of the water body.
 - Tether the AFI to shore with cables. This method works in a site with low wave action.

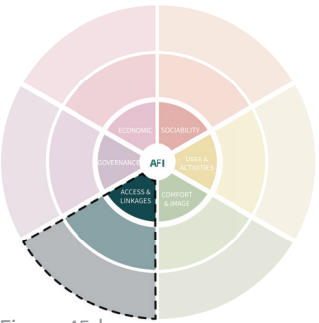


Figure 45d

- Tether a concrete block – sized relative to the AFI – to the bottom of the AFI. This is not applicable on a site with high water level variability.
- Make access ramps that are adaptable to varying water heights.
- The AFI should be placed in a site so that it does not conflict with boat traffic.
- A social AFI should be directly accessible and clearly visible from adjacent terrestrial public space.
- Social AFIs should be situated in an area with relatively high existing foot traffic.
- Social AFIs should be situated in a place with significant scenery, whether it be naturalized or urban.
- When choosing a site, consider the sunlight – or lack thereof – and wind.
- A social AFI should not be too exposed to the elements.

3.4.3.5 Governance

“Governance” pertains to the management of a social AFI. This section of the guidelines includes ownership, programs and initiatives, who’s responsible for the maintenance, and when the AFI is open to the public.

- Aim to become part of a program or initiative. It is an effective way to garner support and increase public awareness of the social AFI.
- Having a public owner or client usually entails hired maintenance staff and, sometimes, security.
- The owner or client must be able to provide consistent funding for ongoing maintenance and monitoring after the social AFI’s implementation.
- Allow the social AFI be opened to the public year-round.

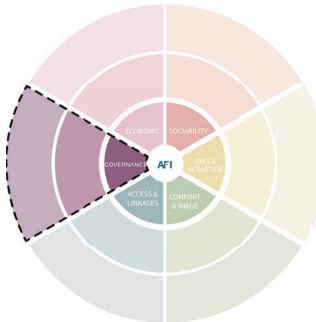


Figure 45e

3.4.3.6 Economy

“Economy” pertains to the finances of a place. This section of the guidelines includes who pays for the fabrication, installation, and maintenance of the AFI, and any additional funding from outside parties.

- Be aware that readily available funding is key to keeping a site well-maintained, monitored, and accessible to the public.
- When needed, apply for public and private funding such as grants and loans.
- Work to market the social AFI. High-profile public projects tend to be better-funded.
- Maximize the ecological and educational aspects of the social AFI, as it is more likely to be better-funded.

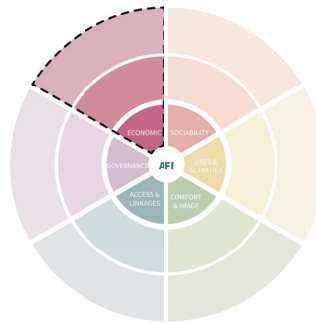


Figure 45f

3.5 Projective Design

Using the design guidelines, I have developed a projective design for a social AFI in Rotterdam, the Netherlands. The Dutch have a long history and experience in water management. They have been very successful with reclaiming land, but what they reclaimed, they’ve developed. Thus, Rotterdam faces the problem of having too much water and not enough land for green space. The city has started to view the abundance of water as an opportunity for unique design. AFIs are a way to reclaim space on the water.

There are quite a few precedents in Rotterdam where floating designs have been used to reclaim space. Such precedents include Recycled Park (See Section 2.2.1) and its adjacent Floating Pavilion in Rijnhaven (Fig. 47). Rijnhaven was also the location for “Dobberend Bos,” or “Bobbing Forest,” a floating art installation by Jorge Bakker. The installation included buoys planted with small beech trees floating the harbor (Fig. 46).

Casanova and Hernández also envisioned a concept for floating open spaces in Rotterdam. Their concept, “Atoll,” is an urban acupuncture strategy. Floating park modules can be quickly constructed and tugged around Rotterdam’s many canals. These floating parks are meant to temporarily fill the public outdoor needs of changing neighborhoods. Some models that Casanova and Hernández have conceptualized are the “Park atoll,” “Eco atoll,” “Theater atoll,” and even a “Golf atoll”. The authors proposed potential sites for these floating interventions in the Rotterdam area (Fig. 48) (Casanova and Hernández 2014).



Figure 46: Bobbing Forest
(Oliver Scheffer n.d.).



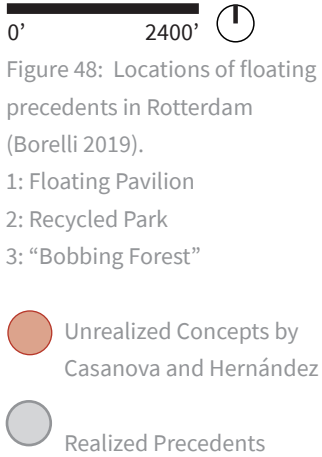
Figure 47: Floating Pavilion
(Rick Lightelm 2012).



3.5.1 Site Selection

An important aspect to social AFI design is site selection. The guidelines state that a social AFI should be situated directly adjacent to, and visible from, an existing public open space with high foot traffic. This way, the AFI acts as an extension to the existing public green space and will not be neglected due to underuse from the surrounding site. The best spot for a social AFI would be in downtown Rotterdam, easily accessible from an existing public space with pleasant urban scenery.

I used this criterion from the guidelines, locations of the realized floating precedents in Rotterdam, and unrealized concepts from Casanova and Hernández to inform the site selection (Fig. 48). I narrowed down the site selection into three possibilities using the previously mentioned criteria from the guidelines (Fig. 50).



The first option, site A, is in Rijnhaven in Rotterdam South (Fig. 49). It is the site of three previous floating precedents: Recycled Park, the Floating Pavilion, and “Bobbing Forest.” This site is appropriate because there is enough space in the disused Rijnhaven port and it’s next to an existing public green space. In addition, this site has previously been a successful location for three floating precedents, and one of Casanova and Hernández’s conceptual sites. However, the surrounding public green space doesn’t have much foot traffic and the Rijnhaven port seems too exposed, both spatially and to the elements.

Site B is based in the Spoorweghaven port (Fig 51). It’s an appropriate site because it also has little existing boat traffic. The AFI would be anchored next to one of three small plazas next to the water. Newly-developed apartments and businesses surround the harbor. So, the AFI would be used by residents and would benefit the community more than tourists. The AFI would especially make a good “front yard,” as many apartments look onto the old harbor. Spoorweghaven has potential for a social AFI because of the available surface area on the water. This site seems exposed, but is not as exposed as site A.



0' 900' ⓘ

Figure 49: Rijnhaven (Bing Maps 2019; GraphyArchy 2018).



0' 2400' ⓘ

Figure 50: Precedent locations inform site selection (Borelli 2019).

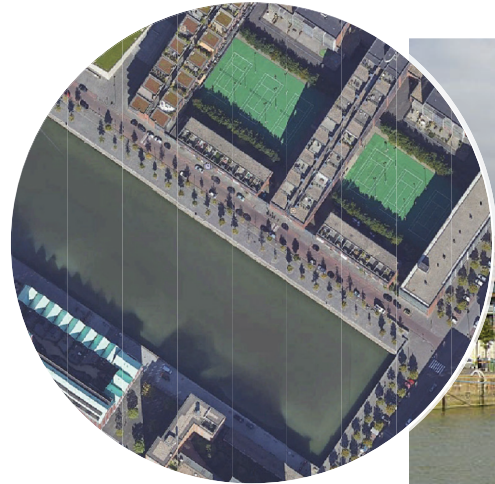
Site A: Rijnhaven

Site B: Spoorweghaven

Site C: Oude Haven

● Site used in projective design.

● Site not used in projective design.



0' 300' 🕒

Figure 51: Spoorweghaven
(Google 2019; Joris 2007).



0' 250' 🕒

Figure 52: Oude Haven (Google
2019; Berkelaar 2015).



Site C is in the historic Oude Haven harbor in Rotterdam North (Fig. 52). It is a tourist area with restaurants, hotels, museums, and iconic architecture. Oude Haven is also used by the Harbour Museum to moor old, historic ships. Otherwise, there is little boat traffic. Foot traffic of the adjacent plaza and pedestrian street is high. The AFI would be visible from this plaza as well as the outdoor seating areas of nearby restaurants. Users of the AFI would have views of the surrounding iconic architecture as well as the Willemsburg Bridge. This site is used more by tourists and has less available space than sites A and B.

Ultimately, with the help of the design guidelines (See section 3.4.3.4), I determined that Spoorweghaven would be the most appropriate site for a social AFI. The site is surrounded by apartments, so it would have greater community value. In addition, Spoorweghaven has more space to implement a social AFI, and is less exposed than Rijnhaven.

3.5.2 Design Process Using the Design Guidelines

The projective design process is cyclical with that of the design guidelines. Before developing the first draft of guidelines, I created an initial projective design. This serves as the control to demonstrate what I would do without the design guidelines. However, the initial design was influenced by the precedent and interview findings. I also used the initial design to identify elements that needed to be included in the guidelines. The result was the first draft of design guidelines (See Appendix D) which I used to inform the second projective design. The second design informed the final draft of design guidelines. Lastly, I used the final design guidelines to inform the final projective design.

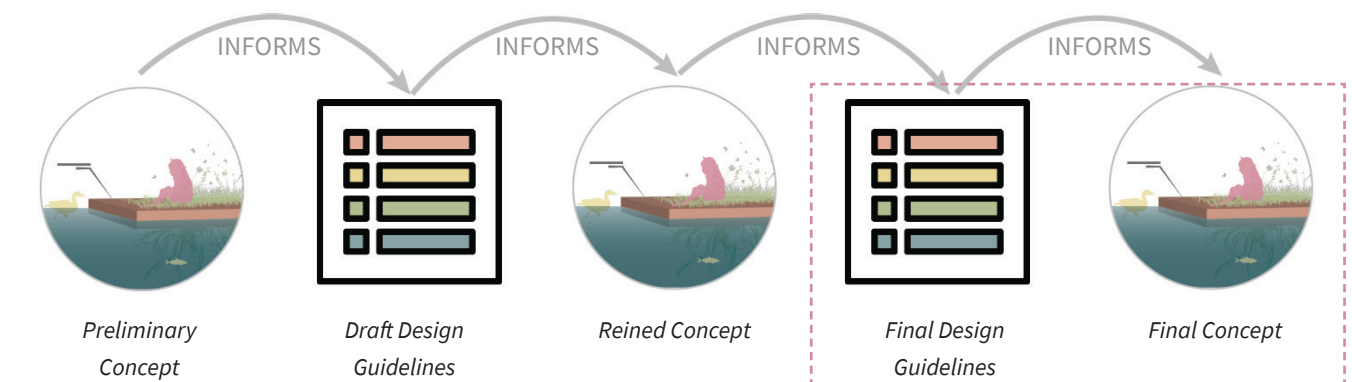


Figure 53: The guideline development and projective designs inform each other in an iterative process (Borelli 2019).

3.5.3 Preliminary Concept

Before creating a draft of the design guidelines, I designed a projective design to act as a control and show what I would do without the design guidelines. I selected Site C, the touristy Oude Haven, as the site for the social AFI. This site provides views to iconic architecture, the marina, and the Willembrug bridge. The design is fitted into to the corner of the harbor and fully visible from the adjacent pedestrian walkway, plaza, and outdoor eating areas (Fig. 54-55).

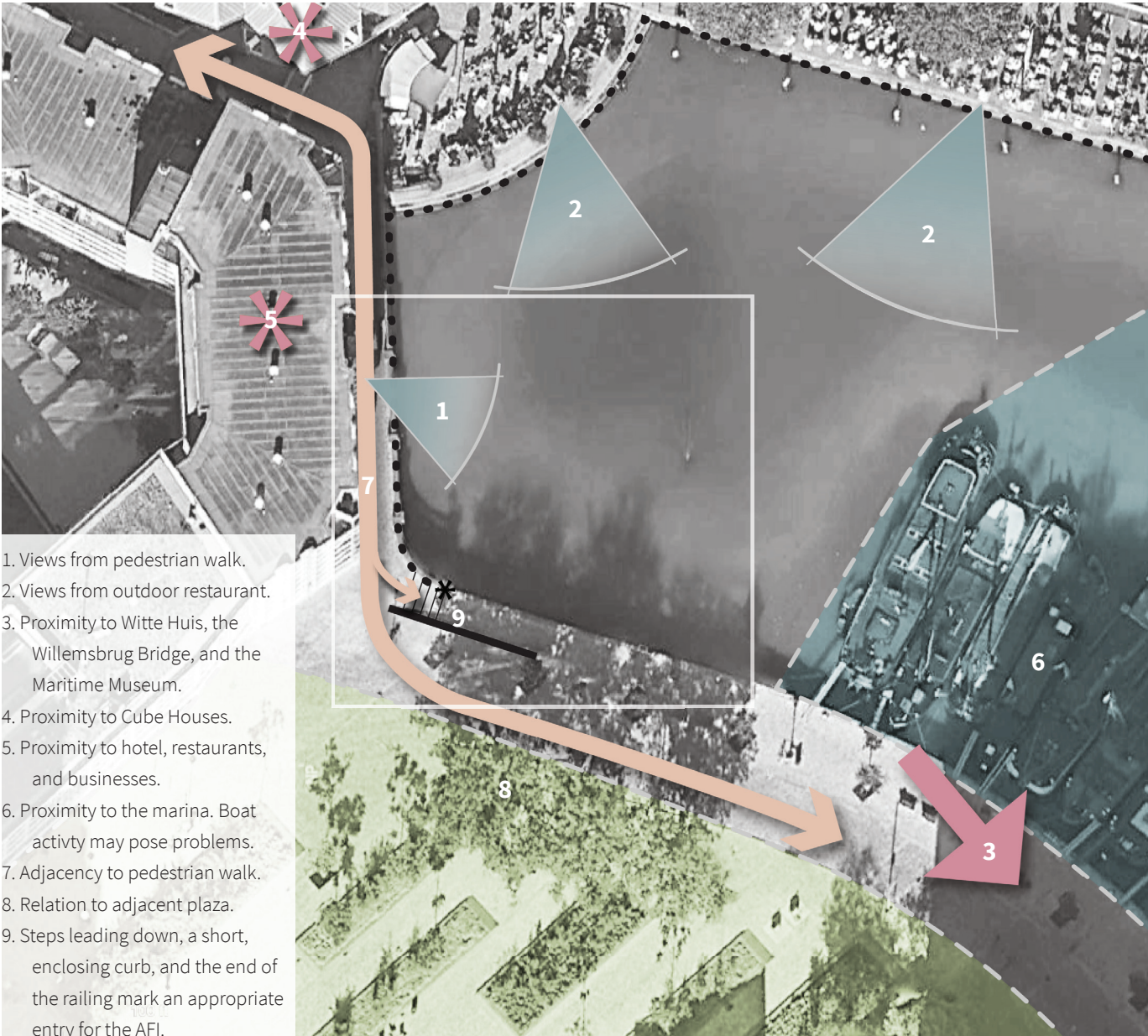
The main AFI includes seating and an area for educational uses, small gatherings, and individual contemplation. The plants around the perimeter of the main AFI are fully-submerged AFI vegetation and are accessible to users.

The L-shape of the main AFI encloses an independent wildlife AFI that is not accessible to visitors. It is meant to be a habitat for wildlife. The wildlife AFI is far enough from the main AFI to provide wildlife refuge, but close enough to provide educational value. Signage is attached to the railings that look out onto the independent wildlife AFI. This signage educates users about the AFI and the local ecology.

A galvanized steel frame wraps the perimeters of the main AFI and wildlife AFI for durability. The design also includes a floating tree well in a reused buoy, similar to those of the Bobbing Forest. Both the wildlife AFI and floating tree well are tethered to the main AFI via cables to keep them in place.

Underneath the main AFI are nylon ropes similar to those used at the Jetty. These ropes gather biofilm and serve as habitat for fish. Plastic buoyancy modules, similar to the system at Merchant Square, make the main AFI buoyant. Composite wood decking sits on top of the buoyancy system. The seating elements and railings are also constructed with wood composite.

The main AFI is divided into three sections, with an inch gap separating each section. This allows the AFI to move more freely with the waves. This is a strategy, used at Merchant Square, reduces tension on the AFI. Lastly, a ramp allows access from the adjacent plaza to the social AFI. The entire design is kept stationary by several piers positioned around the AFI. From this design, I learned that I had to consider lighting, anchoring, and tethering options.



- 1. Views from pedestrian walk.
- 2. Views from outdoor restaurant.
- 3. Proximity to Witte Huis, the Willembrug Bridge, and the Maritime Museum.
- 4. Proximity to Cube Houses.
- 5. Proximity to hotel, restaurants, and businesses.
- 6. Proximity to the marina. Boat activity may pose problems.
- 7. Adjacency to pedestrian walk.
- 8. Relation to adjacent plaza.
- 9. Steps leading down, a short, enclosing curb, and the end of the railing mark an appropriate entry for the AFI.

- Railing
- * End of railing
- Curb

Figure 54: Oude Haven site analysis (Borelli 2019).



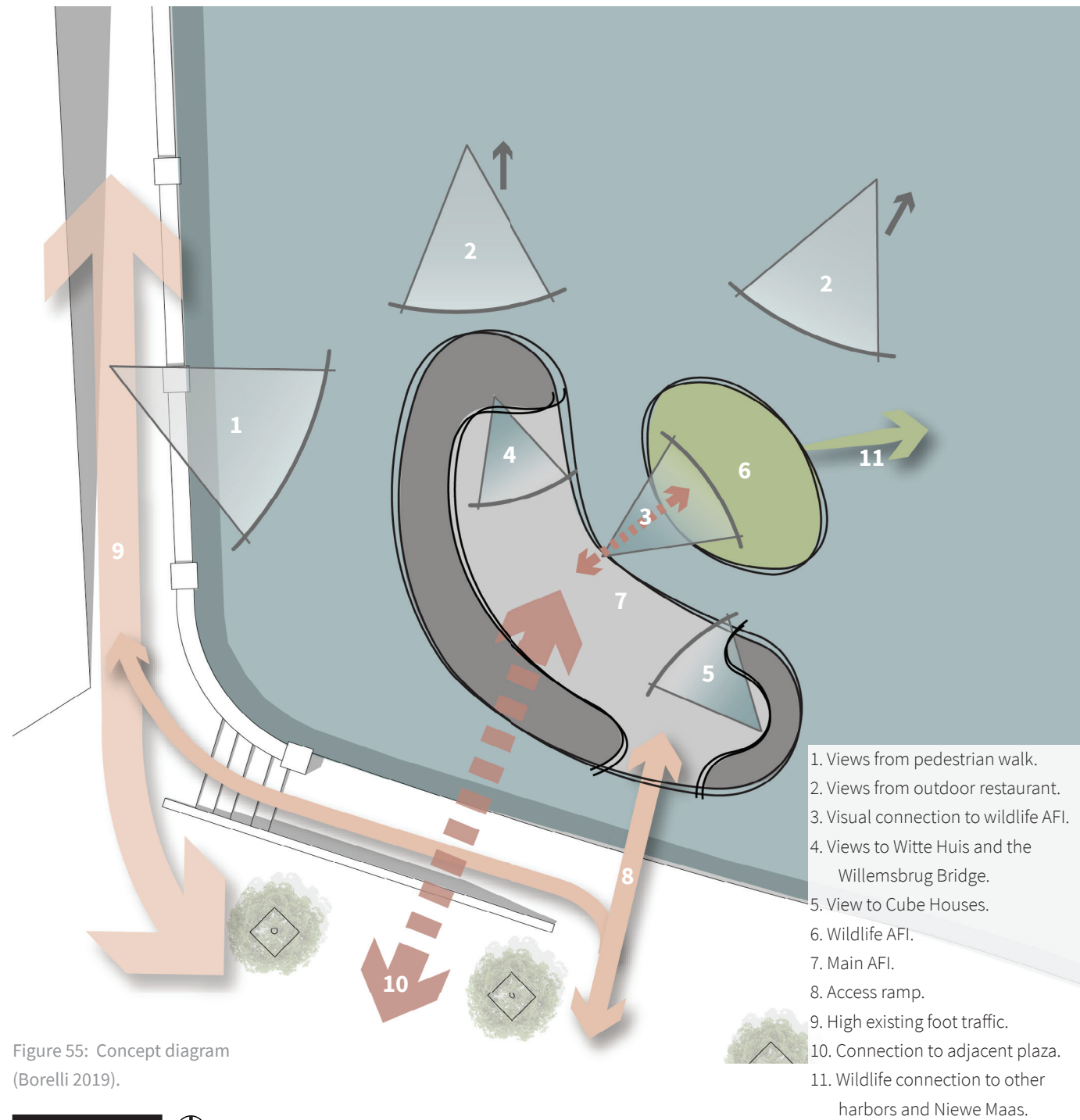
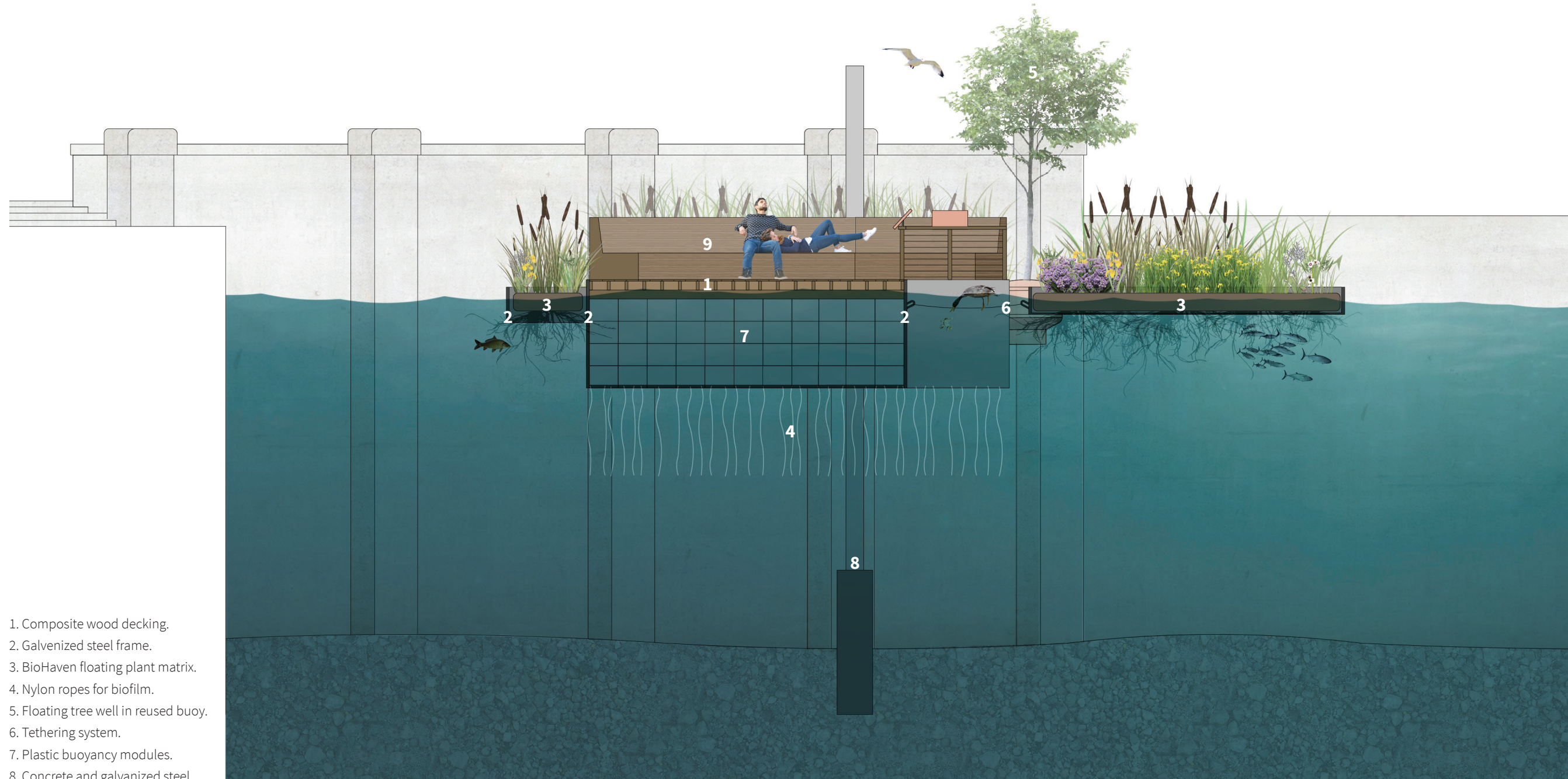


Figure 55: Concept diagram (Borelli 2019).



Figure 56: Plan (Borelli 2019).



1. Composite wood decking.
2. Galvanized steel frame.
3. BioHaven floating plant matrix.
4. Nylon ropes for biofilm.
5. Floating tree well in reused buoy.
6. Tethering system.
7. Plastic buoyancy modules.
8. Concrete and galvanized steel pier system.
9. Composite wood seating,

Figure 57: Section A-A (Borelli 2019).

0' 10'



Figure 58: The iconic Cube Houses line one side of Oude Haven.

3.5.4 Refined Concept

This revised projective design is informed by a draft of the design guidelines. After creating the draft guidelines, I noticed that many of them were concerned with community engagement and stewardship. Oude Haven has some nearby housing, the Cube Houses (Fig. 58), that may contribute to community engagement and stewardship. However, Oude Haven is mostly a tourist area with museums, restaurants, hotels, and other destinations, and I felt that there would not be a steady sense of community. Spoorweghaven, on the other hand, is almost entirely lined with apartment buildings. Some of the units face directly onto the harbor, and the proposed AFI would serve as a “front yard” for the community. Thus, I changed the AFI’s location to Spoorweghaven. The site has views to and from iconic architecture and apartments and is accessible from the adjacent plaza and pedestrian walkway (Fig. 59-60).

Like the preliminary design, the refined concept includes the same anchoring system, plastic buoyancy modules, materials, floating tree wells, nylon ropes for biofilm aggregation, perimeter AFI vegetation, and a wildlife AFI with educational signage. The main AFI is divided into two sections, which are separated by a one-inch gap and makes the design more flexible with wave action.

Unlike the preliminary concept, this design offers a variety of seating opportunities and sub-spaces. The space on the northern half is a multipurpose space with benches and movable seating. It can be used for different events such as school visits, small concerts, and community meet-and-greets. It can also be used for day-to-day lounging, picnicking, reading, and other actives. On the southern corner of the AFI is a children’s play area with play mounds. The mounds are formed from a lightweight foam matrix and covered in artificial turf.

With this AFI design, I further explored technical strategies such as the bumper system and access ramp. The bumpers absorb shock from the wildlife AFI and floating tree wells when they come in contact with the main AFI. Then, the access ramp for this design is considerably longer than the one in the preliminary concept. It’s length of 50 feet is accommodating to water level variability.

Lastly, for this refined concept, I included an art feature, string lighting, and an overhead canopy. According to the first draft of the guidelines, lighting will increase the safety of the AFI and lead to more nightlife events. Meanwhile, the unique art feature will draw in visitors at all times of the day. Lastly, the overhead canopy protects users from the elements.

