Landmark Refugia:

An Urban Bird Sanctuary for the Christchurch, NZ Cathedral Rebuild

Lihui Yang

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Abstract

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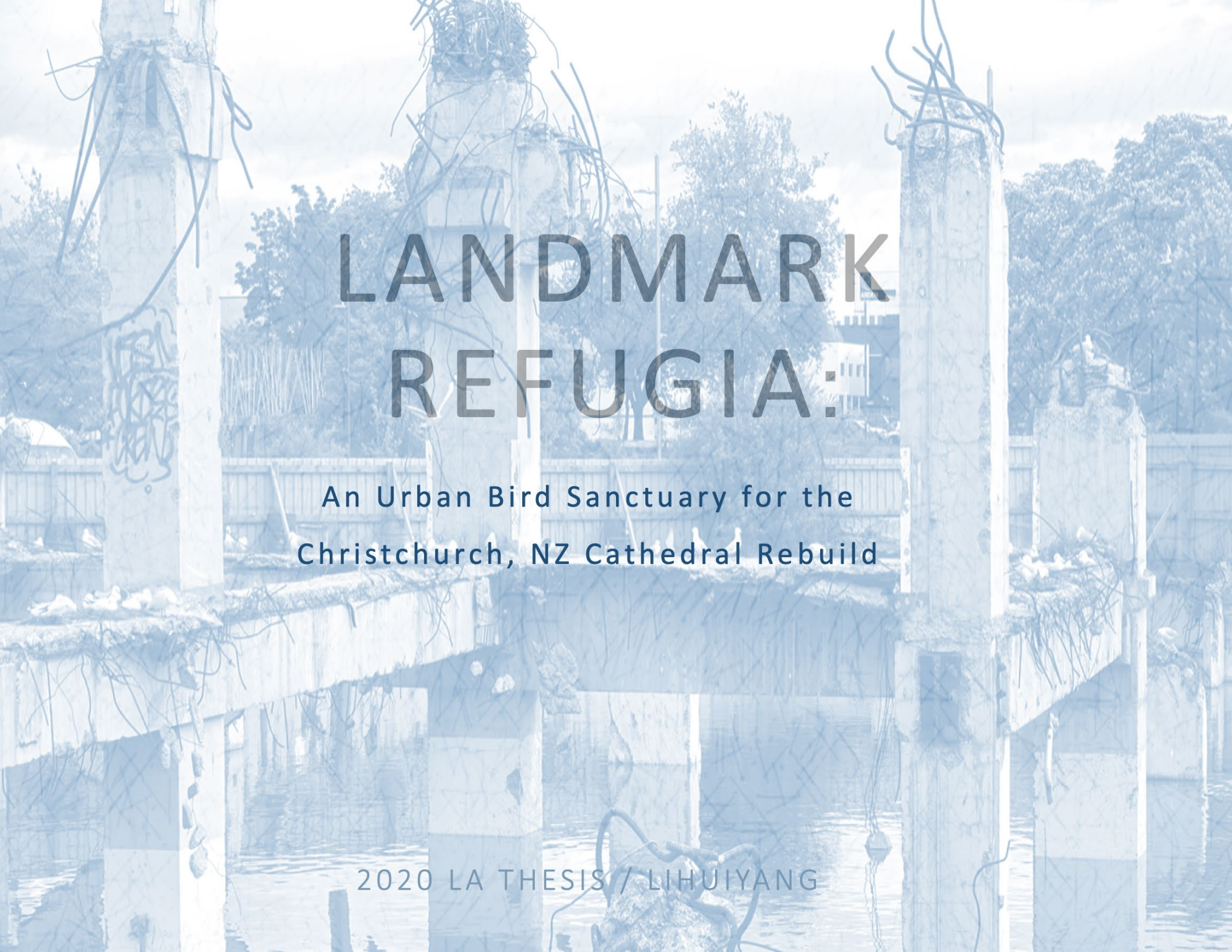
The influence of urbanization, climate change, land use changes, land fragmentation and natural disasters have destroyed many birds' natural habitats near cities. However, some birds are attracted to urban landscapes, and begin to nest and breed in urban areas, and even for some endangered avian species the city has become a valuable adopted home. After the destruction of urban structures from the 2011 earthquake in Christchurch, New Zealand, building ruins near the Otakaro Avon River attracted a local endangered species, the black-billed gull, to establish a breeding colony near the city center. While the colony will be displaced by new construction, the reconstruction of the Christchurch Cathedral in the city's center near the existing colony offers opportunities to design and construct new gull habitat where the public may easily observe nesting activity. The main research direction of this thesis is to foster awareness of the ecological value and requirements of urban spaces as protected endangered bird habitat, and stimulate social value for urban bird habitat to promote healthy and positive relationships between humans and birds. The focus of the design work is to uncover and express possibilities to integrate the ecological, historical, cultural and spiritual values in the rebuilding of the Christchurch Cathedral site.



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2020 LA THESIS / LIHUIYANG

CONTENTS

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Keywords:

Urban Birds
Refuge
Sanctuary
Habitats
Endangered
Landmark
Public Space

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Finally, I must express my very profound gratitude to my parents and to my friends for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

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01 Introduction

Birds are commonly known to inhabit natural areas such as forests, wetlands, oceans, shorelines and riverbanks, and nesting and roosting colonies of many species can be found in these habitats. In addition, several avian species build their nests and breed in cities. Although large bird colonies are rarely seen in urban areas, they do exist and can be quite spectacular.

While visiting Christchurch, New Zealand, I discovered a bird colony in the city center and was deeply impressed by it. As shown in the photos below, about 300 black-billed gulls had established a colony with about 130 nests in the flooded foundations of a former office block on Armagh St. The building was severely damaged during the devastating 2011 earthquake and was left as remains, waiting for replacement. The birds colonizing the ruins are black-billed seagulls, which are endemic and can only be found in New Zealand. It is also one of the most threatened gulls on Earth. These gulls usually nest in braided rivers. However, as their nests suffered from flooding, weed invasion, water pollution, and riverbank damage caused by the earthquake, some of the population moved away from their natural river habitat and were attracted to Christchurch's city center. To view this breeding colony in the middle of the city was impressive not only because it exhibited a trace of the earthquake, showing how natural disasters can destroy the built environment, but also because of the unexpected ecological value that damaged structures in urban areas could have. I couldn't help but think that there are other opportunities to have structures in cities play important roles in providing habitat, including nesting and breeding sites for urban birds.

While not all the structures in cities can become suitable sites for habitats, this ruin was a perfect choice for the gulls because it achieved all the requirements that a good nesting site should achieve:

Black-billed gulls colony in city center of Christchurch, photos by Lihui Yang

Being attractive.
-The foundation has some features imitating black-billed gulls natural habitat which are attractive to them, such as open water and ‘rock-like’ nesting surface and structures;
-There are adequate food, water and nesting supplies close at hand along the Avon river nearby.

Being safe.
-There is little disturbance of human and predators since the ruins are surrounded by a protective fence and water.
-It has high points which are less flood prone;
-There is only little vegetation for all round visibility.

In the context of current urbanization, it has become a trend to provide appropriate wildlife habitat. However, creating bird habitat in highly dense city areas has always been challenging. Land is fragmented and few vacant lots are left as a result of urbanization development. Also, exposed nests in cities are threatened by predators like cats and rats, human disturbance, pollution, etc. Therefore, the possibility of deploying structures that are not in use in cities as habitats and making them into protected areas for urban birds should be considered. Such protected avian habitat in a city can function as an “urban bird sanctuary”.

Research Questions

The establishment of an urban bird sanctuary in dense city area is accompanied by several research questions:

1. Why it is important to have protected habitats (sanctuaries) in the city? For what species?

2. How can bird sanctuaries be built in dense urban areas? With what features that can benefit the birds’ survival?

3. How can they be designed to foster a healthy coexistence and trigger positive interaction between birds and humans?

Urban bird sanctuaries are important not only for their ecological value of saving bird species from the loss of original habitats and improving urban biodiversity, but also for the educational effects on the public as ‘show cases’ that help people know about birds and consider relationships between the city and nature. As people learn more about threatened species and the importance and meaning of providing habitats for them in cities, it is more likely that people will start to care about birds and their nesting habitat, and will help to support the provision of urban bird sanctuaries. As a result, there will be a virtuous circle of the relationship among birds, their breeding sites, and humans. How to build such positive relationships through providing suitable avian habitat in the public realm is the main goal of my literature review, gives direction to my design framework, and the thesis design aims to replace the gull habitat in a space adjacent to the Cathedral, to foster awareness of the ecological value and requirements of protected endangered bird habitat in dense urban areas; to promote healthy and positive relationships between humans and birds; and to uncover and express possibilities to integrate ecological, historical, cultural and spiritual values in the rebuilding of the city landmark - Christchurch Cathedral - and its central city site.

02 Literature Review

Urban birds and their city habitats

Urban areas are often regarded as ‘concrete jungles’ isolated from nature, but in fact, our urban environment is not completely unrelated to nature (Basu., 2018). There is a range of wildlife that can, and do, live successfully within the city (The Urban Landscape), including many avian species, or ‘urban birds’. ‘Urban birds’ is a concept that emerged with the rapid growth of our urban population as urbanization continues globally. (James Reynolds, S., 2019) Although the total number of birds is declining in urbanized areas, some birds can thrive. These urban birds are good at using human resources, such as new food sources and artificial nesting holes. In some cities with mild climates, urban birds can also benefit from the warm environment created by the ‘urban heat island’ effect. (reviewed in Isaksson, C., 2018) Data shows that out of more than 10,000 recognized bird species in the world, about 2,000 occurs in cities, accounting for 20% of the known species. (reviewed in Isaksson, C., 2018) As Caroline pointed out in Impact of Urbanization on Birds “Birds are probably the loudest and most visible animal group in the urban habitat.”(Isaksson, C., 2018) In many cities, birds are seen flying, foraging, and resting. Urban birds can tolerate and even thrive in the city. (Basu., 2018)

photos by Lihui Yang

Why do birds live in cities?

Some birds are classified as ‘ancient urban species’ by appearing in cities historically. (Møller, A., 2012) Birds such as pigeons and sparrows are the most common species of urban birds, having historically thrived in cities. (Kenn, & Kaufman, K., 2020) For example, people living in ancient Mesopotamia and Egypt brought pigeons to human-inhabited areas and encouraged them to inhabit and breed on their land. In the following centuries, pigeons have been regarded as a food resource of high-quality protein and are excellent messengers to transmit messages over long distances. As poultry became more popular, people started to breed pigeons as a hobby. Inevitably, these pigeons broke through their cages and began to breed freely in the city. (Bryce, E., 2018) The long development process of the rock pigeon in European towns has given these birds enough time to adapt to this change, which is the key to their spread in cities.(Møller, A., 2012) Today, the rock pigeon population all over the world has exceeded 400 million, and some of pigeons are living in cities. (Bryce, E., 2018)

Other bird species are classified as recently urbanized (Møller, A., 2012) whose habitats in cities are the product of urbanization processes destroying their natural habitats. Urbanization has profoundly affected most birds and their habitats. On the one hand, urbanization resulted in reduced natural and semi-natural habitats by irreversibly transforming habitats such as forests and farmlands into roads, buildings, and urban spaces. (reviewed in James Reynolds, S., 2019) On the other hand, urban construction and landscape changes have also created artificial surfaces that serve as bird habitats with new environmental characteristics that didn’t exist before, including buildings, houses, parks, etc. (Seress, G., & Liker, A., 2015) The driving force of losing the original habitat and the attractiveness of the new habitat in the city have caused birds with broader adaptability (Møller, A., 2012) to come to the city, inhabit and breed. Studies also concluded that conversion to urban habitats favors the occurrence of very abundant bird species.(reivewed in Møller, A., 2012) Thanks to the suitable living conditions provided by the city, the breeding season of these urban birds has been extended, the breeding success rate has increased, and their density has even exceeded that in the countryside. (reviewed in Ciach, M., & Fröhlich, A., 2017) This encourages certain species to migrate into urban areas, where populations are growing rapidly (Ciach, M., & Fröhlich, A., 2017)

What species survive in cities?

In fact, only a small portion of birds could survive in the urban environment. According to several studies, the characteristics that decide if species can successfully adapt to urban habitats include their life histories, nesting and breeding behavior, population and dispersal, foraging patterns, and defense mechanisms.

Life history

To survive in urban environments, individuals should attempt to breed there, suggesting that the species has a history of innovations allowing for colonization. Urban birds also differ from other bird species in terms of life history by having high annual fecundity and adult survival rate so that there will be adequate population surviving in the city colonies. (Møller, A., 2009)

Population and dispersal

A high propensity of population would contribute to successful colonization of urban birds because it is essential for a species to reach sufficient survival rate to be able to establish permanent populations. (reviewed in Møller, A., 2009) A wide range of dispersal is important to adapt to the patchy and fragmented habitats and scattered nesting sites in cities. (Pennington, D., & Blair, R., 2011)

Nesting and breeding

Species that nest at heights are more likely to survive in cities than birds that nest on the ground since ground nesters may suffer from frequent changes caused by urbanization. According to (Weber, W. C., 1967), none of the bird nests found in cities was at the height less than 5 feet from the ground. High points have more security by keeping humans and predators like rats and cats away.

The growth season of urban birds is usually longer than other species due to high temperatures and precipitation in urban environments. (Møller, A., 2009) Thus, species with more reproductive events or longer breeding seasons during a year may have more advantage than single-brooded species which have less time or seasonal limitation of breeding and reproduction.

Since there is usually limited space in dense urban areas, birds having smaller nesting and breeding territories are more suitable to colonize in cities. These birds are usually smaller-bodied species so that small spaces can meet their needs. (Pennington, D., & Blair, R., 2011)

Foraging pattern

Urban bird species are usually omnivorous so that they can live on diverse but also limited food resources in the city. For example, most urban birds not only feed on natural food resources found in grass and trees, they often also feed on human food in the city. Urban species also developed more efficient ways with high rates of feeding innovation (ways of foraging that deviate from those commonly recognized for a species) to adapt better to the environment.(Møller, A., 2009) Additional evidence also suggested that these species do not show exclusive defending behavior to protect their feed territories and often forage at same distance from their nests.(Weber, W. C., 1967)

Defense mechanism

The defense mechanisms of various species are effected in different ways. Appearance and features that develop by evolutionary history can have some effects. Characteristics like loose rump feathers can benefit some species as a means to escape from their predators. Species with high thresholds of fear and short flight distances are less susceptible to predation, and are most likely to survive. (Møller, A., 2009)

Other than predators, urban birds have to deal with various of disturbance in cities as well, which includes the massive changing land-use, pollution, noise, human activities, etc. Bird species with relatively

high reproductive rates, high flight, small home range sizes and small body size may be more defensive to these issues since they are more likely to escape from danger on the ground, and keep moving to adapt to changes. (Kociolek, Angela; Grilo, Clara; Jacobson, Sandra., 2015)

Urban structures as birds habitats

Successful urban bird colonies suggest that urban structures with some key features of natural habitats of those species has made their nesting in cities possible and successful. These structures usually have high points, pipes or ventilation shafts that provide secure places for nests and sufficient food and water resources nearby (Nests In & On Buildings.; BlogHow Do Birds Choose Where to Nest?.; Bird City Habitat.) As urban structures are classified with different features, different species may have their own preferences for nesting places. Some common types of urban structures for nesting are as follows.

