# Landscape Design for Everyday Wellness

Leah Rampton

This practicum is to be viewed with two-up continuous page display.

Cover image: figure 1  south riverbank

Landscape Design for Everyday Wellness

by

Leah Marlise Rampton

A Practicum submitted to the Faculty of Graduate Studies of
The University of Manitoba
in partial fulfilment of the requirements of the degree of

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture
University of Manitoba
Winnipeg

Landscape Design for Everyday Wellness
By Leah Rampton

Advisory Committee

Chair: Dr. Marcella Eaton
Internal Advisor: Dr. Alan Tate
External Advisor: Dr. Douglas Olson

## abstract

The loss and degradation of our natural environments is increasing at an alarming rate. Within the urban environment there is very little evidence of natural environments left, and what does still exist has been significantly impacted by human activity. Not only is there a need to restore and reintroduce nature back into the urban context for the health of the environment, but as well for the health of the human population. The “biophilia hypothesis” suggests that human beings have an innate connection to nature, and need this connection for their general well-being.

The University of Manitoba Fort Gary campus is an everyday environment for many students seeking a post secondary education in Winnipeg, MB. It is a place that students and staff experience on a daily basis, and where high levels of

stress and anxiety are ever apparent. This practicum explores how landscape and theories of biophilia can be utilized in the context of a post-secondary institution to mediate the negative impacts stress can have on well-being in this environment. Designing exterior spaces for the well-being of people will encourage a reconnection with nature, wildness, wonder, and awe that we are beginning to lose sight of as we continue to move towards a technology dependent world.

An understanding of the various theories surrounding biophilia, wellness, and the environment is outlined in a literature review, resulting from an examination of existing research. Following research, a focused site analysis of the University of Manitoba Fort Gary Campus was conducted and resulted in a design at varying scales and levels of detail incorporating aspects from each stage of the design process.

## acknowledgements

*I would first and foremost like to thank my advisory committee. To Dr. Marcella Eaton for the endless amount of support, guidance, and many hours of your time, and for instilling the confidence I needed to get to the point I am today. To Dr. Alan Tate and Dr. Douglas Olson whose knowledge, time, and input have been invaluable.*

*To my family, friends, and colleagues for their patience and constant encouragement, especially my parents, Monique and Denzil Rampton. To Jaclyn and Shannon, this would have been a much more difficult process if it were not for the support at home, and to Marie and Steph for the much needed breaks and words of advice.*

*Thank you. I could not have done this without all of you.*

## table of contents

## preface

Throughout my studies it has become increasingly evident that my passion and interests lie in everyday spaces – the spaces that we frequently visit or simply pass through. The ways that people interact with their surroundings and the other people in a space has always been curious to me. This curiosity about people and their environment has carried on throughout my entire education. I first began in the Faculty of Arts studying sociology and psychology, enrolling in as many classes pertaining to the environment as was allowed. Since entering into landscape architecture, each of the projects I have worked on has taken on a certain dimension regarding human experience in the landscape.

During the initial stages of this practicum exploration I researched the idea of healing landscapes with a focus on medical facilities. As I continued to explore

the literature I became increasingly intrigued by the various theories surrounding biophilia and how they can be applied to the design of all spaces. This eventually pushed me back toward the concepts that I have been passionate about since the beginning of my design education, and to the decision to view this practicum as an opportunity to further my understanding of everyday environments.

The term *nature* will be referred to frequently throughout this practicum. When referring to nature in a non-urban setting, it is intended to mean uncontrolled, unaltered vegetated systems; a place where the environment has not been impacted by human beings. When nature is referred to in an urban context, it is intended to mean vegetated areas or plantings that are controlled and influenced by human intevention.

Re-establishing a sense of wildness to the urban setting is one of the

key ideas behind what characterizes a biophilic city (Beatley, 2011, p.89), and it has one of the largest impacts on well-being both on the human and non-human life forms. A connectedness with natural environments is rapidly being lost in our advancing technological world, and ideas of biophilia will be important in designing our landscapes to redress this balance. The goal of this practicum is to obtain a deeper understanding of how our environment affects everyday wellness. All black and white photos seen throughout the document are taken from my exploration around the University of Manitoba Fort Garry Campus.