The guidelines that influenced this design are:

- Creating fish, waterfowl, pollinator, and other wildlife habitat and using native plants will encourage the presence of native species.
- There are ecological benefits to having a separate AFI for wildlife that floats independently from the rest of the design but is still close enough to offer educational value.
- Strategies constructed underneath the social AFI base can provide extra habitat and add to the ecological value of the design.
- Attractiveness and unique features of a social AFI attracts more users and creates opportunities for photography.
- Special events and art installations are an effective way to draw users and garner public support.
- Comfortable and varying seating is crucial to the usage of a social AFI.
- When choosing materials, opt for those that are lightweight, durable, and low-maintenance.
- Appropriate buoyant materials include plastic buoyancy modules.
- In some contexts, overhead structures should be used for shelter from the elements.
- Provide adequate lighting to promote night-life usage.
- A social AFI should be directly assessible and clearly visible from adjacent terrestrial public space.
- Social AFIs should be situated in an area with relatively high existing foot traffic.
- Social AFIs should be situated in a place with significant scenery, whether it be naturalized or urban.
- Make access ramps that are adaptable to varying water heights.
- The AFI should be placed in a site so that it does not conflict with boat traffic.

From this refined design I learned that various sub-spaces and seating types should be present on a social AFI. I also learned that, depending on the context, the access ramp may need to be considerably longer to account for the water level variance.

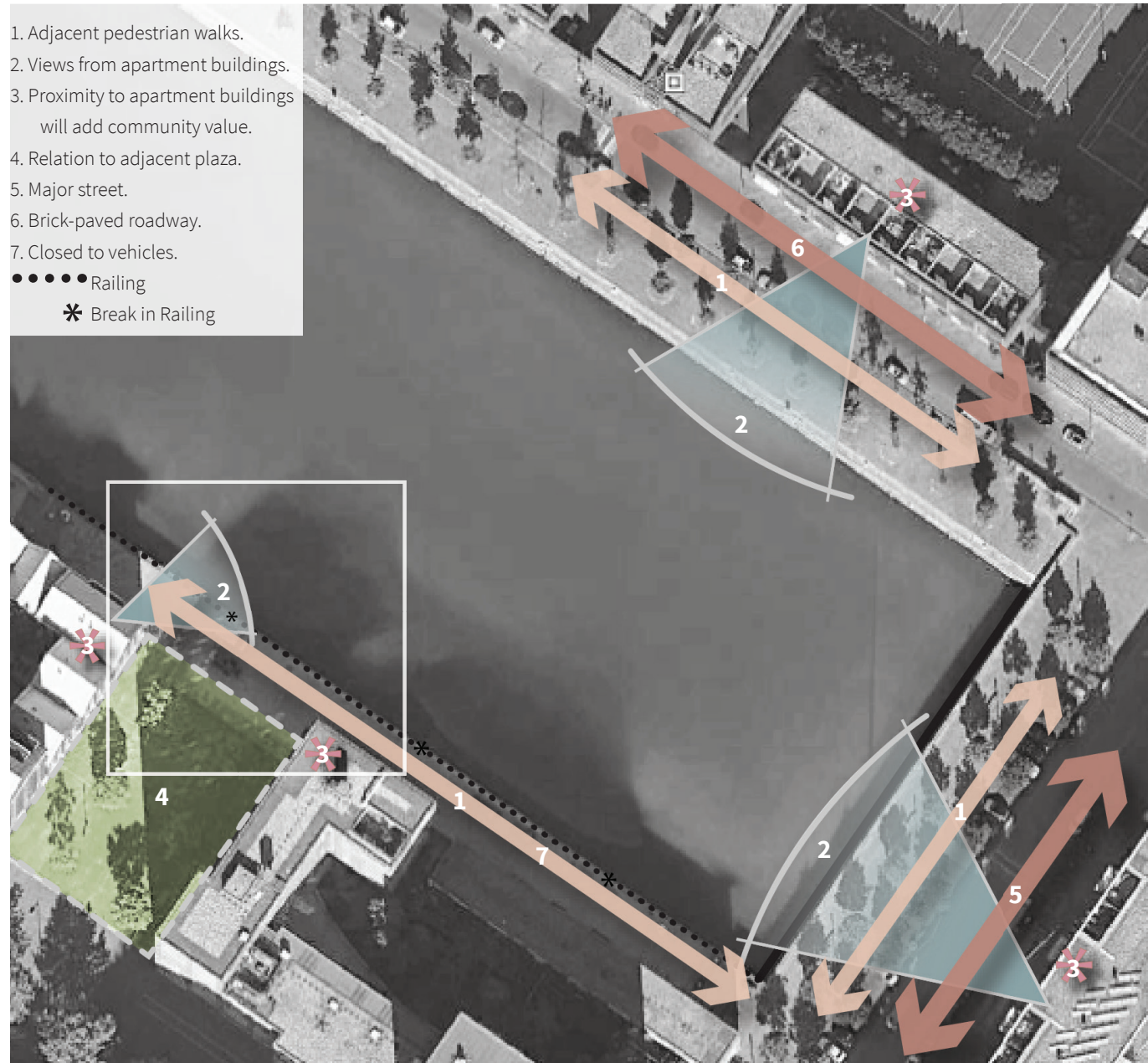


Figure 59: Spoorweghaven site analysis (Borelli 2019).

0' 80'

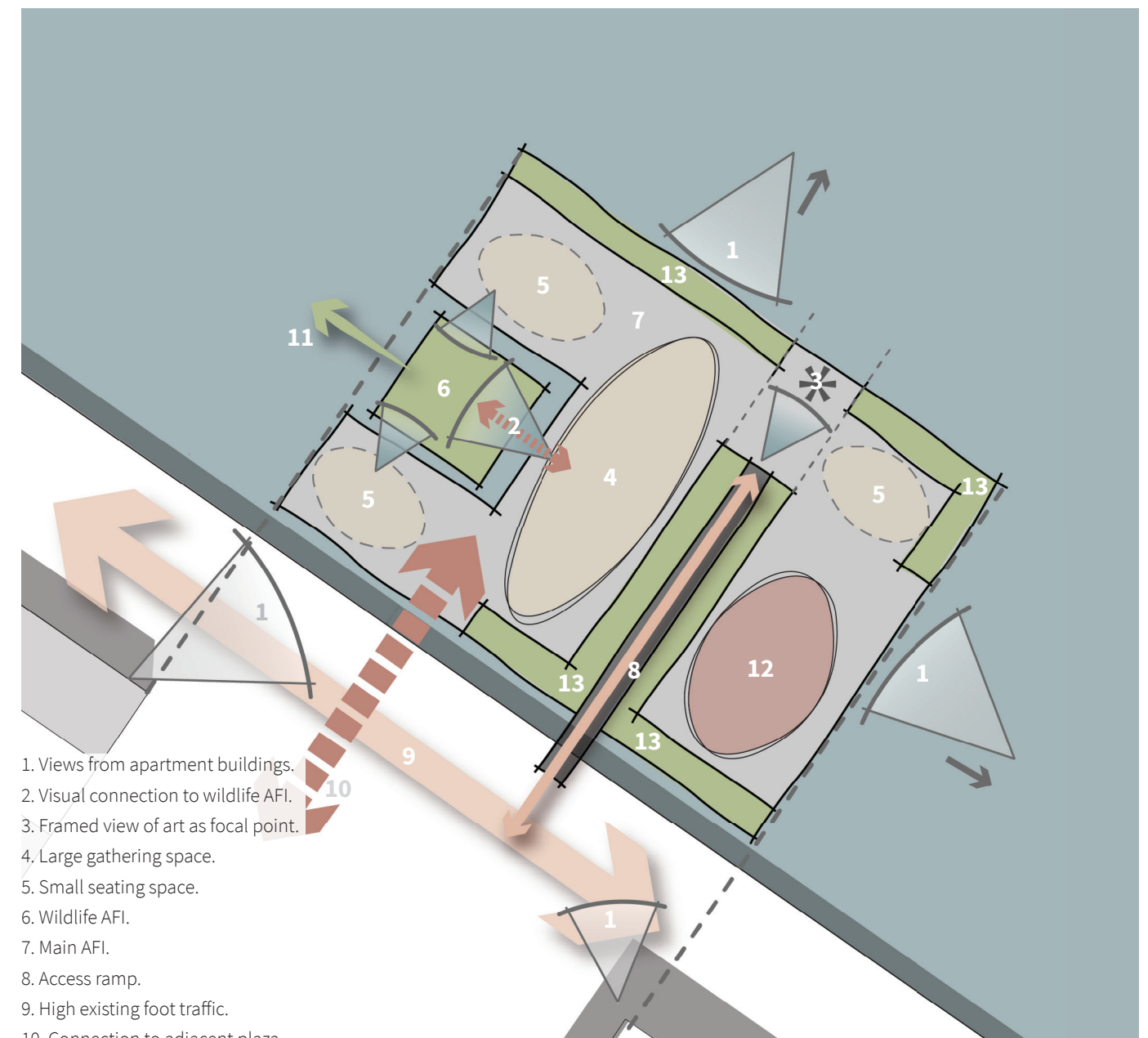


Figure 60: Concept diagram (Borelli 2019).

0' 24'

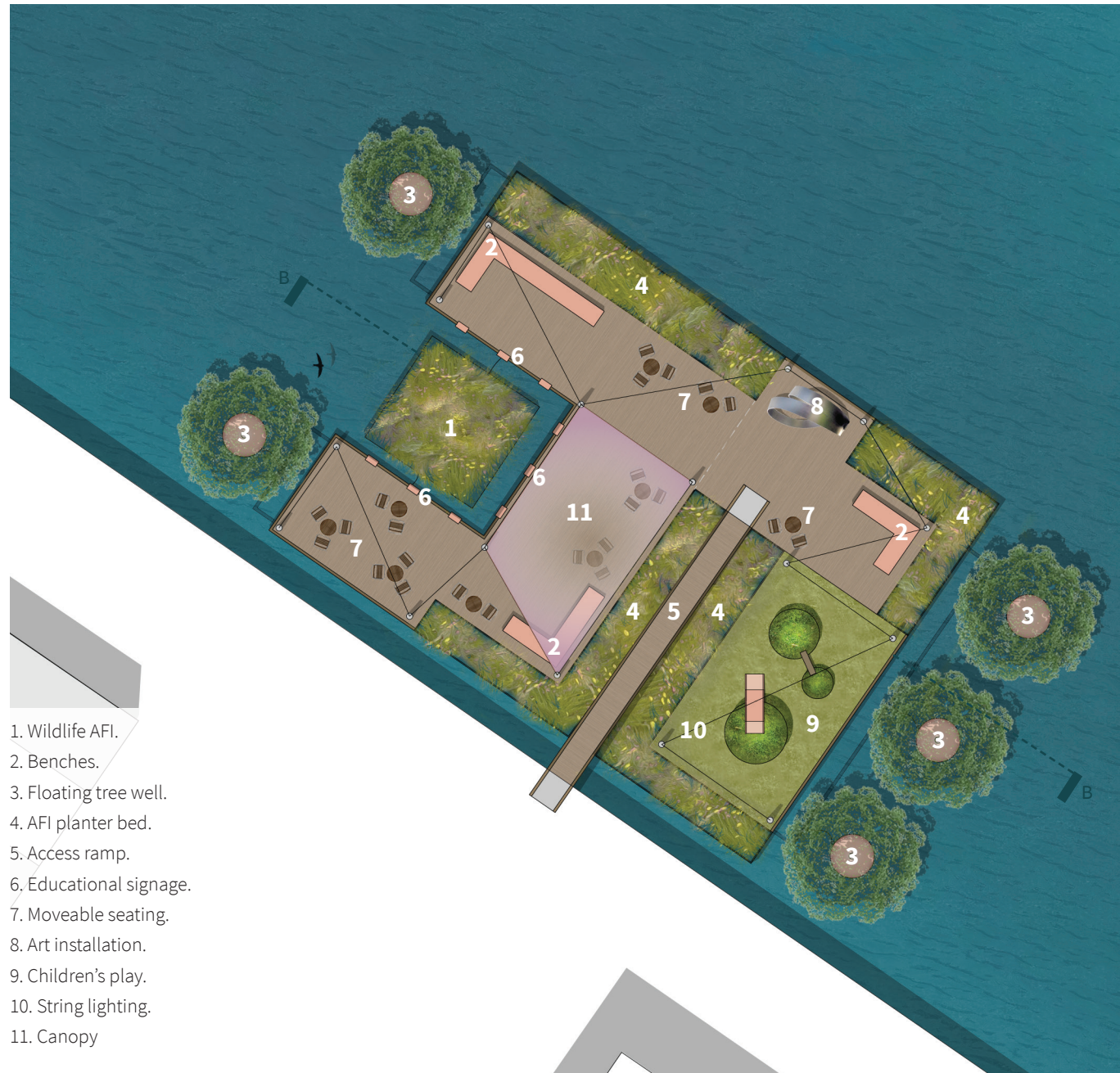


Figure 61: Plan (Borelli 2019).

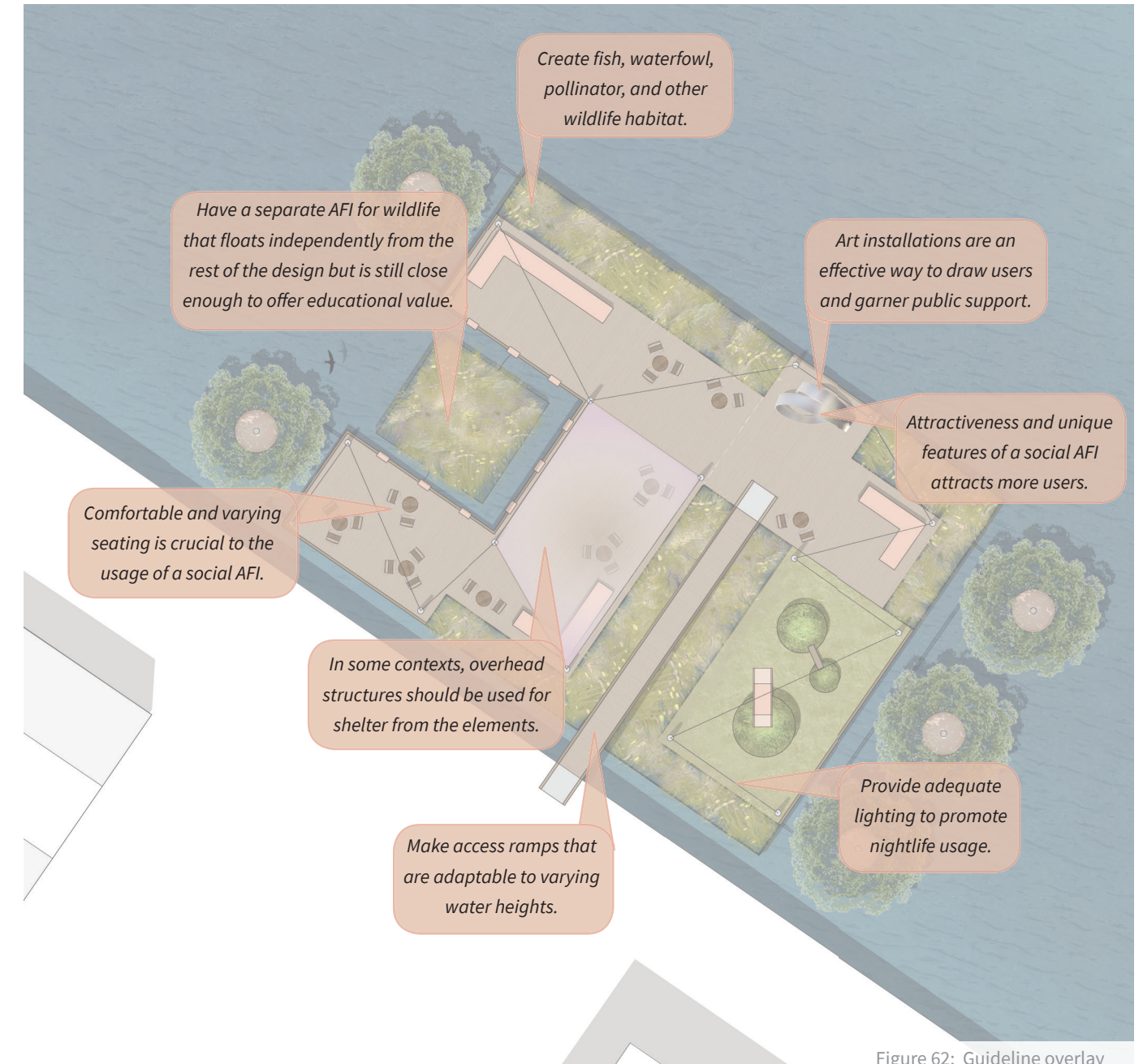
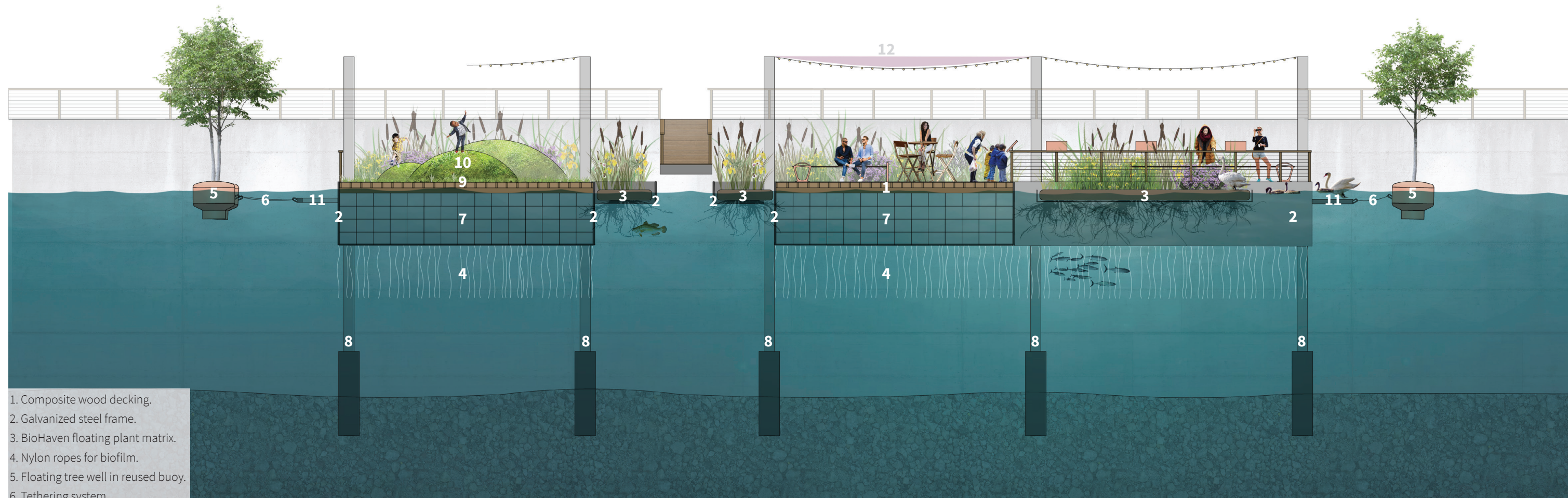


Figure 62: Guideline overlay (Borelli 2019).





1. Composite wood decking.
2. Galvanized steel frame.
3. BioHaven floating plant matrix.
4. Nylon ropes for biofilm.
5. Floating tree well in reused buoy.
6. Tethering system.
7. Plastic buoyancy modules.
8. Concrete and galvanized steel pier system.
9. Artificial turf.
10. Foam matrix for play mounds.
11. Galvanized steel bumpers.
12. Lightweight canvas canopy.

Figure 63: Section B-B (Borelli 2019).

0' 10'

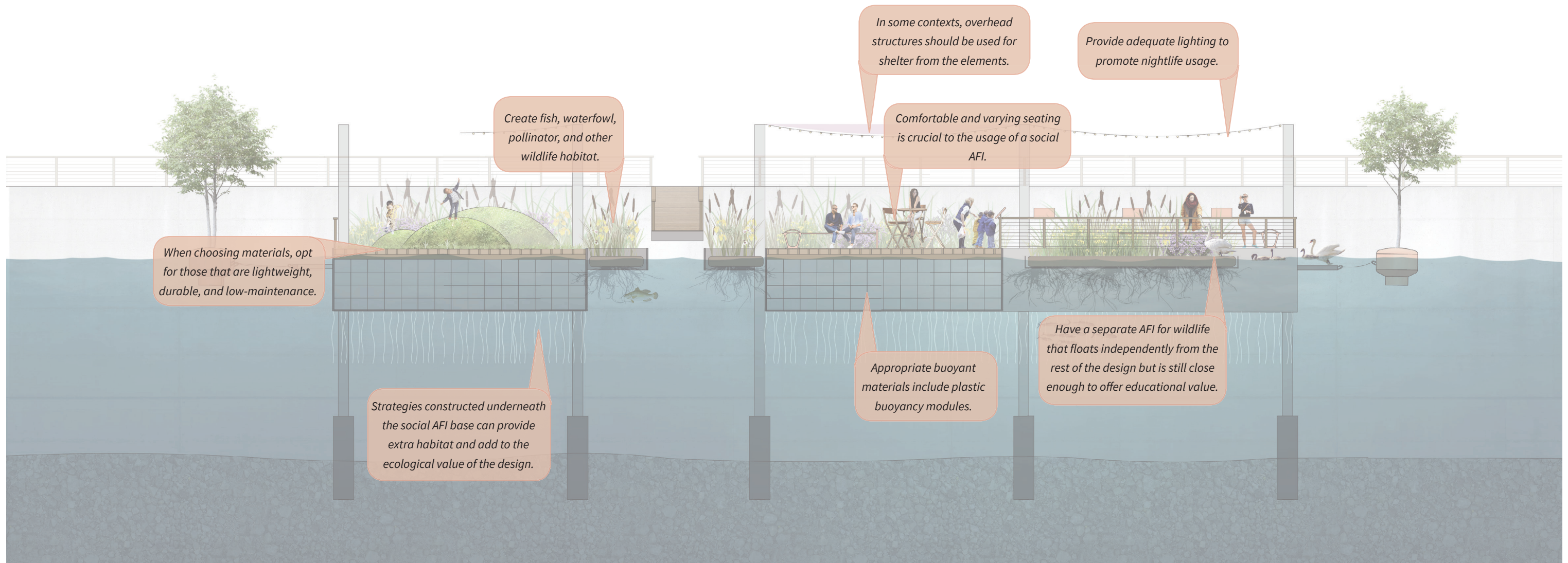


Figure 64: Section B-B guideline overlay (Borelli 2019).

0' 10'

3.5.5 Final Projective Design

After writing the final design guidelines, I produced the final projective design, still located in Spoorweghaven. Like the refined concept, the final projective design includes the same anchoring system, materials, floating tree wells, nylon ropes for biofilm aggregation, perimeter AFI vegetation around the perimeter, and a wildlife AFI with educational signage. The final design also has a children’s play area, large gathering space, string lighting, and a 50-foot access bridge. Once again, the AFI is divided into two sections, which are separated by a one-inch gap. This increases the flexibility of the AFI in wave action.

This final AFI design changed based off of different flotation strategies, anchoring systems, and further consideration of the context. First, the final design includes two spaces for art installations. One is at the end of the access ramps, like in the previous concept. The second is in the large gathering space, close to the edge of the wharf. Pedestrians on the wharf can interact with it and be drawn into the space. In addition, the access ramp is placed at a break in the railing when it wasn’t in the previous concept. This move minimizes off-site modifications, which were already limited. Thus, this final design cooperates with and integrates the surrounding environment more than the previous concept.

Then, from Dr. David Benjamin, I found it’s possible to use a pontoon system for the floatation of the main AFI. This system would be much simpler than stacking layers of buoyancy modules, as was done in Merchant Square. The pontoon system is also easier to move or deconstruct if needed. It also adds a more complex surface under the AFI which is beneficial for aquatic life.

Going more in-depth with researching technical strategies, I came across a marina manufacturer, Marintek, that produces pier, anchoring, and pontoon systems. I specified Marintek for the anchoring and pontoon system of this final design.

The plant palette for the final projective design was informed by Recycled Park’s plant palette, courtesy of Ramon Knoester. All the plants are native and are tolerant to wet conditions. The plant palette includes:

- *Iris pseudocarus* (Yellow Flag Iris)
- *Limonilum vulargare* (Sea Lavender)
- *Sagittaria sagittifolia* (Arrowhead)
- *Typhia latfolia* (Broadleaf Cattail)
- *Carex acutiformis* (Sedge)
- *And Ulmus x hollandica* (Dutch Elm) for the bobbing trees. These were the trees used for the bobbing forest, and the selection was based off of research done by the Van Hall Larenstein College (Bobbing Forest n.d.).



Figure 65: *Iris pseudocarus* (Yellow Flag Iris).



Figure 66: *Limonilum vulargare* (Sea Lavender) (Pichard 2007).



Figure 67: *Sagittaria sagittifolia* (Arrowhead) (Bendel 2010).



Figure 68: *Typhia latfolia* (Broadleaf Cattail).

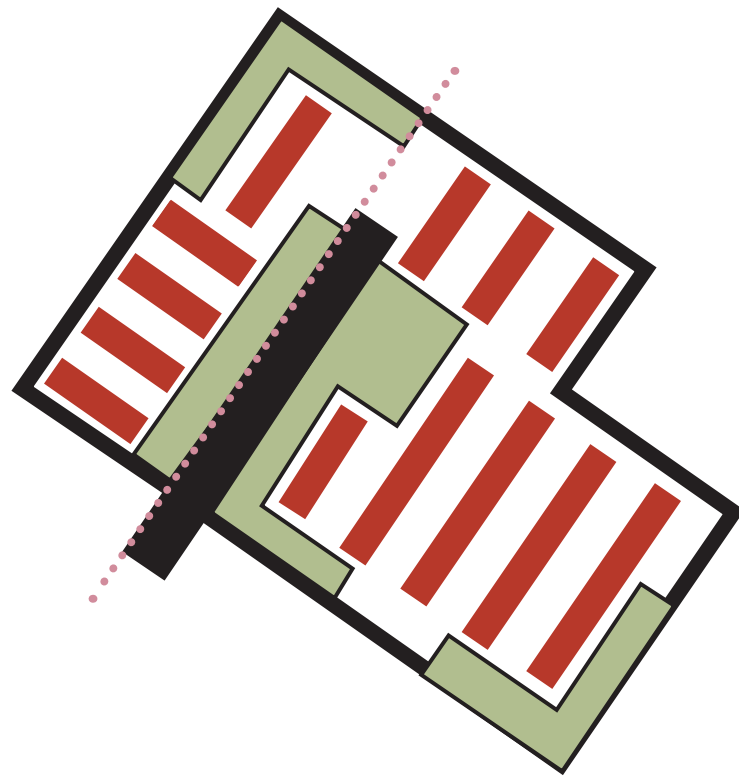


Figure 69: *Carex acutiformis* (Sedge).



Figure 70: *Ulmus x hollandica* (Dutch Elm) (Nijboer n.d.).

Figure 71: Pontoon system diagram (Borelli 2019).