Buildings

One common type of place where urban birds usually occur is city buildings. For examples, chimneys are popular nesting sites for chimney swifts, swallows can nest under the eaves of any accessible building, nesting on flat gravel roofs are common for herring gulls and killdeer, and American kestrels, barn owls, and Carolina wrens can be found housing in corners in the a building.(Nests In & On Buildings.)

Buildings in cities can be classified as inhabited buildings and uninhabited buildings. (James Reynolds, S.) In most cases, urban birds live on or around inhabited buildings since large population are living in cities due to urbanization and inhabited buildings usually have sustainable foods and water resource.

There are also some bird species living in uninhabited buildings such as factories, vacant shops and abandoned residential buildings in the city. (James Reynolds, S.) Uninhabited buildings can be suitable habitats for several reasons. Many uninhabited buildings in cities are old, and their traditional structures such as eaves and chimneys provide more potential nesting sites for urban birds. Old buildings can be more accessible while modern buildings are designed for efficiency and economy, making them impenetrable for birds. (Snep, R., Kooijmans, J., Kwak, R., Foppen, R., Parsons, H., Awasthy, M., . . . Van Heezik, Y., 2016) According to existing studies, uninhabited buildings in cities seem to provide urban birds with breeding grounds that are as good as in rural in terms of the equivalent breeding performance exhibited by population in both areas. (James Reynolds, S.)

City infrastructure

Infrastructure in cities include public and private physical improvements such as roads, railways, bridges, tunnels, water supply, sewers, electrical grids, and telecommunications, some of which are ideal nesting sites for some bird species. Nests of some species can be found on or under bridges, on utility and light poles, and on railroad tracks. Some birds even nest on gravel roads. There are also man-made nesting boxes platforms that are placed for such use as well.

Other structure

Many species would place their nests on the ground in cities. Some species use cavities in the ground or in various structures in the urban environment as their nesting sites. These structures include stream banks or even steep slopes of dirt stockpiles. (figure. 1) (PROTECTING NESTING BIRDS - Portland, Oregon)

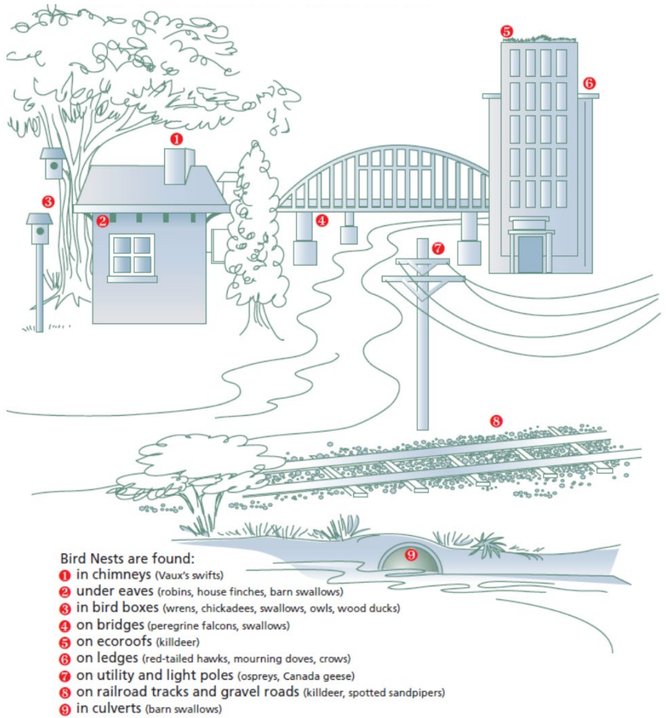


figure 1. bird nest locations in the built environment

Problems of Birds Nesting in the City

In many cities, the growing number of urban birds nesting on buildings sometimes has a negative influence on living environments in urban area and may increase conflicts between birds and humans. (James Reynolds, S.) Birds can be aggressive sometimes since human beings are their competitors and predators and they have competition and anti-predator response to humans. (Lunney, D., Munn, A., & Meikle, W., 2008) Urban birds can be pests for buildings. Nesting sites are noisy and odoriferous, and their droppings can contaminate and erode building materials and pollute the urban ground. (Fitzwater, W.D., 1988) There are also some associated health problems related to birds nesting on buildings. Frequently used nests are breeding ground for histoplasmosis and source of ectoparasites which can cause discomfort for residents.(Fitzwater, W.D., 1988)

In reverse, urban environments and human activities can have impacts on birds that live in cities as well. The architectural surfaces, especially glass, of city buildings may kill flying birds, and artificial light of buildings at night can hurt some birds too. Roads and traffic are another typical threat to the safety of urban birds. Millions of birds are killed by collisions with vehicles annually. Growing surface traffic has become a big issue to many bird populations throughout the world, causing habitat loss and direct death. (Jacobson, Sandra L., 2005) In addition, air pollution, artificial light at night, noise, human food, and human disturbances can be threats to urban bird colonies as well. (Isaksson C., 2018) As the dangers of building nesting are known, various types of bird repellent devices have been designed to mitigate the drawbacks. (Assouline; David., 1981) Although devices with sounds, light, and electricity have prevented birds from alighting on buildings successfully, saving humans from bird disruption, they hurt birds at the same time.

Need of Urban Bird Sanctuaries

In many places, although it is well known that the populations of some bird species are threatened or endangered, there is little possibility that this trend can be reversed in a short time under the influence of socio-economic development, urbanization, climate change and other factors. In view of limited space and funds, protection of urban birds in areas where there is a high concentration of endangered species can be more effective. Establishing protected areas as bird sanctuaries provides a possible solution to safeguard some species. (Reif, J., Marhoul, P., Čížek, O., & Konvička, M., 2011) 'Sanctuaries' are protected areas, which can be defined as "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values". (reviewed in Sharma, N., Gaur, S., Dhyani, R., & Singh, A. 2016) A sanctuary is usually a small space in the landscape and there are usually high populations of range-expanding species colonizing within the area. (reviewed in Sharma, N., Gaur, S., Dhyani, R., & Singh, A. 2016)

In fact, many cities around the world have built birds sanctuaries in the urban environment to protect bird populations. The following cases and their measurable impacts suggest that the urban sanctuary is an effective and measurable way to conserve wildlife and local biodiversity. (Sharma, N., Gaur, S., Dhyani, R., & Singh, A. 2016)

Zealandia, Wellington, New Zealand

Zealandia is the world's first fully-fenced urban ecosanctuary. The sanctuary in the city of Wellington aims to reintroduce 18 species of native wildlife back into the Wellington valley's forest and freshwater ecosystem area, and many wildlife now living in the sanctuary are native and endemic bird species.

To make the area ideal habitat for endemic wildlife, Zealandia restored the Wellington valley's forest and freshwater ecosystem to a vision of what it was before human arrival, aiming to provide an ideal living environment for the wildlife. The sanctuary also built a 8.6km fence, protecting birds by keeping out introduced mammal predators. The number of tourists that can enter the area are limited to one at one time, and everyone has to go through a double-fenced entrance to get in. In this way, some species once endangered in the region, such as the tūī, kākā and kererū are recovering from formerly low populations and now thriving in central Wellington. (Zealandia > About.)

Zealandia, Wellington, NZ
image source: https://www.visitzealandia.com/

The Sanctuary in Pride Park, Derby, England

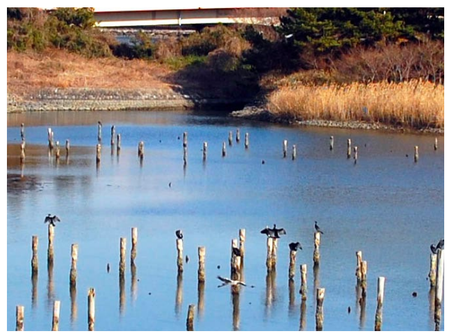
The Pride Park in Derby is a bird and wildlife sanctuary, a project designed in the interest of nature conservation. The park used to be heavily contaminated from its former use as a gas works area. In 2001, the site was found to be a place where some ground nesting birds, and passage migrants [?]would like to stay and colonize. Then, the park was designed into ‘the city’s first bird reserve’ to become the home for some species needing grassland habitat and to encourage their nesting and breeding. Physical access to where habitats or species populations are in the park was limited to protect birds that are small and sensitive to disturbance. Some view platforms and information boards were provided for people so that they have opportunities to learn about these urban birds. The reserve has provided easy access to habitat for wildlife in the busy city center, and is an ideal place for quick bird-watching in the city on a shopping trip, football match day, or visiting friends in Derby. (Derby Nature Conservation Strategy, Derby Nature Conservation Strategy, 2006; The Sanctuary Bird and Wildlife Reserve.)

The Sanctuary in Pride Park, Derby, England
image source: https://www.facebook.com/media/set/?set=a.435670979789020&type=3

Tokyo Bay Bird Sanctuary Park, Tokyo, Japan

Tokyo Bay Bird Sanctuary Park (TBBSP) is located in Tokyo Bay, about 10 km away from the center of Tokyo, 2km from the Haneda Airport. The site used to be surrounded by industrial facilities such as factories, warehouses, and vegetable and fruit markets. The site was abandoned during a relocation of the industry. As vegetation covered the land and rainwater accumulated to form ponds over time, migrating birds stared to rest and nest here, and the site became a bird sanctuary park in 1978. By restoring and managing the Tama River basin ecosystems, many species were attracted to the area. In the park, there is one freshwater zone and a sea water zone to provide natural habitats for the birds. Currentluy, about 160 bird species visit the park annually, including some endangered species such as cormorants, herons, sandpipers, and plovers. (Yokohari, M., & Amati, M., 2005)

Tokyo Bay Bird Sanctuary Park
image source: https://whereintokyo.com/venues/25307.html



Observation Huts of Tokyo Bay Bird Sanctuary Park
image source: http://www.wildbirdpark.jp/en/facilities.html

Tommy Thompson Park, Toronto, Canada

Tommy Thompson Park is located on an abandoned land in Lake Ontario, and was restored into a bird sanctuary after migrating birds had started to colonize the site as the land was covered by vegetation after being out of use for a long time. After carrying out the planned ecosystem conservation of the area, the population of native vegetation and plant species has increased by 70%, and wildlife including birds, fish, and mammals are thriving in the area as well. (Yokohari, M., & Amati, M., 2005)

Tommy Thompson Park, Toronto, Canada
image source: https://tommythompsonpark.ca/about/

Value of Urban Bird Sanctuaries

From these listed cases, it is obvious that bird sanctuaries provide multiple values which can benefit both birds and humans. Bird sanctuaries as refuges for endangered birds can protect huge populations. As a part of the regional wildlife protection system, bird protection areas are conducive to the protection of local species diversity. In addition to being bird sanctuaries, these protected areas have the potential to be a small park or public space to meet the needs of society at the same time. (Gürlük, S., & Rehber, E., 2008) Bird sanctuaries are also important in their entertainment and economic value as urban spaces. Sanctuaries in the city help to connect local community residents with their outdoor activities. Walking trails, leisure facilities, popular science areas, and research areas in the sanctuaries provide people with places for activities and education. In this way, they can bring economic benefits by promoting the development of local activities and tourism and help areas gain future investment. (Urban Wildlife Refuges bring the outdoors to your front door., 2018)

Urban Bird Sanctuaries Relevant to Christchurch, NZ

New Zealand has a fragile biodiversity. Since birds in New Zealand have gone through evolution in the absence of mammals for millions of years, they did not develop any natural defense mechanisms to protect them against mammal predators over time. (reviewed in Rastandeh, A., Brown, D., & Pedersen Zari, M., 2018) This suggests that these native bird species do not have effective ways to protect themselves and are vulnerable to predator pressures from exotic species. In fact, the introduction of exotic mammals has led to wide-ranged biodiversity loss across the country. (reviewed in Rastandeh, A., Brown, D., & Pedersen Zari, M., 2018) As exotic species invade the land, native species have to compete for food sources with indigenous fauna. Exotic species may also have negative effect on their home range and

and even carry disease. (reviewed in Rastandeh, A., Brown, D., & Pedersen Zari, M., 2018) These conditions have led to an exceptionally high level of vulnerability of local biodiversity, and make protected area for wildlife really important. As a result, within New Zealand, there are several bird sanctuaries distributed in different areas across the country, in addition to Zealandia which is mentioned above. Some successful cases are described below. places for activities and education. In this way, they can bring economic benefits by promoting the development of local activities and tourism and help areas gain future investment. (Urban Wildlife Refuges bring the outdoors to your front door., 2018)

Orokonui Ecosanctuary, Dunedin

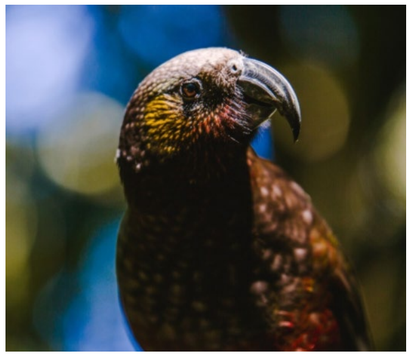
The 307-hectare sanctuary sits 20km north of Dunedin, a city on the South Island. It is a flagship biodiversity project for the South Island. In the sanctuary, wildlife including birds, butterflies, fish, plants and fungi are protected from predators by the application of a predator fence surrounding 307 hectares of Coastal Otago forest. Pests have been removed so that many endangered species can be re-introduced. Also, by carrying on educational programs, there are opportunities for the public to participate in biodiversity conservation and management within the area. (Orokonui Ecosanctuary)

Sanctuary Mountain Maungatautari, Hamilton, Waikato

Sanctuary Mountain Maungatautari is a world class conservation project which aims to reintroduce native species, support breeding programs and create bio-diversity in the existing ecological environment. The initial goal of building this sanctuary is to protect the plant and animal species in Maugatautari. The eco-system in this area has been considered as a reserve since 1912 and it was during the past few years that the community came together to build a pest-proof fence to help restore and protect this precious environment. As the fence was built, all the mammals were removed to provide a safe environment for some endangered native species to be reintroduced back to their natural habitat. The sanctuary was also designed to encourage people from both a national and a worldwide area to contribute to environmental and wildlife conservation. (Sanctuary Mountain Maungatautari)

The Enclosures in Sanctuary Mountain Maungatautari
images source: https://www.sanctuarymountain.co.nz/about-us

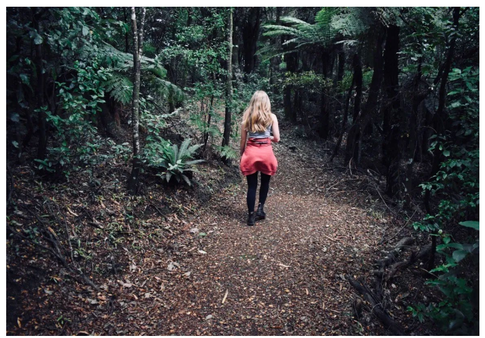
Wildlife in Sanctuary Mountain Maungatautari



Pūkaha National Wildlife Centre, Tararua

Pūkaha National Wildlife Centre is a captive breeding facility and visitor center located in a protected forest area on State Highway 2 in New Zealand's Tararua district. The forest was historically protected as a Forest Reserve, where 55 ha of the overall area was further protected as a Native Bird Reserve to protect endangered bird species and help restore native wildlife. Controlling invasive pest populations is the main method that the reserve used to ensure the successful restoration of wildlife in the area. Traps and other pest control methods have been applied to the area to keep the protected species safe from threats of rat, stoat, and possum populations. The sanctuary also has educational programs to provide opportunities for people, including local and the international tourists, to learn about environmental problems facing New Zealand. (Mt Bruce Wairarapa Aotearoa NZ., 1970)