# chapter one
## introduction

*"When sight came, the first moment of sight was the realization of beauty. I don't mean beautiful, or very beautiful, or extremely beautiful. Just simply beauty itself, which is stronger than any adjectives that you might find to add to it. It is total harmony without knowing, without reservation, without criticism, without choice. It is a feeling of total harmony though you were meeting your maker, the maker being that of nature, because nature is the maker of all that is made. You cannot design anything without nature helping you."*

(Kellert et al., 2008, p.229)

figure 2  south west corner of campus along Pembina highway

"The freedom to flip over rocks looking for bugs or to dip one's feet in local streams, in endless and slow time, is important for getting to know, in a very hands-on way, the nature around us" (Beatley, 2011, p.12). We are approaching a time where our generation and those before us must come to the realization that we have been lucky to have the opportunity to experience an intimate relationship with nature, as we are facing a rapid deterioration of our natural areas. This is referred to as the extinction of experience (Kellert et al., 2008, p.213). "The profound disconnects from nature in childhood and adulthood suggest the time is ripe to revisit how we design and plan our communities and cities" (Beatley, 2011, p.2). The ways in which we experience nature is also shifting; interpretations of nature, by designers and television producers, are what we most commonly encounter. This includes even our national parks where nature has been

significantly altered to accommodate vehicles and tourists (Kellert et al., 2008, p.214). There is a concern that the lack of nearby nature has caused people today to spend too much time inside, which is leading to an increase in health concerns about obesity, especially in children. "We have become mostly an indoor species spending upward of 95 percent of our time sealed away from anything remotely like authentic nature (Kellert et al., 2008, p.214). Without allowing children the chance to explore nature, there is the prospect of future generations of adults that do not have affection for nature, and therefore do not have an interest in protecting or restoring natural environments (Beatley, 2011, p.2).

Kaplan (1998) argues that we need to focus the nature that people encounter on a daily basis and how it can affect their well-being (p.2). "It is our conviction that everyday nature can make a significant contribution to people's

everyday lives" (Kaplan, 1998, p.2). In order to achieve this it is important that nature becomes part of the design process from the primary stages, and that we must reconsider existing urban neighborhoods to include nature (Kellert et al., 2008, p.286). There is already a chance to incorporate and restore nature or natural processes in the existing urban fabric of cities. This opportunity exists in pocket parks, courtyards, street trees, permeable paving, medians, utility corridors, green walls, and the unused spaces between buildings (Kellert et al., 2008, p.286). By embracing these spaces as areas to re-insert nature it provides opportunities to enjoy, visit, explore, ponder, and be fascinated by nature (Kellert et al., 2008, p.286).

E.O. Wilson asserts that "we need daily contact with nature to be healthy, productive individuals, and indeed have coevolved with nature" (Beatley, 2011,

figure 3  sidewalk along Chancellor Matheson Road

p.3). Nature provides us with wonder and awe; it amazes and stimulates us which generates an interest in wanting a deeper understanding of the world in which we live (Beatley, 2011, p.14). "The qualities of wonder and fascination, the ability to nurture deep personal connection and involvement, visceral engagement in something larger than and outside ourselves, offer the potential for meaning in life few other things can provide" (Beatley, 2011, p.14). This is what Wilson refers to as biophilia, human's innate connection to nature (Kellert et al., 2008. p.3). It is important to understand what biophilia is and how its principles may be incorporated into the design of our exterior environments to affect the well-being of both humans and nature.

# chapter two

## design process

*"We cannot win this battle to save species and environments without forging an emotional bond between ourselves and nature as well – for we will not fight to save what we do not love"* – S.J. Gould (Orr, 1994, p.43).