For the governance and economy aspects of the projective design, the City of Rotterdam will own the site and fund its design, construction, and ongoing maintenance through the Physical Planning, Traffic, and Transportation Division of the Public Housing Department. In the past, public open space was under the jurisdiction of the Parks and Public Gardens Division of the Department of Public Works while public space maintenance was under the Physical Planning, Traffic, and Transportation Division (Goossens, Guinée, and Oosterhoff 1995). Now, the design of public space falls under the Physical Planning, Traffic, and Transportation Division, abolishing the separation between the design of public open space and its management (Goossens et al. 1995).

For post-implementation monitoring, the Division will hire an expert to assess the condition of the AFI once a month for a year after implementation, once every other month for the next year, and the biannually after the second year of implementation. The Division will also hire a maintenance staff to maintain the AFI as outlined by the Public Green Management approach of Rotterdam (Gemeente Rotterdam n.d.). Lastly, the social AFI will be open to the public year-round.

The guidelines that influenced this design are:

- Integrate native plants and wildlife habitat wherever possible.
- Position the wildlife AFI close enough for the users to observe wildlife, but far enough away to provide more comfort to both the wildlife and users.
- For more effective fish habitat, maximize the space under the AFI with man-made strategies such as nylon ropes that acquire biofilm.
- Install educational signage to inform users of the local ecology, the AFI's systems, and any other relevant information such as aquaculture or local history.
- Integrate unique features into the social AFI, such as art installations or interesting lighting.
- Provide comfortable and varied seating that can accommodate special events, as well as a myriad of day-to-day recreational activities.
- The social AFI must be large enough to accommodate different recreational uses.
- Materials should be attractive, lightweight, durable, and low-maintenance.
- Use additional buoyancy materials such as a pontoon system or plastic buoyancy blocks.
- Strive to establish post-implementation monitoring. It is critical to ensure that the design remains stable.
- Provide adequate lighting to promote nightlife usage.
- Social AFIs must be held in place close the water's edge to maintain accessibility.
- Tether the AFI to multiple vertical piers inserted into the bottom of the water body.
- Make access ramps that are adaptable to varying water heights.
- The AFI should be placed in a site so that it does not conflict with boat traffic.
- A social AFI should be directly accessible and clearly visible from adjacent terrestrial public space.
- Social AFIs should be situated in an area with relatively high existing foot traffic.
- Social AFIs should be situated in a place with significant scenery, whether it be naturalized or urban.
- Aim to become part of a program or initiative.
- Having a public owner or client usually entails hired maintenance staff and, sometimes, security.
- Allow the social AFI be opened to the public year-round.
- Be aware that readily available funding is key to keeping a site well-maintained, monitored, and accessible to the public.
- Maximize the ecological and educational aspects of the social AFI, as it is more likely to be better-funded.

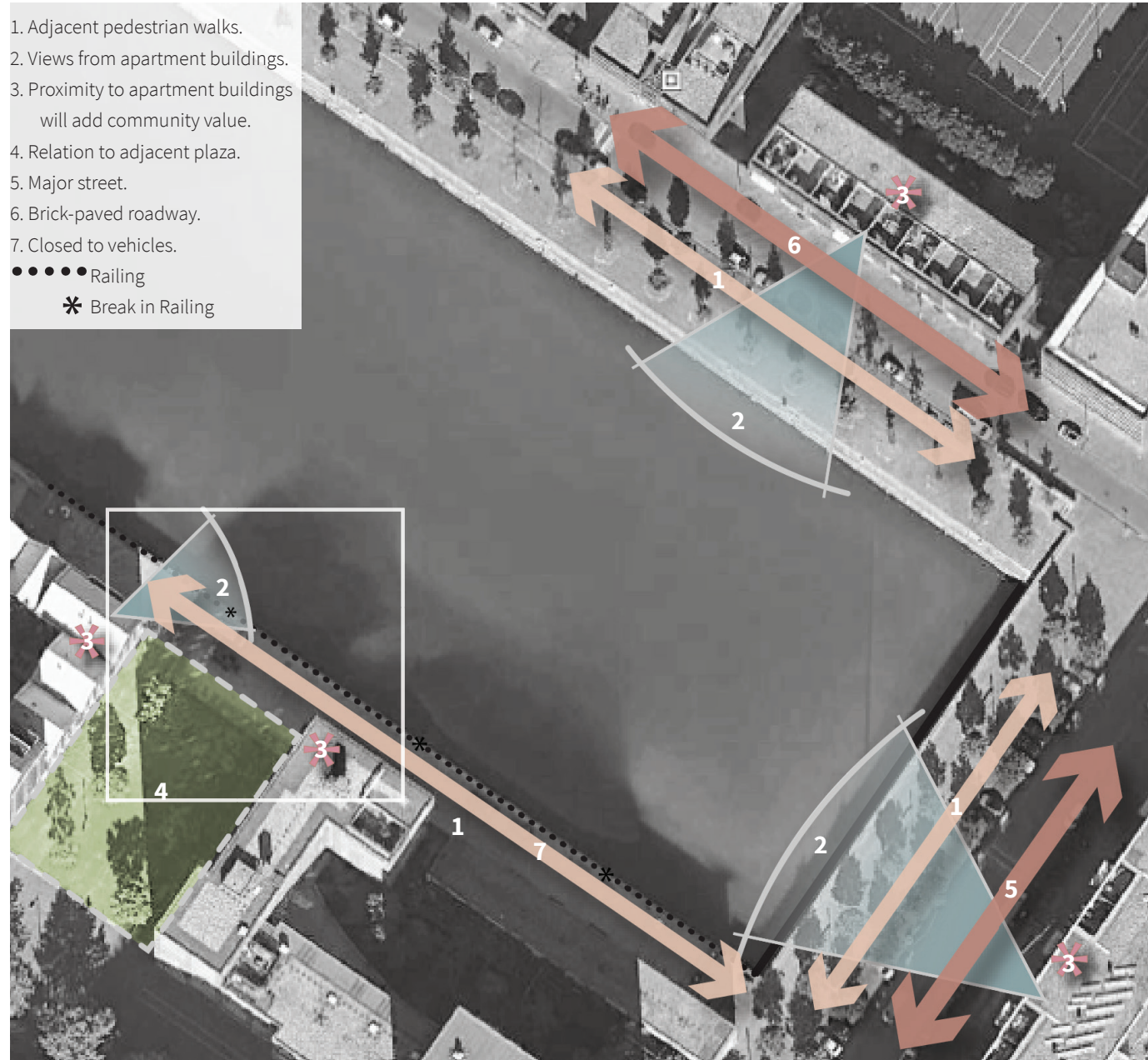


Figure 72: Spoorweghaven site analysis (Borelli 2019).

0' 80'

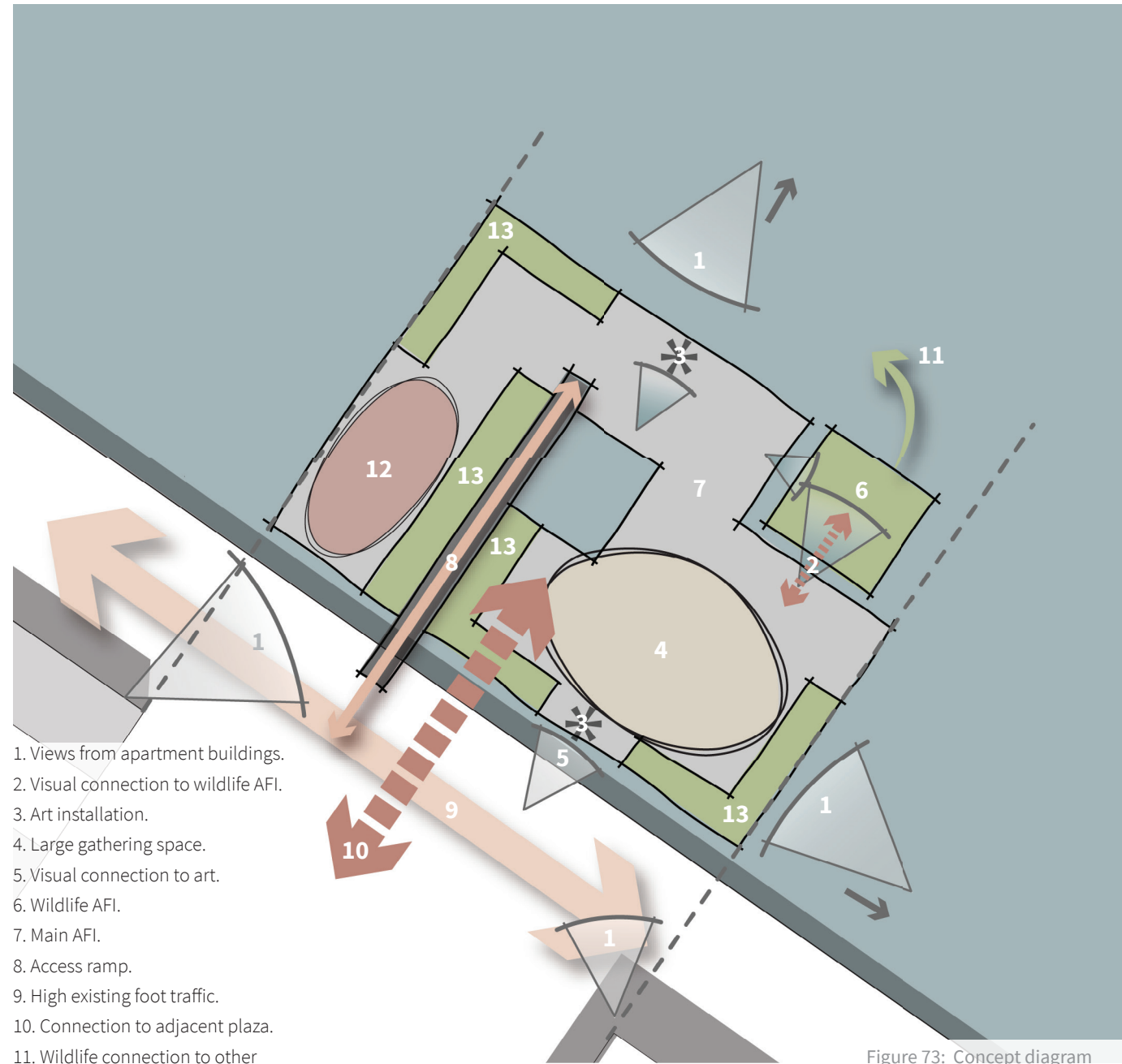


Figure 73: Concept diagram (Borelli 2019).

0' 24'



1. Wildlife AFI.
2. Benches.
3. Floating tree well.
4. AFI planter bed.
5. Access ramp.
6. Educational signage.
7. Moveable seating.
8. Art installation.
9. Children's play.
10. String lighting.

Figure 74: Plan (Borelli 2019).



Figure 75: Guideline overlay (Borelli 2019).





1. Composite wood decking.
2. Galvanized steel frame.
3. BioHaven floating plant matrix.
4. Nylon ropes for biofilm.
5. Floating tree well in reused buoy.
6. Tethering system.
7. Marintek pontoon system.
8. Marintek pier system.
9. Artificial turf.
10. Foam matrix for play mounds.
11. Plastic bumpers.

Figure 76: Section C-C (Borelli 2019).

0' 10'

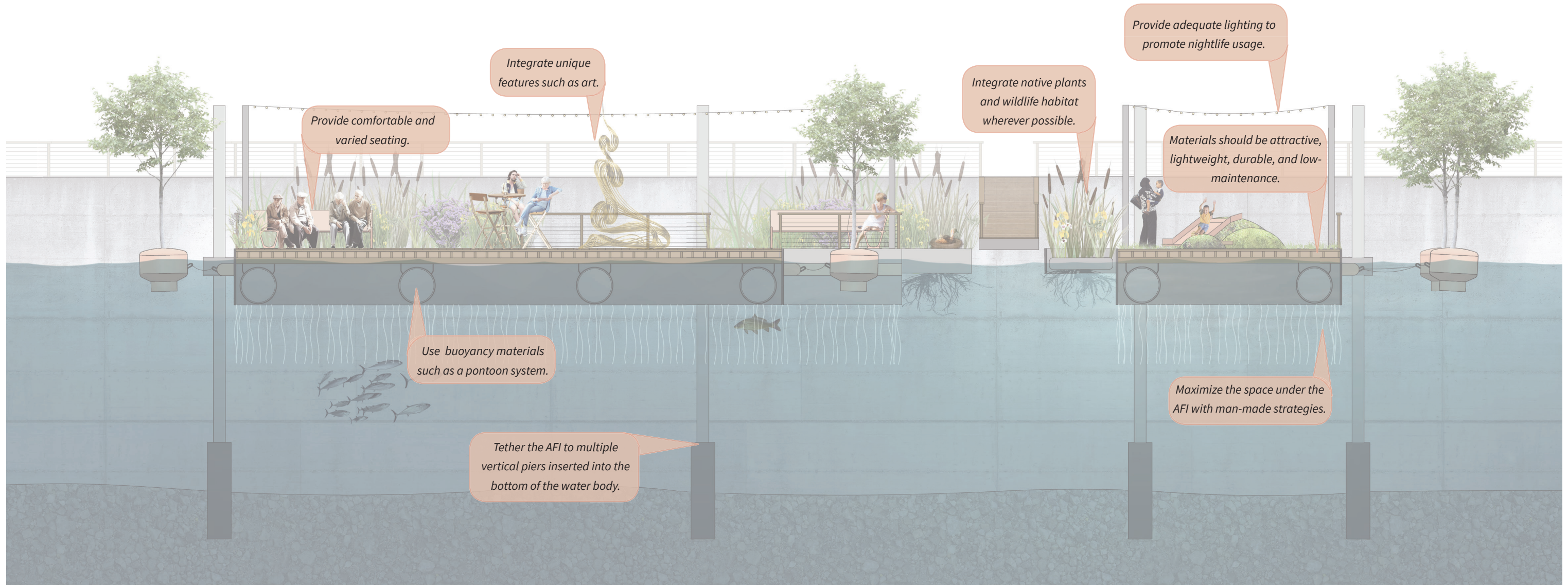
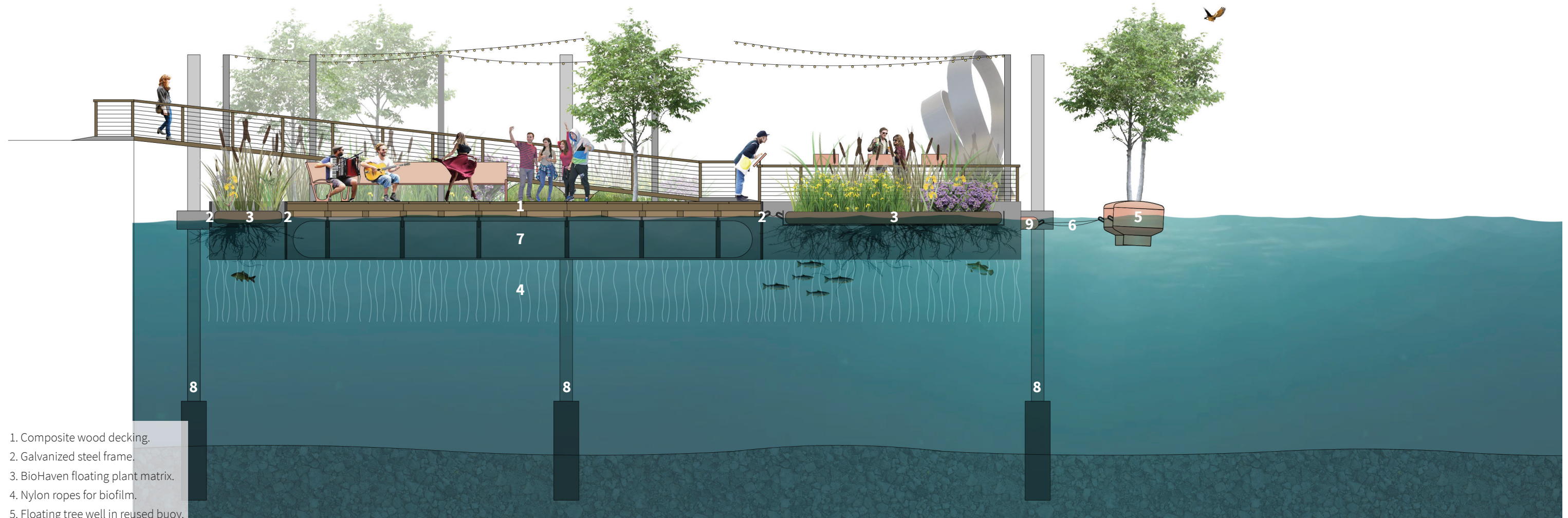


Figure 77: Section C-C guideline overlay (Borelli 2019).

0' 10'



1. Composite wood decking.
2. Galvanized steel frame.
3. BioHaven floating plant matrix.
4. Nylon ropes for biofilm.
5. Floating tree well in reused buoy.
6. Tethering system.
7. Marintek pontoon system.
8. Marintek pier system.
9. Plastic bumpers.

Figure 78: Section D-D (Borelli 2019).

0' 5'

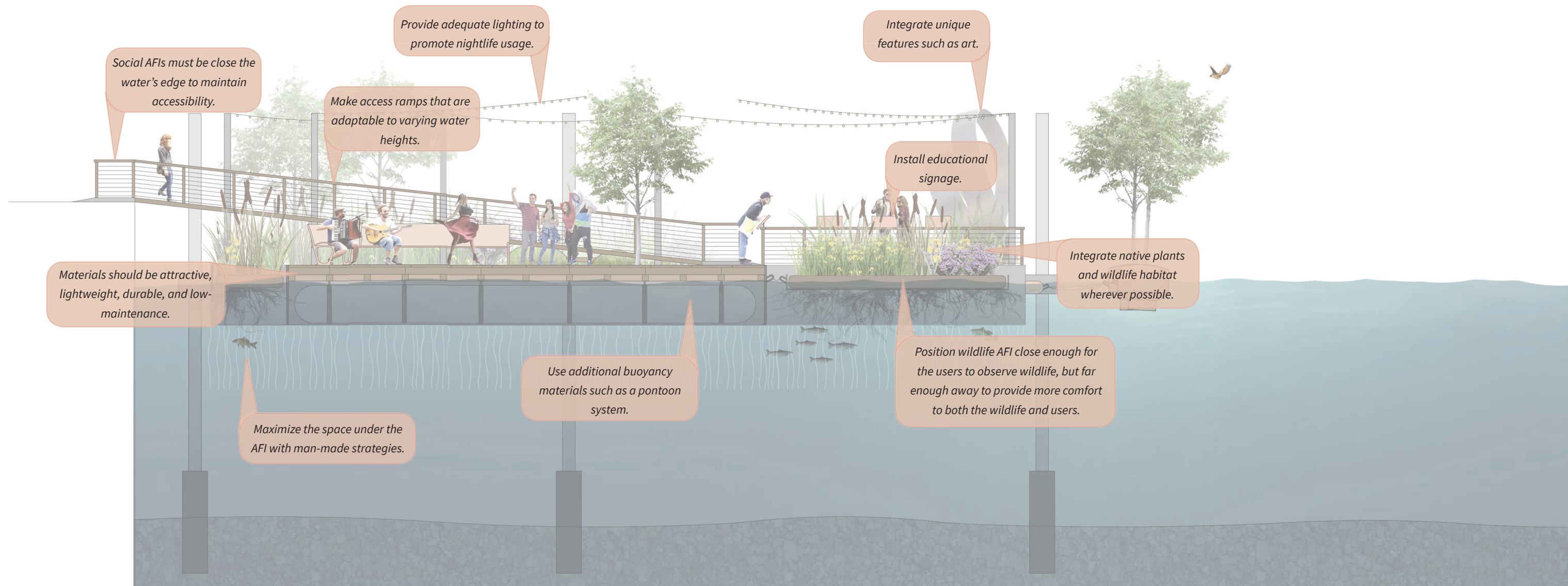


Figure 79: Section D-D guideline overlay (Borelli 2019).

0' 5'

4

CONCLUSION

4.1 Summary of Research Findings

Through this research, I have answered the question: “How can artificial floating islands (AFIs) along urban waterfronts support human social and recreational activities while maintaining their existing ecological services and contextual appropriateness?” I have looked at artificial floating islands through a social/recreational lense, providing insight into an aspect of AFIs that has hardly been researched.

To achieve this, I looked to the literature, precedents, and experts to provide evidence of the possibility of AFIs becoming a new type of public green space. I have taken knowledge from many successful precedents and condensed them into one set of social AFI design guidelines. This research has introduced the possibilities of AFIs in landscape architecture in a time when it is most relevant due to sea level change, climate change, and increasing urbanization. AFIs have the potential to strengthen urban waterways socially, recreationally, and ecologically.

4.1.1 Development of a New Guideline Framework

Through the analysis of well-recognized frameworks - ecosystem service framework, the Place Diagram, and the sustainable development framework - I developed a new framework for the design guidelines of social AFIs. This developed framework can be applied to other types of sustainable green spaces design and can be added to and adapted in the future.

4.1.2 Development and Application of a New Methodology

Through this research, I have also developed a more quantitative method of synthesizing information about multiple precedents. The method uses matrices that focus on different themes, bar charts to compare the variables of each theme, and radial graphs that allow for a more visual comparison of the precedents. This method can extend beyond AFIs and apply to other types of public green space. It can be adapted even further to apply to the rest of the design realm, such as precedent studies in planning, architecture, product design, and interior architecture.

4.1.3 Further Application of the Design Guidelines

These guidelines can be applied on a global scale. The design guidelines are meant to inform social AFI design but, ultimately, the design is dependent on the best judgement of

the designer. The use of the guidelines may vary depending on different elements such as the context, budget, and governance.

4.1.4 Limitations

One limitation that I faced in this research is that there was not enough time or resources to test the construction, use, and maintenance of a social AFI. Implementing a social AFI into a real site and conducting a post-implementation evaluation would help support the design guidelines. This is an opportunity for future research.

Another limitation I faced is that due to time constraints and not being able to schedule interviews, I had to remove two precedents from the precedent study. The two precedents were Sengkang Floating Wetland in Singapore (Fig. 80) and Spruce Street Harbor Park floating garden in Philadelphia (Fig. 81).

4.1.5 Essential Components

The intention for this research is to integrate social uses into AFIs without disturbing their ecological goals. In the case of the projective design for this research, the social aspect took priority in order to better address the research gap. Usually, a balance between the social and ecological components would be preferred. However, in a real-world situation, and limited budget, designers and clients may have to prioritize one component, whether it's ecology, social space, quality of materials, or maintenance and monitoring. On a budget, it would be preferable to scale down all components proportionally. However, if any component should take priority over the others, it should be maintenance. The other components can be proportionally compromised, but if the AFI has strong maintenance and monitoring, it will have more longevity. Then, there is more opportunity in the future for the AFI to be strengthened in the other components once more funding is accumulated. The opposite is true as well. A design with great social space, ecological strategies, and materials cannot be successful long-term without a stable maintenance regime.

4.1.6 Hypothesis

At the beginning of my research, I hypothesized that AFI designs can be developed into a new type of public open space. Through the literature, precedent studies, interviews with experts, and projective design, this hypothesis has been proven true.



Figure 80: Sengkang Floating Wetland in Singapore (Anton V. 2016).



Figure 81: Spruce Street Harbor Park in Philadelphia (The West End 2014).

4.2 Future Research

The design realm is constantly evolving and the potential for social AFIs has yet to be fully realized. Additional research and design are necessary if AFIs are to be added to the repertoire of landscape architecture. Future research from others will help pioneer AFIs as a type of public open space. Future research may include:

- Focusing on the different construction materials and methods for AFIs.
- Filling the research gap of the “provisioning” ecosystem services for AFIs in an urban context. These ecosystem services include the provision of food, raw materials, medicinal resources, and fresh water.
- Construction and post-implementation evaluation of AFI designs as public green space.
- How AFIs perform socially in different contexts.
- To what extent humans can occupy AFIs without disrupting the ecological goals of AFIs.



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APPENDICES

6.1 Appendix A: Precedent Studies

6.1.1 Recycle Park

AFI?: Yes

Location: Nieuwe Maas in Rotterdam, the Netherlands

Year Implemented: 2018

Dimensions: 1,500 sq. ft.

Designer(s)/ Corporation(s) Involved:

- Recycled Island Foundation
- WHIM Architecture
- The City of Rotterdam - wanted to realize more green spaces
- HEBO Maritiemservice - supports the litter traps associated with Recycled Park
- Wageningen University – studied the best recycling techniques for the plastic litter

General Description:

The design currently consists of 28 AFIs, two of which are for sitting. The bases for the AFIs are made from recycled plastic litter from the Nieuwe Mass. The plastic litter is collected from litter traps in the river. Recycled Park is located next to a floating pavilion. This is a temporary location. The Recycled Island Foundation is seeking a permanent one. However, the Recycled Island Foundation recognizes that the floating character of the plastic modules will allow for more flexibility and temporary spaces. These temporary spaces could be used for festivals and new urban development. The hexagonal modular system of the park makes it easy to expand in the future. The modules are different heights to allow for variation in use. For example, trees can be planted on larger ones.

Social/ Recreational Uses: The primary use of Recycled Park is seating. But sports fields and water recreational activities are anticipated uses for a larger, future design.

Ecological Goals:

- Clean the river of litter.
- Prevent litter from reaching the North Sea via litter traps.

- Demonstrate that litter from the river is worth retrieving and recycling.
- Wildlife habitat for birds, fish, snails, flatworms, larva, beetles, etc.
- Potential to be used along the shores to soften edges. This would also support wildlife and be used as public space.

Construction Materials + Methods:

The floating base is made from recycled plastic. The bottom is a plastic “mesh” made from the same recycled material. Plants with root balls are installed on top of mesh. The roots grow through the mesh and in to the water.

Limitations:

Limited recreational/social uses (for now).

Additional Notes:

- The city helped create the three litter traps, and volunteers helped gather litter for a year and a half.
- One year and a half was dedicated to testing and developing the litter traps.
- Recycled Park opened July 4th, 2018 as a prototype.
- Recycled Island Foundation is proposing similar projects worldwide.
- WHIM Architecture has thought of many other future designs for the Rotterdam area.

Sources:

Neelis, Koty. 2018. “This Dutch City Has Made a Floating Park Out of Plastic Waste.” World Economic Forum. July 30, 2018. <https://bit.ly/2DeILXG>.

Waste 360. 2018. “The Only Plastic That Should Be Allowed in Rivers.” Waste360 (Online), July 17, 2018. Business Insights: Essentials. <https://bit.ly/2AycvMD>.

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6.1.2 Merchant Square

AFI?: No

Location: Grand Union Canal in London, England

Year Implemented: 2017

Dimensions: 7,858 sq. ft.

Designer(s)/ Corporation(s) Involved:

- Garden Club London
- European Land and Property - client
- Greater London Authority

General Description:

The design consists of a decked area, shade canopies, and a pergola with free WiFi. The park provides spaces for different events. There are also two lawn area, planter beds, trees and different types of seating. The floating park is open to the public all year round. The design is meant to create a greater connection between the users and the water.

Social/ Recreational Uses:

The floating park is a gathering space for the surrounding residential community and other visitors. The WiFi pavilion is used as an outdoor workspace for people from the surrounding offices. The spaces and seating are adaptable to many uses like children’s play, picnicking, and yoga classes.