Pūkaha National Wildlife Centre
image source: https://www.lostinsilverfern.com/2019/03/24/mount-bruce-pukaha-national-wildlife-centre/



Wildlife (bird) sanctuaries distribution map in NZ
image source: google map

As seen in the map above, sanctuaries for wildlife are located in different areas across the country in addition to the three cases listed. However, there is currently no sanctuary in Christchurch and the surrounding area although the city and the area are in or close to biodiversity hotspots of the country. In fact, Christchurch has a great potential of having high city biodiversity. Wetlands in the city, such as Travis Wetlands, are considered by many to be ideal habitats for New Zealand wetland birds. The city is also home to many vulnerable bird species. After the 2011 earthquake, the city has gone through natural regeneration, and a large amount of native vegetation has appeared along the Avon River after the surrounding area was damaged by the earthquake. The former urban land is gradually being replaced by natural grassland and woodland, and is becoming resting and nesting habitat for many birds and other wildlife. The riverside area provides a great opportunity to bring wildlife habitat back, restore ecosystems, and improve biodiversity, so that endangered native species can be reintroduced into the region and thrive again. (Back to nature – boosting biodiversity)

A NZ Bird species that needs protection

There are some bird species that are native to New Zealand and commonly seen in the city of Christchurch, including black-billed gulls, red-billed gulls, kingfisher, falcon, wood pigeon, pipit, etc. Among these bird species, the black-billed gulls have shown great reason and value to be protected in an urban sanctuary. Black-billed gulls are a unique endemic species, being very different from the other two gull species in NZ, and almost 78% of their population is in the South Island Region where Christchurch is located. They are considered the most endangered gull species in the world.(Buller, L., 2015) During the past 30 years, their population has undergone a rapid decline by 6% every year. (McClellan, R. K., 2009) The gull can be attracted to urban areas as long as there are accessible refuse and food scraps. (Higgins, P. J.; Davies, S. J. J. F., eds. 1996) Living in the city, however, also brings some threats. Introduced mammals such as ferrets, stoats, cats, and hedgehogs as these gulls' predators are primary factors that affect their productivity, successful nesting, and long-time colonization. (McClellan, R. K., 2009) The two other indigenous gull species of black-backed gull and red-billed gulls are also threats to the black-billed gull population. (McClellan, R. K., 2009) Although the black billed gulls have relatively high tolerance to human disturbance, human activities like shooting still kill a large number of their population. (McClellan, R. K., 2009; Massacre of native rare birds, 2009) People's aggressive attitude towards these gulls is partly because they mistakenly recognized them as the disliked red-billed gulls, which suggests the very limited knowledge and information that people have about these endangered species. Climate change could also impact black-billed gulls' population, putting them under the risk of flooding. (Morris, Bill, 2019; McClellan, R. K., 2009)

Due to the loss of their natural habitats and the appearance of regenerated nature in the city, the black-billed gulls have already colonized Christchurch. About 300 black-billed gulls, have set "a colony with about 130 nests in the half demolished and flooded foundations of a former office block on Armagh St". (Pennington, D., & Blair, R., 2011) However, the block is privately owned and will soon be replaced by new buildings, which means that these colonizers will lose their nesting site in the city. Thus, it is necessary to provide an urban sanctuary for them.

Black-billed gulls flying

image source: https://www.pickpik.com/seagull-flight-bird-beach-switzerland-lake-1760

Urban Sanctuary Design in Highly Dense Cities

Site Selection

According to research done by Amin Rastandeh, Daniel K.Brown and Maibritt Pedersen Zari (2018), there are several things that should be considered when identifying candidate sites of urban wildlife sanctuaries. Knowing about existing vegetation composition at a site can help planners make appropriate decisions about the management of vegetation and establish new pest-free protected areas. The potential ability to deal with climate change impacts is important when facing increasing acute climate change in the future. Human activity and predators in and around the site, and pollution sources in the surrounding area will also affect the environmental quality of the habitat and bird and other wildlife survival. It is surprisingly proved that patch size is not an important factor for urban bird sanctuary site selection because for some native birds, even small sites can provide suitable habitat. Instead, the relative position of the patch is more important, especially when considering bird migration habits and their flight distances.

Connection between Urban Sanctuaries and Public Space in Cities

The intersection of expanding urban areas and increasing number of protected areas has created a trend that the distance between urban areas and protected areas is getting closer over time. (Mcdonald, R., Forman, R., Kareiva, P., Neugarten, R., Salzer, D., & Fisher, J., 2009) It is unavoidable for urban sanctuaries to have some connection to public space in the city. Thus, the ecological environment of a sanctuary will depend not only on its internal structure, but also on the urban environment surrounding it. Changes to the surrounding urban area will impact the ecological environment within the reserves, and the sanctuary can affect the surrounding urban area in reverse. (Mcdonald, R., Forman, R., Kareiva, P., Neugarten, R., Salzer, D., & Fisher, J., 2009) These two-way impacts can be both negative and positive.

Negative impacts

The continuous construction and growing urbanization around a sanctuary can lead to environmental, structural and natural functioning problems in and around the protected area. (Sharma, N., Gaur, S., Dhyani, R. et al., 2016) Large consumption and production activities in urban areas can cause greenhouse gas emissions, create waste, and lead to air and water pollution. Noise in a city can affect wildlife within a kilometer or more of its surroundings. (reviewed in Mcdonald, R., Forman, R., Kareiva, P., Neugarten, R., Salzer, D., & Fisher, J., 2009) Urban residents may introduce invasive species to the sanctuary since some invasive species are able to enter from the surrounding developed area, parking lots, and city roads and then spread within the area. Some negative effects can also be caused by the diseases that spread from domestic animals to wild populations, and the transmission direction can be in a reverse. Light pollution in cities is biologically harmful to birds and insects. As some birds and insects can be attracted to lights, their migration patterns can be changed and some of them even die directly. (reviewed in Mcdonald, R., Forman, R., Kareiva, P., Neugarten, R., Salzer, D., & Fisher, J., 2009)

Positive impacts

The close distance between the city and the protected area provides residents with daily leisure and entertainment venues, which has shortened the distance between people and the nature. Established urban sanctuaries are considered places for urban populations to get out of stress and rest healthily everyday. (reviewed in Mcdonald, R., Forman, R., Kareiva, P., Neugarten, R., Salzer, D., & Fisher, J., 2009) It is also a good opportunity for the public to have a quick bird watching experience and learn information about endangered species. In addition, the urban sanctuary can also contribute to improving the urban ecological environment. Many cities rely on protected areas to provide clean water resource to their reservoirs. In some larger areas, protected areas are efficient in flood protection of local buildings and residents. (reviewed in Mcdonald, R., Forman, R., Kareiva, P., Neugarten, R., Salzer, D., & Fisher, J., 2009)

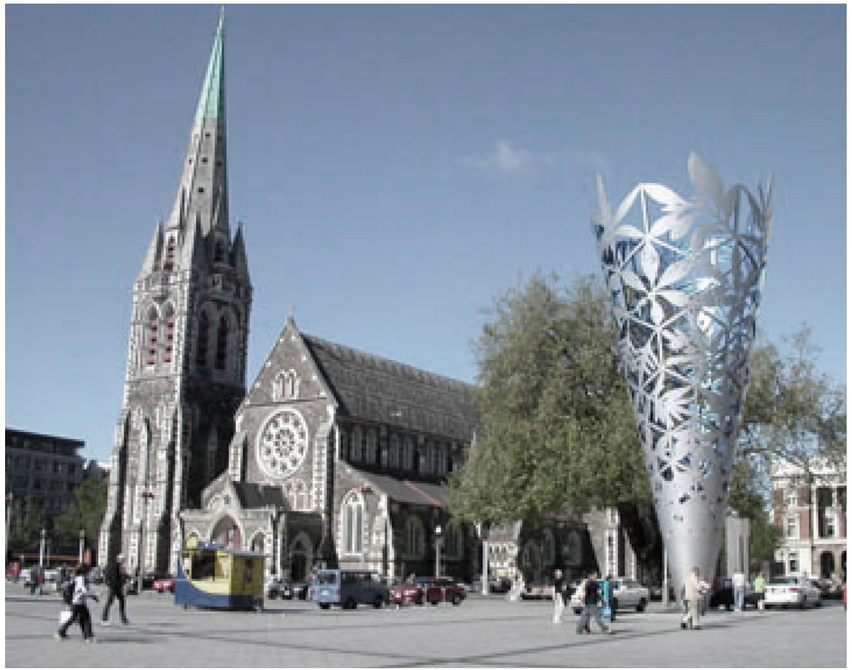
Managing the impacts

Since urban sanctuaries have been increasingly distributed in cities and their edge areas, the conflicts between humans and wildlife will become an important issue to be resolved in the following years. (Sharma, N., Gaur, S., Dhyani, R. et al., 2016) How to build the connection between urban sanctuaries and public space is important to both wildlife and humans as well. The built connection must work to minimize the negative effects and maximize the positive effects to benefit both the city and the sanctuary as much as possible.

Urban Landmark Design in the City Center

A public landmark in a city reflects the spirit of the city, and the perception of this spirit is the result of the combined attributes of the function, symbolic meaning, and emotional relationship with people in the design. At the same time, people's age, gender, occupation, education level and living environment all affect their feeling about landmarks. Successful landmark design can enhance the recognizability of the area, convey local cultural and values and make the distance between residents closer. (Lang, C. 2006)

For a landmark with important historical and cultural values, its design "requires minimal change to its distinctive materials, features, spaces, and spatial relationships". The historic character of the site should be preserved and too much removal of distinct materials should be avoided since they hold memories of its time, place and use in the past. New additions, if needed, should be built in either historic materials, or share the same features with the existing property so that the new and the old part can have spatial and characteristic relationships with each other to protect the integrity of the property and its environment. (City and County of Denver Official Site)



Christchurch Cathedral Square
image source: https://asd.gsfc.nasa.gov/archive/tiger/tiger03_11_9.html

03 Design Framework

Driven by the thesis focus on how bird sanctuaries can be built in dense urban areas, especially how they can be designed to foster a healthy coexistence between birds and humans, integrating the ecological, historical, cultural and spiritual values of a local landmark, concluded from the researches of urban bird habitat requirements, specifically those related to the endangered black-billed gull, a design framework was developed to be applied to the design of a breeding sanctuary for this species in Christchurch's central civic space, as part of the reconstruction of the Christchurch Cathedral site, and can also be applied to other places under similar circumstance around the world.

Design Goals and Objectives

The design concept is to provide space for both birds and humans. A main objective of the design is to create protected habitat for the gulls - an urban bird sanctuary that can be publicly viewed without disturbing the nesting birds. Integrating the architectural forms of the cathedral and reusing construction materials to create new structures and features, the design reinterprets the existing architectural language and evokes site memories in the new public space. By designing for a healthy coexistence, the site can become a sanctuary for both birds and humans.

Adding the gull sanctuary to the cathedral site is important not only for its ecological value of saving bird species from the loss of native habitats and improving urban biodiversity, but also for adding a new layer of meaning to the landmark. In addition to its historical significance, cultural heritage and spiritual importance, the landmark can become recognized for its ecological value, contributing to the city's evolving environmental identity. The educational experience of the sanctuary and visitor center will help people learn more about the threatened species and understand the importance of providing urban habitat for the gulls as well as other species.

Species Selection

1. Design and build sanctuaries for those who are more likely to be attracted to urban area and have higher adaptability to survive in the city. Not all bird species will nest and breed in urban areas after leaving their natural habitats. The types of natural habitats that can be imitated in urban areas are limited. In general, only birds that would like to nest in bushes, on riverbanks, or on rocks can find similar habitats in the city. Among these species, only a small portion has the adaptability to survive and build their colonies in the urban environment due to predators, human activities, pollution and other disturbance factors.

2. Native and endangered or threatened bird species should be considered as the primary protection object. The limited space with potential structures in urban areas would indicate that the number and species of birds that a sanctuary can protect are limited.

3. Choose species that are friendly to the city. Since the protected species are going to live in urban areas for time ranging from months to years, it is important to make sure the species won't have negative effects on people in the city and their living environments. For example, the species should not be very aggressive, do not carry bacteria and viruses that are difficult to prevent, etc.

Black-billed gull colony
image source: https://www.nzgeo.com/stories/tending-the-flock/

Site Selection

A thoughtful site selection will contribute to the successful colonization in the sanctuary. A successful sanctuary can demonstrate how we can stimulate the ecological value of built structures, and have significant educational function and meaning as well.

1. Not all dense cities have abandoned structures that have the potential to be transformed into a bird nesting sites. A suitable site is more likely to be found in the following **city conditions**:

- ***Cities under rapid development***. City development usually requires buildings and facilities be updated and replaced, and many unused structures and spaces may be available in the city during these times. Habitat features can also be incorporated into the design of new structures.
- ***Cities damaged by disasters.*** The strike of a disaster often brings the collapse and damage to ground, roads, bridges, and buildings in the city. Large areas of urban land may be abandoned. These abandoned sites and the structures may become places where urban birds inhabit.
- ***Cities with collapsed industries.*** The decline or disappearance of an industry will cause related factories, buildings and facilities to be abandoned. These abandoned structures are likely to be occupied by bird colonies while waiting for renewal.

2. Site selection should be base on consideration of both the **urban environment** and **existing ecological value** of a place. The relative position of the site in an ecological corridor is more important when considering bird migration habits and their flight distances. The surrounding urban area should have adequate living resources (food, water, etc.) For the birds to satisfy their daily needs. The site itself should be protected from predatory pests and have features that meet the species' habitat requirements including perching and nesting surfaces, vegetation, and shelter, and have the ability to positively respond to climate change (have high points to keep birds safe from flooding.)

3. Site selection should consider the **life history, habits and behavior of the protected species**. Selecting sites that can be attractive and safe for the birds can help urban birds survive city conditions.

Black-billed gull colony
image source: http://www.arrg.org.nz/black-billed-gulls-looking-to-nest/

Design Strategies

1. ***Restore the regional environment and ecosystem.***

The sanctuary does not exist independently, but is part of the regional ecosystem. In addition to establishing habitat in the city, the ecosystem within the area should also be restored. The regional ecological environment should be improved so that the surrounding region provides adequate area to support the population. Ideally the urban sanctuary will help bird populations grow and reestablish in new habitats outside of the city as well as within it. The regional environment may include nearby forest and water ecosystems where the birds' natural habitats are, as well as urban ecological environments such as green and "blue" open space systems.

2. ***Clear or relieve threats.***

All the cases studied in the literature review built their sanctuaries to remove or exclude predators. Predators like cats and rats can be big threats and can be devastating pests to birds; therefore it is necessary to create a pest-free area to ensure successful bird colonization in the sanctuary. Other than predators, there are some threats to birds that may only exist in urban areas, such as massive human activities, high speed traffic, severe air/water pollution, continuous noise, etc. Relieving these threats, blocking them to some extent around the sanctuary, can improve the local environment and can contribute to higher living quality and survival rate of the birds in the sanctuary.