I began this practicum journey by identifying a site and allowing myself to explore the site before engaging with research of both a topic and the site. I wanted to approach it without any guided knowledge so I would be able to simply just experience the spaces as they currently exist. I walked the site on several occasions consciously tuning into my emotions and reactions to the various areas of the site and identifying their strengths and weaknesses in terms of pleasurable experience. I then proceeded to delve deep into the literature surrounding biophilia.

This involved reading, a lot of reading. The breadth of the topic is large and the realization of this forced me to narrow down the scope of research to include everyday environments with a focus on their impact on stress and well-being. In order to organize my research, thoughts, and ideas I immediately wrote the literature review. This was helpful in understanding what I had read and how I would move forward into design. Next I studied a series of precedents to see how others have applied similar concepts in designs at various scales and contexts. I then turned my focus back onto the practicum site and conducted a site analysis to understand the history of the site, as well as the physical aspects through further research and drawing. From here I developed a strategy and framework for the University of Manitoba Fort Garry Campus Core followed by illustrating details of how the framework would be realized on the site.

# chapter three
literature review

## part one: biophilia
### introduction

"The nice thing about the city is that it eventually ends." This was a statement in an advertisement that was published in the Washington Post alongside an image which illustrated sidewalks, a fire hydrant, and other grey surfaces in the foreground, contrasted with idealized images of forest and farm fields in the distance. It was intended to portray the city as bad, something that is meant to be avoided, and the countryside to be thought of as good, a place to escape to. The implications of this advertisement were obvious, "if you want any meaningful exposure to nature, quickly exit the city. Nature was out there, not in the city, not

close to where most people live" (Kellert et. al, 2008, p.277). People enjoy being outdoors and are drawn to a variety of different outdoor spaces such as urban parks, wilderness areas, backyard gardens, and waterfronts. We may not be drawn to these spaces purely out of interest; there could also be a psychological need that we unconsciously respond to (Kellert et. al, 2008, p.227). This phenomenon is defined by the biophilia hypothesis. Biophilia has been defined as "the inherent human inclination to affiliate with natural systems and processes, especially life and life-like features of the nonhuman environment" (Kellert et. al, 2008, p.3). This implies that humans' desire to access nature is due to a genetic factor, and not culturally determined; however, this is not to say that culture has had no influence on biophilia (Kellert et. al, 2008, p.227). Others, such as Erich Fromm, have defined the term more broadly. He defined biophilia simply as "the passionate love

of life and of all that is alive" (Orr, 1994, p.132). It is argued that the biological need that we have for natural features is apparent from a young age, as Wilson (1984) writes:

> "From infancy we concentrate happily on ourselves and other organisms. We learn to distinguish life from the inanimate and move toward it like moths to a porch light. Novelty and diversity are particularly esteemed; the mere mention of the word extraterrestrial evokes reveries about still unexplored life, displacing the old and once potent exotic that drew earlier generations to remote islands and jungle interiors. That much is immediately clear, but a great deal more needs to be added" (p.1).

Superficially humans' need to associate with nature may appear to be for material exploitation, but the theory also maintains that contact with the natural environment is essential for people's physical and mental well-being, making it a necessity, even in urban society (Kellert et. al, 2008, p.4). Wilson makes the case that to explore and affiliate with life is a deep and complicated process in mental development (1984, p.1). Additionally our emotional, cognitive, aesthetic, and even spiritual development is influenced by this affiliation. It is also suggested that human identity and personal fulfillment in some ways depend on our relationship to nature. Even the tendency to avoid, reject, and destroy elements of the natural world can be viewed as an extension of an innate need to relate deeply and intimately with life (Kellert & Wilson, 1993, p.42).