Ecological Goals:

The main ecological goal is to provide bird habitat. There is custom planting scheme that aims to attract wildlife and a specific section reserved for ground-nesting birds.

Construction Materials + Methods:

Need more information from interview.

Limitations:

Not an AFI, so the ecological focus is limited. However, the focus on creating bird habitat is more than would be expected from a non-AFI project.

Additional Notes:

The floating park is part of the Greater London Authority’s green infrastructure initiative. This aims to improve local infrastructure, parks, and waterfront spaces in London.

Sources:

Garden Club London. n.d. “Merchant Square.” Garden Club London. n.d. <https://bit.ly/2KNtfCr>.

Jewell, Nichole. 2017. “London’s First Floating Park Slated to Open This Spring.” Inhabitat. Inhabitat (blog). 2017. <https://bit.ly/2OXY79j>.

6.2.3 “Seeds of Change”

AFI?: No

Location: Bristol Harbor in Bristol, England

Year Implemented: 2012

Dimensions: 1200 sq. ft.

Designer(s)/ Corporation(s) Involved:

- Maria Thereza Alves – artist and author of the “Seeds of Change” project. Started the research of ballast seeds in 1999.
- Commissioned by Bristol City Council
- Bristol Harbour Authority
- Arnolfini Centre for the Contemporary Arts in Bristol and their construction team
- University of Bristol Botanic Garden (Nick Wray) provided plants
- University of Bristol Centre for Public Engagement
- Gitta Gschwendtner - designer
- Ramboll - structural engineer
- Eudaimon - consultant on solar-powered irrigation and lighting systems.

General Description:

“Seeds of Change” is an art installation implemented on a disused barge. On top of the barge are raised platers, a path that runs down the center, and steps that lead down to seating. The planters are filled with vegetation germinated from the kinds foreign seeds that would have been mixed up in the barge’s ballast. Species are planted in blocks for

more color and impact. The design also has night lighting powered by a solar panel.

Social/ Recreational Uses:

- In 2007, Alves invited immigrant community members from foreign countries the barge would have visited to help germinate the seeds from their respective regions.
- Talks and tours through the Arnolfini led by botanists, historians, curators, performers, local chefs, and storytellers.
- Events through the Arnolfini such as family planting days and a performance by Traveling Light Theatre Company Summer School.
- School visits.
- Seating.

Ecological Goals:

General sustainability: the irrigation system is pumped straight from the river it floats on and the irrigation and lighting systems are powered by a solar panel on the barge. The materials used were also sustainable.

Construction Materials + Methods:

“Seeds of Change is constructed on a disused barge. The walkway in the center covers the opening where grains were originally loaded into the barge. The decking, stairs and seating are constructed from sustainable pine. The wood is treated with an environmentally-friendly oil stain to preserve it from weathering.

Limitations:

- Limited ecological goals.
- The plants are not native to Britain, but Alves brings up a good point: When does a plant become native? Some of the “foreign” ballast plants in the installation are quite common to us and have been used in British gardens for centuries.
- Limited space for different activities.
- Access by appointment only.

Additional Notes:

- Ballast is made up of soil and gravel and was loaded onto barges to weigh them down for their return journey home. Naturally, the ballast would also contain native plant seeds from the region. From the late 17th century to the 20th century, barges unloaded the ballast into Bristol Harbor. Alves learned that some of these ballast seeds could still be germinated today. Alves used local archives to locate ballast sites and took soil sample from the sites.

- “Seeds of Change” is part of the Port City Project.
- Alves has created similar works around the world.
- The next phase is for schools to grow their own (terrestrial) ballast-seed gardens.

Sources:

Alves, Maria Thereza. n.d. “Seeds of Change.” Maria Thereza Alves. Accessed January 28, 2019. <https://bit.ly/2DjNFRB>.

Arnolfini. n.d. “Seeds of Change.” Arnolfini. Accessed February 2, 2019. <https://bit.ly/2UsPyRT>.

Chalcraft, Emilie. 2012. “Seeds of Change Floating Garden by Gitta Gschwendtner and Maria Thereza Alves.” Dezeen. 2012. <https://bit.ly/2DcDMXI>.

6.1.4 The Jetty

AFI?: Yes

Location: Chicago Riverwalk on the Chicago River in Chicago, Illinois

Year Implemented: 2015

Dimensions: The AFIs are 2,048 sq. ft. collectively

Designer(s)/ Corporation(s) Involved:

- Sasaki
- City of Chicago
- Chicago Department of Transportation
- United States Coast Army Corps of Engineers
- United States Coast Guard
- Martin Ecosystems
- Friends of the River- grant funding

General Description:

Sasaki’s Chicago Riverwalk design consists of five main segments: The Jetty, The Water Plaza, The River Theater, The Cove, and The Marina. “The Jetty” segment includes a series of eighteen rectangular and polygonal AFIs interspersed between protruding piers. The AFIs are planted exclusively with native water-tolerant plants and are anchored by posts

that have markers notating the water level.

Social/ Recreational Uses:

- Ecological education.
- Education about the Chicago River and its engineering feats.
- Fishing.
- Bird watching.

Ecological Goals:

The main ecological goal is to provide bird and fish habitat. The Jetty is also marketed as removing pollutants from the water, but there no data to support this yet.

Construction Materials + Methods:

- The floating planting matrix is constructed from recycled PET plastic.
- Stainless steel frame around planting matrix.
- The northern edge of AFIs have trash guards on top of the steel frames.
- Caissons support the piers.
- Nylon ropes attached to caissons, steel AFI frames, and underneath the piers. The ropes gather biofilm which is beneficial to fish.
- Lunkers are fitted around caissons. Lunkers are wide hoops of metal that ring the caissons leaving a small gap between the two. Small holes are cut in the lunkers for fish to swim through and find shelter from predators.

Limitations:

Visitors cannot physically interact with the AFIs.

Additional Notes:

- The Jetty is part of Phase III of the Chicago Riverwalk.
- The Chicago Riverwalk was designed to the standards of the Coast Guard and the Army Corps of Engineers.
- AFIs were implemented because they were a low-cost low-construction option.
- If needed, the AFIs can easily be removed.

Sources:

Sasaki. 2017. “Chicago Riverwalk.” Sasaki. December 10, 2017. <https://bit.ly/2aqaXx>.

City of Chicago. 2019. “Chicago Riverwalk Expansion.” Chicago Riverwalk. 2019. <https://bit.ly/2UsgOQD>.

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Beaumont, Mary. n.d. “Chicago’s Riverfront Comes Alive.” Midwest Living. Accessed January 29, 2019. <https://bit.ly/2DI0FkY>.

Martin Ecosystems. 2017. “The Double Impact Floating Islands Are Making Along the Chicago River Waterfront.” Martin Ecosystems (blog). October 4, 2017. <https://bit.ly/2UkaEWH>.

Designing Innovative Habitats: Urban Infrastructure and Aquatic Habitat. 2017. Los Angeles, CA. <https://learn.asla.org/asla/sessions/413/view>.

6.1.5 Baima Canal Restorer

AFI?: Yes

Location: Baima Canal in Fuzhou, China

Year Implemented: 2002

Dimensions: 1640 linear feet = 1/3 mile

Designer(s)/ Corporation(s) Involved:

- John Todd Ecological Design
- Ocean Arks International - non-profit research outreach organization
- Fuzhou municipality - wanted an affordable, low-maintenance solution to improve the water quality of Baima Canal.

General Description:

AFIs flank a linear walkway on either side. The AFIs are planted with 20 native species. The restorer is 1,640 feet long and the canal is 1,970 long, so it takes up most of the length of the canal.

Social/ Recreational Uses:

The only evident use of the linear walkway is walking

Ecological Goals:

Wastewater treatment through the “Eco-Machine.” The “Eco-Machine” is the AFI and aeration system. Water enters from one end of the canal and is run through an aeration system. As the water runs downstream through the canal, it comes in contact with the AFI plant roots and is treated with fine-bubble air blowers located on the restorer. The restorer also inoculates the canal with beneficial bacteria that remove nitrogen and break down sludge and grease.

Construction Materials + Methods:

Need more information from interview.

Limitations:

Limited social/recreational uses on walkway

Additional Notes:

Baima Canal had extreme problems with odor and pollution and was considered the most polluted canal in Fuzhou. 750,000 gallons of untreated domestic sewage was emptied into the canal per day. The untreated wastewater was a health hazard to the surrounding citizens and was a threat to the fishing communities downstream. The canal restorer successfully reduced the chemical oxygen demand (COD) and the biochemical oxygen demand (BOD) influent by 92%. The water clarity also went from less than 6 inches to several feet of visibility.

Sources:

Andrews, Leann, Nancy Rottle, Biurk Belay, Peter Cromwell, Ann Dinthongsai, Kristen Gelino, Taj Hanson, et al. 2013. “Floating Wetlands Research.” Academic Report 1. Seattle, WA: University of Washington. University of Washington. <https://bit.ly/2F5vZvF>.

John Todd Ecological Design. n.d. “Baima Urban Canal Restorer.” Baima Urban Canal Restorer. Accessed January 30, 2019. <https://bit.ly/2sUrtYH>.

Ocean Arks International. 2018. “About.” Ocean Arks International. 2018. <https://bit.ly/2Znne6Z>.

Date: March 11, 2019
Interview Platform: Phone call
recorded by Rev Call Recorder
phone app.

6.2 Appendix B: Interview Transcripts

6.2.1 Recycled Park – Ramon Knoester

Borelli: There we go. So, the first question is whether or not you would like to be affiliated with your answers or remain anonymous.

Knoester: Yeah, you can put my name. That's okay.

Borelli: Okay. Um, and also you can change your affiliation up until April 1st. So. Just know that. The second question is, um, if you could go over what inspired you to do this project?

Knoester: The inspiration began over 15 years ago when I read a very small article about the plastic pollution in the Pacific, and that really triggered me to kind of look for solutions of approaches to the plastic pollution in the ocean. And well, we had some difficulty in starting with the global scale. So eventually, like five years ago, we saw the potential in finding a local approach. Then we presented it to the local municipality and they also go for the aspect. That's basically I we got started.

Borelli: Great. And then what were the driving goals you wish to achieve for this design? That's sort of similar to the inspiration.

Knoester: Yeah, the main objective was to stop the plastic pollution from entering the scene via the rivers that we have here. So, that was the main starting point. But we saw that people were only going to talk about the plastic pollution and the ways in dealing with that, in other words cleaning up. That would be a kind of negative approach and we saw that we also needed some kind of public initiative, to also turn the cleaning or the retrieval of the plastics into something new and valuable again.

Borelli: Right. Then, do you feel like you've achieved your goal so far and how so?

Knoester: No, I think we've achieved only a small part of what we can. We've seen in general that the approach takes a lot of time to be implemented because of

time to get local support and local commitment and also nailing the budget together. We hoped when we started about five years ago, that we already would save and really stop the plastic pollution from the river here [from going] to sea. But, so far, we only stopped only part of that. So, we're really disappointed about that, that it takes a lot more time than we expected. But, at the other hand, we have done quite a lot in the last five years. We have organized on cleanups that they're still doing. We set out a lot of litter traps to retrieve the plastics. We find a way to recycle these plastics and reuse them as valuable building material and we have been able to realize a floating park structure.

Borelli: Nice!

Knoester: Thank you.

Borelli: And then have you conducted any post implementation evaluation, and what were the results if you have?

Knoester: No, we haven't done it science-ly. Of course, we had the opening of the park. So far, we've realized 140 square meters of park in Rotterdam. And at the opening of that we were kind of looking back to what we have achieved so far but didn't really make a report on that. It's more like general conclusion. Okay, now we've been working on this project for five years. We have a set ambition and we have a sort of realization. But we still see that the ambition was much bigger than what we're actually able to achieve. But now we see we've learned a lot in the past five years. That's something that you can really turn into our benefits at the moment. So, at the moment we are having the benefit from what we learned to now. It's easier to continue to expand. It's also easier to have implementations elsewhere.

Borelli: Alright. Then, what feedback have you heard from visitors of the site?

Knoester: Sorry?

Borelli: What feedback have you gotten on the project? Especially from people who have gone to the site and experienced it?

Knoester: Ah, okay. Generally, that's good, sort of, positive. We get a good response of the animals, all the animals that are taking use of the park. So, the park is now being used by several birds. We've got a fish swimming through and you see that really draws a lot of enthusiasm from the people that visit the park. Um, and at the same time, people are really impressed by all the litter that we took from the water and that have been able to recycle that into this new landscape. Uh, and also the general response is that people would like to have it bigger. So far, it's still relatively small. And we have to design with a wish to expand, but it's also the main response from the visitors that we have so far. Like, "When are you going to be able to expand and when can we walk a little bit further on the park?" But now we just have two seating elements where people can go and have a seat, but it's the idea to really have a number off the parks that people could take a stroll there.

Borelli: Nice. Then, how are people using the site right now?

Knoester: Maybe when people come, they're going to have a look. And also, people are going to have a seat in one of the seating elements. People come there to relax mainly or to talk with other people. Yeah, that's the main menu so far.

Borelli: Alrighty. So, some of these questions you might feel like you've already answered, but I do need to ask them for my research. So, if you feel like you've already answered them, just feel free to give a short answer if you'd like. So, the next question is, are there any special events that happen on site?

Knoester: Yeah, so, we had the opening of the park on July last year. So that was the biggest event. We had about 150 guests at the opening event and luckily also significant press. We are still having excursions to the park. We see that, for example, other people from the recycling industry, they're keenly enthusiastic to see what we can do with recycling. We have excursion from different schools. Um, we have other different governmental institutions that are curious to see what we can do about greening the city, but also with the unionization of a park on the water. It's also an international interest. So, we have had a lot of people from cities abroad, coming to Rotterdam to see if they could also implement something like this in their own city. Uh, and I think that's basically it.

Borelli: Yeah, that's really cool. I know I'm interested in coming and seeing it someday.

Knoester: That would be nice.

Borelli: Yeah, it would be. And then what kinds of species of plants do you have on the planters?

Knoester: Yeah, it's a different kind. Um, we made different kinds of building blocks. Our park is a modular system made of hexagon building blocks. It'll reach 5 square meters. And with the modular system, we also are able to vary in the different kinds of building blocks. So, we have blocks which are filled with soil, with earth, where the vegetation is really separated from the water in the harbor. And this vegetation is welcomed by the rain. I'm not familiar with all the English names. What do we have? Vegetation that you couldn't find in your juice. Some juniper vegetation. And we have some sweet potato. And, yeah, some others. What I can do is give you the list with the Latin names and send them to you, because I don't know them all by head. But we have the vegetation that's loose from the water in the harbor. Then we have some, some water vegetation like leeks and... what else to call it? Yeah, we need the plants that disturbance in the water.

Borelli: Okay, great. Yeah, if you could send me that plant list, that would be very helpful. So, what different kinds of animals have you seen onsite, have been using it?

Knoester: Yeah, we'd have small crabs going through the park or living in the park. Small fish, but also the bigger fish come to the park to eat from the algae. So that's what we've seen. Of course, a lot of beetles and different kinds of birds. Let me see if I can find the English names... Yeah, it says here, like a grouse. It's a small black bird. We have ducks. We have geese. The swans, they also come to the park. Then we have (I'm just Googling the translation) graver? Does that say anything to you?

Borelli: Say it again?

Knoester: It says here "graver."

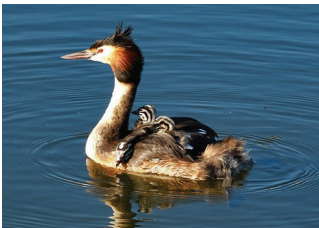


Figure 82: This is a grebe.
(Kinistino 2017).

Borelli: G-R-A-V-E-R?

Knoester: Uh, without the last “R.” G-R-E-B-E.

Borelli: Grave? No, that doesn’t sound familiar. That’s all right. Maybe some photos would help.

Knoester: It’s a beautiful bird.

Borelli: Alright, that sounds like a lot!

Knoester: Yeah, like four to five different kinds of birds.

Borelli: Nice!

Knoester: Yeah, they actually also really nest on the park, so we also have the young birds coming for our bugs.

Borelli: That’s great! I’m sure also for people to see that, to be able to see the wildlife.

Knoester: Yes. Yeah, definitely.

Borelli: And then what are the different maintenance procedures that you have for the park? Like, how often do you maintain it and how do you take care of it in extreme weather and who takes care of it?

Knoester: Yeah, we take care of it ourselves. Which basically means that we should go there about once a month to look at the vegetation and take out the let’s say the unwanted vegetation. Yeah. And then at the same time we actually do have work to do to take out the plastic pollution from the park. So, we do have our litter traps, but these are on another location and we see unfortunately that there’s also a lot of plastic pollution getting into our park for the that’s also something that we have to do on a regular basis. For the last year we were able to let it go. In the first summer we had to give it some water because it was an extremely dry summer. But in principle there is a water buffering system inside of the park so that for long terms of drought we still have the water buffering inside. So that we don’t actually have to go there to water the

plants.

Borelli: Okay. Overall, has this maintenance procedure been successful?

Knoester: Oh yes. Yeah. No, it looks good.

Borelli: Good! Okay. Then, who owns the site? Who’s responsible for it?

Knoester: Yeah, we do actually. We are the owners of the park.

Borelli: Okay. Then, who paid for the cost of the implementation and the design?

Knoester: We had some subsidies from local government and national government, and we had some sponsors who help to contribute.

Borelli: Do you mind telling me who the sponsors were?

Knoester: No, I don’t mind. It’s a local project developer from the Netherlands. You can also find all the names on, on our website. One of our biggest sponsors was the Audi Environmental Foundation. For the rest, a lot of the partners that helped to the realization, they sponsored by reducing their costs. That also really helped.

Borelli: Nice. Then for the next question, “What local policies or jurisdictions, land jurisdiction did you have to navigate for your design to be implemented?”

Knoester: We had to apply for a building permit because the park has a certain dimension and the biggest restrictions come from the fact that we wanted to make the park accessible for the public. So, we really had to follow the building regulations, which was still rather open for floating parks because there haven’t been so much floating parks. So, we had to show calculation and simulation that park is stable enough for the public to go to. And that there is enough floating capacity to carry I think about 8 people on the square meters.

Borelli: Okay. And may I also ask how this floating park has dealt with flooding issues?

Knoester: Yeah, it doesn’t [flood]. It goes up and down with the water level. So, the water goes higher, and the park also inclines with that. So, the rising of the water or

heavy rainfall has no impact.

Borelli: Nice. So, then even with high water, people can go out onto the seating elements?

Knoester: Oh yes. Of course., when there's a big storm, I think people might be a little anxious. Yeah, but in high water of course people can go. Yeah.

Borelli: Great. Then, in your opinion, what could have made the design more successful?

Knoester: We could make it bigger to have more people or to increase the accessibility. So maybe now it's just too small. And it would draw much more attention and more people who want the park bigger.

Borelli: Yeah, I saw some plans on your website, some illustrations, making the park bigger. That's very neat.

Knoester: Yup, we definitely have a good ambition, but yeah, we're still depending on funding and collaboration from the city of Rotterdam.

Borelli: Sure. Is there any other additional information you want to provide?

Knoester: No, I don't think so.

Borelli: Okay. Lastly, would you be able to send me a high-resolution photo of your floating park?

Knoester: Yeah. Oh, I haven't already? Maybe I forgot. Is it okay if I send it by WeTransfer?

Borelli: Yeah, that would be really helpful. Thank you so much.

Knoester: Okay. I'll do it right away.

Borelli: Okay. Well, that's all I have for you today. Thank you so much again for taking time out of your day to talk to me.

Knoester: No, it's my pleasure! And thank you for your interest. Good luck with your study.

Borelli: Alrighty. Well, thank you so much. Have a good rest of your day.

Knoester: Thank you. Have a good day. Bye-bye.

6.2.2 Merchant Square – Ben Dewhirst

Borelli: Recording you here. Okay. I'm going to record the call. Just had to let you know that. So, the first question here is, you did say that you wanted to remain affiliated?

Dewhirst: Absolutely. Yeah, happy to.

Borelli: Okay, that's great.

Dewhirst: Yeah, happy to. If you could, you know, politely advertise our company over there, we do design specification and all that as well. So, it was even sort of a partial marketing angle as well.

Borelli: Yeah, and as I understand, you were kind of were the ring master for the construction design for this project as well.

Dewhirst: Yeah, correct. We didn't have many precedents really at all to look at, you know? I mean, it's sort of strange how it happened. It all happened pretty quickly. My side with the company and the sort of softly rolling along. It didn't look like it was going to come to fruition, really. The boss was occupied with something else and said, "Look, why don't you just look after this and just keep it going. I don't think it will ever happen. And then all of a sudden it was sort of waved through and they said, "Yeah, we are doing it. We've got the money for it." We sort of looked at each other with wide eyes and scratch our heads and thought, "How the hell are we going to do this?" Personal research and then research at work... there were a real lack of precedents in terms of structurally how are we going to deal with buoyancy? There were all these different modules to use. It took a lot of time, measured with a pretty small amount of time to actually build the stages the client wanted to get to and whatnot. Yeah, it was stressful, but I thought I enjoyed the challenge. That anxiety of not really knowing what's going on, but you've got to produce something.

Borelli: Yeah, it kind of seems like that's what always keeps us going, right?

Dewhirst: Yeah, exactly. I really enjoyed it. I had a bit of... not serious depression but,

Date: February 8, 2019
Interview Platform: Phone call
recorded by Rev Call Recorder
phone app.

you know, a bit of a lag when it was all done because I thought, “Oh, I’m just not getting challenged by that anymore.” But, yeah, that’s sort of how it came about. It’s a huge estate, but it’s based on Merchant Square Estate and the client is the big property developer that owns the estate.

Borelli: Yeah, the European Land and Property?

Dewhirst: Yeah, European Land and Property. Andrew [Scrivener] is the CEO there and we dealt with him and thankfully still have a good relationship with him as well. You know, it’s quite a historical spot as well, the Paddington Basin. And that’s where there used to be, you know, London’s got a huge canal system, and back in the day when it was all industry, they used to have the canal narrow boats transport all the goods from north of London. And that had come right down into the space and they’d park up in the basin, unload, and then the road just outside it was the main road into the city. So, it has real historical significance and it was in this position of darkness. It’s surrounded by hard surfaces, shadowy, unappealing area and all these new buildings have been going up around it with stupidly expensive apartments in them. It just didn’t fit. It really lacked it. Now with all the shops and stuff. There’s M&S, one of the big supermarket chains, has their headquarters there. So, you’ve got about 10,000 residents and workers that move through the estate on a daily basis. So, we’re going to get good people movement. And [Andrew] said, “Yeah, I want to do something on this part of the canal I want to do a floating garden or a floating park.” And we said, “Okay, let’s do it!”

Borelli: Neat! Well, that sounds great! Thanks for all the background. I didn’t know.

Dewhirst: Yeah, just to be clear, I could bore you to death night-time, day-time...

Borelli: Well, I hope you do bore me to death! That would be probably be the best.

Dewhirst: But feel free to cut me off if I’m waffling on too much, I won’t mind.

Borelli: No, no, that’s fine. Okay, so, you talked about how the project got started and then what was the main design inspiration or design concept for this project and were you working on a larger design team or was it just you that came up with this concept?

Dewhirst: It was the boss more so. He obviously engaged before I was employed here and he probably drafted six, seven, eight different imagery concepts.

Borelli: Who were you working with?

Dewhirst: The boss. It was all us. So, we were commissioned to do the whole design and the build. Garden Club London was both Principal Designer and Principal Contractor. And for the build - because it was a larger project and our build teams could handle - we got various sub-contractors to do various elements. But essentially it was all us, like I said, which was exciting and extremely scary. There’s a huge amount of risk with the value of the contract and the public exposure we were going to get for doing a project like that. So, it was high-risk.

Borelli: Was this floating concept something that the client wanted? Or was it something that you guys came up with as a concept?

Dewhirst: The clients just gave us the brief of what he wanted it to include and the activities and whatnot. He envisioned a carry on it because as part of the estate they have a big events schedule. So, he wanted that to be able to fit in with it and not just for it to be plunked there and used by passers-by, but accessible. We’ve got a couple of more mooring points on there that boats can come down the canal system and rent the mooring space. But in terms of the design, we took what he wanted to happen, and it was also informed a lot by the buoyancy module and the construction method as well. We had to work out how it was actually going to float with this amount of weight on it. It’s about 110 tons altogether completely floating. Then we’ve got a couple of one-ton concrete blocks that sit underneath it and chains connect to it and that just stops it moving back and forth. So, the brief of the clients and the buildings’ hard surface space around. It was always probably going to lean towards the geometric layout to sort of mimic the shapes. But also, this allowed us to do that classic outdoor room set up. To try and have seen thinner bridges, a wider part, a softer part, a quieter part. So that boosted the general concept first. Then looking into how we were going to make it float and build it. It seems that that shape was the way to go. The buoyancy modules we ended up using were these little plastic cubes. Essentially, the high-density polyethylene. They basically are a bit bigger than a paving stone, so 493 x 483 x 390 millimeters. And they basically linked together like bricks.

Borelli: They were shorter than they were long?

Dewhirst: Yeah, they weren't overly deep, but because of the shape and size they've got the ability to play around with the geometric layout a lot more. Because they were so small, we had a lot more control over the footprint of it whereas some prefabricated system that sort of... A lot of the places I looked at used really large sections and one we looked at was 6 x 3 meters. It was just really constrained how we could shape it and we wanted a bit more freedom. So, sort of a combination of what of worked out well with the geometric surroundings and going, "What works out well? What seems the best way to build what it's going to be with? It's going to be these square things and then have steel and timber frames on it to help do the service build up." So that part works all right. "Okay. We think this is going to work." But then you've got the added of the balance and the weight of soil. Now that was a huge challenge.

Borelli: Right, and the weight of the planters and the weight of people moving across it.

Dewhirst: Yeah, correct. You would've looked at a few photos, no doubt, and you've seen how most of the [planters are] on the edges. If you can imagine, say, one of the biggest parts of them has so much as thirty tons with the weight that it's got in it. So, if you imagine that's sitting on the edge of something and then nothing sitting on the other edge...

Borelli: That wouldn't work out.

Dewhirst: Yeah, exactly. So, we engaged a marine engineer to draw into a bit of back and forth with calculations. He was slightly out of his depth to a degree as well. because he was used to huge ships and ballast and draft and all that sort of stuff, rather than a little floating park. So, his calculations we found out weren't overly accurate in terms of how it was going to behave once the weight went onto it. So that was a bit of a roller coaster during the project, especially once the soil went on. The modules were basically stacked up. So, in some of the corners you've got about, I think at most four rows deep of the modules to give that extra buoyancy. And where it's across the lighter areas, it's just a surfacing. It's only one and two layers and that seems to have worked. But that took a lot of back and forth and divers trying to get this

exactly right. Obviously with the weather it behaves differently every time. If it gets really hot, the modules expand and push up certain corners up a little bit. And when it gets really wet, they sink because of the weight of the soil or the water storing in the planters. It's quite a dynamic structure. Even after almost two years we're still seeing that sort of thing that we didn't expect it to do.