3. *Maintain distance.*

All the cases studied in the literature review built their sanctuaries to remove or exclude predators. Predators like cats and rats can be big threats and can be devastating pests to birds; therefore it is necessary to create a pest-free area to ensure successful bird colonization in the sanctuary. Other than predators, there are some threats to birds that may only exist in urban areas, such as massive human activities, high speed traffic, severe air/water pollution, continuous noise, etc. Relieving these threats, blocking them to some extent around the sanctuary, can improve the local environment and can contribute to higher living quality and survival rate of the birds in the sanctuary.

- Green space and water area with plants and vegetation can become buffers, creating gaps between public space and the sanctuary site to limit public accessibility to the sanctuary.
- Structures like fences, walls and gates can be efficient ways to block the disturbance. Double fences can be used to maintain sufficient gap distance if necessary. Gateways can be added on the enclosure surrounding the sanctuary to made more secure, such as at Zealandia and Riccarton Bush.

4. *Encourage Positive Interaction.*

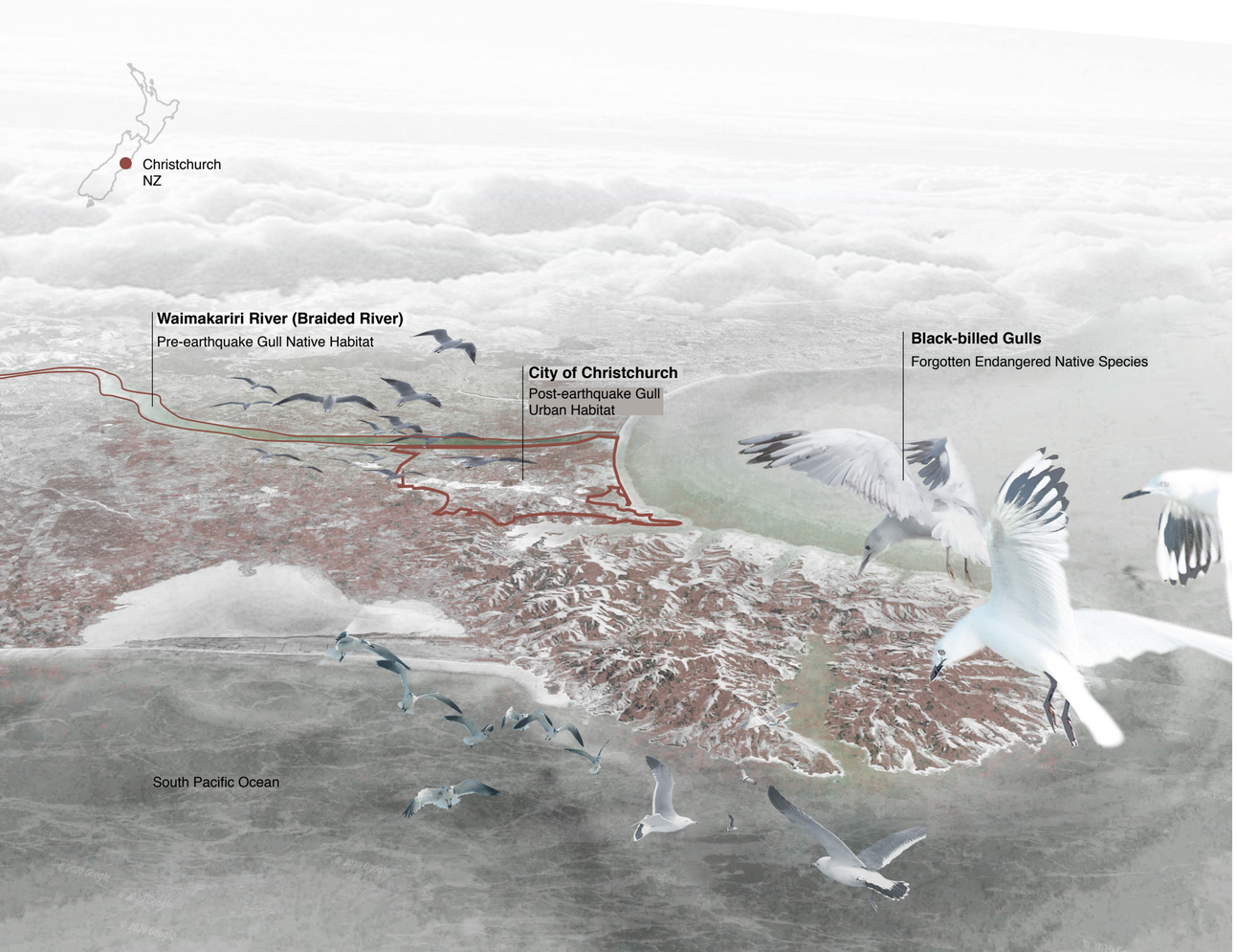
To foster positive interaction between people and urban birds there should be some interaction between people and the wildlife, but we should minimize both the negative influence of human activities and the problems that birds living in cities may bring to the public during the interaction process. To protect the birds, public accessibility should still be limited when getting close or entering the sanctuary. The limitation may involve building trails to restrict people's walking routes and reachable areas, or setting up certain birdwatching points to provide fixed places to see the birds and their habitats. People who get close to or in the sanctuary should be protected from possible aggressive behaviors, bird wastes, and the bacteria, virus, or diseases that may be carried by their wastes. In this way, we can make sure that the interaction builds upon the premise that both birds and people can feel safe, the health of both parties is protected, and people can learn more about the birds and their habitats without harming them.

5. *Provide Educational Programs.*

Nearly all the cases mentioned above involved educational programs to help people know about the history, conditions of the sanctuary as well as the wildlife, and the ecological environment within the sanctuary. Educational programs are important to help people understand the necessity of building or maintaining the habitats to protect or reintroduce the wildlife, which will encourage the public to take part in conservation efforts. It is meaningful not only for the city or country where the sanctuary is located to raise people's awareness of protecting the local environment and wildlife, but also for different regions worldwide by providing inspiration and ideas for protecting birds and wildlife internationally.

04 Design Proposals

The proposed design for a black-billed gull sanctuary as part of the Christchurch Cathedral rebuild includes maintaining and extending the existing circulation and axes of the site, designing garden and public space zones with different programs to facilitate various functions and experience on the ground. The bird sanctuary is designed to reflect the architectural language of the cathedral in providing protected breeding features that give people a variety of ways to experience the gull colony and the new outdoor sanctuary space. The design also includes proposals for collecting the bird wastes for reuse, and to collect and recirculate water to increase the hydrologic sustainability of the site.



Pre-earthquake: Waimakariri River

Post-earthquake: Flooded River Bed

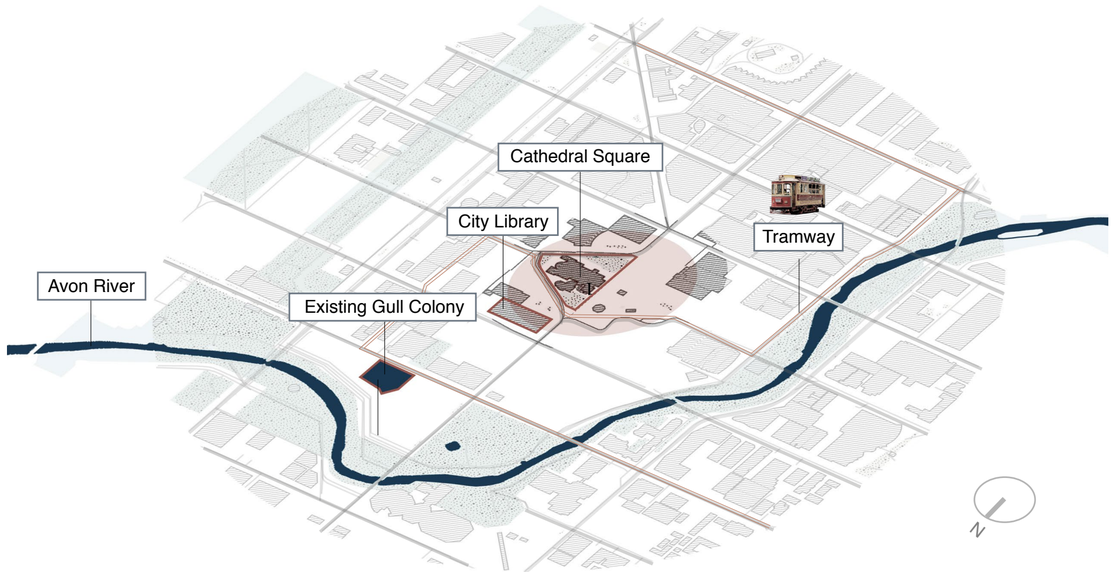
Post-earthquake: Damaged Urban Space

The **New Zealand Black-Billed Gull** is endemic to New Zealand and is one of the most threatened gulls on the planet. These gulls breed in colonies, mostly on braided rivers on New Zealand's South Island. The Waimakariri River north of Christchurch is one of their local natural habitats. However, threatened by modifications to their nesting habitat, flooding, and disturbances from aerial and terrestrial predators, some of the population has found new nesting sites within the city of Christchurch, near Cathedral Square, on the columns and beams of earthquake-damaged building foundation ruins. A preferred breeding site usually has open water, rocky nesting surfaces, and safety from disturbance such as floods or threats from humans and predators. The building ruins where a black-billed gull colony near the city center has taken up residence possesses these features; however the site is slated to be cleared for impending new construction.

Christchurch is located on the South Island of NZ where an endemic endangered species, the black-billed gull, breeds on braided river banks. However, frequent flooding after recent earthquakes has pushed the gulls to move their colonies to the city.

Site Context

The nearby location of the Christchurch Cathedral provides an alternative relocation site for the black-billed gull colony, and also opportunities for people to watch their breeding activity.



Cathedral Square

The central location of the cathedral and the significance of it as the “city’s living room” can attract public attention to the plight and value of the gulls.

Existing Gull Colony

The existing colony is salted to be destroyed and replaced, which give reason to build a new one nearby for nesting needs.

Avon River

The Avon River flowing through the city center and its riverbank area provides sufficient water, food, and nest building source during the breeding season.

City Library

Excellent views are provided from the upper floor balcony of the city library, and from the tram which takes visitors on a circuit around Cathedral Square.

Site History

Located in the city of Christchurch, Christchurch Cathedral is a symbol of the city that bears its name, and a building of considerable heritage and architectural value. Prior to the 2010/2011 earthquakes, the adjacent Cathedral Square in the urban center had become the city's " living room," holding many cultural and arts activities and events. Throughout its history, the site has been a place to exchange ideas and goods, a place of spirituality, a place of knowledge, and a place of welcome and meeting. Given the damaged condition of the building and its adjacent tower from the earthquakes, a restoration approach has been applied to the church's rebuild that will demolish and replace the unsafe architectural structures, making them fit for future purposes as well as honoring the past.

Before Earthquake, 1864 - 2010

The building of the cathedral began with the foundation stone with a city road across in the front in 1864. It is a landmark in the city center. The Cathedral Square went through several times of changes and new elements including status, tramway, and the columbarium were introduced to the site gradually. From the 1980s until the late 2000s, the square has become the "city living room" where cultural and artistic events, festival celebration, and arts and crafts markets happen a lot.

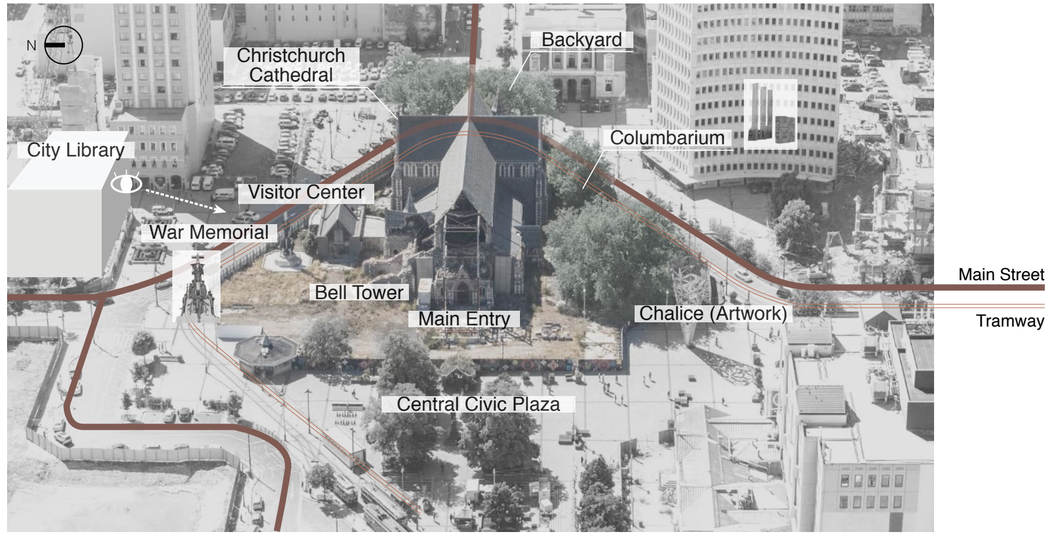
Earthquake, 2010/2011

Cathedral Square was among one of the areas hit the hardest by the 2011 earthquake. The Cathedral was badly damaged with some structures damaged beyond repair in the earthquake. Part of the bell tower collapsed.

After Earthquake, 2011-2020

The cathedral is under rebuild construction after the earthquake, and no public is allowed to get close for safety issue. The old architectural structures will be reinstated to make the cathedral fit for purpose for the future as well as honoring the past. The connection between the cathedral and the surrounding public space will be reconsidered to broader its civic role as the city landmark.

Site Analysis



Structures on the north side of the building will be moved, leaving space for the gull sanctuary and better connection to the central civic space. Materials from the deconstruction process can serve new functions in the design.

Site Photos

War Memorial &
Visitor Center

Will be moved to new locations.

Bell Tower

Will be rebuilt.

Old Stones &
Construction Materials

Will be replaced or reused.

Existing Trees & Lawn

Will be protected and retained.

Columbarium on the South Side

Will be retained.

Cathedral Backyard

Trees will be protected and retained.

The ongoing work of the cathedral deconstruction and restoration provides an opportunity for building viable gull habitat on the Church property.

On the north side of the cathedral, the existing War Memorial statue will be moved to another location and the Visitor Center will be removed for a new design, which will leave a large area of open space for the gull colony.

The deconstruction and replacement of the old stone architectural structures will make it possible to reuse old stones as artificial nesting surfaces.

Lush vegetation existing on the site including large trees and grass should be protected and retained. The green space has potential to become habitat for small invertebrates that can become food and nest building source for the gulls, and for other bird species and butterflies to stay and live.