This feeling of affection for nature is becoming increasingly important in

a time when we are experiencing what Wilson referred to as the bottleneck – the convergence of climate change, species loss, ecological degradation, and human population growth. In order for people to respond to such a situation, there must be a deep-rooted connection to what is being threatened. As we are seeing these changes become ever more present, it is clear that people are passionate about the natural environment and are beginning to recognize that it is essential for survival (Kellert et. al, 2008, p.222). He also believes that the degree to which we come to understand other organisms will determine the value we place on them, and on ourselves. The more we learn about the life and life-like processes that surround us, the greater we will come to value them (Wilson, 1984, p.2). Biophilia facilitates the understanding of our preferences for natural environments, life, and life's processes. This knowledge can then be used to help shape spaces in ways that restore us, refocus us on the life support systems that sustain us and that involve, reassure, and fascinate us (Brown, 2011, p.107).

figure 4  pathway along north west edge of campus adjacent to the Victoria Hospital

## the biophilia hypothesis

> "People can grow up with the outward appearance of normality in an environment largely stripped of plants and animals, in the same way that passable looking monkeys can be raised in laboratory cages and cattle fattened in feeding bins. Asked if they were happy, these people would probably say yes. Yet something vitally important would be missing, not merely the knowledge and pleasure that can be imagined and might have been, but a wide array of experiences that the human brain is particularly equipped to receive" (Wilson, 1984, p.118).

Elements such as water, wind, trees, clouds, rain, mist, mountains, landscape, seasons, and the night sky shaped and brought to life thought and language, and

have taught us things only the earth can really teach us, such as silence, humility, connectedness, courtesy, beauty, celebration, giving, restoration, obligation, and wildness (Orr, 1994, p.51, 52). We can also look to nature to explain the shift in how we view the environment in the twentieth century. Water has shaped our landscape in the form of rain, ice, lakes, rivers and seas. We experience water bodily; we consist mostly of water, we drink it, play in it, and fish in it. Oil, on the other hand, has changed the way we consider using the landscape, by bringing forth a fascination and addiction to speed and accumulation. We no longer experience the landscape that surrounds us in the way we used to, now we quickly pass through it or fly over it causing our relationship with nature to become increasingly abstract (Orr, 1994, p.54-5). In order to truly comprehend human feelings that may not be easily expressed through any spoken language, it may be imperative that we aim to

reach a deeper understanding of the environment that the brain has evolved within (Wilson, 1984, p.109). Throughout past generations the mind has evolved within a culture where genetic advantages have been derived from planned modifications of the environment. This has brought us to a place where we are conflicted between differing ideals of "nature and machine, forest and city, the natural and the artifactual" (Wilson, 1984, p.12). Another take on the evolution of biophilia is as a result of the brain and sensory systems having evolved in natural environments, natural content may be more easily and efficiently processed (Ulrich et. al., 1991, p.205). Kellert and Wilson (1993) suggested that biophilia has likely evolved through biocultural evolution, during which "culture was elaborated under the influence of hereditary learning propensities while the genes prescribing the propensities were spread by natural selection" (p.32). Charles Lumsden and Wilson made the hypothesis that

this biocultural evolution increases the likelihood of a behavioural response which then enhances survival and reproductive fitness of a specific genotype. Biocultural evolution is also known as gene-culture co-evolution. This allows the genotype to eventually spread throughout a population and causes the frequency of the behavioural response to increase. The genetic component of biocultural evolution, in conjunction with the tendency of humans to express emotions in the form of dreams and narratives allows biophilia to persist from generation to generation (Kellert & Wilson, 1993, p.33). Wilson clarifies the biological basis of the biophilia concept by referring to it as a set of "learning rules." By this he means that it is more than just a simple instinct, it is a type of prepared learning (Kellert & Wilson, 1993, p.22). Clinical psychology and psychophysiology has started to take a closer look into biologically prepared learning. The research being conducted in

these fields is showing strong findings that may explain some of the “strong fear responses, avoidance, and phobic reactions with respect to situations and objects that presumably were survival threats throughout evolution” (Ulrich et. al., 1991, p.209). Due to these findings it is now thought that biological preparedness could also show itself in respect to positive emotional and physiological responses to natural environments that may have aided in survival and well-being throughout evolution (Ulrich et. al., 1991, p.209). However, the biophilia hypothesis holds that even when human beings remove themselves from the natural environment these learning rules are not replaced by modern versions. They continue from generation to generation, although they are becoming weakened as we transition into a new technology dominated culture. People have lived in a hunter-gatherer society which fully engaged one with the environment and other organisms throughout the

majority of human history. The human brain has evolved in a biocentric world; as time has passed and language and culture continues to expand, the living natural world has been a primary source of myth and metaphor. Even if over time biophilia in human biology has weakened, it is still "relevant to our thinking about nature, about the landscape, the arts, and mythopoeia" (Kellert & Wilson, 1993, p.31-2).