Borelli: Yeah, so you guys basically stacked these modules to get some extra buoyancy? That's what it sounds like.

Dewhirst: Yeah, correct. The engineer could get the exact calculation, so it was influenced by him. But then a bit of trial and error once you're on site and trying to predict what would happen in the future once the plants matured and all these other variables. We did our best, but it seems to be going really well.

Borelli: Yeah, it does. One of the questions is, "What were the driving goals?" You talked about that already with having it being able to function and float on the surface without flipping anybody over. Is there anything else that was really a driving goal for this design?

Dewhirst: It was just basically the urban oasis because of the surrounding area and the sheer number of people that were going through this area. Even the residents, at least in the high-rise apartment buildings right next to it were looking down onto this dark and black body of water. "How can we give the space what it needs and for it to be a free amenity for the public?" But you're catering for events as well as creating chats and becoming an attraction to visit in London. Then obviously the environmental benefits of trying to draw in insects and more fish, birds and animals to an area that's not accessed really by them at all.

Borelli: Yeah, and that leads to one of my other questions: has there been any wildlife around? I know that was something that you guys tried to do with your planting, was to attract more wildlife. Has that been achieved?

Dewhirst: Yeah, we've had geese, ducks, coots, water fowl, and these smaller birds. They've got photos of the geese and ducks up on the structure, checking it out whilst we were building it and wandering around going, "What the hell is going on here?" The plants have established. A bit floats off to the side which is

where the birds are supposed to nest. We had a goose plunk itself right on the anemones and grasses up that we had. But that was fine. We were replanting the independent part of it last season and there were a couple of coots and waterfowl nesting on it. Because of the regulations for the protection of birds over here we had to wait until they moved. And the client was getting a little bit itchy going, “Oh, well this planting... and the big investor who paid for the structure is coming. It just needs to be good.” And we’re like, “Well, we can’t do anything. We can’t touch the birds or do anything with their eggs. They’re just going to have to wait.” And we’re seeing an increased number of fish. There’s carp, bass and pike that swim up to the canal. The modules actually have started to moss up underneath and creating a little environment under there. Essentially the bottom of the canal was just tarmac, and it was really plain and nothing was happening. But development of algae underneath has brought more fish having a look around and we’ve even noticed a craw fish nuzzle in between the modules in the little gaps.

- Borelli:

So, maybe there’s some things in there that you haven’t even seen?
- Dewhirst:

Yeah, exactly. And that’s something that I’ve watched unfold over the last two years because our office is pretty close to it and we’ve got the plant maintenance contract for it. So, we always get feedback from our maintenance guy and I try and pop by whenever I can and show it off to friends. And you notice all these little things. I did see one of the questions you had towards the end about “What could you have done to make it better?” I think we could have investigated beneath the water more to see what could be done under there, or if we could set up a camera to monitor underneath it now that it’s grown up a bit of moss. I think it’d be interesting to see the behavior of the structure, how this underwater wildlife interacts with it, and how we could improve that or increase the numbers more. And then the classic piece with butterflies around the flowers.
- Borelli:

Sure, pollinators. And then, have you conducted any post-implementation evaluation? And what were the results?
- Dewhirst:

Not officially in terms of a scheduled program. But like I said, with the changing behavior of it, I pop down there and personally take the water levels on all the edges of the floater to try and work out how much it’s varying in the basin because even the Canal and Rivers Trust who own the land (and then

European Land and Property lease it off them) couldn’t give us definitive water levels. They gave us one, a measurement of 150 millimeters variation, but that was from a part in the canal system 10 miles away or something like that. So, it was useless really. We’ve got the two access ramps. So, you get onto it and try to account for that movement, but they only have a particular range and we had to get them built to account for this range that we were uncertain about. We had a mess. They are going okay, but it doesn’t seem to want to stay on this little strip of metal that’s there to protect the decking. Every time I go there it’s slid off one end or the other and it’s starting to frustrate me.

- Borelli:

You said the little bit of metal is on top of the floating module?
- Dewhirst:

The free-floating part of it. Is that what you mean?
- Borelli:

Yes?
- Dewhirst:

It’s an independent island off of the mooring area that can’t be accessed by humans unless you jumped into a boat. The idea was to try and have a little wildlife haven there planted with wild flowers that the chicks can feed on. On the back end of it, there’s a little bird ramp that we built attached so the smaller little chicks can swim up and easily waddle up to the planted area and back to their nest.
- Borelli:

I’m looking up some pictures... The way I understood the free-floating part in the center was the portion that you were responsible for. So, there’s the portion with pavilion on it. And that is not free floating?
- Dewhirst:

Oh, no, no. I thought you meant the one that’s not accessible by people. There’s a rectangle the big rectangular planter next to the decked area that’s by itself.
- Borelli:

Oh, yeah, I see it now. Okay.
- Dewhirst:

Yeah, that’s a little planted area for birds. It started to get up and its own space in the lovely planter bit in the main. But no, it was the whole thing. The whole thing was under our scope of works.
- Borelli:

Cool, and then what feedback have you heard from any visitors on the site?

Dewhurst: Glowing feedback, Taryn, all glowing.

Borelli: I know you guys won a lot of awards for this.

Dewhurst: Yeah. Yeah. We've managed to bag three awards. We actually won our third one last Friday.

Borelli: Oh! What was that?

Dewhurst: The Society of Garden Designer over here, which was nice. It was in the commercial category, I believe. It's the project which keeps on giving, which is fantastic because it was extremely difficult, and we turned it around. It was probably only 12 months, really, from design to build. It was a quick turnaround for a pre-unit project like this. So, we're really happy to get recognized for it.

Borelli: Yeah, that's awesome! Congratulations!

Dewhurst: Thank you very much. Interestingly as well, from someone like yourself, I'm called in! Great! I love it. Like I said, I can bore anyone to death about it. I also spoke to Urban Rivers. It's a start-up company trying to rejuvenate a section for the Chicago River, and they've developed all these little floating gardens. One of the guys running it asked, "You built this. Can we have a chat?" He wants to take that idea and try and make it more accessible to people. It was thinking about how he could join an accessible system to his currently planted system, and the risks, difficulties, and costs of doing that. So that was cool to engage with a him. I think it was just after Christmas and we sat there and chatted through some details. Yeah, it's really exciting. I'd really like to do something like that again. Then we had another company that's doing some floating restaurants in Liverpool. If that goes well, they'll do some in London as well. And they were chatting to us about how they marry the two systems. They've got this ridiculously extensive system to make the restaurants float. But I would say that I've made quite a standard to make the public realm area float. I'm waiting for a call back and hopefully we can get a little design proposal with them as well. But they've got to get it past planning. The dock they're doing it at in Liverpool is a big heritage area. So, there's the awards and all these inquiries. It's really good that there have been roll-on effects

from doing something like [the floating park] and taking that risk in the first place.

Borelli: Yeah, that sounds great.

Dewhurst: Yeah, very pumped.

Borelli: I probably don't even need to ask this, but have people used the site since its implementation? It sounds like they have.

Dewhurst: Oh, yeah. If the sun's out, generally [Londoners] just get outside. It really does change, especially as an Australia. When I came over here, I thought that they'd gone nuts. I didn't understand why there were so many people in the park. "Is there an event going on? What's going on here, man?" No, no. When the sun comes out, people just go and sit in the park in the day and it's not even that warm. It's huge with the residents. It's packed in the summer months.

Borelli: Yeah. Do people bring their laptops and work there? Use the pavilion?

Dewhurst: Yeah, laptops. Chilling out, lunch dates, meetings, and exercise classes in addition to the two mooring points there. Currently there's a young startup business with a canal boat that you can rent for events and take little trips out of the system. That's moored right in there, so it gets lots of exposure. And we included a little pedestal that has a light tower and water services for the canal boats. They can pull up and plug into that, which gives it a little bit of extra appeal. It's bustling always, which is fantastic. Except for in the colder months obviously. But if the weather is half decent people are on it, which is great.

Borelli: Yeah. Are there any other special events that happen there like educational, cultural, religious events, or concerts?

Dewhurst: Yeah. We opened it in June 2017. I'm sure you've heard of the Chelsea Flower Show over here. A festival that runs in parallel with it is the Chelsea Fringe. BBC Radio 4 "Gardeners Question Time," is a popular gardening radio [show] here that they do once a week that all the old people who love their garden listen to and probably a few others. They had a live-recorded show on there with our director as a guest because his specialty is plants. He really is quite

impressive, whereas I'm not. Thank god for him, but I'm getting there. We've had a cool art installation there where they had all these different lights, scattered in the water around it and it looked awesome. We've got lighting on it at night. So, you have that and then there'll be a starry installation around it in the canal. It looked really cool. And then the Merchant Square Estates has their events calendar. They had a gin cocktail bar there last summer. They had live music for up and coming British artists once a week, movie night, exercise classes and all that. It's ticking all the boxes in terms events. For ridiculous a fee you can also hire it for a private event. I don't have that sort of money, but it's possible. And we're also hosting a regional meeting for the British Association of Landscape Industries, or BALI, later in the year, which I've got another little talk at. For one of their regional meetings they've asked us to host it on [the floating park], which will be cool. I got a little brief for that the other day. Hopefully the weather's a bit nicer. It's terrible here today.

- Borelli: Same here! Moving on to the plants and the maintenance of the site. I know you said you weren't the top dog that decided what went there, but generally...
- Dewhurst: The top dog is definitely the director. He did the whole scheme. The client wanted color all year round. The trickiest thing was the constraints of the site that the boss really had to think about because it's surrounded by these large buildings. So, sunlight is pretty lacking and there's just an absolute wind channel through there. We had heras fencing, the thin rectangular mesh that sits with heavy feet on the bottom that surrounds construction sites. We had set up around during the build and the winds got so strong that they a whole section of [fencing and their] concrete footings. I was walking down to my lunch one day and saw this section [fall]. Boom! It collapsed into the water. So that was a big consideration. And with the buildings either side as well, in the summer months, you've got quite a harsh reflection from the sun coming off them. So, there was a really tight brief for the planting palette. But, the boss, the designer, the "top dog" as you say, Tony Woods came up with this plan with minimum soil. All the planters completely filled with soil to the sheer top just wouldn't have been able to handle the weight on it. We're certainly only operating with about 400 millimeters of topsoil. And then the rest is a drainage layer, then lightweight void former. To give you a quick wrap of the plants I made my notes because it's not my bag particularly. You can put this as quoted from [Tony Woods], "The garden plants are a mix of wind-

tolerant grasses that move around in the breeze and nectar-rich flowers such as Alliums and Salvias. On the independent little wildlife island, we've got waterside plants including Great Vernate, Purple Loosestrife, and Yellow Flag Iris. For the year-round angle, you can look at the Alliums and Wallflowers in the spring, Salvias and Astrantia in the summer, Anemones and Liriope in autumn, and the Dogwoods, Holly and Hellebores in the winter. If you'd like, I can send you a species list if it would be handy at all for your project.

- Borelli: That would be handy. I'd like that. Thank you.
- Dewhurst: Yeah, absolutely. I could even send across the planting plan. The one we used for construction has probably changed a little bit now, but the majority would be as it is on the plan.
- Borelli: Yeah, that would be great. Any materials that you want to provide or can provide, I would be open to any of that. That would all be very helpful.
- Dewhurst: Fantastic. Okay, cool. After this, have a think about it and then drop me an email and what you'd like in an ideal world. I could really give you some stuff to look through. But the whole privacy thing you've got to be careful about. And I have to make sure that the client is happy for it to be sent off and that the boss is happy for it to be sent off. Anything I can do to help you get a smashing mark in your report.
- Borelli: Thank you!
- Dewhurst: So, yeah, that's the plants. Like I said, I'll send you the list and then you can go nuts on that and do what you will.
- Borelli: Great! Then for the next question, I guess you already talked about the materials and the methods used to construct the floating park.
- Dewhurst: Yes. So that was another thing we had to think very carefully about because the estate was bustling. We had to manually move all the materials through the site between the busiest hours. That was a huge consideration. Things to do in terms of health, safety and regulations, then having a construction site that's on water. That also had its challenges. We had to think about what we can get prefabricated off site, but to the size where we can still move it

through site safely and with minimal people and minimal costs. Every single section on it is bespoke in terms of the structural build up. You've got the buoyancy modules and on top of that sits 100 x 50 millimeters steel sections, all bespoke shapes. The majority [of the steel sections are] 6 x 3 meters. Those came from that initial pontoon system that I was telling you about. It was 6 x 3. We took that and thought, "Oh, hang on. These measurements could work." Because of the movement and the weight distribution, there's flexibility across the whole structure. If it was just one or two sections of steel, it would snap under the sheer pressure and probably do some real damage. We got these bespoke sections made up. There was only one place in the U.K. that had a tank deep enough to galvanize the steel at six meters, six meters long. The metal fabricator here, whom we're good friends with now, was like, "No, you're making this difficult for me. I've found one place in the U.K. that I can galvanize your steel at." The galvanization was important because of the water factor in preventing rust and structural risk once it has been exposed to the elements and water. So that was hugely important. You've got all those sections joined together then there's a big section down the middle of it where the steel is not touching. So, there's two different layouts. And it's not wide. It's only about a 50-millimeter gap. But because of the weight distribution, this allows the bigger sections to wobble about and not be too stressed. So that was one of the good things that the engineer told us. Then you've got smaller timber sub terrains that sit on top of that. And again, them being smaller allows for more movement as it builds up. And then that's our base for all the surfacing - so the artificial grass buildup and the decking buildup. The cavity created by that also allowed us to run all the services. We've got water power for all the lighting, a waste pipe for the canal boats. So, there's wires running all away across between the modules and the surfacing itself.

Borelli: The hardscape material on top, that's mostly decking?

Dewhirst: Yeah, it's a composite decking. So again, the weight of the decking was really an issue when you've got a hundred tons of soil on there. But we wanted something that was still going to be light-weight, low maintenance, and still give a really tasty aesthetic. We use the company quite a lot even with our domestic clients. It's called the Millboard. It'll be probably be detailed on any drawings I send across to you. It's a really cool product. It's a composite, so it's lightweight. It's not actually timber. There's only waste timber and plastic and it's a mold taken from these amazing hundreds-of-years-old

French Oak timbers, which they've gone out and sourced. It's got this really natural wood grain look to it, so did it beautifully. The client liked it and we already were advocators of it, so we through it in as the hard surface. It's a little bit annoying with maintenance tickets. It's not really getting looked after properly. That's unfortunately not our problem anymore. Then the astro turf grass, or the fake grass. We explored the idea of real turf. And then between us in the office, we straight away knew that there was no way that that was going to happen.

Borelli: Because of the weight?

Dewhirst: Yeah, the soil that you need to build up. But, ideally for it to go well, I don't think we even had the depth that we would have needed to be able to guarantee it. Then it's shit whether for nine months of the year here. So, you don't want a big mud patch on this lovely structure. And then the maintenance of watering it as well... It just didn't make any sense at all to attempt to have real grass on there. The buildup for the fake grass is 18 millimeters, new Marine grade ply, and a little shop pad underneath that. It's nothing. It's not even 15 millimeters.

- RECORDING CUTS OFF -

Continued via email

Borelli: What was the overall project cost, and did you receive any additional funding or donations?

Dewhirst: Cannot comment on overall cost. The client covered entire project cost. Because there were limited, to no, precedent examples that could be applied to our site the structure is entirely bespoke and therefore not cheap.

Borelli: Who paid for the fabrication and implementation costs of the design?

Dewhirst: Client. There was a lot of back and forth before a final design brief was established. Because of the project's unique nature, the scope then varied and changed in scale and specifications as the design iterations unfolded.

Borelli: What local policies and land jurisdictions apply to your site and how have you navigated those?

Dewhurst: The Basin (body of water where FPP is) is owned by the Canal & River Trust and leased by the client (European Land & Property). We presented our idea to CRT as early as possible, and prior to planning submission, to ensure we had their support and had addressed any of their concerns (e.g pollution potential and effects on biodiversity). The CRT’s input to variances of water levels in the basin also informed the final design. The site was not in a conservation area nor did it have any specific landscape designation, such as part of a Green Belt or a Site of Special Scientific Interest (SSSI), so we only had to navigate the ‘standard’ planning process through Westminster City Council (WCC). This involved pre-application submission where WCC provided initial feedback on the proposal. We then incorporated elements of their feedback into the scheme and explained, in detail, the reasoning for other elements which they had raised questions over. Following submission of full planning permission, we also undertook a public consultation with adjacent land/business owners and residents. Again, any feedback was taken on board and communicated with CRT & WCC. This ensured all interested parties were up-to-speed on proposal development. The obvious fact of the build site being on water meant increased H&S levels/monitoring such as life jackets, life buoys, battery powered tools and induction information. Because the areas surrounding the site has approximately 10,000 people living and working, we had to spend a lot of time working out best way to construct the floating park and how the materials could be safely moved through the estate to the site in off-peak hours and not posing any risk to the general public or the contractors. All elements, aside from the 90-odd tons of topsoil, were moved to site manually by hand or pallet trucks. The soil was brought down the canal in a narrow barge with a hiab and lifted onto the floating park in 1tn bags (A tribute to the historical transport method!).

Borelli: Was this part of a program or initiative, and were there any specific guidelines used?

Dewhurst: Not directly. Because there were no real precedents of this type of project, and we weren’t bound by any drastic environmental legislation, we had relative freedom in how the design was developed (within reason of course). We wanted it to become a destination to visit in London and play a part in the Greater London Authority’s (GLA) push for greener infrastructure.

Borelli: Is there any other information you wish to provide?

Dewhurst: An obvious statement but analyse the site to the finest detail. For example, water levels, prevailing winds, building facades and site access all had a big part in influencing design development and specification. Carry out tests on buoyancy modules and weight distribution. Extremely crucial. The floating park is a dynamic structure. Almost 2yrs after completion we are noticing different and varying behaviours resulting from seasonal environmental changes and human interaction. Think carefully about material choice. Longevity, maintenance, weight, potential effects to water body.

6.2.3 “Seeds of Change” – Maria Thereza Alves

Borelli: First question is whether or not you would like to be affiliated with your answers.

Alves: Yeah.

Borelli: Okay, great. My second question is if you could re-explain what the main inspiration for the design, or the main concept was for “Seeds of Change” in Bristol.

Alves: In 2007 Arnolfini gallery approached me to do “Seeds of Change” in Bristol. So, I began all the preliminary research (which is in the archives) figured out where the ballast could have been dumped. I did all that research and there was an exhibit of samplings from those sites. I found where ballast was taken off the ship and they also wanted a garden. I always wanted a garden. From the first time in 1989 I wanted a garden. Then we started to look around the city to find a spot that we could ask the city for a garden. It was very hard in Bristol. We found a little area, which was a bit problematic because it was not an area that people know about. Very few people would go there. Only if you were a jogger in that neighborhood, would you go there. So, it didn’t quite work for me and it wasn’t very easy to access. For example, we did a ballast garden in the Botanical Gardens. And my problem there was that it was so far away from the normal working-class neighborhoods of the city. If we had the opening of the garden here, how were the people that were involved in the project going to get here? Most of them had to take two or three buses to get there, and I don’t think that’s very nice. So, then they rented a bus for the opening to pick up the people who had participated. But in the long run doesn’t help because the Botanical Gardens become an area in Bristol. The

Date: February 15, 2019
Interview Platform: Called and recorded on Skype phone app.

Bristol [Botanical Garden] is in an area that you really have to have a car, or you live there to access it. It was still in our minds to do another garden and not in the Botanical Gardens. Years later, [in 2012], somebody from the city council called me and they had a proposition which was a barge in the center of town, which was perfect. I really liked the idea because you could look at the garden from on top a public pathway that is very well used. Especially if it's Saturday or Sunday and there's sun, people are walking there all the time. People come to that area to hang out in the evening, on the weekend. So, for me, I liked it very much. And people would go to the Arnolfini if they wanted to register to get on the little boat to go and visit the garden. I liked it very much and it was basically vandalism-proof. One of the big problems I have with these gardens is the vandalism. There we didn't have any problems with vandalism, so that was another added feature. It was something very simple that was about celebrating the garden and that would have comfortable seating for people. If you go all the way out there and you're listening to somebody talk and give the lecture, you need to be comfortable. It was very open and not about design, but about the garden. Then we looked at different architects and landscape architects and chose Gitta. So, that's how that happened. And the garden was [inaudible] for by the Botanical Society. I did the research on the type of ballast plants that were found at Bristol and the Botanical Society then chose from my list of the plants to plant.

- Borelli: You said that the Botanical Society paid for the installation?
- Alves: No, that botanical society. The city of Bristol.
- Borelli: Okay. Sorry, I misheard you. So, then what were the overall driving goals that you wish to achieve through this design?
- Alves: I wanted people to see what ballast flora could look like – a lot of the nature that they consider British might not be so British - and that it was witness of commercial trade and that there was a history that was a little bit of a hidden history. That's what I wanted people to have access to, that kind of hidden history of shipping in commerce and that the landscape is more complicated than you have been told it is.
- Borelli: Yeah, I thought that was very interesting. Flowers like marigolds that ... of course I did some research before I contacted you... but you say "When does a plant really become native? Like marigolds?" And I thought that was really

interesting. Kind of goes against what we know.

- Alves: This study was for Europe. The study for the US is very different because they had a colonial situation where we have massive entry of plants and an environment of genocide within a very short amount of time. So, that is very different than what the European context was. The European context was they were bringing in those plants themselves into their land base, which is very different than what happened in the Americans.
- Borelli: Yeah. That's very interesting. Do you feel like you have achieved your goals through this design and how so?
- Alves: Oh, I never looked at myself as that. I always think of things as processes, and I don't think that way. I never think that way of achieving my goals. I always think, "What am I supposed to be looking at and thinking and researching and how do I go about that?" I do think if it has been a complete failure. This I didn't think about [in Bristol], but everything else to me is just a process. Bits happen bit by bit. So, I don't consider ["Seeds of Change" in Bristol] a failure at all.
- Borelli: Yeah, I wouldn't either.
- Alves: There were some projects in my past when I was younger that I considered to be close to failures, but I learned a lot from them. But I think this was a project that worked very well. And I think what was really amazing to me was also the possibility to have funds to invite scientists, the artist, musicians, and storytellers to use the space. I think that was an amazing possibility, a great privilege.
- Borelli: Yeah. I really do also admire the community engagement portion of this project and how it serves as a cultural platform for the city as well. Have you conducted any post-implementation evaluations? Again, these are questions that I have to ask every interviewee. So, if you could just answer them to your best ability.
- Alves: These questions are not very applicable if you're an artist because you don't get any post production monies to be able to do that. Yet the reality is that if I go back, I have to pay my own hotel. I have no salary to be able to work

and ask people so that doesn't happen. Having said that, for a project to get funding from the city, Arnolfini had to conduct studies beforehand. They had to ask the population that they thought it was an interesting project. They did all that beforehand, this I know. But I wasn't part of that process because again, that's flying me in that's paying my hotel. That's paying me a per diem and that makes it ridiculously expensive. That makes no sense.

Borelli: Right. On the other side of that, what kind of feedback have you received from visitors on the site? Or any type of feedback?

Alves: The feedback I have is that it is the most visited public work in Bristol.

Borelli: Wow, that's amazing.

Alves: It's there for the bees, but when it was a functioning garden, it was the most visited place.

Borelli: So, is it still functioning though? As part of the Arnolfini?

Alves: No, because there's no funds. So, on the last planting it was decided that it would become an area for bee pollination. That the last plants planted would be ones that are friendly for bees to own it. So now it's a bee area.

Borelli: When was that last planting? What year about?

Alves: About [2017].

Borelli: How have people used the "Seeds of Change" in the past?

Alves: In the past? Let's see... In Marseille I didn't get to exhibit it too much later because the government was right-winged and there was no support. In Finland, that one worked out very well because I worked with the community for almost like a month. There was a very small community and I took samples in their gardens. Their gardens were by the ports, so they had ballast in them. It was in their museum in the small town. I mean, it used to be a town, but it's so small now that there's hardly any people. Then there was a town nearby that I think like 30 minutes away that had a museum. The museum of contemporary art and I put the samples of the garden in a greenhouse there.

There were chairs around the greenhouse and the idea was that the people from the community could go and have discussions about it. The opening went very well, people were very pleased to see their names. Every sample I took I put the name of the person where I took it from, and this was very much enjoyed. I don't know what happen afterward. Liverpool was in Liverpool Biennial, so that was in a very much art context. There was not much funding to do that work at all and that was a great pity. I really wish I could do a garden in Liverpool. There they had an amazing amount in ballast coming in because of the slave trade. They had so much ballast coming in that they had to get rid of it. And so they used it as foundations for buildings. I wish I could have done a garden because it would have been very important. But there was no funding, so it was just a very basic exhibit of the research material and of some of the plants growing. And then we had Dunkirk. And in Dunkirk I had no community network there. But we were able to do it in a ship, which I thought was really nice. It was a ship museum, so the plants growing inside the ship. So there was an audience of people that were interested in the history of ships that would go visit it. And then we did it in Exeter. There it was in a local cultural center. People in the neighborhood go see it and not many others. That worked for me. And then we had Bristol, of course. Now we're going to have Antwerp. That was done in 2009, but it was never exhibited because it was supposed to be shown at Extra City in Antwerp, the cultural center gallery. The director that commissioned me was leaving at the end of the year and the new director was not interested in the work. So, I never got to show it. And then this exhibition space called "Stuk" in Leuven in Belgium wanted me to do a "Seeds of Change" there. The port is very small, so the history is very limited. And I said, "Well, that's a lot of effort for a small amount of work that would be missing. So why don't we show Antwerp that has never been exhibited?" So that is next weekend. It will be shown this coming weekend and so I'm excited about that. That's just research that's shown because the port area has no community area anymore. It's very chic, trendy restaurants and boutiques. It's transformed a lot already. When I was there the airport – which was most interesting to me – was being transformed. I have not been back to Antwerp, so I don't know what it looks like. I would be curious to see what happened to everything that I was interested in. It's very sad that in Bristol, Liverpool and Antwerp the research could have saved an area and made it a study area of commerce and history. It was before they were renovating, just before they innovated these ports. They could have been an interesting small little thing. They didn't have to be big, but some memory of that. In all these spaces that

was not possible. So, too bad.

Borelli: Yeah. And then for the floating garden and Bristol specifically, what kind of special events have happened on it.

Alves: Dozens and dozens.

Borelli: Dozens and dozens? That's great.

Alves: They have a book published on it because the list is very, very long. I just know that some friends who are artists have talked there. I have a friend who's a scientist, from Finland, Yrjö Haila. He's an ecologist and was invited to give a talk. There were musicians there. There were dozens and dozens of events to play. And that's very well documented. There are pamphlets with everything for each year with the events. I thought they did a very nice job.

Borelli: Great. What types of species of plants were maintained on site? And I know that varied from year to year.

Alves: Yeah. It was from the ballast flora and the Botanical Garden made a selection that would look interesting. Each garden was visibly different. They made a selection from that list.

Borelli: Great. Um, and then I know you said that right now it is a pollinator garden, but have you noticed or has anyone else noticed any other animals on the site or immediately surrounding? This is a question pertaining to its ecological use.