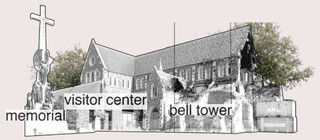
Design Objects & Strategies

Create Gull Habitat

Honor the Landmark

Build Healthy Relationships

Activate Public Space

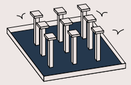


Reuse Old Construction Materials

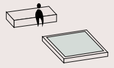
Integrate Architectural Language

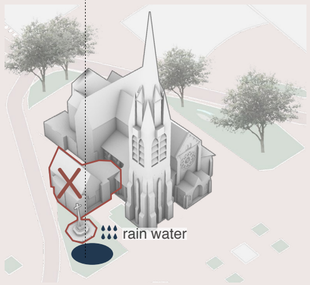
Temporary Gull Habitat

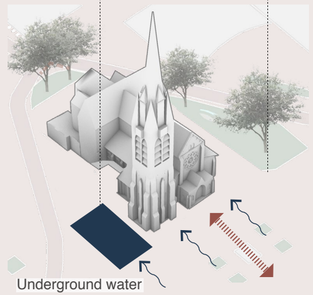
Gull Habitat + Spiritual Space



Public Use







Design Phase 1: 2020 - 2030

Design Phase 2: after 2030

Design Concept: a sanctuary for both birds and humans

The design concept is to provide space for both birds and humans. A main objective of the design is to create protected habitat for the gulls -- an urban bird sanctuary – that can be publicly viewed without disturbing the nesting birds. Integrating the architectural forms of the cathedral and re-using construction materials to create new structures and features, the design reinterprets the existing architectural language and evokes site memories in the new public space. By designing for a healthy coexistence, the site can become a sanctuary for both birds and humans.

Adding the gull sanctuary to the cathedral site is important not only for its ecological value of saving bird species from the loss of native habitats and improving urban biodiversity, but also for adding a new layer of meaning to the landmark. In addition to its historical significance, cultural heritage and spiritual importance, the landmark can become recognized for its ecological value, contributing to the city's evolving environmental identity. The educational experience of the sanctuary and visitor center will help people learn more about the threatened species and understand the importance of providing urban habitat for the gulls as well as other species.

Design Phases

Design Phase 1: 2020 - 2030

Informing the gulls of potential urban nesting site here through retaining rain water into an open pool, moving the stones on site to the pool as nesting surface, and fencing it off into a temporary sanctuary during rebuild.

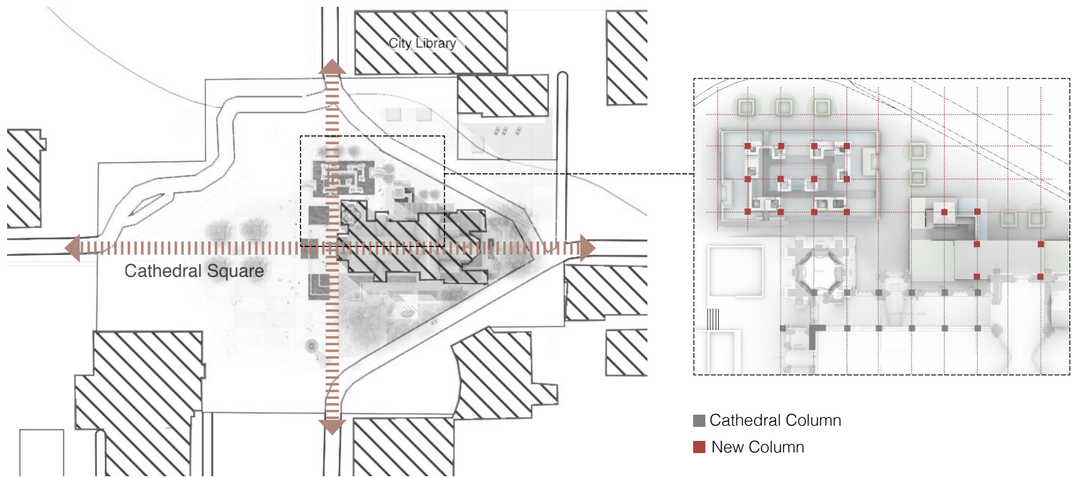
Design Phase 2: after 2030

Create a new sanctuary through integrating city ground water, building new nesting sites with old materials and setting up fence to keep it safe. Build connectivity between the sanctuary and other public space.

Master Plan

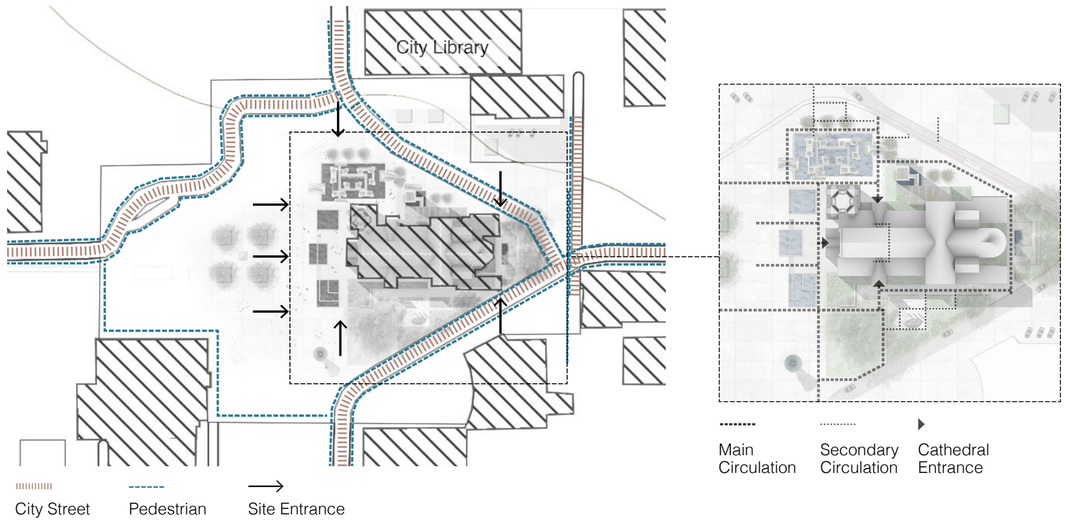
The proposed design includes maintaining and extending the existing circulation and axes of the site, designing garden and public space zones with different programs to facilitate various functions and experience on the ground. The bird sanctuary is designed to reflect the architectural language of the cathedral in providing protected breeding features that give people a variety of ways to experience the gull colony and the new outdoor sanctuary space. The design also includes proposals for collecting the bird wastes for reuse, and to collect and recirculate water to increase the hydrologic sustainability of the site.

Design Axis



The new structures (sanctuary & education center) are extensions of the existing architectural spatial structures.

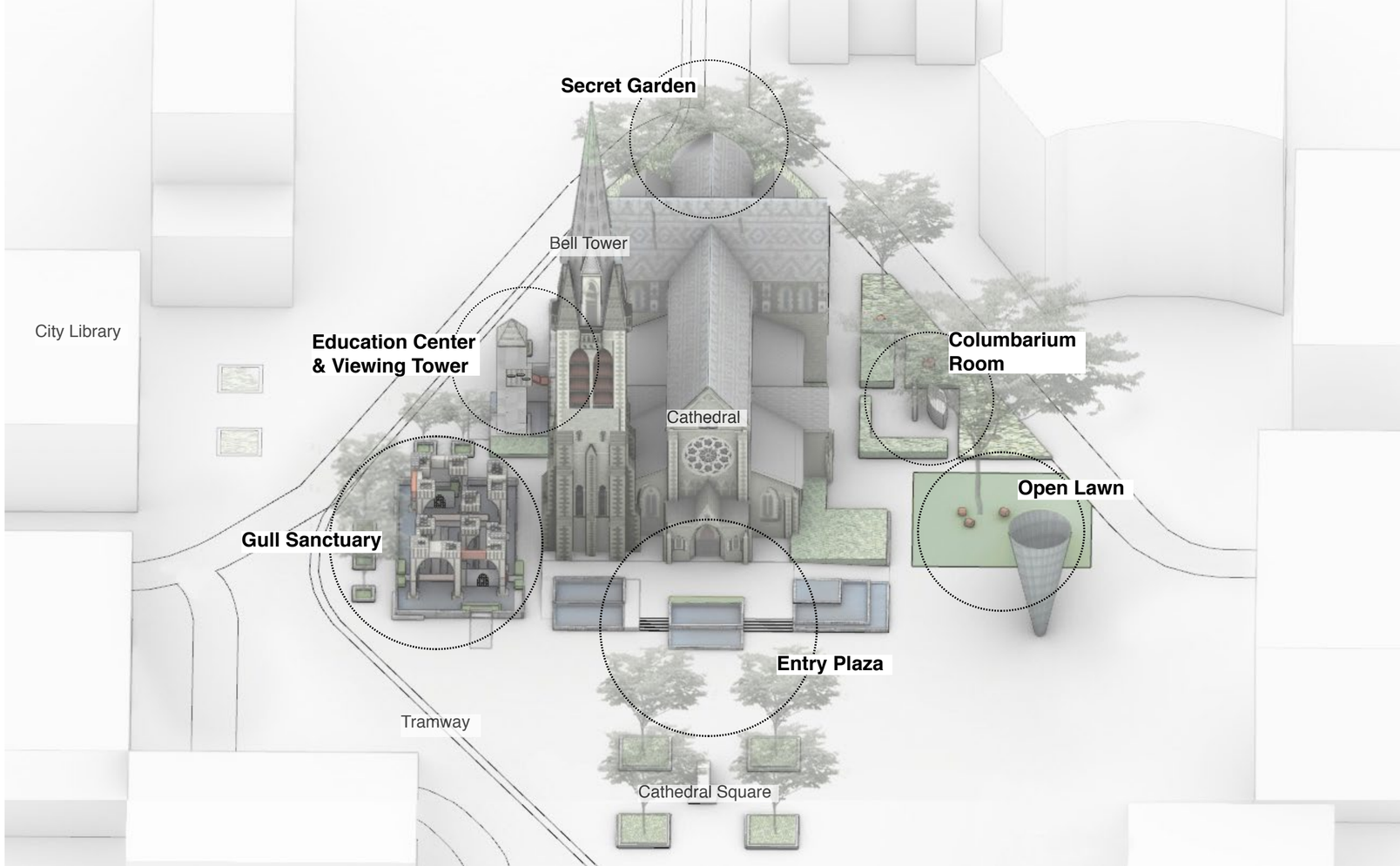
Circulation



Multiple entrances were designed for accessibility from different directions. Circulation throughout the site reinforces the connectivity between different zones and between the architecture entrances and the landscape.

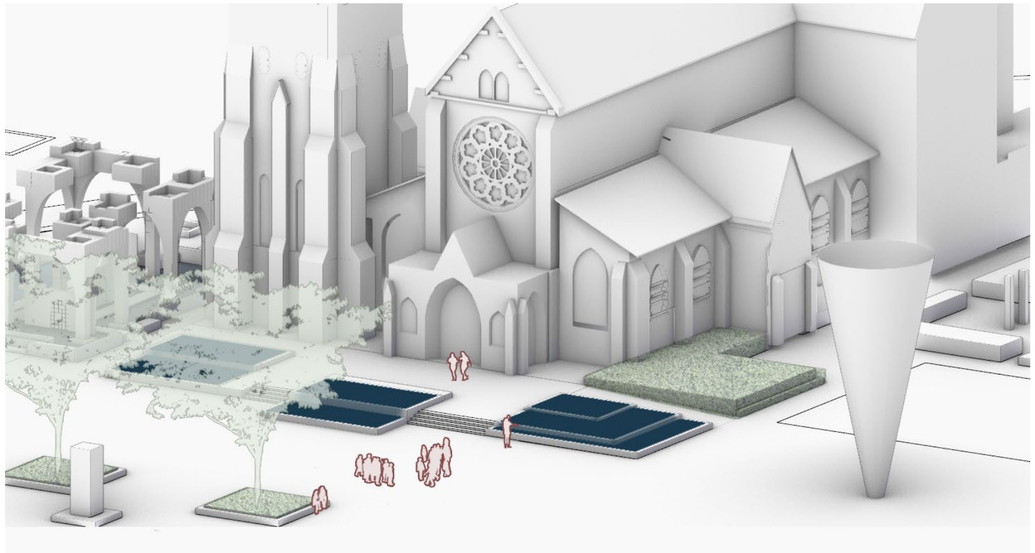
Site Program

Different site programs are developed to serve both wildlife and humans in different zones of the cathedral site, including an entry plaza in the front, a gull sanctuary and an education center with a viewing tower on the north, a secret garden on as the cathedral backyard, a columbarium room and an open lawn on the south. Different programs of different zones provide the wildlife and public here various places to stay.



Entry Plaza

The entry plaza design utilizes the existing height difference of 2 feet between Cathedral Square and the church's main front entrance to set apart the entry space, with ramps provided for accessibility. The plaza leaves enough space for public gathering and events. Water features are designed to reinforce the building axis, lead people to the entry, reflect the historic architecture and offer restorative experiences for visitors to the church and square.



Gull Sanctuary

The sanctuary applies an approach of seasonal flexibility to serve both birds and humans. During breeding season, elevated arches with nesting platforms located over a large pool will attract black-billed gulls, provide nesting surfaces for them, and protect the gulls from threats and disturbance including humans, predators, traffic and wind. Gates to the sanctuary space close to protect both gulls and visitors during the nesting season. During non-breeding season, visitors can access the planted pools under the nesting columns, providing the public a sanctuary experience of nature through the water, light, stones, and plants in the enclosed space. The design of the sanctuary through reuse of historic materials also makes it a memorial for the earthquake and the restoration construction work.

Gull Sanctuary

The concept of this gull sanctuary is to attract and protect the nesting black-billed gulls and provide the public with space for human experience in different seasons. Multiple strategies are applied for each layer of the sanctuary to provide seasonal flexibility so that this place can serve for the birds and people during both breeding and non-breeding season.

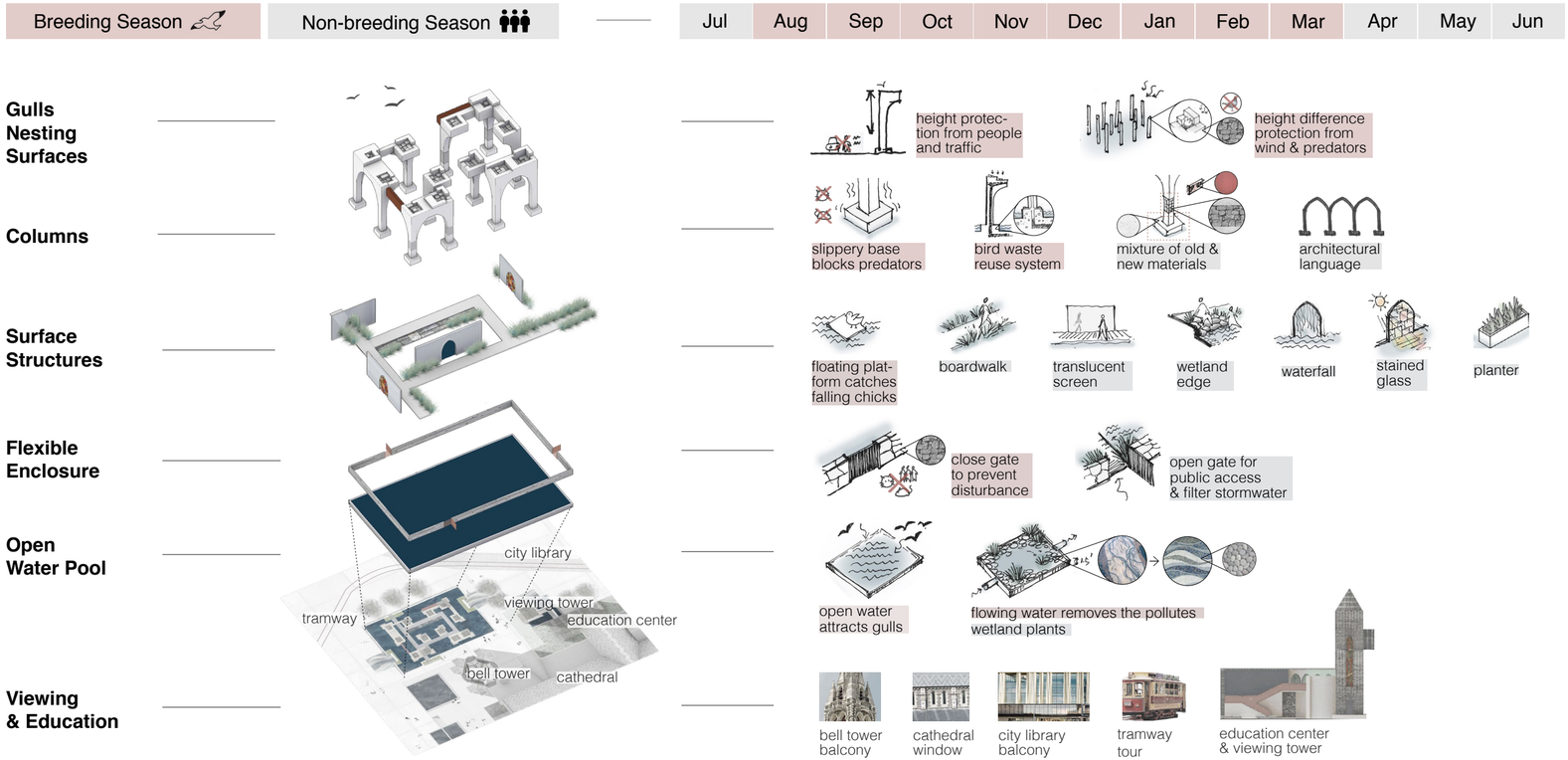
Gull nesting surfaces: Use height difference protection to minimum the disturbance and protect the nesting birds from wind and chicks from falling down into the water.