Kellert and Wilson (1993) further explored biophilia by taking a closer look at what they believe to be the nine fundamental aspects of humans' biological basis for valuing and affiliating with nature. They identify these as utilitarian, naturalistic, ecologistic-scientific, aesthetic, symbolic, humanistic, moralistic, dominionistic, and negativistic valuations of nature (p.43). The utilitarian aspect addresses the advantage human beings inherit for exploiting nature for food, medicine, clothing, and tools for protection, sustenance, and security. The naturalistic aspect refers

to “the satisfaction derived from direct contact with nature.” This is where they believe humans’ sense of fascination, wonder, and awe towards nature is derived (p.45). The aesthetic aspect simply refers to the way human beings are drawn to the beauty of nature. “One of the most clear-cut findings in the ...literature... is the consistent tendency to prefer natural scenes over built views, especially when the latter lack vegetation or water features. Several studies have [shown] that even unspectacular or subpar natural views elicit higher aesthetic preference...than do all but a very small percentage of urban views” (p.49). The symbolic aspect addresses the ways in which humans “use nature as a means of facilitating communication and thought” (p.51). Referring to the humanistic aspect they discuss how the experience of nature can elicit deep emotional feelings of attachment to individual elements of the natural environment (p.52). The moralistic aspect covers strong

figure 5  dyke on north side of the point lands adjacent to agricultural area

feelings of respect, ethical responsibility, and liking for the natural world (p.53). Finally, the negativistic aspect consists of fear and aversion toward the natural world which often leads to unjustified destruction of these environments (p.56).

The exploration into humans' relation to the natural environment and the possible mental consequences has been very limited until recent years when compared to other branches of science such as social behaviour. This lack of an investigation may not have seemed so urgent in the past; however research in this area will become increasingly difficult as we are beginning to see the natural environment disappear (Wilson, 1996, p.170).

> "The portmanteau terms 'biophilia' and 'biophilia hypothesis' will serve well if they do no more than call attention to psychological phenomena that arose from deep human history, stemmed

> from interaction with natural environment, and are not quite likely resident in the genes themselves. The search is rendered more urgent by the rapid disappearance of the living part of that environment, creating a need not only for a better understanding of human nature but for a more powerful and intellectually convincing environmental ethic based upon it" (Wilson, 1996, p.178-9).

However, the emergence of large-scale agriculture, fabrication, technology, industrial production, engineering, and the modern city makes up a small fraction of human history. These altered environments have not yet compromised our innate affiliation with nature or created a substitution for the benefits of adaptively responding to a largely natural environment (Kellert et. al, 2008, p.3). Urban public open space is

an important part of the history of the city. These places create opportunities for leisure and recreation as well as social protest and cohesion; additionally, it can be “a catalyst for improving human health and societal well-being” (Martensen, 2011, p.59). There is strong evidence, uniform across classes and cultures, that a connection to nature and natural light may promote faster healing, social interaction, and a heightened ability to absorb information (Kellert et. al, 2008, p.222). If we make the assumption that biophilia is inherently a part of us regardless of whether we are exposed to authentic nature or not, then it could be possible that man made environments that incorporate qualities found in nature that would still promote healing, learning, sociability, and comfort (Kellert et. al, 2008, p.222). The effects that the environment has on behavior and psychological states vary with different seasons. A most notable example is found in northern climates where during the