Alves: I think obviously birds would use it. Birds were using it when I was there as a place to hang out on, specifically seagulls. I saw a lot of seagulls down there. So, I would imagine that seagulls are still hanging out there. And probably ducks and pigeons. I mean, this is a city urban context. They like it because it's higher from the water, but a duck can fly onto it, a seagull can fly onto it. It's like a landing pad and they're near the water and away from people.

Borelli: Yeah. Can you talk about the different maintenance procedures for this site? Like how often and what to do and extreme weather?

Alves: I think now there are no maintenance procedures because there's no funding.

The Botanical Gardens took care of it. There was an irrigation system, but they were there every week making sure that everything was neat and they trimmed the plants, whatever they do. They took care of it. That barge has been there forever. It's been there a long time and they wanted to do something nice with it. Nothing has happened with that barge before under extreme conditions and I don't think anything ever happens with it because it's a concrete barge. So, I don't imagine there's any problems since there hasn't been sixty years before.

Borelli: You said that Bristol City Council owns the site, is that correct?

Alves: No, they don't own it. They funded it. I don't know who owns the barge, but maybe they do, but I'm not sure.

Borelli: Okay. I'll have to reach out to them as well. Were there any local policies or jurisdictions that you had to go around for this art installation?

Alves: I don't know because that's not my job. The commissioner, the person that hired me, that's their job. This is a very nice guy, Aldo Rinaldi. I can give you his email if you need more specific answers.

Borelli: Right. That would be nice.

Alves: As [the barge] was already there we didn't bring in anything new to the area. We were just bringing in a little boat that would bring people in. They made a ramp that was very secure and all that was very well planned. I mean, the barge didn't move. It's been there forever.

Borelli: Right. In your opinion, what else could have been done to make the design more successful?

Alves: Maybe a little area for when it rains.

Borelli: Yeah. Oh, that makes sense.

Alves: Yeah, we didn't have that. So that might have been helpful. When people come for talks, like the day I went, it was really raining and windy. We had the talk in the boat and then we went in there and had a quick tour, which is one way

to do it. But maybe next time it would have been nicer if the barge was bigger. This is the problem: the priority were the plants. If we had a bigger space, a little covered area would have been nice.

- Borelli: Right. And lastly, is there any other information you wish to share about “Seeds of Change” beyond the questions that I’ve asked you?
- Alves: Just that the work in Europe is very different than the work in the U.S., like the “Seeds of Change” in New York. We’re looking at different industries and different situations with plants with different context. That’s important to keep in mind that the questions that arise in the European context is very different than the questions that would arise in the U.S. context.
- Borelli: Well, that’s all I have for you today. Thank you so much for taking time out of your day to talk to me. It was very helpful.
- Alves: Yes, they were very painless questions and anything else you need that are specific, let me know and I will put you in touch with the, the person that would best be able to answer it.
- Borelli: Yes, that would be great. Thank you so much.
- Alves: And how do you pronounce your name?
- Borelli: Taryn. It’s a little different.
- Alves: Yeah. Thank you, Taryn. Thank you. And enjoy the silence of the snow that’s coming. It’s a good time to work because it’s very quiet.
- Borelli: Yes, that’s true. No distractions. Few people are out. Well, have a good rest of your day.
- Alves: You too. Thank you.
- Borelli: Thank you. Bye.

6.2.3.1 “Seeds of Change” – Supplementary Information from Aldo Rinaldi

- Rinaldi: Thanks for your email, and I am happy for you to use my response in your document and research yes, that is indeed what it should be used for. I would welcome seeing a copy of the final report as well, as I am interested in this territory you note. I am a commissioner of public projects and part of this includes those with an ecological link. Maria’s work in Bristol was one reapplied project, but I also developed a proposal with N55 from Denmark for Cardiff in Wales that was a floating garden (in a geodesic form) that only animals could access. It did not progress but is a lovely proposal. I am also working on a garden in London with an artist, architect, and horticulturalist (Nigel Dunnett).
- Borelli: Who owns the site and who is responsible for the maintenance of the site?
- Rinaldi: The site (floating garden or barge) was owned by Bristol Harbour Authority. They had left it moored near Castle Park as they did not know what to do with it really. It had been there (along with one other similar) for many years, possibly event 40 or more. The other barge was used for a scout hut and was dry and working. Our barge was full of water, rubbish and was semi derelict. The building opposite the two barges was undergoing development and refurbishment and with it, the developer asked the Harbour Authority to move the barge, as they felt it was ‘unattractive’. They approached me about it and I then connected that opportunity to the ballast seed garden idea, which had been in gestation in Bristol since Maria’s show at Arnolfini (Port City) in 2007. So, 5 years later from her show there, and the proposal to develop a ballast seed garden in Bristol we realised a garden, on water. The Harbour Authority allowed us to use it and it still sits on the floating harbour, but the [“Seeds of Change”] project completed after 5 years in 2016, and with it the responsibility to maintain, move, or dispose of this flipped to the Harbour Authority. The [Harbour Authority] are part of the city council, a department of that. As for future, the University of Bristol Botanic Garden who were involved were/are interested in the barge for a further project and Nick [Wray] there (cc’d in) can comment on that perhaps. Not sure if he is developing that now or not, but it was an option.
- Borelli: What local policies and land jurisdictions apply to your site and how have you navigated those?
- Rinaldi: The site (Floating Harbour) is a heritage site, it was designed by Brunel

Date: February 23, 2019
Interview Platform: Via Email

(Isambard Kingdom) the skin or edge of the floating harbour being a listed structure. So, we needed to consider that. We also had to look into water runoff, and contamination, working with the council’s ecology and pollution advisors to ensure that the cleanup of the barge did not pollute, and that the new barge did not introduce any pollutants into the harbour. Also, that the water that was used (sucked up from the Floating Harbour) to irrigate the garden was safe and would not inversely pollute our plants. So, there are policies that were relevant, and we had to deal with, but the Harbour Authority and others were helpful there and Nick was the expert on the plants, compost, soil and other issues there.

Borelli: And then, of course, any other information you wish to provide would be extremely helpful and appreciated.

Rinaldi: There is a lot of information on the project and the programme over the last 5 years it was in existence on the dropbox folder and happy to provide you with further info. We had some 90 events over 5 years and I am working towards a publication on the project to cover the design, 5 annual planting designs, the programme over the years, and contributions by the many people involved. Important to note, that the project/barge was designed by Gitta [Gschwendtner], but the concept is that of Maria. Maria is the author of this project, and the product design or landscape design was Gitta, with the planting and horticulture by Nick Wray at [University of Bristol Botanic Garden]. A collaboration that stemmed from the idea by Maria. We were delighted to see [Maria Thereza Alves] win the Vera List prize too, the project was a powerful work that drew new audiences, and discussed the projects darker underbelly (Bristol’s links with the slave trade) in an indirect way, a topic that continues in Bristol, and has led to the renaming of several buildings (previously called ‘Colston’) such as Colston Hall.

Date: February 25, 2019
Interview Platform: Via Email

6.2.3.2“Seeds of Change” – Supplementary Information from Nicholas Wray

Wray: Just to support Aldo’s comments. I would like to add. We are currently applying for funding to convert the Ballast Seed Garden in to a demonstrator pollinator planting. The shape and form of the Ballast Seed Garden will remain the same, but the planting and interpretation will change. It is our intention to move the Ballast Seed Garden further up the harbour to a new site that is being developed by the University of Bristol. This is a long-term project, but if it comes together will see another longer life for the Ballast Seed Garden

project.

Borelli: Thank you for the additional information. I am wondering if the new pollinator garden is planned to be accessible to the public?

Wray: Yes, but how is uncertain at present.

6.2.4 Chicago Riverwalk – Steven Walz

Borelli: Hi, can you hear me?

Walz: Yes. Yep.

Borelli: Great. I think I got it now. Sorry about that. That was unexpected.

Walz: All good.

Borelli: And I can, I can see your screen, too. I think we’ve got it all figured out now.

Walz: Okay, cool. So, you’re all set with the recording on your end?

Borelli: Yes, I believe so.

Walz: Okay. Sounds good. Well, thanks for reaching out again to the Sasaki and Zach about the Riverwalk. It’s exciting to hear that your master’s report is in part about the walk. Have you visited yourself?

Borelli: No, I haven’t, and I wanted to do that pretty soon, but last time I was in Chicago it wasn’t implemented yet.

Walz: Oh really? Okay. Well, I would suggest going there in the summertime. You’re going to want to see the river walk in it’s full effect. It’s nice. It’s nice wintertime too, but more enjoyable in the summer when there’s activities happening along the Riverwalk. I guess we want to jump into your questions, or do you have...

Borelli: Yeah, so my first question for you is whether not you would like to be affiliated with your answers.

Date: February 15, 2019
Interview Platform: Zoom
Meeting recorded with Rev Call Recorder phone app.

Walz: Yeah, I can. I'll say yes for now. And I think I saw that until April 1st you can change.

Borelli: Yeah, for sure.

Walz: Okay. I'll say yes for now. And then if anything changes, I will let you know.

Borelli: Okay. My first question for you is, "What was the inspiration for implementing these floating wetlands along the Chicago Riverwalk?"

Walz: The inspiration for the floating gardens was to try to bring back, in a conceptual way, what the Chicago River used to be prior to the city's development. As you may be aware of, Chicago went through a massive change during the industrial revolution. It went from the river seen as an ecosystem. And then it became more of a conduit for industrial trade et cetera. And then in the 1900's and 2000's it started to become more geared towards recreation, but still serving as a commercial conduit for the city. That's how most of the commerce was conducted in the city, was via the Chicago River, even in conjunction with the train lines that went into the city. So, that's where it started as an origin. We want to tell the story of the river bank from when it was in its pre-development stage. So, we took an ecological cross section of what one typically finds in northeast Illinois in wetland areas. So, we have the forest savanna, prairie and wetland in this northeastern Illinois ecology. We simplified it a little bit saying, "Well let's start with inundation-tolerant plants to be used as the forest and savannah, and then emergent plants for prairie, and submergent for the wetland." That's how it evolved. Um, and then we looked at precedents for different floating garden installations around the world. We had a couple of ecologists in house that helped look at what types of fish and mammal species would benefit from the floating gardens that are native to the northeast Illinois region. Then, taking that conceptual section and putting it into our design, we had inundation-tolerant species high and dry behind a seat wall underneath the Upper Wacker arcade. And then as you go towards the Chicago River main walkway, and as you go into the floating garden itself, we have emergent and submergent species. We worked with our wonderful local landscape architect, James Ryan Associates, to develop the plant palette for all the Riverwalk, specifically, for the floating garden plants. The Jetty is the closest "room" to Wolf Point to the west, which is the big green space that separates River North from the

Loop downtown. That's historically where a lot of the farms and stock yards were located before the city developed. We wanted to have the Jetty to be a learning environment, or outdoor classroom to learn about fish and mammals that are native to the area as well as the plant palette that is typically seen in this area. What many people don't know is that there's an underwater habitat that we designed for fish. So, the floating gardens have their roots grow and go through the planting matrix into the water and provide a food source for fish. Then around the caissons, or eight-foot diameter columns that are driven into the riverbed, they have structures called lunkers that provide shelter for fish from predators, larger fish or mammals. Then, underneath the entire walkway... the Jetty is the only room that sits on top of the water. Every other room is filled out to a sheet pile wall and back filled with gravel. But the Jetty, being an ecologically-driven room of the Riverwalk sits above the water. There's about nineteen caissons that support the entire room above the water. Underneath the walkway we have these curtains hang down from either side of the walkway.

Borelli: What are the curtains made out of?

Walz: The curtains are made out of nylon rope and the thinking behind it was biofilm would accumulate on the nylon rope and provide a food source for fish. One's around the caissons. Underneath this was the walkway and we have these lunkers in this location. We have the structures that are essentially like a fence turned on its side with nylon rope that hangs down from the chain link part of it. These are the caissons. Around the caissons we have our lunkers, and then below the lunkers we have what we call "pole hulas" that are made of steel and then they have nylon rope that hangs off of those as well. I'm sharing these details with you, but these will not be able to be used unfortunately in your report. Heads up.

Borelli: Okay, yeah, that's fine.

Walz: So, these are the lunker structures with the caissons. And these are the nylon rope pole hulas. So, that's what's happening below everything.

Borelli: The pole hulas, are those also made out of the nylon rope? So, it's another way to gather biofilm?

Walz: Yes, correct. These are the peers that jut out into the river. On the outer peers they have the lunkers. And then on the outer caissons they have the lunkers, and inner caissons they have this nylon rope. This is the structure that hangs down from the main walkway. It's like a fence turned on its side with nylon rope that hangs down. That's how it's laid out under underwater. Everything is focused on the west end of the Jetty. The thought was if it's successful and we're able to measure its success (which we're working on now), it could be implemented on the other caissons that support the under-bridge crossings that go underneath all of the basket bridges along the Riverwalk. So, it's a kind of a test for it.

Borelli: The lunkers are the structures with the little cutout holes around them. What is the purpose of that? Is that supposed to be a habitat for fish to provide like a little hiding spot for them?

Walz: That's exactly it. These are the lunkers when they were being delivered to site. Then there they are being craned over Upper Wacker and down onto the caisson foot. They drilled the caissons in first before they put everything else, like all the finishes on concrete-wise. They slipped this over the caissons and down into the resting spot for it. I think this video here shows them...

Borelli: And it's snowing too. Oh, boy...

Walz: You can see it. You can see them lowering it around the caisson into place. We have documentation that it went in, so that's good. That's good.

Borelli: Yeah. It is there. You can't see it, but it's there.

Walz: Believe it or not. That's what's happening below the walking surface. Then we have the floating garden system that we worked closely with several suppliers. But we were tracking towards one that seemed like it would provide the best opportunity for success in the harsh environment that these floating gardens sit in.

Borelli: Harsh in what way?

Walz: So, the main branch of the Chicago River is controlled by the Army Corps of Engineers and there's a lock system at the main branch's interface with Lake

Michigan. The Chicago River still acts as a combined sewer overflow CSO system for the city, which is being phased out and will be completely phased out by 2030 with the opening of the Deep Tunnel Project. That will bring sewer overflow to a quarry south of the city. But now it still acts as a CSO. So, if they're expecting a large storm event, they have the ability to lower the river 4 feet from where it is in this photo, and then it can vary up to 8 feet. So, they lower it down to 4 feet. Then the maximum with all the CSO overflow can go from -4 to +4 feet. So, it's 8 feet of vertical change, and +4 (plus or minus a couple of inches) is the maximum that the river can get before basements of buildings downtown flood. They have to lower the river in order to allow for the influx of overflow to prevent buildings from being flooded. On the pylons, we have etched level markers every foot that shows what the elevation of river is. Yeah, so that's a big constraint. The other one is the ice flows in the river in wintertime. There's a lot of lateral pressure being put on the floating garden system itself. So, when you're combining the need for the floating gardens to go up and down vertically, you also need to account for the lateral forces of ice flows and wave action from boats when it's in the summertime.

Borelli: So, is that the reason for the stainless-steel bases?

Walz: Yes, that's exactly right. We have this stainless-steel frame that wraps float material within the stainless steel. There are very careful calculations that we did. We had a structural engineer, a civil engineer in-house who did buoyancy calculations, which were to determine what the depth of the felt material needed to be. Then, it was confirmed by the contractor during construction. Because the stainless-steel system (the protective barrier) needed to float independently of, but at the same elevation as the self-buoyant planting matrix within the floating garden frame itself. So, this planting matrix is self-buoyant. It's like a woven poly... almost like a fabric that they inject Styrofoam into to give it buoyancy. So that system on its own floats by itself. The floating garden frame around it with all the connections et cetera needed to float at the same elevation in order to make sure the plants are sitting at the right elevation in the water for the root mass. The matrix is four levels thick, and this is where the bottom of the pots is. This is where the waterline is. So, this is like the magic spot right here. That was a major engineering exercise that we took on to design the system. This detail here shows you how the system works around the pylons to allow for vertical movement. And then the third, maybe even most important design constraint, was this act of Congress

that the project had to be awarded, which is the loan of construction. This white dashed line here, called the “Volpe Limit,” is limit of construction. That was granted by the act of Congress. So, in all of the rooms, it was 25-foot offset from the existing dock wall, which was right here. This is where the existing edge of structure was. So, we could build out 25 feet to this dash line in between the “rooms” – that’s what we call them – between the streets that cross over the river. And then, at the under bridges, I believe it was 20 feet offset. Then, at the boardwalk, we had 60 feet because there’s more space, by Wolf Point to build out. The board walk is the last room and the latest construction to the west. So, those are all the mandates that helped inform the design requirements for the floating gardens. This is what they looked like before they went in. This is that woven fabric and stainless-steel edge. That’s them preparing. They closed down Upper Wacker and did it at night. They closed down two lanes of Upper Wacker and then brought the crane out to do this all at night. That’s, them getting it ready, lifting up in the air and then setting it into the river.

Borelli: How big are they each? About 5 x 10?

Walz: They vary in size. I believe they were about 7 x 20, approximately. I have the precise dimensions somewhere... Yeah, so they vary in size, but they’re all about 7 feet wide. The typical floating garden is 17 feet.

Borelli: Okay. So rather large.

Walz: Yeah. I forgot what the total weight of each one was, but it was quite heavy. The stainless steel was used because the water’s fresh water. It has all these salts and solids that are discharged into the river. So, we use marine-grade stainless steel to promote its longevity in the water. So that was it going in and this is how it looked two years after installation.

Borelli: It looks great!

Walz: Yeah, and these, these photos were provided to us by Martin Ecosystems, the floating garden matrix supplier that we use for the Riverwalk.

Borelli: And then I saw a picture that said BioHaven, a label. So those are Martin Ecosystems’ BioHaven and they source it out to you guys, the designers?

Walz: I believe BioHaven is a product that Martin Ecosystems makes. They produce several different types of floating gardens or floating applications. And the system that we used was this BioHaven floating garden material. But I believe that Martin Ecosystems offers other systems. This one just seemed to fit the bill for what we needed it to do in the Riverwalk and as I mentioned before, we worked with several different manufacturers because it was a publicly bid job. So, we had to list alternates for each of our products. There were several different manufacturers that could have been selected and they ultimately selected the supplier that we were working with during the design and documentation phase. But we spoke with others and the system would have worked with several different types of infill matrix. They just happened to select the fabricator that we were working most closely with.

Borelli: That’s a lot of great information.

Walz: Yeah. Probably wasn’t really what you were really looking for.

Borelli: No! Exactly what I was looking for!

Walz: Okay, that’s good.

Borelli: It provided a lot of clarity. Sorry if some of my interview questions might seem redundant. It seems like you’ve already answered most of them, but I have to go through each one of them just to make sure that I have all the questions answered. So, the third question is about the driving goals and what you wished to achieve through this design. If anything seems redundant, just feel free to give a short answer if you want.

Walz: Yeah. So, the driving goals were most importantly to provide underwater habitat to start to bring back fish and mammal species to the main branch of the river. And that will happen exponentially. There’ll be an exponential growth of a fish, animal, and plant species in the river as the CSO is continued to be phased out. On the main branch, this starts to show improvement in the water. We’re getting water quality tested as part of some case studies that we’re doing with various entities. So hopefully we’ll have measurable, positive impacts. So, bringing fish and wildlife back to the main branch of the river was a driving goal. Another one was to have it be an educational room for an outdoor classroom, like a fishing habitat. This low rail that’s

along the entire walkway is preparation for seating, while the upper rail that we have in the north east corner of each of the peers that go out into the river... we did studies in house, as you can see here, for fishing. So, this rail dimension is what was installed. We studied it and looked at the guidelines for a fishing height in that dimension. What we have in the corner is just perfect for fishing and it provides a safe area for people to cast and reel. I think for the next item, I do feel that the design has achieved these goals. There's an annual fishing derby that they have in the Jetty that they've started maybe last year. I'd have to confirm that it's an annual event, but I believe it is an annual event that they're starting to have children go out and fish in the river and catch and release. When I've been out there, I've seen ducks and geese. I don't think I've seen any mammals out there, but I have definitely seen ducks and geese sitting on top of the floating gardens or around them, which probably wouldn't have happened. There's also ton of butterflies and birds that otherwise wouldn't be down here without these floating gardens or the planting improvements that were made along the river in general. More specifically the floating gardens, I personally have not noticed an increase in diversity of fish, but with the case study investigations, we hope to be able to confirm that. So, I guess that leads into the next question about post-implementation evaluations. Yes, we have. The University of Michigan did a case study investigation. Their report isn't finalized. I think it will be finalized by the end of this semester. We're also working with Polanski Architecture Foundation, too. We're working with Illinois Institute of Technology right now for additional research using the University of Michigan report, but we haven't given that to them yet because it's not finalized. I'm actually working with two individuals from the Illinois Institute of Technology right now to help inform their research, at least the starting point for their research for the Riverwalk. They were looking at the entire section from the phases two and three. So not just the Jetty, but all those rooms that we designed.

- Borelli:

Okay, great. The sixth question is what feedback, if any, have you received from visitors on the site?
- Walz:

Yeah. So, we're based in Boston, but my family lives in Chicago and when they're downtown, there always seems to be a buzz about the Riverwalk and it's a destination spot. Now, it's a revenue-generating amenity for the city. Whereas before, at least after the industrial revolution, it wasn't a place that people went down to to explore. It was kind of a harsh environment. You were

separated from the water by several feet. So, this brings you down to the water. There are so many different amenities. The City Winery is very popular in the summertime. There's also Tiny Tapp, which has food and beverages. There's also boat docking, kayak rental, a water taxi stop, and river theater, which is two rooms to the east of the Jetty. It's a series of architectural stairs where the water taxi stop is. They have art installations that they put on barges and dock them along the dock edge. It's good spot for people to bring their brown bag lunches and take a look at the art installations, movies, or live performances. Then, the Water Plaza, the one immediately east of this room has an interactive water play feature with changing rooms. There's also a lot of art installations along the Riverwalk now. I think it's been a big positive. It's had a positive impact on commuters, visitors and the everyday business people as well. The Riverwalk is used daily by people who walk from Ogilvy and Union Station to the west. If they work in River North or by the lake, they use the Riverwalk to bypass all of the stoplights that cross the street. This is a continuous, one-quarter mile walkway that's uninterrupted. It cuts down on walking time dramatically if you're not just out there to take it all in.

- Borelli:

So, it also serves as a transportation network or walkway for pedestrians. That's awesome.
- Walz:

Yeah, I guess the next question is kind of what I had described.
- Borelli:

How people use the site? Yeah.
- Walz:

Yeah, I think they use the Jetty specifically for education and fishing. It's a good spot to sit. It's also very calming to hear the floating gardens. The water hitting the floating gardens and the stainless-steel links hit together. So, it's a calming environment. And on the Merchandise Mart across from the Jetty, I think it's the largest public art projection installation in North America. Um, and all the equipment was installed after the Jetty was opened. All the equipment is under the Upper Wacker arcade that shoots video onto this big canvas. I don't think it's been opened in the summer yet. I can't remember when it opened exactly. But it's a big draw on weekends and evenings when it's fun.
- Borelli:

That sounds really cool. That sort of answers the next question: are there any special events? I know you said it's used for education. Are there any specific

educational programs or instances where kids would come down from school to learn about it?

Walz: Off the top of my head, I can't name any specific event that children have come down to the site for. I know that its intention is to be used as an outdoor classroom, but I can't note a specific event. But I'm sure Chicago's Department of Fleet and Facility Management, who manages the Riverwalk, they might have a list of a calendar of events. There might be an archive of that to see if anything has been scheduled in the past or in the future for it. But I know that in the summertime there are marriage proposals and wedding party photos which are cool to see on the Riverwalk. So, in addition to scheduled events, there's the spontaneous as well.

Borelli: And then also spontaneous learning from the public. I know you guys have some educational signage posted around the Jetty.

Walz: Yeah, I think we're still working on getting the language finalized for educational signage. I don't think anything's out there permanently yet, but I think that's in the process.

Borelli: Okay. What species of plants are maintained on site?

Walz: So, this is for the floating gardens specifically. This is the plant list that we have, um, out there. We have Sweet Flag, Swamp Milkweed, Palm Sedge, Fox Sedge, Blue Flag Iris, Cardinal Flower, Obedient Plant, and Cup Plant. I can name the botanical names if you'd like. Otherwise if you're writing them down then...

Borelli: Yeah, let me write down the common names really quick, just as a backup.

Walz: Would you like to plant list for the larger Jetty room, or just the flooding gardens?

Borelli: Just floating gardens would be helpful. Thank you.

Walz: Yup. This is the extent of the list for the floating gardens.

Borelli: And these are all native?

Walz: Yes.

Borelli: That's awesome. Moving onto the next question, which seems like you've already answered, too: have you noticed any animals in or around the site? You mentioned ducks and geese.

Walz: Yeah, definitely ducks, geese, and other bird species. Butterflies, certainly. I personally have not seen aquatic mammals, but I'm sure there are others. If I were to reach out to our local consultants, I'm sure they would have a better solid answer on that. Then fish, again, I haven't noticed an increase in the diversity of fish, but hopefully it's happening. I know that historically there has been an increase in fish species. I'm not sure how that's being accelerated at all by this project.

Borelli: What are the maintenance procedures for the site? How often is it maintained and what do you do in some of the climate extremes?

Walz: As I mentioned before, Chicago's Department of Fleet and Facility Management, "2FM", maintain the site. There are people out there when I've been out there walking the site, cleaning up litter, emptying out the trash and recycling receptacles. There is also security but I'm not sure who provides it. I'd say maintenance is an ongoing thing because it's visited by so many people. In the wintertime I don't think they use salt, but I could be wrong. They definitely shovel a walking path that's several feet wide to provide that walkway for people in the winter time. It floods annually. It was designed to flood. All the materials were designed for inundation. Everything's precast granite for hardscape, 316 marine-grade stainless steel, and hardy hardwood species. Everything is meant to be able to be washed down with either a light power washing or minor scrubbing after a flood event. There is silt material that accumulates on the walking surfaces and, sometimes, on the seat walls, depending on how flooded it gets.

Borelli: Has the maintenance been successful and complaint to the recommendations? I'm not sure who was responsible for making these recommendations or if you have any knowledge about how successfully they've been maintained.

Walz: Yeah, I don't have that information or any record, but they are out there daily



Figure 83: Flooded conditions of the Jetty (©Chicago Sun Times).

cleaning things up. Let me see if I can find a photo really quick of a flooded condition. So, here's an image with the floating gardens above the walking surface. I think this is from the Chicago Sun Times. There's a photo, some place of the floating gardens above this railing system.