Columns: Slippery base are applied to prevent the predators from climbing up the nesting surfaces; bird waste reuse systems are placed inside; various materials are used on the surface to fit the future use as well as remember the past; the shape of arch makes the structure fit the cathedral building better.

Surface Structures: Boardwalk, translucent screens, stained glass, planters are designed to create various human experience.

Flexible Enclosure: Gates of the enclosure can be closed in breeding season to prevent predators. The enclosure is also made with the reused old stones.

Open Water Pool: The water pool is designed in a large area to attract the gulls. Water is flowing so that bird waste will be removed in time without leaving pollutant. The bottom is filled with round stones, forming a pattern of braided river for education purpose.



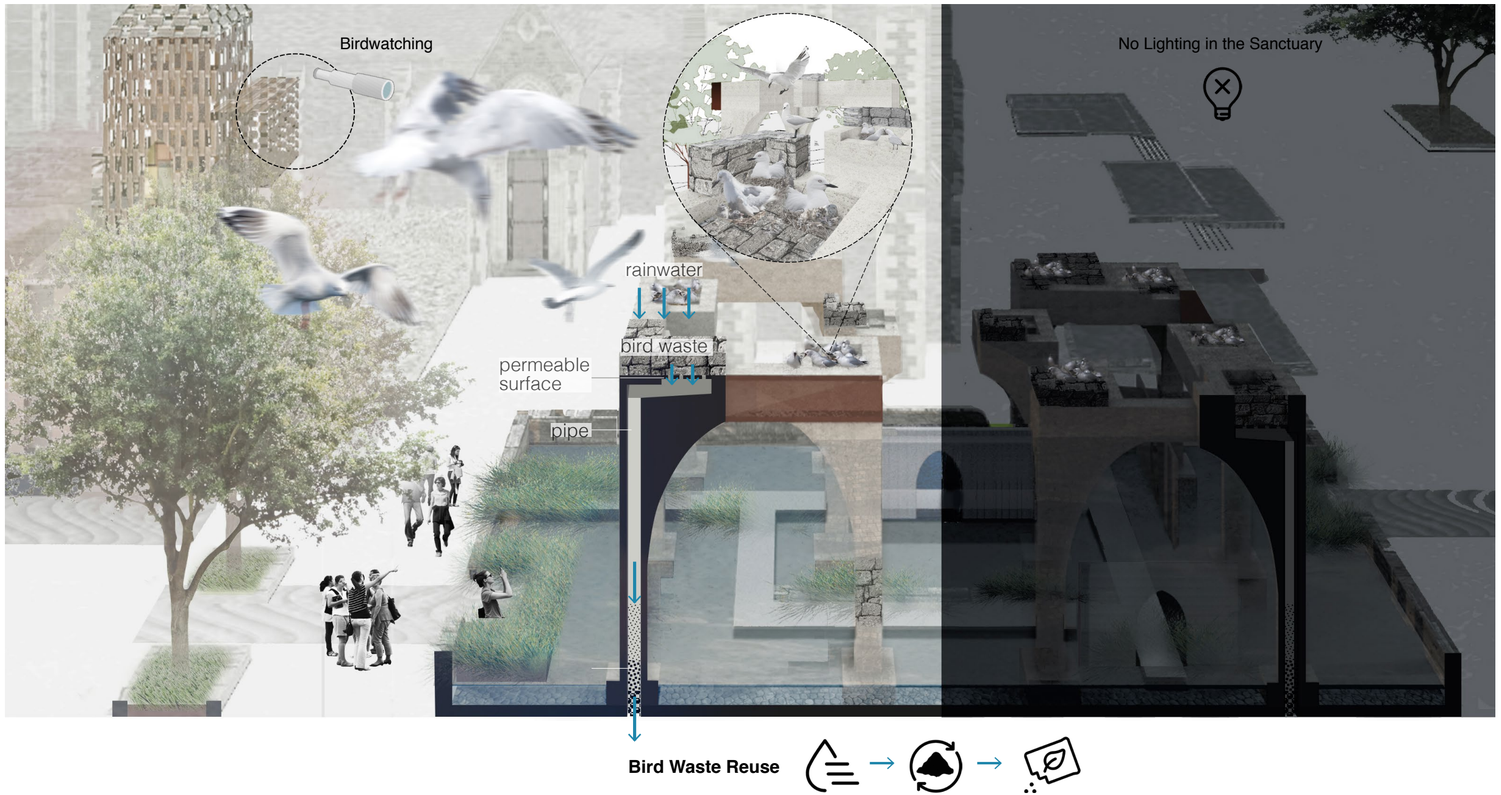
Gull Sanctuary in Breeding Season

During breeding season, elevated arches with nesting platforms located over a large pool will attract black-billed gulls, provide nesting surfaces for them, and protect the gulls from threats and disturbance including humans, predators, traffic and wind. Gates to the sanctuary space close to protect both gulls and visitors during the nesting season.

A blind balcony on the top of the viewing tower on the east side of the gull sanctuary provides great views of the nesting sites and the breeding activity. Although The balcony is about 30 feet away from the sanctuary to keep humans away from the breeding birds, telescopes are provide at different height for birdwatching for different groups of people.

No lighting is allowed at night at this sanctuary to protect the birds.

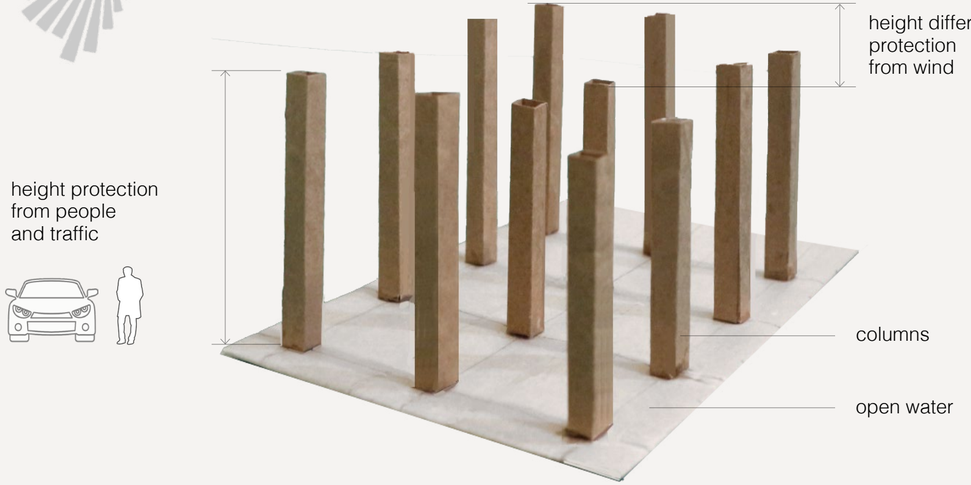
The gulls' waste will be washed down into the pipes in the columns with rainwater through permeable surfaces, and will be filtered, collected, dehydrated, and treated for re-use as fertilizer.

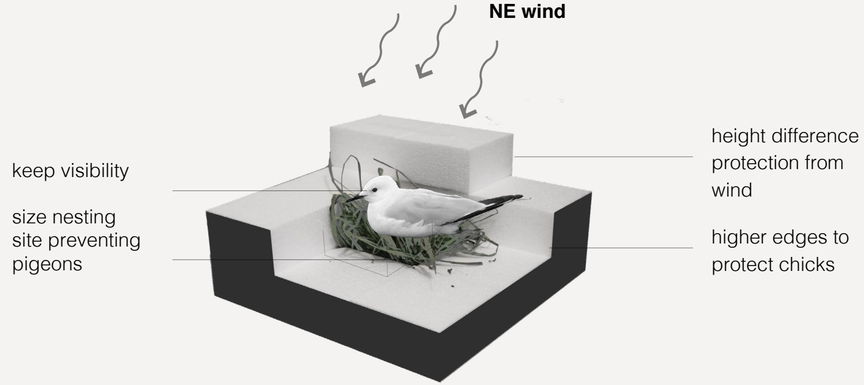


Physical Models & Protection Strategies in Breeding Season

Main Wind Direction Map in Breeding Season

Columns separate gulls from people and traffic, and are built with taller ones on the edge and northeast for protection from wind. Nesting surfaces of different height protect gulls form wind, and the higher edges protect chicks from falling down.





The higher edges on the main wind direction during breeding season functions as screens to protect gulls and their nests from the wind. Since the overall visibility is kept on the nesting surfaces, gulls are still be able to know what's happening in the surrounding.

To keep other bird species, especially pigeons from nesting on the surfaces, the surfaces are designed very open without any shelter that pigeons would love to nest beneath. The nesting surfaces are also sized so that only the small nests of the black-billed gulls with a maximum size of 1.5 feet can fit in.

nest size of pigeons:
> 2 feet

nest size of pigeons:
< 1.5 feet

Gull Sanctuary in Non-Breeding Season

As the gates of the enclosure opened during non-breeding season, people are allowed to enter the sanctuary and experience the space underneath the nesting surfaces.

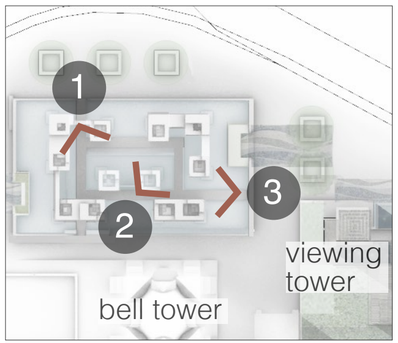
Walking on the boardwalk through the site with various features like wetland plants, waterfall, translucent screens, stained glass which can project colorful light, the space becomes a sanctuary for people to experience nature and to heal from the losses caused by the earthquake. The old stones embedded on the surfaces of the columns remind people of the power of nature, and the history of the earthquake and the construction work on the site. The mixed use of the concrete, steel, and the old stones makes the sanctuary structures and its history part stand out from its context as an artwork.

The water pool is designed in a depth of 1.5 feet so that children would be safe to walk on the boardwalk without any railing.

Stormwater is filtered through plants to keep the pool clean.

The round stones at the pool bottom from the pattern of braided river - the native habitat of the gulls.

A “Sanctuary of Nature” - Space for Human Experience in Non-breeding Season



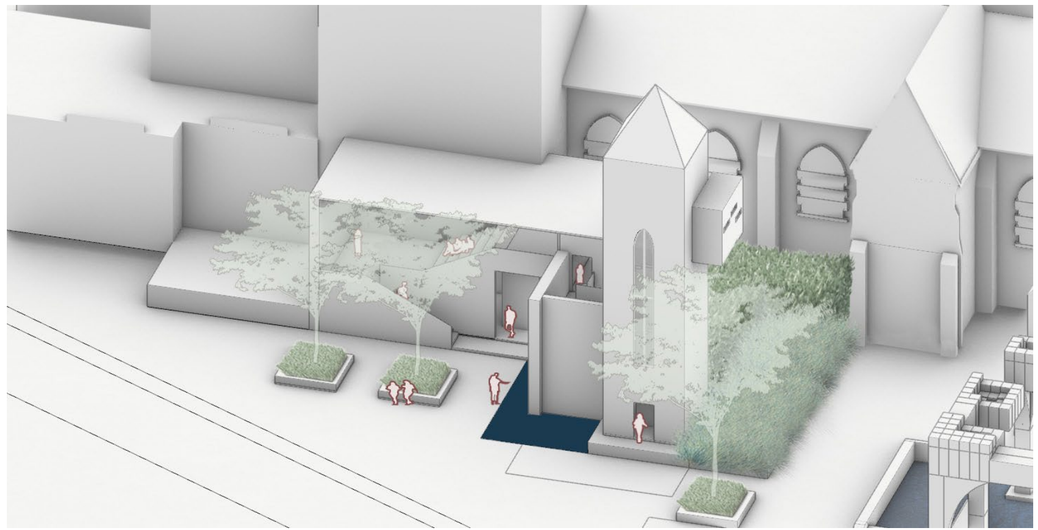
The wetland edge with wetland plants grown in the rocky habitat beside the boardwalk invites people into the water. Old stones on the columns are at a touchable height for people to feel its texture at a close distance.

The translucent wall separates the space as screens, and people’s shadow can be seen through the screen when lights go through. Waterfall provides people with the experience of water, and stained glass transform sunlight into colorful light and patterns.

Wetlands plants are grown on the side of the boardwalk, providing people with the experience of plants and nature. The enclosure of the water area is also made of old stones to remind people of the history.

Education Center

To provide the public with knowledge of the black-billed gull species and the earthquake history of the cathedral, an education center is designed on the east side of the sanctuary. The education center consists of a viewing tower which provides views of the top nesting surfaces of the gull sanctuary, a public classroom, a video room, and an exhibition room underground. The underground portion is connected to a space where visitors can see the cathedral base isolators that will protect the structure from future earthquakes, as well as the sustainable water cleansing and re-use system. Videos and models about the construction would also be provided.