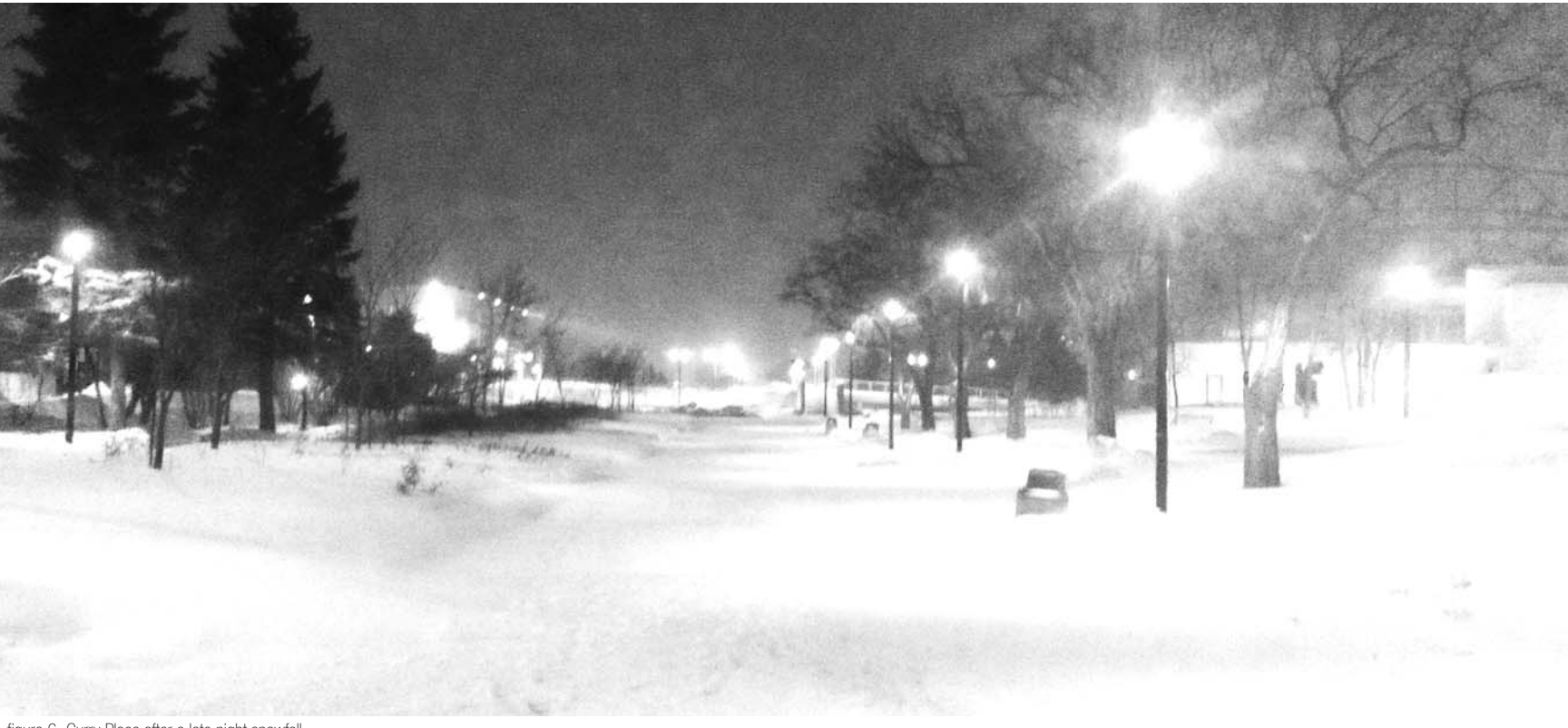


figure 6  Curry Place after a late night snowfall

winter months daylight is significantly reduced and the occurrence of seasonal affective disorder, or SAD, is increased. This is when people are lacking sufficient exposure to natural light and begin to experience feelings of a more depressed state (Kellert et. al, 2008, p.230).