- Borelli: Wow.
- Walz: From what I've heard, and from my own experience walking out there when I am back in Chicago visiting family, there are people out there maintaining it.
- Borelli: Great. That was a really cool photo, thanks for showing me that.
- Walz: I can give you some of these photos. I can probably share with you. It's just the construction documents we're unable to share.
- Borelli: Yeah. Understandable. Any materials that you are able to share would be extremely helpful and appreciated.
- Walz: Sure. We have a press kit, so I'll see if I can send that over to you.
- Borelli: Okay. Who owns the site and who was responsible to the maintenance?
- Walz: The Riverwalk is owned by the city because it's on the south side of the river, which is public land. The north side's all privately owned, which is why the Riverwalk could happen on the south side. There are no private entities that I'm aware of that own property on the south side of the main branch of the river. That's how we were able to do the Riverwalk on the south side of the river.
- Borelli: Very interesting. And then, who paid for it's a implementation? Was that the City of Chicago or CDOT?
- Walz: It was paid for by a loan. It was a \$99 million federal Transportation Infrastructure Finance and Innovation Act, or TIFI-Up Loan. That was provided from the U.S. Department of Transportation, USDOT. That was a big bulk of where the money came from to pay for it. Mayor Rahm Emanuel was instrumental in securing the funding for the project. It's technically \$98.7 million if you wanted to be exact. Additional funding for the floating gardens

and fish habitat structures that we talked about earlier – the lunkers, lonetic curtains, and pole hoolas – were funded, in part, via a \$175,000 grant from the National Fish and Wildlife Foundation.

- Borelli: Wow!
- Walz: Yeah, and the loan, if I'm not mistaken, will be paid back over the course of 35 years, with revenue generated from the vendor contracts along the river.
- Borelli: Great. What local policies or jurisdictions applied to your site and how did you navigate those or any kind of restrictions or design guidelines that you had to follow?
- Walz: Yeah, there were over 20 regulatory agencies involved with the permitting of the Chicago Riverwalk, including the United States Coast Guard, the Army Corps of Engineers, and the Illinois Department of Natural Resources (IDNR). But there were at least 17 other agencies that we worked with in the permitting and design review phase in addition to CDOT, the Chicago Department of Transportation. I'm trying to find the other one that we worked with quite a bit. The acronym is MOPD, the City of Chicago Mayor's Office for People with Disabilities. We worked with them closely to provide companion seating so that users in a wheelchair have an equal experience to the Riverwalk, and the Jetty specifically. Each of these little notches here that are the same width as the pier extensions at the end of the pier, those little niches were designed for people with disabilities. So, when in a wheelchair and they're in this space, they are at the same sitting plane as somebody who's able-bodied, sitting on the bench next to them. Each of the six rooms has features like this that are integrated into the design. You'd think it was a design expression, but when you actually see people with wheelchairs or strollers, you can see what their true intended function is.
- Borelli: Yeah. All right. That's very cool. Anything else?
- Walz: No, not the local policies and jurisdictions. I mean, there's so many to name. If you need it, I can follow up with others. But, there's so many to name.
- Borelli: Yeah, I'm sure. Lastly, in your opinion, what could have been done to make the design more successful? Especially in terms of the flooding gardens?

Walz: Well, I think the lessons learned was we didn't have wave action studies that were done. There is a posted speed limit for boats, but in my observation, which isn't an official observation, they go much faster than what the posted signage is. So, they create larger waves than what would otherwise see on the river. And the boats are large and of many different sizes. There are 400 foot barges. If you stand on Franklin Street Bridge and you're just looking on the river for a five to ten minutes snapshot, you'll see... well, in this photo alone you've got a water taxi and two architectural boat tours. You have two kayakers over here. It looks like somebody's doing maintenance on a DNR boat. And then what you don't see in this photo, are personal watercrafts, jet skis, boats that people rent or own, yachts, there are also barges that are up to 400 feet in length and they all use the river at the same time. So, it's like a dance between the multiple modes of transportation and everyone has to be cognizant of what's happening around you. Otherwise, you're going to end up in a bad spot. So, with all those modes of transportation, there are varying wave heights that are generated, maybe in part because people are going too fast on the river. What we learned was... you can kind of see it here. This is a fiberglass fin that was installed after the first fall because we noticed that there was wash out of the first three rows of planting. That was because of the wave action going up over the stainless-steel edge and washing out the plants. So, we could consider that to provide some sort of a wave deflector as opposed to having it be installed after the fact. When these photos were taken – again, these are by Martin Ecosystems – they went up there and took these photos. Wonderful photos. This is maybe early summer, late spring when these photos were taken. The plant material gets up to at least this wood rail here in height. So, you don't even see this wave deflector fin that we have in the front, which is great. That's one thing. The other thing is the links between the gardens. Here's the wave deflector. You can see it better in this photo. The links between the gardens, because of the wave action, some of them came loose. We had a mechanical connection, as opposed to a welded connection. So, some of the links had to be welded in place after the fact just because of the waves that I'd mentioned before. Floating gardens-wise, those are my couple of design items. But in general, I think it's, it's working extremely well.

Borelli: It definitely seems to be. You said the links. What, what did you mean by the links? Are those the links between the floating gardens that hold them together?

Walz: Yeah. So, these links here. We were showing a mechanical connection for ease

of installation.

Borelli: Yeah, but those could easily be knocked out by waves.

Walz: So, they became unthreaded. They backed off. They had to be tack welded after the fact. But other than those two items, I personally think it was designed with all the constraints that we were up against. It was pulled off very well.

Borelli: Those are all the questions I have except for if there's any other information you wish to provide?

Walz: As I mentioned, I'll ask, our marketing team here if we can provide you with our press kit and I'll try to find some photos of the flooded condition if that would be helpful. None of the photos of flooding, I believe, are from people at Sasaki, so you have to provide proper credit, as well as crediting our photos and images that we provide. But I'll see if I can get those items over to you.

Borelli: Then also with the photos, I would I be able to use those in my report?

Walz: Yeah, as long as crediting is provided.

Borelli: In that case I will also send you a form, either to you or to the person who is credited for the photo, for you to sign or for them to sign, so I have that for myself.

Walz: Yeah, that's fine.

Borelli: Well, that's all I got for you today. Thank you so much for taking time out of your day to talk to me. This has been really helpful.

Walz: Yeah, of course. Before the report is finalized were you thinking about sending it to us to take a look at? What were your thoughts, just before things are finalized?

Borelli: I can send you a draft. I'm also doing that with one of my other interviewees, so it wouldn't be a problem.

Walz: Okay. Out of curiosity, how many other applications are you.... is it all floating garden based, or are there other items that you're studying?

Borelli: So, it's basically all floating floating garden based except for my research is really focused on the integration of the social aspect with the floating gardens, which is why I like the Jetty precedent so much. I'm studying six other precedents in addition to the Jetty. So, at least one interviewee from each of those precedent. One expert per precedent is what I'm shooting for for my interviews.

Walz: Yeah, that's wonderful.

Borelli: Yeah! So, some of the precedents actually are not considered floating wetlands, but they have the social integration and the vegetation on a floating platform, which I thought came close. For this research there's not a lot of

precedents, so I had to cast a wider net.

- Walz: Yeah, well, I'm not sure who your other floating garden research projects are, but there is another installation on the north branch of the Chicago River that is quite a large installation. So, I'm not sure if you've seen that. It was on the north branch. So, something to consider or look at.
- Borelli: Alrighty. Well, thank you very much.
- Walz: Yeah, of course. And you're good with the recording?
- Borelli: Uh, I believe so.
- Walz: All right, fingers crossed.
- Borelli: Right, we don't really know until we end the interview, but I've also been taking notes.
- Walz: All right, well, if you have any other questions, feel free to reach out. I'm happy to help.
- Borelli: Great. Thank you so much.
- Walz: Have a good weekend.
- Borelli: Thanks, you too. Bye.
- Walz: Thanks, bye.

6.2.5 Baima Canal Restorer – Dr. David Benjamin

- Benjamin: There are different gradations of artificial floating islands. So, for example an artificial floating island that would be completely artificial would be made of fiberglass or media mesh, and metal and either plants or some kind of phytoremediation system in it or other treatment system. At the other end of the spectrum would be a floating island where the framework could be a media mesh of some kind of fiberglass or other fiber or even jute fiber. It's inoculated with a bacteria and mycorrhizae and different kinds of bacteria and plants, so that the floating island itself is constructed of biologically based material, either material that's made into a fiber like jute or an artificial fiber where the source comes from plant material like soy. So, there are gradations even within artificial flavoring islands of how artificial it is. And over time the artificial island can become more or less artificial. So, for example an artificial island as it treats waste, the mycorrhizae and all the treatment species and the plants live... Because they live within that ecosystem of whatever is being treated over the seasons sometimes some of those species, which can be, you know, the three or four kingdoms of life from mycorrhizae to bacteria to viruses to plants and mycelium, live and die, some of them, and others take over. You see what I mean? For example, sometimes in an artificial floating island like the Baima canal or the artificial floating islands that were built for Tyson Chicken in Berlin, Maryland, they can become more natural because the plants start to take over and dominate the island itself. So, these things have from the first build stage, they have gradations of artificiality or naturalness, and also over time they can change.
- Borelli: Yeah, very interesting. Yeah, I hadn't thought about that.
- Benjamin: Right, and so that's something that one wants to take into account in design. Architects are not taught to take into account. We're not taught very much to take into account time other than weathering. Whereas you, landscape architects, you work with time all the time.
- Borelli: Yeah, that's true.
- Benjamin: Right. And that's very important to think about because life is dependent on time and that's sort of like what you're working with. So, as time moves forward and the thing becomes more or less artificial, and hopefully the

Date: March 31, 2019
Interview Platform: Phone call
recorded by Rev Call Recorder
phone app.

designers have designed the AFI in such a way that it, um, continues to achieve a dynamic equilibrium with its environment. The challenge very often in AFI construction, design and maintenance over time, is that sometimes you'll get pulses of very large amounts of sewage or something, like sewage that is predicted, or you'll get a pulse of something that could not be predicted like a whole new toxic chemical or pathogenic chemical. This happened in one of our projects. For example, we built for a very large drink manufacturer, and I can't tell you the name of the drink manufacturer. The system received a pulse of an acid, and it caused the system to go anoxic and stink. It's because the drink manufacturer didn't tell them that they were flushing their pipes with acid to clean the pipes. So that's the other thing you want to try to design as much as possible into a system. Unless you're designing a system for the next 50 years, it's only going to get one kind of a waste, let's say municipal sewage, and you can get a guarantee from the client in writing that that's the only type of affluent you're going to treat. You want to try to design the system so that if one or a few species die of like critical treatment bacteria, other bacteria will take its place and grow, and take over the place and the functionality and the efficacy of those species that died. So, you want the thing to be able to continually deal with change like ecosystems do.

Borelli: Yeah. Continue to evolve over time.

Benjamin: Right. You can say in the interview that it was David Benjamin that answered these questions. 99% of what I've learned about this from my partners in the firm, John Todd and his son, Jonathan Todd, and talking with other people about phytoremediation There's a few guys over in Scandinavia who understand this very well and use AFIs also in their work. Although the use of AFIs, especially those that use ecological treatment methods, hasn't become as popular as we thought it would in the '80s, because the large engineering firms can't make a profit on building these systems, right? So, they haven't become as popular as we thought they should be because these systems are very low power. They're very low energy use. They're very robust. They require a low amount of maintenance. You don't have to be highly skilled to maintain them, but it requires a lot of work even though not a lot of training. Right. Whereas, a conventional system, you got to be a certified operator by the state wherever it is. And you've got to go for years of training and CEU credits. Well, these systems don't require that. So, it's unfortunate, you know, but the reason these systems have not become... well, for example, getting

back to the Baima Canal project. The original instigation for this project was there was raw sewage in the canal. And the canal went through a part of the city where there happened to be several Buddhist monasteries and it stank.

Borelli: Oh, really?

Benjamin: Yeah, and the Buddhist monasteries complained about this and everybody complained about it. It's in an area of housing. It's a 600- 500-meter-long canal that led to a river. The name of the river is the Minjiang River. That goes through Fuzhou That's in Fujian Province. So, in about 2000 or 2001, the mayor of the city, you know, the squeaky wheels there started to complain so much that he said, "Okay, let's build the project and clean up the canal." Because the canal was polluting the river also besides stinking up the city. There was a Chinese woman over there in Fuzhou who's interested in this stuff and I think she's some kind of an environmental engineer and kind of a "fixer," you know? She'd get deals done in that area of China. And everything's political over there. So, they contacted John Todd because, you know, John's Todd's famous. He's built projects all over the world.

Borelli: Yeah, definitely.

Benjamin: And so they brought us in on the project. They asked us, "Can you build a project that will clean up the water?" "Yes," we said, "we can." So, we sent John's son, Jonathan, who's been trained over many, many years by his father to build these kinds of projects. He's not a scientist, so he doesn't understand the science behind it as well as his father does. But he's better at screwing these things together with nuts and bolts. And he's built projects all over the world: South America; Central America; he built a project in Saudi Arabia; and he helped to build this project in China. It took them, I think, a year. They finished it in the summer of 2002. All right. And it took several months before they started to see an effect. But after, I think, about six or nine months, the water was clear. And so, the turbidity and the clarity of the water started to change dramatically. By the time that the treatment system achieved a state where it wasn't going to get any better. The clarity of the water went from six inches to several feet where you could see it. And they knew that before the treatment system was installed, before these AFIs were installed, if you had stuck your hand in the water, you would have gotten sick probably from cancer.

Borelli: Really?

Benjamin: Oh, yeah.

Borelli: Oh, my goodness.

Benjamin: Well, there was toilet paper floating on the surface. I mean, that's still true in China in many places, even today.

Borelli: Yeah, and for the clarity to go to several feet, that's amazing.

Benjamin: Right, and so they were able to go from a BOD of probably like, 500- 600. They went to second level treatment standards. It's not tertiary, but it's second level. The fluent standards in the United States. So, what happens is that they allow the water to flow through these AFIs all the way down to the end of the canal and they recycle it back up to the beginning of the AFI's at the head of the canal where it's anoxic and it goes through the treatment system again.

Borelli: Is that the aeration system?

Benjamin: Yeah. There's an aeration system right at the beginning and then, along the way on each one of the AFIs, there's very small aerators that are very low power that continue to aerate it along the way. But, in comparison to a conventional treatment, the power rating, the whole system is very low.

Borelli: What is it powered by?

Benjamin: I think it's just grid power. They could have used, you know, now that could use photovoltaics. This was in 2001- 2002 when photovoltaics weren't that efficient. But now, the whole balances system could be completely photovoltaic. And you use high capacity of discharge batteries to power the system. That would be certainly possible now, but I think it's grid power. But, it's very low power anyway. For the whole system, it's 750,000 gallons a day that they treat. By the way, they selected 20 native species. So, they went over there, they did their research, they talked with this Chinese engineer, and they found 20 native species that worked. And then, Jonathan brought from the United States particular bacteria. I don't even know what they are. He won't

even tell me what they are. They're proprietary bacteria.

Borelli: Wow! Okay.

Benjamin: Yeah, he inoculated the AFIs with these bacteria. It's like probiotics you buy in a store. And so, they started with 12,000 plants for, I think the system is like 500 meters long. So, they didn't have to start with like, all of the AFIs being completely overgrown with plants right away. And the plants grew and grew and grew because they were getting amazing amounts of food, right? That's the issue with most phytoremediation systems for, you know, small systems for housing is they don't get enough food because people go on vacation. But the Baima Canal is like a birthday party for these plants. They love it!

Borelli: It's a huge food source.

Benjamin: Yeah, it's a huge food source for them. So, they love it. So, the plants grew and grew and grew and they just took over the place and they have to cut the plants back. You notice from the photographs that through the center of these AFIs, they have a walkway. So, you can go down to the walkway and walk along the river and it doesn't stink, and t's a place where people go and sit and read a book.

Borelli: Cool!

Benjamin: Yeah. So, these sorts of things could be propagated all over China, or, for that matter, in places like the Cuyahoga river canals in the city of Cleveland.

Borelli: All over the world.

Benjamin: Yeah, which need that. I don't know if you know this, but the Cuyahoga County - that's where I come from, Cleveland - that Cuyahoga River is the one that burned in '69 and '72. That's why Richard Nixon created the EPA.

Borelli: Really? Okay.

Benjamin: Yeah, because the Cuyahoga River lit on fire, you know? It was a scandal for him. So anyway, Cuyahoga County has introduced several original, indigenous species of fish and waterfowl. If they used AFIs in the canals of the Cuyahoga

River that lead to the river itself, they could make the water quality even better. But the main reason it's not being done is because the big engineering firms that the cities and the counties talk to say, "Oh no, no. It's just a bunch of hippies that build these systems. They don't know what they're talking about. They're not good engineers or scientists. And there's not a shred of evidence that says that these things actually work." Just one thing after another. So, landscape architects, have a really important role to play here because you have the chance to talk to clients and they ask you for advice. So, if you have the opportunity to build landscapes to make a park, or something like that, beautiful, you can say to them, "Oh, by the way, we can also do this for you, too. We can make this not only an amenity that's visual, we can make it an environmental, an ecological, and a health, safety and welfare amenity for the city or the county. Right. Then other there's studies that show that it just costs less to treat water this way.

Borelli: Right.

Benjamin: But you have to be careful about... The main thing of the design is finding out what the water affluent is that's coming into the beginning of the system. Right? And learn over time, you can't just take snapshots of the affluent that's coming in. You have to look at the affluent over time to see if there's any surprises that come in once in a while. Like, there might be a source, an industrial or a hospital, that'll only dump their water once a week. You know what I mean?

Borelli: Mmhm.

Benjamin: So, you have to get time-based studies of what the affluent is for these designs. Then when you develop that kind of historiography of the affluent, you can design a system that will be able to treat and adapt to these different affluents.

Borelli: Yeah.

Benjamin: Especially if there's commingled sewage with the runoff water. Because runoff has high turbidity. It's not clear. It's got sand and gravel and all kinds of stuff in it, you know?

Borelli: Right. You have to know you're working with first.

Benjamin: Yeah, it's really important. Once you know what you're working with, then you can design a system for it. I think one of the obvious applications for this as pilot projects would be large college campuses that want to go green and be sustainable, right? There's a whole bunch of networks out there in the United States sustainable universities. So, I've talked to [Frederick] Steiner over at University of Texas, Austin about this. And he told me, "Oh no, don't worry. We've got it covered. We don't need to talk to you. I know what I'm doing. I'm designing the sustainable landscapes for the University of Texas and we don't care about phytoremediation or anything like that." Steiner, he's the guy who wrote the textbooks on this stuff!

Borelli: Yeah.

Benjamin: So, K-State and University of Kansas, they could be leaders, in this. I think it would be especially interesting for, really the whole part of the Midwest and the western United States because you guys are dealing with an arid environment, but also dramatic wash outs where you have very large rain events, right? And these kinds of systems could take up the challenge of treating waste when the sewers overflow.

Borelli: Yeah, we do have a terrible flooding issue in Manhattan, Kansas. And we also have, what we call, Campus Creek. It's the creek that runs right through campus, but there's very low too little water in that campus creek. And that's one of the projects that K-State Landscape Architecture department has been working on over the past few years.

Benjamin: Okay, yeah, cool! So, I'm looking at the questions because I want to make sure that I try to answer as many of these as I can.

Borelli: If you wouldn't mind, I could just run through all of them and-

Benjamin: - Yeah, you ask the questions.

Borelli: Okay, great. So, you said earlier that you wanted to be affiliated with your answers, is that correct?

Benjamin: Sure, yeah. And I also have a PhD.

Borelli: Great. Okay. Yes, I'll make sure to note that. And then, I would also like you to know that you can change whether or not you would like to be affiliated or anonymous up until April 1st.

Benjamin: Yeah, it's cool.

Borelli: Okay, great. The first question is, "What was the inspiration for the design?" And, before you begin, I just want to say, if you feel like you've already answered these questions then feel free to go ahead and give a short answer. You don't have to feel like you have to go on into a full description of what you've already answered.

Benjamin: Yeah, the inspiration for the design was that John and Jonathan had been working on these artificial island ideas for years. I think the Tyson Chicken system was built before Baima. John Todd is not the only one who's done AFIs. Other ecological designers have done it before. So, they figured instead of planting plants and phytoremediation on the bank, they figured, well, let's build some AFIs and build a new amenity that does more than just clean the water, but it allows you to walk in the park. So, the inspiration was to take what they already knew how to do building AFIs and use it in a long, thin application. And they saw that because the thing was 600 meters long, there was an incredible length of treatment volume and square area that they could use and, therefore, it would function because they had so much treatment area because of the length. Right?

Borelli: Yeah. And then, what was the goal for this design?

Benjamin: Well, to get the affluent water along the entire length of the canal to the point where, you know, people didn't get sick if they mistakenly stuck their hands in there. So, that's why they take the water from the end and recycle it back up there so that the entire canal is clean, not just at the end. So, they're not treating just the end point affluent, but they're treating the whole canal amenity all of its water. You see what I mean? It's a big difference there.

Borelli: So then, I'm wondering at what point is the water released into the next branch of the system?

Benjamin: Well at the end it goes into the Minjiang River.

Borelli: So, they allow it to go through one cycle of remediation and then they release it into the river?

Benjamin: Yeah, I believe it's one cycle. I believe that it gets treated in one cycle, yes, to the point where it's a second level treatment. Although, there may be some bleed off where some of the water that's already treated gets back and gets recycled again. But there is bleed off. They do allow the treated water to empty into the Minjiang River, otherwise it would flood. Right, right. So, they allow the water to release into the river. Which is really similar to another project that they did for the Blackstone River municipal canal project. But anyways, we can keep asking. We can stay on Baima, Go ahead.

Borelli: Okay, I'm also wondering how long do those cycles take, or how often do they release the water into the river?

Benjamin: Oh, it's continuous. They release the water continuously.

Borelli: Really? Okay.

Benjamin: But I don't know how long it takes for the water to go from the top to the bottom. It's 600 meters long. There's a drop in elevation and I don't know how long it is. Unfortunately, to tell you the truth, I don't know. But, send me an email and I'll send it out. I'll write to John and Jonathan and ask them that question about how long it takes for the water to get from A to B.

Borelli: Okay. Yeah, that would be very helpful. And then I'm also wondering, in some photographs and sketches I've seen a little pavilion. Is that the powerhouse for the aeration system or is that... What's housed in there?

Benjamin: Yeah, unfortunately, I don't know. If you put that in your email, too. I don't know the answer to that, unfortunately. I'm sorry. You know, I wasn't involved in the building of the project. But I know enough about it to answer most of your questions.

Borelli: Yeah, no, you have definitely been very helpful so far, for sure. And thank you also for taking time out of your day to talk to me. It's very helpful. And then, the next question is, "Do you feel like the design goals were achieved, and

how so?”

Benjamin: Oh yeah, the design goals were achieved by using knowledge that they already knew, design solutions that they already knew worked in other situations, and they reapplied what they already knew in a creative way so that the solution looks different, but it's with many of the same components like AFIs, plants, inoculated bacteria, and mycorrhizae. I think there's mycelium in there, too, and plants, and a walkway. It can be walked upon. So, it's a design structurally, you know, to be walked upon. So they took a bunch of things that they already knew worked and they reapplied it in a creative way, in a new situation. So yeah, they're satisfied that it achieved what it was supposed to achieve. And the mayor and everybody in the Buddhist monasteries are very happy about it. It's just unfortunate that it hasn't been reapplied in other places in China. Although, if you look, the Chinese scientists and engineers have written thousands of papers about phytoremediation. The Chinese are studying, and I think they're trying to build it, but you know, they just don't have much traction because they have the same issue over there that we have here. Phytoremediation and advanced techniques and all that kind of stuff is being very much studied. And I think that they're using the Baima Canal project as one of their case studies when they do this research.

Borelli: Okay, very neat. Then, have you guys conducted any post-implementation evaluation? What were the results?

Benjamin: We didn't get money for that. But we have heard from them, that they're satisfied. We didn't do a full POE. Which would have meant that we would have had to send somebody over there and there wasn't money for that. They didn't care. They were satisfied that the smell was gone. They don't get sick if they touched the water. And the water is relatively clear. So, they didn't feel the need for a POE, unfortunately.

Borelli: Well, with my prior research, it sort of sounded like you guys had done some water testing, at.

Benjamin: Oh yeah, sure. We did water testing. And they did their own water testing, the Chinese of the city, and found that it reached this second level of treatment that you would have in the United States. But I mean, we didn't do a POE where we would, you know, do surveys of people and do a full analysis of the

water of the affluent coming in over time and time-motion studies. We didn't do that.

Borelli: Okay, and then what feedback have you received from the visitors at the site?

Benjamin: Well, they think it's wonderful and the monasteries think it's good. They appreciate it very much. People go there and sit and read a book or walk along the waterway. So, it's used by people of the city. I mean, I don't have any quotes for you, unfortunately.

Borelli: No, that's okay. That leads into my next question: how have people used the site since its implementation?

Benjamin: Well, they basically use it as a park. Probably, there's many people don't realize that the water is being treated unless they ask somebody about it. So they mainly use it as a park amenity.

Borelli: So, even though it has a linear design, they don't use it just for walking or transportation, they use it for other park-like uses as well?

Benjamin: Yeah, just for people like just to go there and be, you know, just to enjoy it and sit down or walk along and take a walk.

Borelli: That's neat. And then, this question is, “Are there any special events that happen on the site?”

Benjamin: Yeah, I don't know about that. Put that in your email. I don't think so.

Borelli: Okay. And then what types of species of plants are maintained on the site?

Benjamin: Well, there's 20 native species that were used besides other species that were brought in. But the 20 native species, I don't know if John or Jonathan will remember what the native species are, but I can try to find that out, which species of plant. If you could put that in your email and I'll try to get them to remember which were the species.

Borelli: Yeah, okay. And if not, it's enough just to know that there were 20 native plant species. Are there any that were not native?

Benjamin: I think so, yes.

Borelli: Okay, and those were brought in?

Benjamin: Yeah. Well, they might've been from a different part of China.

Borelli: I see.

Benjamin: Yeah, they did. But these, these native species where species that grew in the region.

Borelli: Okay.

Benjamin: Yeah, because we know that they're adapted to that climate. You know what I mean? And humidity and the changes over the season and stuff like that.

Borelli: And then what kind of animals have been reintroduced to the site or have been attracted to the site since the implementation?

Benjamin: Well, I would probably guess that there's crustacea and maybe even fish, waterfowl maybe, but I'm not sure about that. But waterfowl could create a problem for the people there because waterfowl poop on places, right? So, that can cause its own problems for a park. Right?

Borelli: Right.

Benjamin: So, I don't know. But I think lower-order species above bacteria, like crustaceans and fish, at least I think have begun to repopulate and I think the fish would attract waterfowl.

Borelli: Great! Do you think the AFIs are serving as habitat for these fish? I know that's a common use for them.

Benjamin: I don't think so. The AFIs might serve as habitat for crustacea or other species that like barnacle-type species that attach themselves to stationary objects. Right? And then, crustacea might feed off of that and then the fish feed off the crustaceans, you know, for the waterfowl. And of course, there might be species of crustacea or fish that eat plants. Right? Or other things there.

I'm not sure about this. This is a good question to ask John or Jonathan, if they know what fish species or crustaceans have begun to get back into the environment. And obviously, crustaceans and a waterfowl and fish create their own waste. Right? But they use native species of plants. Those plants know how to deal with those organic waste because they're adapted to those species.

Borelli: Okay. The next question is, "What are the maintenance procedures for this site?" How often is it maintained and what about what happens in the extreme weather? Then also who is in charge of the maintenance for the site?

Benjamin: Well, I think it is the city as far as I know. And all they do is cut back the plants and take the plants, which taking up wastes and probably heavy metals. And I don't know what they do with the plants. I don't know if they send the plants for organic recycling or they just put it in the landfill. If they put it in the landfill, that's unfortunate, but that's what they may do. And I think that's all they do. That's the only thing. Well, you know, they maintain the pumps and things like that. And I think it's the city that does that.