Education Center Zoning

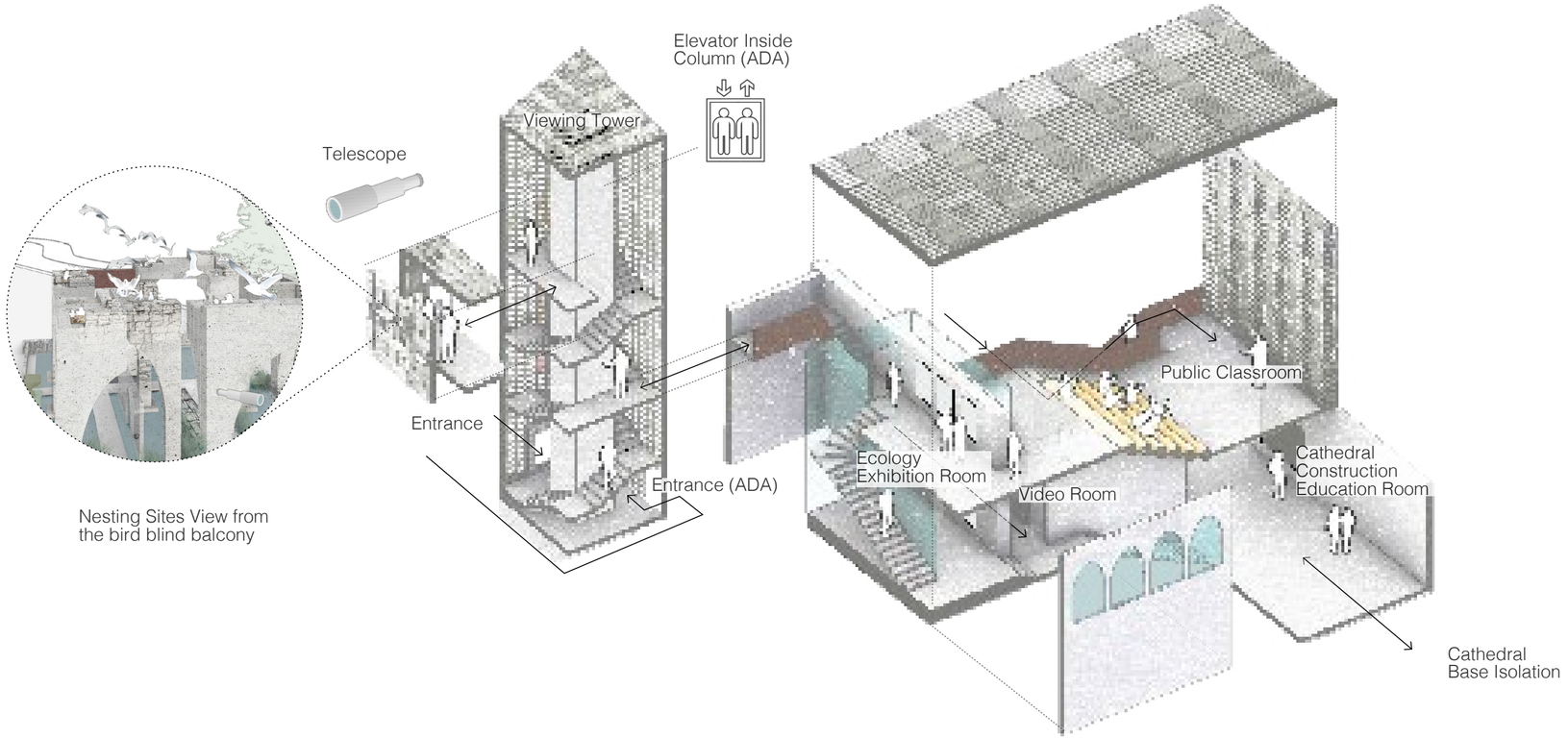
The education center consists of spaces that serve different educational functions to help the public learn about the site's history, the endangered species and their habitat, and earthquake-protective construction techniques used in the cathedral rebuild.

One part of it is the viewing towering, which has a bird blind balcony on the top to provide great view through telescopes of the nesting site and breeding activity for the public without bothering the gulls. The telescopes are placed at different heights for people of different heights. The surface of the tower is built with exposed bricks, allowing people to have a gimps of the outside when stepping up to the top.

There is also an elevator for disabled people in the column in the center with an ADA entrance at the back of the tower to provide the disabled people a place where they can wait for the elevator under a shelter.

The other part of the education center consists of spaces for different education programs to enrich the educating experience, including a two-floors exhibition room, a public classroom, a video room, and an underground part connected to the base isolator of the cathedral as an education room of the cathedral rebuild construction.

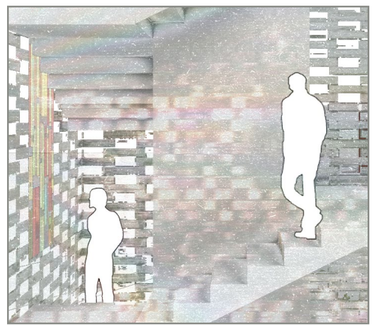
All the spaces in the center are connected through circulation to ensure the accessibility within the architecture.



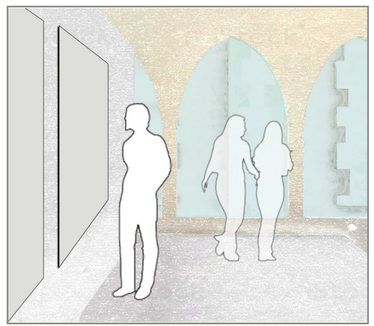
Nesting Sites View from
the bird blind balcony

Spaces in the Education Center

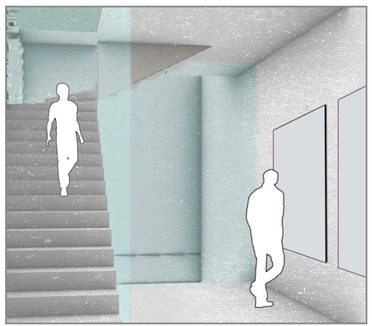
View Tower



Ecology
Exhibition Room

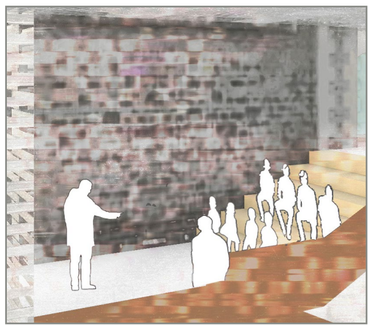


Ecology
Exhibition Room



Video/Class Room

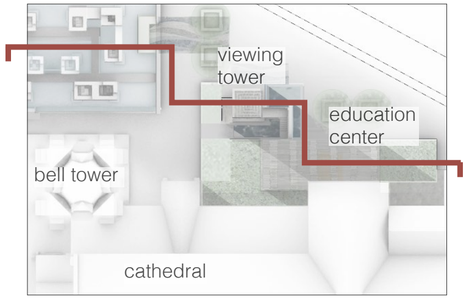
Public Classroom



Cathedral Construction
Exhibition Room

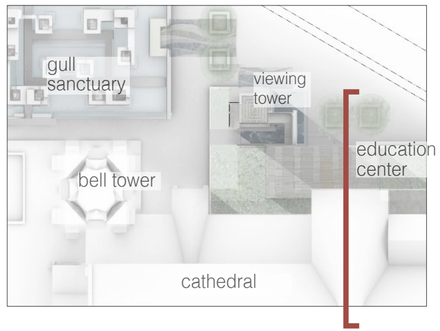
Education Center Section

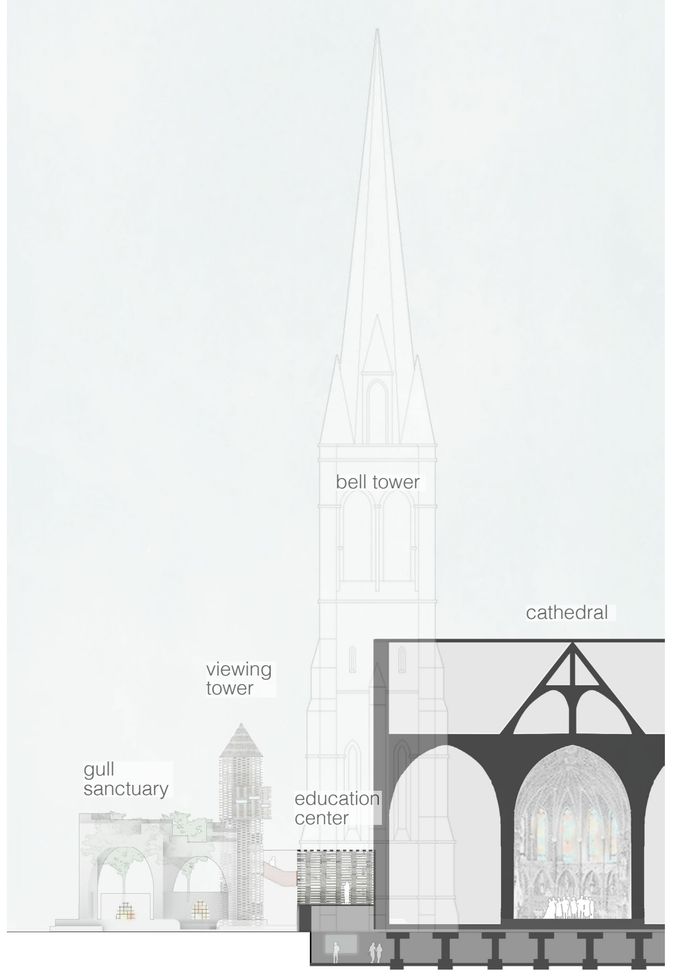
The center provides tower viewing of the sanctuary nest sites. Underground, the water features are connected through an underground purification system so that people can see the purification process for education purposes.



Education Center Section

The visitor center rooms are connected to the cathedral's underground base isolators so that people can go to the isolation part of the cathedral directly from the underground room of the center. This connection also provide an opportunity for people to see the base isolation work.

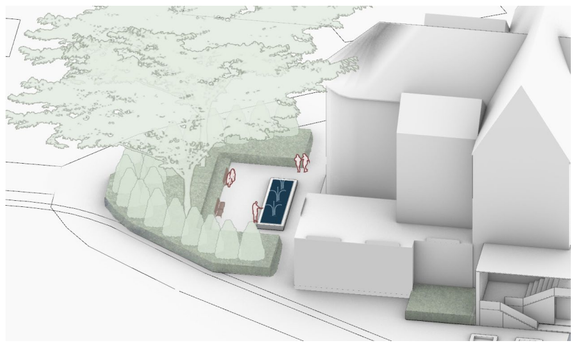




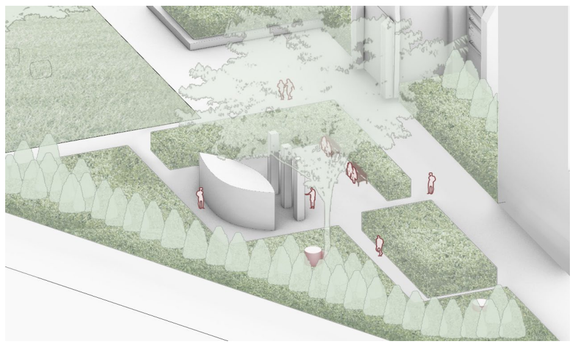
Places for Humans and Plants

Spaces on all sides of the cathedral have been designed for people to find refuge, and for wildlife including other bird species, butterflies, and invertebrates. Pathways around the cathedral link new spaces for people and connect them to the cathedral entries and public realm. The existing plants and mature trees on the south are retained, with hedges, the new “secret garden” and outdoor columbarium room vegetated with plant species native to the Canterbury region of New Zealand.

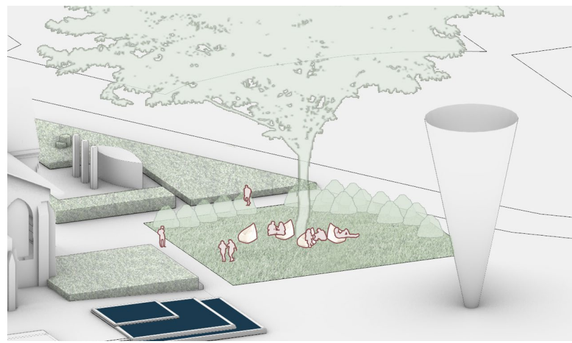
Secret Garden



Columbarium Room



Open Lawn



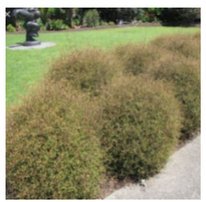
Secret Garden

For the backyard garden of the cathedral, two existing old trees and the greening area are protected and retained. The design of the garden is simple with a seating area under the tree and a water feature with fountains separate the seating area with the pathway, and balance the traffic noise, create a quite and calming place at the same time. In this way, the secret garden plays the role of a traditional cathedral garden where people can enjoy a quite moment.

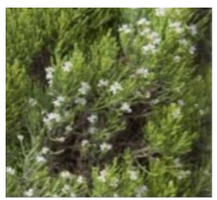
Planting

Coprosma crassifolia

Muehlenbeckia astonii



Hebe cupressoides



Columbarium Room

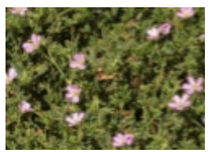
The Columbairum was introduced to the site at 2000, and functioned as a place for people to remember the death. Considering its important meaning to the local, the memorial structures are retained, some new plants including shrubs and flowering ground covers are added to create a private room for people visiting the memorial. The space also becomes a garden with several benches where people can have a seat and rest peacefully.

Planting

Leptinella dioica

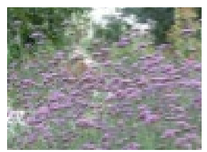
Poa colensoi

Geranium solanderi



Hebe pimeleoides

Teucridium parvifolium



Linum monogynum

Brachyscome pinnata

Open Lawn

The existing old tree on the south side of the cathedral and the lawn area beneath it are retained, and some new grasses are added in the area to create a open lawn for public entertainment. As some outdoor furnitures are placed on the grass, people can have comfortable seats here to enjoy their outdoor life.

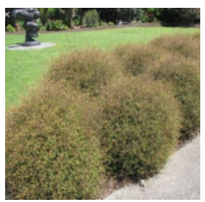
The location of the lawn facing the cathedral square also makes it a place where people can sit to enjoy the public events there.