Although the ways that human beings will react to natural environments will be different from one person to the next, there are some consistencies that have been found in what people attribute positive and negative reactions to. Places where the opportunity is present to move from one scale to a progressively larger scale that is home to more diverse ecosystems are believed to have the highest biophilic qualities in an urban setting. Beatley (2011) refers to the term wildness in regards to urban nature, where human activity has impacted the natural environment, not to be confused with the common term wilderness. "It is not

distant and pristine, defined by how little humans have used or impacted it, but nearby and nuanced; it is as much defined by its resilience and persistence in the face of urban pressures (Beatley, 2011, p.3). Equally as important in a biophilic environment as these ecological connections are pedestrian connections. Allowing opportunities for people to move freely through a site, be it by foot or bicycle, is extremely important. "A livelier, more active mixed-use street will make walking easier and may even change the perception of distance; walking trips will feel shorter, more manageable, and more enjoyable (Beatley, 2011, p.85). Recently we have seen an increased domination of the motor vehicle, and overcoming the obstacles that this type of traffic creates can prove to be a challenge (Kellert et. al, 2008, p.279). It is these types of issues that need to be taken into consideration when designing urban spaces. Making a conscious effort to ensure that nature is a

central focus in urban design, not an afterthought, is becoming more important as we continue to lose our natural environments (Beatley, 2011, p.3).

> "We need the design and planning goals of cities to include wonder and awe and fascination and an appreciation for the wildness that every city harbors. The incredible and abundant nature around us even in dense cities represents an important antidote to the boredom and sameness that otherwise characterized much of our built form and lives" (Beatley, 2011, p.15).

Not only is it important to ensure a focus on nature when designing the urban environment, as Beth Meyer argues, "We need also to emphasize the beauty and pleasure and enjoyment we derive" (Beatley, 2011, p.14). The simple

pleasures that children seem to find in nature is something that slowly gets lost as people move into their adult years. Aesthetics is often forgotten or compromised because we strive to ensure that everything serves a functional purpose. Biophilia would suggest that creating a space to enjoy the simple workings of the natural environment could be sufficient. Human beings find joy in watching birds, walking or biking in the woods and listening to the sounds that are so often drowned out by the hum of the machine-dominated city (Beatley, 2011, p.14). Ideally we would find ourselves surrounded by these types of spaces in an everyday context. They would not necessarily be a destination, places that are only visited periodically, but in a "ubiquitous context that delights, relaxes, soothes, replenishes, and inspires, and uplifts us in our daily urban lives" (Beatley, 2011, p.16). Integrating nature into the smaller scale of the urban environment may be achieved by placing greater

importance on restoring the existing green systems, such as forests, rivers, and riparian networks and connecting them to the surrounding context (Beatley, 2011, p.85).

In discussions about biophilia it can often be wrongfully assumed that there are only positive reactions to connections with nature. However, natural environments do not channel behavior or emotion in any one direction. They provide a variety of choices and opportunities that support human needs, and every individual will experience spaces in a different way (Kellert et. al, 2008, p.234). It has been found that although there is no one ideal environment for the population as a whole, there tends to be general consensus on what people view as low and high in preference. Large, expansive areas where there is nothing to focus on, and densely vegetated areas that obstruct views are both low in preference. Open

expanses do not invite visitors to explore because there does not appear to be anything there to discover. These types of space also give people the impression that they could become easily disoriented and lose their bearings. A densely vegetated area also lacks focus and people become fearful that they could get lost. These types of space suggest confusion and it can be difficult for people to know what lies ahead because there are few clear views through them (Kaplan, 1998, p.11). Spaces that are higher in preference are those that have openly spaced trees and smooth ground, referred to as Brownian Landscapes. These spaces provide a clear focus and seem to invite people to enter the site (Kaplan, 1998, p.12). They also appear to be more complex and provide visitors with the opportunity to explore and discover (Kaplan, 1998, p.13). Uninterrupted views are also important as they create a sense of confidence and may be more important