Borelli: Okay, so people hired by the city?

Benjamin: Yeah.

Borelli: Alright. And then do you think the maintenance has been successful so far and compliant to the recommendations?

Benjamin: Yeah, I'm almost positive about that. We have not unfortunately followed up because, you know, they haven't given us money to follow up with them. Doing these sorts of things with China, you have to have either a very good connection with the university over there or a fixer like this engineer, so that you can get information out of these people and work with them even to do a POE or, you know, get information about who's maintaining it. And we just haven't had the money to get that out of them.

Borelli: Right, I understand. Okay. Who owns the site?

Benjamin: Well, it's the city.

Borelli: The city. And they also own the floating walkway and the AFIs?

Benjamin: Oh, yeah. It's like a city park.

Borelli: Sure. Also, the walkway, is it actually floating or is it standing on peers?

Benjamin: No, no, it's floating.

Borelli: How does that work?

Benjamin: Yeah, you know, in a rain event it'll float up and down. There's a good reason why it doesn't stand on peers. So that it can react to dramatic rain events and flooding and things like that.

Borelli: And so, is it just like how a floating dock floats on the water? It has these floating modules underneath?

Benjamin: Yeah, I think they use pontoons or something like that for that.

Borelli: Sure. And then who paid for the fabrication and implementation of the design?

Benjamin: That was the city.

Borelli: The city as well?

Benjamin: Yeah, the mayor's office themselves. They paid for Jonathan's travel and they paid us. They paid for the fabrication and making it. It was the City of Fuzhou. And I don't know where their money came from.

Borelli: Okay. And then what local policies or land jurisdictions applied to the site and how were those navigated?

Benjamin: Well, when it comes to China, you know, it's just like a politician decided he wants to do it and he just gets it done. You know, there might be policies in place or laws, but at the time, that didn't have any relevance. The politician just wanted to make it happen and he said, "Just do it," because they have environmental laws in China now that they disregard all the time. The policies and laws didn't spur them. It was the initiative of the mayor who was tired of

getting so many complaints from the populace.

Borelli: Right. And then in your opinion, what else could have been done to make the design more successful, if anything?

Benjamin: Well, one thing would be a POE. The second thing would be, if the Chinese people wanted this, is to talk to the Chinese people who live there and the monks in the monastery about creating a nonprofit organization to maintain the facility and to build like facilities in other canals in the city. And it could be like a community service organization that's an NGO, where people would pool their money and do this on their own. And I think there would be opportunities to do that. Although the Chinese government usually doesn't like that because the Chinese government doesn't like anything that's not part of the government. So that's the challenge of working in China is that the government controls every aspect of life, even citizen community initiatives like that.

Borelli: Really, okay.

Benjamin: Yeah, but there are traditions in Chinese culture for doing things on a neighborhood level together as a group, as a community. Right? But it's very difficult to do now in the political environment that it's in China. But I'm sure that there are Chinese universities that would welcome a collaboration with K-State about these things for performative landscapes. Even more than us they're dealing with literally deadly levels of toxic waste and pathogens in their air, in their water. And so, they're desperate to build this kind of stuff. They just can't because the government doesn't care. So, if K-State, I'm sure, has opportunities to collaborate with universities there on this. I think I was reading a statistic recently that China educates about 750,000 architects of year.

Borelli: Yeah, they have a lot enrolled, that's for sure.

Benjamin: I mean, they probably educate like hundreds and hundreds of thousands of landscape architects a year. So, there's a lot of opportunity there for K-State also. For K-State students, if they get a chance to go there to really see how bad it can get.

Borelli: Yeah, I bet that would be pretty eye-opening.

Benjamin: Why I think that's important is if K-State students see how bad it can get, it can come back to the United States and tell people in the United States, "We don't want to even get close to this."

Borelli: Yeah, that's true. "Let's do everything we can to prevent conditions like this."

Benjamin: Right, "because this is dangerous for your children." Before this, they weren't even able to, take their dog down there because the dog might drink water from the canal.

Borelli: Oh, that's scary.

Benjamin: Or a child or something like that. So, it was really important for them to build this project. Can you hang on a second? Just a minute.

Borelli: Okay.

Benjamin: Okay, I'm back. Go ahead.

Borelli: Yeah, so I knew that the conditions were bad in Baima Canal, but I didn't know that they were that severe.

Benjamin: Yeah, there was toilet paper floating on the surface before they built it, because it's what they do. I don't know if they still do this in China, but it was very common at the time for raw sewage from apartment buildings to empty directly into these canals. Literally raw sewage, with toilet paper, the whole thing, condoms, whatever.

Borelli: Yeah, that's hard for me to believe.

Benjamin: Yeah, well, and that's besides the industrial stuff, like somebody who has a metal shop or something like that.

Borelli: Yeah, that's true. That could be so dangerous. That is dangerous. That's very dangerous.

Benjamin: By the way, do you know the place in the United States that has the heaviest metals in their municipal water stream?

Borelli: Is it LA? What is it?

Benjamin: Providence, Rhode Island because it's the cosmetic jewelry capital of the United States.

Borelli: You said Pottawatomie?

Benjamin: No, Providence, Rhode Island.

Borelli: Oh, I didn't know that.

Benjamin: Yeah, they have the heaviest metals in their water stream.

Borelli: Wow.

Benjamin: Yeah, it's bad. Anyway, go ahead. Keep going on Baima.

Borelli: Well, anyways, this is actually the last question. It's just if there's any other information you want to provide about the Baima Canal restorer?

Benjamin: Uh, let's see, just a minute. I'm looking at my notes here. Well, it's important that you know all along the way of the continuous aeration systems on each one of the AFI components, that it's uniformly distributed low intensity. So, it's low power. I think the reason it's low intensity is so that when the bubbles are pushed out and hit the hit the plants, they don't hit them at a high velocity and power, but it's low intensity. So, it's gentle aeration.

Borelli: Yeah, that makes sense.

Benjamin: Yeah. So, the inoculation of the bacteria were selected especially to deal with sludge greases, and nitrogen removal. Now, I'll try to find out which bacteria they were, at least a genus. I don't know. I probably won't be able to give you the species because they're proprietary.

Borelli: Oh, okay. That's fine.

Benjamin: Yeah. Like, if you look at phytoremediation, there are labs that supply bacteria for phytoremediation. And I think a lot of those bacteria are patented.

Borelli: Okay. Wow, that's interesting. I don't know bacteria to be patented.

Benjamin: Oh, yeah. Well you did hear about Craig Venter? You know, he's a biologist. He's a billionaire now because he's the guy who created the first artificial life form in the world, a bacterium.

Borelli: Really? Huh! Artificial life form?

Benjamin: Yeah. The first one in the world. Venter, Craig Venter.

Borelli: Yeah, I'm going to have to look that up.

Benjamin: Yeah. So anyway, I don't know what bacteria word that they used. The three things that they had to deal with mainly were sludge - which is like sewage - , grease from kitchens, and nitrogen because the water was anoxic and overfilled with nitrogen and probably phosphates and phosphorous. So, those are the three main things they had to deal with the design.

Borelli: Okay.

Benjamin: Yeah, so I will work on contacting your dean and talk to her, send her an email. Because I think you have a fantastic opportunity to build a design-build studio like 804 or rural studio. The spurge that would be, you know, just after the next tornado, right. It destroys a town in Kansas. What are they going to do about sewage, right? And run off? Well, you know, K- State could come in there and build a system in a month, a couple of months. If the students built a system, you could deal with the runoff water which is not being treated because the treatment plant was flooded during the tornado. So, all you have to do is wait for the next tornado to hit and destroy a town in Kansas, and you got your first projects.

Borelli: Well, alrighty then!

Benjamin: Yeah, no, I mean, because you know it's going to happen this summer or next

summer, right?

Borelli: Unfortunately.

Benjamin: Right. So, I mean that can be the spur to the Dean saying, "Well, let's try to find some money for this and we can get a grant maybe from the NSF or the state of Kansas or somebody like that, and maybe work with a county or city." The Studio 804, I think they helped rebuild Greensburg, Kansas. I don't know where they got the money from, but you know, maybe if you or your dean talks to the people, the guy who runs 804 now, they can find out how they got the money to do that.

Borelli: I think that'd be really interesting and really beneficial to the students to have that design-build and field experience.

Benjamin: Oh, yeah. There's a guy named Tom Benjamin, who I think I'm actually related who's a landscape architect.

Borelli: Right.

Benjamin: Do you know him?

Borelli: No, I just remember your name was Benjamin.

Benjamin: Yeah, yeah. He's one of the leaders in the ELA, the Ecological Landscape Alliance. He's in Massachusetts. He's a landscape architect and he said he spends most of his time actually building his landscapes. He doesn't just sit there with Rhino and Revit and AutoCAD and sit there at a computer. He actually goes out and builds this stuff with his own hands. And so, he's a craftsman. So, there's an opportunity for landscape architects to be, not only a designer, but a craftsperson.

Borelli: Yeah. That's a very valuable. And we actually have taken classes in construction materials and methods so that we can help build that craftsmanship. But I definitely think there're more opportunities.

Benjamin: One thing is reading the book and taking the test. And the other thing is actually getting out there and screwing it together. I worked at Arcosanti, you know, for a couple of months. You know that thing that Paolo Soleri designed,

that town near Flagstaff in Arizona that they're building? They need systems, too. But anyway, when I got out there, I was building formwork for concrete and I learned so much about architecture just by actually screwing the thing together and actually picking up a hammer drill that weighs like 20 pounds and drilling through six inches of concrete. Learning about that is completely different. And you learn different things about architecture than you do sitting in front of a computer with AutoCAD, right? And you cannot teach that stuff in a webinar. You have to get out there and get your hands dirty and do it. So, he understands how to plant plants. He understands how to mulch. He understands what's the best way to dig a ditch and the slope of the ditch, so he doesn't destroy the surrounding soil, and care for it. So, he can educate the client and the landowner and people like that about how to care for the landscape that he's built. You know what I mean? So, having that kind of a studio would give the landscape architecture students, when they graduate, more of a repertoire. Those are services that they can sell. So, when you graduate as a landscape architect, you not only can sell the fact that you sit in front of a computer all day and draw AutoCAD drawings and you know about which species to specify. But you can also go to the site. You can help to direct the contractor to do it right. And if the contractor says, "A, B and C," and you know that's wrong because you've built systems, you can tell the contractor, "No, you're doing it wrong. That's not the way to do it. And I'm going to show you how to do it right."

Borelli: Yeah, that's very valuable.

Benjamin: Because, in my experience working with contractors, the drawing is the last thing they look at.

Borelli: Really?

Benjamin: Oh, yeah. They just want to get the system built and get the check. So, it would be wonderful if we could get the chance to work with your dean to build the design-build studio. And I know these people. I could get people like Heather Venhaus and Tom Benjamin, maybe even Herbert Dreiseitl and guys like that to come and run workshops and stuff like that. If we can get luminaries like that, man, K-State would, you know, people from all over the world would apply for your program.

Borelli: Yeah, and we have a great program, too. It's in the middle of Kansas, so not many people know about it or want to go to school in the middle of Kansas, which is a problem.

Benjamin: If you, as landscape architects, start building first pilot projects on the campus, and you start making beautiful places on the campus, you'll attract more students to apply there. Because it's a beautiful, beautiful place to live, you know?

Borelli: Right.

Benjamin: So, I think it has efficacy. And, what else, I think there's an opportunity to work with the Land Institute. What's his name? I can't remember his name. I can't remember if he's still alive or not. Wes Jackson. I mean, he knows more about soil than anybody. He could be a guy that could come and do workshops that are design-build studios, too. I met him. He's a guy who works with his hands, too, right? And he's right there in Kansas.

Borelli: Yeah.

Benjamin: You know, the other thing that I would do is if you could build a project, like even just a small pilot project. You could offer, for example, to the... where you are, does the transit system run buses in your town?

Borelli: Yes.

Benjamin: Alright. When they wash those buses, they wash those buses with harsh soap chemicals. Where does that water go? It goes in the sewer!

Borelli: Yep, it goes in the system.

Benjamin: And it shouldn't, right? So, K-State students and your Dean could offer the county transit system to build a phytoremediation system on nearby land to wash and cleanse and filter and slow down that wash water, clean it up. And when it goes to the sewer, it's clear and not toxic.

Borelli: Yeah, that'd be really interesting to see. That would be really interesting to see a studio that would do that.

Benjamin: The students wouldn't have to build it. But what would be wonderful is if you guys designed the system, maybe with a real [landscape architect] who has a license. And you guys could go on site and watch the contractors build it, and document it.

Borelli: Yeah, that would be very valuable.

Benjamin: And then, throughout that whole process, the idea is your telephones could make a video of that and put it on YouTube.

Borelli: That would be really amazing to see, and so valuable to get that exposure, too.

Benjamin: Right. That's the kind of project that's not that difficult to build. You don't have to meet sewage treatment standards because it's run off water, right? And treating that kind of wash water with soap in it and other chemicals that they use to clean buses is known. John and Johnathan know how to treat that with phytoremediation and mycelium. So, the standard that you would have to achieve wouldn't be as demanding as with sewage. Jonathan knows Paul Stamets. So, we might even be able to get Paul Stamets to come and talk, too.

Borelli: Yeah, that would be really cool.

Benjamin: Just walking around the campus, you can see these opportunities, you know?

Borelli: Right. Maybe even if you come and visit! I think that would be really great too, because you have so many great ideas.

Benjamin: Thank you. That's very kind of you. One of the things you can do is write me one email with those questions and I'll try to get those questions answered. The other email that you could send me, which would get me out there or help to get me out there, is if you write an email saying that you appreciate my answers and you think that it might be valuable in some way to continue talking to the students or some of the faculty at K-State Landscape Architecture. Then, what I would do is, if it's okay with you, I would forward your email to the dean and I would say, "Dear Dean, I would like to offer that myself, or (if I can get a hold of them) John or Jonathan, would be willing to come out there and discuss with you building a design-build studio in some way."

Borelli: Yeah, that would be awesome.

Benjamin: Yeah. I would love to do that, personally. That would be fantastic. I don't know if I can get John or Jonathan. To get John or Johnathan to do it, we'd have to give them money. Because he's doing projects all the time.

Borelli: Super busy, right?

Benjamin: Yeah, Jonathan spends most of his time running a backhoe, building projects.

Borelli: Wow, yeah.

Benjamin: So, I can't get him to go to K-State unless I get money for them, you know what I mean?

Borelli: Right.

Benjamin: But if you're a dean had the money for a plane ticket and a hotel, I'd come out there.

Borelli: Yeah! Most definitely. Yeah, sounds like a plan.

Benjamin: So, send me those two different emails and I'll use those.

Borelli: Okay! Great! Thank you so much.

Benjamin: Yeah, it's been, it's been a pleasure talking to you. And I look forward to you becoming a licensed landscape architect and doing wonderful things.

Borelli: Me too. Me too.

Benjamin: Okay, great. Thanks.

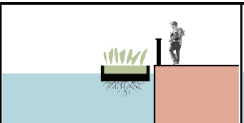
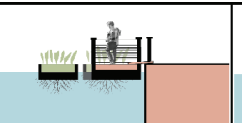
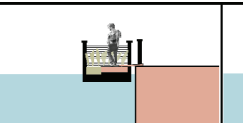
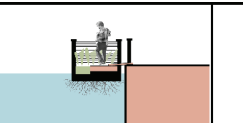
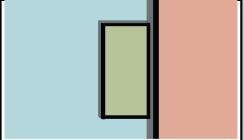
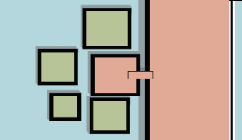
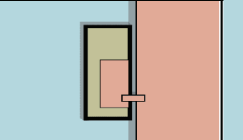
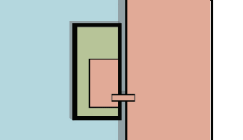
Borelli: Alright, thank you so much. Thank you for your time.

Benjamin: You're welcome. It's been my pleasure. Bye.

Borelli: Bye.

6.3 Appendix C: Precedent and Interview Analysis Matrices

6.3.1 Table 2: Precedent Typology

Section						
Plan						
Rank	1	2	1	3	3	1.0
	Unintegrated, Submerged Roots (UISR)	Semi-Integrated, Submerged Roots (SISR)	Fully Integrated, Unsubmerged Roots (FIUR)	Fully Integrated, Submerged Roots (FISR)	Points	Score
Recycled Park		3			3	1.0
Merchant Square			3		3	1.0
Seeds of Change			2		2	0.7
The Jetty	2				2	0.7
Baima Canal Restorer				2	2	0.7
Total	2	3	5	2		
Value	2	6	5	6		

6.3.2 Table 3: Economic Framework

Rank	3	2	3	6	1.0
	Mostly Public Funding	Mostly Private Funding	Additional Funding	Points	Score
Recycled Park	3		2	5	0.8
Merchant Square		3		3	0.5
Seeds of Change	1			1	0.2
The Jetty	3		3	6	1.0
Baima Canal Restorer	2		1	3	0.5
Total	9	3	6		
Value	27	6	18		

6.3.3 Table 4: Recreational Uses

Rank	2	3	3	3	2	3	2	1	3	2	3	1	2	3		22	1.0
	Fishing	Ecological Education	Other Education	View Scenery	Photography	Sitting	Walking/ Jogging	Biking	Bird + Wildlife Watching	Children's Play	Special Events	Working/ Studying	Dining	Community Engagement	# of Observations	Points	Score
Recycled Park		2		2	2	3			3					2	6	14	0.6
Merchant Square				2	3	3	1		2	2	3	3	2		9	21	1.0
Seeds of Change		2	3		2	2					3			3	6	15	0.7
The Jetty	3	2	1	2	3	1	3	2	3		2				10	22	1.0
Baima Canal Restorer						1	3			1					1	5	0.2
Total	3	6	4	6	10	10	7	2	8	3	8	3	2	5			
Value	6	18	12	18	20	30	14	2	24	6	24	3	4	15			

6.3.4 Table 5: Ecosystem Services

	REGULATING				CULTURAL				SUPPORTING				PROVISIONING						
Rank	3	1	3	1	3	3	3	3	2	2	1	2	1	3	3	3		22	1.0
Ecosystm Service	Pollination	Water Purification + Waste Treatment	Climate Regulation	Erosion Regulation	Stewardship + Education	Aesthetic	Recreation	Spiritual + Religious	Food	Raw Materials	Potable Water	Medicinal Resources	Soil Formation	Photosynthesis	Nutrient Cycling	Biodiversity	# of Observations	Points	Score
Recycled Park	2		2		2	3	1							3	1	3	8	17	0.8
Merchant Square	2		2			3	3							3		2	6	15	0.7
Seeds of Change	2		2		3	3	1							3		3	7	17	0.8
The Jetty	3	1	2		2	3	2		1					3	2	3	10	22	1.0
Baima Canal Restorer	3	3	3			2	1							3	3	3	8	21	1.0
Total	12	4	11	0	7	14	8	0	1	0	0	0	0	15	6	14			
Value	36	4	33	0	21	42	24	0	2	0	0	0	0	45	18	42			

6.3.5 Table 6: Ecological Uses

Rank	3	3	3	3	1	3	2	2	2		18	1.0
	Submerged Roots	Bird Habitat	Fish Habitat	Other Animals Habitat	*Water Quality Improvement	Native Plants	Litter Clean-up	Eco-Friendly Materials	Sustainable Man- Made Systems	# of Observations	Points	Score
Recycled Park	2	3	3	3			3	3	1	7	18	1.0
Merchant Square		3	1	2						3	6	0.3
Seeds of Change		2		2				3	3	4	10	0.6
The Jetty	3	3	3	2	1	3		2		7	17	0.9
Baima Canal Restorer	3			1	3	2		3	2	6	14	0.8
Total	8	11	7	10	4	5	3	11	6			
Value	24	33	21	30	4	15	6	22	12			

6.3.6 Table 7: Materials and Construction Methods

Rank	3	1	2	3	3	2	2	2	2	3	2		22	1.0
	BioHaven Floating Wetland Technology	Disused Barge	Decking	Galvanized or Stainless Steel	Plastics	Plastic Cube Buoyancy Modules	Pontoon System	Concrete Block Counter-Weight	Artificial Turf	Pre-Fabricated Elements	Installed with Divers	# of Observations	Points	Score
Recycled Park					3					3		2	6	0.3
Merchant Square			2	3	2	3		3	3	3	3	8	22	1.0
Seeds of Change		3	2									2	5	0.2
The Jetty	3			3						3	3	4	12	0.5
Baima Canal Restorer			2				3					2	5	0.2
Total	3	3	6	6	5	3	3	3	3	9	6			
Value	9	3	12	18	15	6	6	6	6	27	12			

6.3.7 Table 8: Governance Style

Rank	3	2	3	2	3	3	3	2	3	3	18	1.0
	Public Client	Private Client	Public Owner	Private Owner	Part of Program/ Initiative	Guidelines Used	Hired Maintenance Staff	Volunteer- Maintained	Open to the Public	Opened Year- Round	Points	Score
Recycled Park	1			2	3			2	3	3	14	0.8
Merchant Square		3		3	3		3		3	3	18	1.0
Seeds of Change	2		3		3		3				11	0.6
The Jetty	3		3			3	3		3	3	18	1.0
Baima Canal Restorer	3		3				3		3	3	15	0.8
Total	9	3	9	5	9	3	12	2	12	12		
Value	27	6	27	10	27	9	36	4	36	36		

6.3.8 Table 9: Limitations

Rank	3	3	3	2	2	3		10	1.0
	Limited Social/ Recreational Uses	Limited Ecological Goals	Limited Public Access	Limited Physical Integration with Vegetation	Limited Size	Limited Funding	# of Observations	Points	Score
Recycled Park	3				2		2	5	0.5
Merchant Square		2					1	2	0.2
Seeds of Change		2	3		2	3	4	10	1.0
The Jetty				1			1	1	0.1
Baima Canal Restorer	3						1	3	0.3
Total	6	4	3	1	4	3			
Value	18	12	9	2	8	9			

6.4 Appendix D: First Draft of Design Guidelines

6.4.1 Sociability:

Sense of ownership of a social AFI. This section of the guidelines includes community engagement, stewardship of the place, education, and inclusion of the local culture.

- Creating fish, waterfowl, pollinator, and other wildlife habitat and using native plants will encourage the presence of native species. This relation with the local ecology and culture will cultivate more community engagement and stewardship of the site, as well as provide more opportunities for education.
- The provision of food such as edible plants, fish, and mollusks, can be an effective way to engage the community and encourage stewardship of the AFI. However, this strategy would not be appropriate in overly-polluted bodies of water, as it may contaminate animals and plants, making them unsafe for humans to eat.
- Although these guidelines encourage direct interaction with vegetation, there are ecological benefits to having a separate AFI for wildlife that floats independently from the rest of the design but is still close enough to offer educational value.
- Strategies constructed underneath the social AFI base can provide extra habitat and add to the ecological value of the design. Such Strategies include nylon rope to add more surface area for biofilm to form and other additional enclosed spaces where fish can stay protected from predators. This may increase fish population which will, in turn affect education of local ecologies.

6.4.2 Uses and Activities:

The active use of a social AFI. This section of the guidelines includes the day-to-day use of the AFI, as well as special organized events.

- Attractiveness and unique features of a social AFI attracts more users and creates opportunities for photography.
- Special events and art installations are an effective way to draw users and garner public support.
- Organized events such as concerts, lectures, and fishing competitions will also increase usage of social AFIs.
- Comfortable and varying seating is crucial to the usage of a social AFI.

6.4.3 Comfort and Image:

Physical design and perceived image of a social AFI. This section of the guidelines includes materials used, maintenance procedures, and creation of a safety and comfort.

- When choosing materials, opt for those that are lightweight, durable, and low-maintenance.
 - Lightweight materials help maintain the overall weight of a social AFI as well as added weight from users. Lightweight composites, plastics, and artificial turf for lawn areas are favorable.
 - Silt and other natural build-up may be more common on social AFIs than terrestrial public spaces. Thus, materials must be easy to clean with a light power-washing and scrubbing in times of excess build-up.
 - Materials must be able to hold against weathering from the water and other elements. If the AFI is in a body of water with a lot of boat and wave action or lateral forces from ice, then durable materials are necessary. Galvanized or marine-grade stainless-steel edging is a durable material and will accommodate this situation.
 - Lastly, ensure that the selected materials are attractive to encourage usage of the site. Some lightweight, low-maintenance materials can be used to mimic more natural and desirable materials. For example, used stamped composite decking instead of stained wood decking, and use marine-grade artificial turf instead of real turf for lawn areas.
- Using eco-friendly materials and methods is a bonus.
- Appropriate buoyant materials include plastic buoyancy modules.
- Pre-fabricated elements are favorable for a busy site.
- Post-implementation monitoring is critical to ensure the design is holding steady.
- In some contexts, overhead structures should be used for shelter from the elements. However, overhead structures should be carefully situated as to not obstruct important views. These views are important for drawing in users to the site. Small floating trees may provide some overhead structure, protection, and climate regulation. A tree can be installed on their own AFI and tethered to a main AFI, or it can be implemented on the main AFI structure. However, if implemented on the main AFI structure it's weight must be accounted for and counter-acted. In any case, make sure that the tree is stable and will not be blown over by the wind to

potentially harm users.

- A concrete block attached to the bottom of the social AFI may be necessary to counteract the weight of the site elements and users of the AFI and to keep the AFI in place.
- Provide adequate lighting to promote light-life usage.
- Comfortable seating oriented towards key views will draw more users.

6.4.4 Access and Linkages:

The accessibility, both physical and visual, of a social AFI. This section of the guidelines includes site selection and different strategies for access.

- Sunlight (or lack thereof) and wind should be considered in the site selection of social AFI designs. The presence of adjacent tall buildings may significantly affect this. However, an AFI should also not be too exposed to the elements on open water.
- A social AFI should be directly assessible and clearly visible from adjacent terrestrial public space.
- Social AFIs should be situated in an area with relatively high existing foot traffic.
- Social AFIs should be situated in a place with significant scenery, whether it be naturalized or urban.
- Make access ramps that are adaptable to varying water heights.
- The AFI should be placed in a site so that it does not conflict with boat traffic.

6.4.5 Governance:

The management of a social AFI. This section of the guidelines includes ownership, programs and initiatives, who's responsible for the maintenance, and when the AFI is open to the public.

- Being part of a program or initiative is an effective way to garner support and increase public awareness of the social AFI.
- Having a public owner usually entails hired maintenance staff and, sometimes, security. This will benefit the site and increase the social AFI's comfort and image.
- Having the social AFI be opened to the public year-round will increase its use and popularity.
- The owner may be public or private. However, they must be able to provide consistent funding for ongoing maintenance and monitoring after the social AFI's implementation.

6.4.6 Economy:

The finances of a place. This section of the guidelines includes who pays for the fabrication, installation, and maintenance of the AFI and any additional funding from outside parties.

- Readily available funding is key to keeping a site well-maintained and accessible to the public.
- High-profile public projects may be more well-funded.
- Additional funds are more likely to be given to social AFI designs that include a strong ecological or educational presence.