Planting

Carex resectans

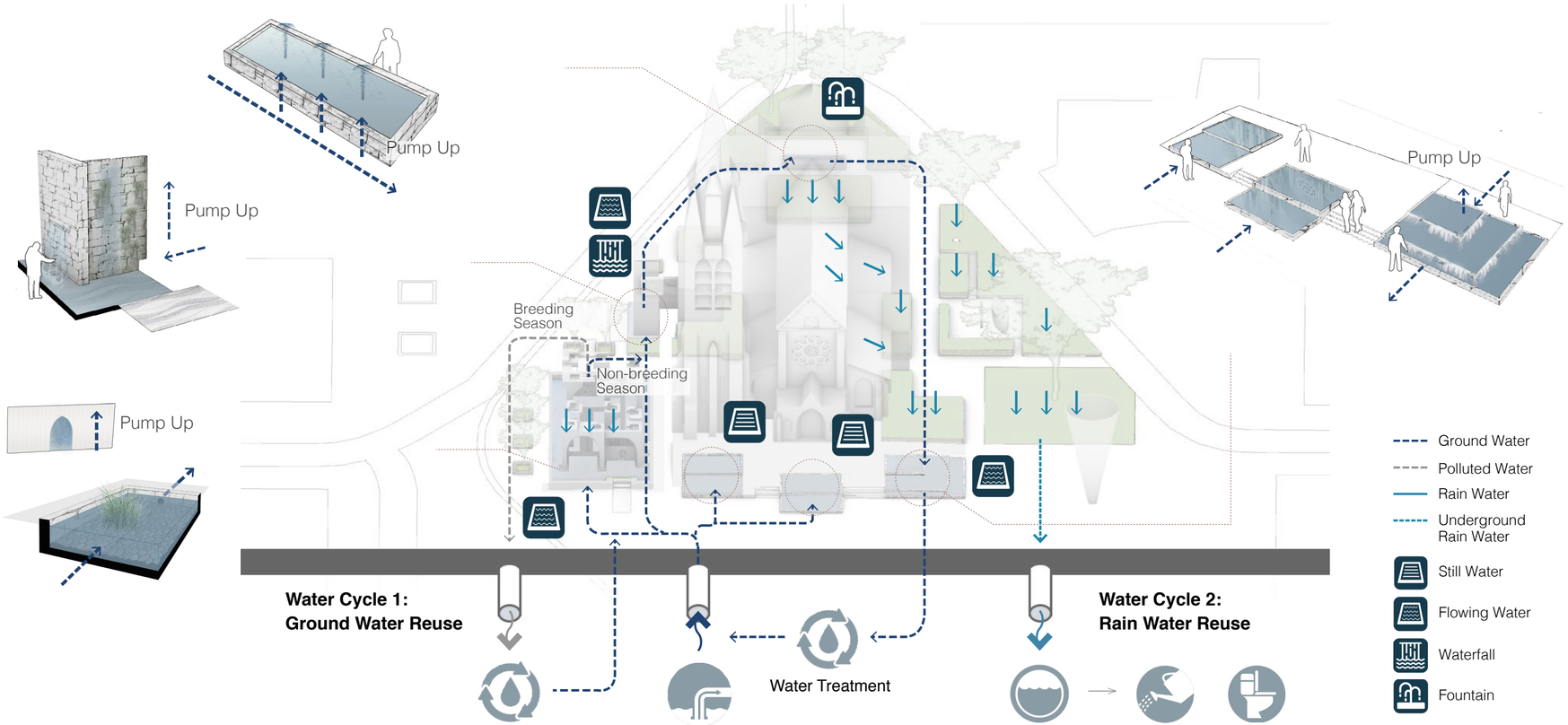
Coprosma crassifolia

Muehlenbeckia astonii



Water Cycle

There are two seprated water cycles underground. One is the ground water reuse system where city ground water is introduced to the water features in front of the cathedral and reused throughout the site. The other one is the rainwater reuse system where part of the roof-water is collected and conveyed to the underground part of the site through the greening. Then, the rainwater is going to be treated and reused for irrigation and as toilet water inside the building.



A Resilient Plaza for People and Wildlife

Adding the gull habitat as an urban bird sanctuary, I'm retrieving the cathedral square as the "city living room", and also adding a new layer to the landmark with this distinctive sanctuary character and the black-billed gulls as city's identity.

It is important not only for its ecological value of saving bird species, but also for its value in integrating the ecological, historical, cultural and spiritual values of the site in the rebuilding.

05 Reflection

This thesis was inspired by the existing black-billed gull colony in the city center of Christchurch, began with research and case studies driven by the questions about how to build sanctuaries for endemic endangered bird species in dense urban area and how to build healthy coexistence between birds and humans, developed a set of design framework, and end up with doing a detailed design work for the Christchurch rebuild.

Overall, the large amount of research on this topic all over the world provided the following exploration of this thesis a solid theory foundation. The case studies focused mainly in NZ so that the urban bird sanctuary design strategies concluded from the cases are universally applicable in NZ. In this way, the design framework developed from the theory foundation and the concluded strategies can not only fit well in NZ, but also be a prototype which can be applied to other areas around the world. The framework also prepared my design work with design principles that fit the context of the city of Christchurch well. It was during this whole process of research and design, I found the importance and necessary of a solid theory base and a rigorous design framework, which can save time and work for the design process and make the design more reasonable and convincing. Also, opening the research to a wider range around the world instead of limiting it in a certain area can help in building more general frameworks and conclusions that serve our world better. This larger picture called my awareness of the issues in different countries and cities, also encouraged me to open up my mind and think about my research questions from different perspectives.

Urban bird sanctuaries is a concept that I have never touched and or been oncerned about before I saw the existing gull colony in Christchurch. As I grew up in a dense city in China, I rarely see wild birds in urban areas and cities are like islands isolated from the surrounding nature world due to the rapid urbanization process. For a long time, I took “birds do not live in cities” as a matter of course, and have never known ‘urban birds’ at all. However, during the process of researching and exploring of this thesis, I started to realize the large bird populations that live in cities around the world, the nificant role of these urban habitats as birds’ adopted homes, and the necessarity of leaving some urban space for the endangered bird species to survive. Through developing the design framework and doing the detailed design, I learned how to protect the endangered bird in an dense urban area. To protect an certain species efficiently, it is necessary to know all details about life history, behavior, threats, living environment, etc. For me, it was like the process of building a friendship, and we can only build a solid friendship with someone when we know the person well so that we know what this person need and what can we do to help when there is a plight. The thesis also broke my traditional thoughts about “landmark” that a city landmark can not only represent the local culture value and history heritage, it can also show people the ecological identity of the city and raise people’s concern about the plight and value of endemic species. What’s more, the special context of the Cathedral rebuild encouraged me to think about the ecological value of the abandoned urban structures, and the potential of their reuse as wildlife habitat in the future.

Other than the wildlife, this thesis is also an exploration about creating public space for people to visit the landmark, get to know its history and story, and also feel the cultural, spiritual, social, and ecological value of it. I learned how to build positive relationship between birds and humans as they share the living space together, and how to create a inclusive and resilient place for both people and wildlife. I also learned to think thoughtfully for different groups of people, how to enrich human experience with various design element, and integrate education programs in design for the public so that they know better about the ecological situation of their city and start to protect the wildlife spontaneously and consciously.

Exploring both sides of protecting the wildlife and activating human activities, and finding strategies to make the site work for both birds and humans taught me a lesson that our urban space can serve for both wildlife and people at the same time as long as we find the balance and keep it flexible. The beautiful picture of the harmonious coexistence of humans and wildlife within the city is achievable.

While I enjoyed most of the time doing this thesis, there is still room for improvement of it. Since The design

my literature review mainly focused on reusing abandoned urban structures as bird habitat and sanctuaries, more research can be done to take cities without many abandoned structures into consideration. The case studies focused only in NZ also gave a limitation to the design framework. If more cases can be analyzed based on various contexts of different areas, the design framework can work better to fit other areas throughout the world.

For the design work, although I have come up with multiple strategies to attract and protect the endangered species, the effectiveness of some of them can not be tested at this time, which leaves the possibility that gulls may not come to breed or they may be disturbed during breeding. More deep research about this specific species and strategies of protecting them from disturbance can be done to make the sanctuary design more thoughtful. Also, since I'm also providing places where other wildlife can stay, research about other possible species should be done to provide them with a better living environment. However, given the time limitation, I didn't do much research on other wildlife and plants, leaving more uncertainty to the environment that I aimed to create. Other than that, some parts of my design are highly related to engineering details and strategies, and it will be more feasible if I can provide more details about the engineering aspects to show how they can work for the site.

Bibliography

1.Basu. (2018, April 26). Top 25 Urban Birds. Retrieved from https://wildbirdrevolution.org/top-25-urban-birds/

2.The Urban Landscape I BIRDS in BACKYARDS. (n.d.). Retrieved from https://www.birdsinbackyards.net/birds/Urban-Landscape

3.James Reynolds, S., Ibáñez-Álamo, J., Sumasgutner, D., & Mainwaring, P. (n.d.). Urbanisation and nest building in birds: A review of threats and opportunities. Journal of Ornithology, 160(3), 841-860.

4.Isaksson C. (2018) Impact of Urbanization on Birds. In: Tietze D. (eds) Bird Species. Fascinating Life Sciences. Springer, Cham

5.Seress, G., & Liker, A. (2015). Habitat urbanization and its effects on birds. Acta Zoologica Academiae Scientiarum Hungaricae, 61(4), 373-408.

6.Møller, A., Diaz, P., Flensted-Jensen, M., Grim, E., Ibáñez-Álamo, T., Jokimäki, J., . . . Tryjanowski, R. (2012). High urban population density of birds reflects their timing of urbanization. Oecologia, 170(3), 867-875.

7.Ciach, M., & Fröhlich, A. (2017). Habitat type, food resources, noise and light pollution explain the species composition, abundance and stability of a winter bird assemblage in an urban environment. Urban Ecosystems, 20(3), 547-559.

8.Kenn, & Kaufman, K. (2020, May 12). City Birds in Urban Birding Hotspots. Retrieved from https://www.birdsandblooms.com/travel/birding-hotspots/city-birds-in-urban-birding-hotspots/

9.Bryce, E. (2018, October 27). Why Are There So Many Pigeons? Retrieved from https://www.livescience.com/63923-why-cities-have-so-many-pigeons.html

10.Møller, A. (2009). Successful city dwellers: A comparative study of the ecological characteristics of urban birds in the Western Palearctic. Oecologia, 159(4), 849-858.

11.Pennington, D., & Blair, R. (2011). Habitat selection of breeding riparian birds in an urban environment: Untangling the relative importance of biophysical elements and spatial scale. Diversity and Distributions, 17(3), 506-518.

12.Weber, W. C. (1967). Retrieved from https://open.library.ubc.ca/cIRcle/collections/ubctheses/831/items/1.0101293

13.Kociolek, Angela; Grilo, Clara; Jacobson, Sandra. (2015). Flight doesn't solve everything. In: van der Ree, Rodney; Smith, Daniel J.; Grilo, Clara, eds. Handbook of Road Ecology. Chichester, UK: John Wiley & Sons, Ltd: 281-289. Chapter 33.

14.Nests In & On Buildings. (n.d.). Retrieved from https://www.massaudubon.org/learn/nature-wildlife/birds/bird-nest-situations-solutions/nests-in-on-buildings

15. BlogHow Do Birds Choose Where to Nest? (n.d.). Retrieved from https://varmentguard.com/blog/birds-choose-nest/

16.Bird City Habitat. (n.d.). Retrieved from https://www.ci.west-bend.wi.us/departments/parks_recreation___forestry/bird_city/bird_city_habitat.php

17.Snep, R., Kooijmans, J., Kwak, R., Foppen, R., Parsons, H., Awasthy, M., . . . Van Heezik, Y. (2016). Urban bird conservation: Presenting stakeholder-specific arguments for the development of bird-friendly cities. Urban Ecosystems, 19(4), 1535-1550.

18. PROTECTING NESTING BIRDS - Portland, Oregon. (n.d.). Retrieved from https://www.portlandoregon.gov/bes/index.cfm?a=322164

19.Lunney, D., Munn, A., & Meikle, W. (2008). Too close for comfort contentious issues in human-wildlife encounters. Mosman: Royal Zoological Society of New South Wales.

20.Fitzwater, W.D. (1988). Solutions to urban bird problems.

21.Jacobson, Sandra L. (2005). Mitigation measures for highway-caused impacts to birds. In: Ralph, C. John; Rich, Terrell D., editors. 2005. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 2 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station: p. 1043-1050

22.Assouline; David. (1981).

23.Reif, J., Marhoul, P., Čížek, O., & Konvička, M. (2011). Abandoned military training sites are an overlooked refuge for at-risk open habitat bird species. Biodiversity and Conservation, 20(14), 3645-3662.

24.Sharma, N., Gaur, S., Dhyani, R., & Singh, A. (2016). Challenges of small protected areas in urban cities: A case study of Okhla Bird Sanctuary, India. Environment, Development and Sustainability, 18(1), 295-310.

25.Zealandia > About. (n.d.). Retrieved from https://www.visitzealandia.com/About

26.Derby Nature Conservation Strategy, Derby Nature Conservation Strategy (2006). Retrieved from https://www.derby.gov.uk/environment-and-planning/planning/planning-policy/

27.The Sanctuary Bird and Wildlife Reserve (Derby City Council). (n.d.). Retrieved from https://birdingforall.com/england/derbyshire/the-sanctuary-bird-and-wildlife-reserve-derby-city-council/

28.Yokohari, M., & Amati, M. (2005). Nature in the city, city in the nature: Case studies of the restoration of urban nature in tokyo, japan and toronto, canada. Landscape and Ecological Engineering, 1(1), 53-59. doi:http://dx.doi.org/10.1007/s11355-005-0012-2

29.Gürlük, S., & Rehber, E. (2008). A travel cost study to estimate recreational value for a bird refuge at Lake Manyas, Turkey. Journal of Environmental Management, 88(4), 1350-1360.

30.Urban Wildlife Refuges bring the outdoors to your front door. (2018, December 18). Retrieved from https://www.doi.gov/blog/urban-wildlife-refuges-bring-outdoors-your-front-door

31.Rastandeh, A., Brown, D., & Pedersen Zari, M. (2018). Site selection of urban wildlife sanctuaries for safeguarding indigenous biodiversity against increased predator pressures. Urban Forestry & Urban Greening, 32, 21-31.

32.Orokonui Ecosanctuary. (n.d.). Retrieved from https://orokonui.nz/Wildlife/Photo-Gallery

33.Sanctuary Mountain Maungatautari - About us. (n.d.). Retrieved from https://www.sanctuarymountain.co.nz/about-us

34.Mt Bruce Wairarapa Aotearoa NZ. (1970, June 3). Retrieved from https://pukaha.org.nz/

35.Back to nature – boosting biodiversity. (n.d.). Retrieved from http://greeningtheredzone.nz/avon-otakaro-forest-park/back-to-nature/

36.Buller, L. (2015, June 21). Black-billed Gull. Retrieved from http://datazone.birdlife.org/species/factsheet/22694413

37.Massacre of native rare birds. (18 February 2009). Retrieved from https://en.wikipedia.org/wiki/Black-billed_gull#cite_note-21

38.McClellan, R. K. (2009). The ecology and management of Southland's black-billed gulls (Thesis, PhD). University of Otago. Retrieved from http://hdl.handle.net/10523/6181

39.Higgins, P. J.; Davies, S. J. J. F., eds. (1996). Handbook of Australian, New Zealand & Antarctic Birds. Volume 3: Snipe to Pigeons. Melbourne, Australia: Oxford University Press. ISBN 978-0195530704.

40.Morris, Bill (January–February 2019). "Tending the Flock". New Zealand Geographic. Vol. 155.

41.Pennington, D., & Blair, R. (2011). Habitat selection of breeding riparian birds in an urban environment: Untangling the relative importance of biophysical elements and spatial scale. Diversity and Distributions, 17(3), 506-518.

42.Mcdonald, R., Forman, R., Kareiva, P., Neugarten, R., Salzer, D., & Fisher, J. (2009). Urban effects, distance, and protected areas in an urbanizing world. Landscape and Urban Planning, 93(1), 63-75.

43.Sharma, N., Gaur, S., Dhyani, R. et al. (2016). Challenges of small protected areas in urban cities: a case study of Okhla Bird Sanctuary, India. Environ Dev Sustain 18, 295–310. doi: https://doi-org.offcampus.lib.washington.edu/10.1007/s10668-015-9628-z

44.Lang, C. (2006). STUDY ON LANDSCAPE PERCEPTION AND COGNITION OF COMMUNITY LANDMARK.z

45.City and County of Denver Official Site. (n.d.). Retrieved from https://www.denvergov.org/content/denvergov/en/community-planning-and-development/landmark-preservation/design-review/design-guidelines-and-application-materials.html

Thank you!