along pathways so users can see what is coming next (Kaplan, 1998, p.33-4). Human beings also prefer to have evidence that they are not alone when in a natural setting. It increases confidence where there are human elements present or some form of obvious human intervention (Kaplan, 1998, p.37). Specific types of vegetation and tree canopy structures, such as those found in a savannah, have been found to be the highest in preference. It is suggested that this is a result of pre-modern human using this type of landscape to obtain food and water (Ulrich et. al., 1991, p.205). Wilson mentions the savannah-type landscape when he writes about how human beings have existed primarily in the savannahs of Africa, then those of Europe and Asia. He says, "These were vast parklike grasslands, dotted by groves and scattered trees. This environment provided food and shelter, while at the same time offering long views to detect enemies" (Verheij et. al., 2008, p.312). People are also very particular about the way trails are designed

figure 7  hill adjacent to construction of Investors Group Field

and incorporated in the natural environment. The width of a pathway can easily compromise how closely a person connects with their surroundings. A wide trail can lead one to assume that it is meant primarily for the use of maintenance vehicles and make them feel disconnected. "Neuropsychological research has shown that things within arm's reach are processed in a different area of the brain than more distant things; thus, it is hardly surprising that a wide trail that puts one physically more distant from nature increases the psychological distance as well" (Kaplan, 1998, p.91). Constructing pathways along the water's edge is also higher in preference; however, it is important to keep in mind that riparian areas are vulnerable ecosystems and this must be taken into consideration when designing in these areas (Kaplan, 1998, p.93).

Branches of science that deal with the human relationship to nature are a

fairly recent addition. Environmental psychology is one of these newer disciplines that address more specifically the impact the environment has on psychological well-being (Tyson, 1998, p.14). Behavioral research that is being conducted by environmental psychologists will become useful to designers by bringing to light the needs, desires, and reactions of users to their surroundings. There is also research being done by environmental designers that looks more look at how the environment affects people on a physical, social, and cultural level (Tyson, 1998, p.15). A further exploration into the restorative effects of nature and its impact on well-being will be conducted. This will inform how, where, and why nature should be introduced into our everyday environments.

"I am convinced," Aldo Leopold wrote in 1941, "that most Americans have no idea what a decent forest looks like. The only way to tell them is to show them"

(Orr, 1994, p.64). Unfortunately, this is rapidly becoming our reality. The increase in logging, corporate monocultures, agriculture, urbanization, road building, recreational development, and air pollution are eliminating our forests and severely damaging what few intact forests we still have left (Orr, 1994, p.64). We should not fear this loss solely for the depletion of an economic resource. As Orr (1994) stated, "we are never more than one generation away from losing the idea of forests as places of wildness and ecstasy, mystery and renewal, as well as the knowledge of their importance for human survival" (p.65). There is the threat that we may reach a time when no one will have the opportunity to experience the natural forest, and the power it has on the human race will be lost (Orr, 1994, p.65). In a technology-dominated world, it is thought that we will need healthy forests now more than ever. The natural environment is needed for both our emotional health and well-being and the health

of the planet. Beatley (2011) suggests that even in a time when we have convinced ourselves that we can live without nature, when we look to biophilia we will find that we do have a biological need to connect with nature (p.16). "The biophilic tendency is so clearly evinced in daily life and so widely distributed as to deserve serious attention. It unfolds in the predictable fantasies and responses of individuals from early childhood onward" (Wilson, 1996, p.8).

## biophobia

With an increasing number of children being raised primarily indoors, with constant exposure to television, computers, cellular telephones, and video games, and living among shopping malls, freeways, and dense urban and suburban settings, exposure to nature is very limited, creating a generation of people that have an aversion to nature. This phenomenon has been defined as biophobia (Orr, 1994, p.131). Today's society likes to have a feeling of control over every aspect of their lives; "more than ever we dwell in and among our own creations and are increasingly uncomfortable with nature lying beyond our direct control" (Orr, 1994, p.131). Biophobia has a varying range of intensity, from a general discomfort in natural environments to an active dislike for anything not manmade (Orr, 1994, p.131). Also included in the category of biophobia are the stimuli and events in

figure 8  north west portion of campus adjacent to sports fields

nature that may not be viewed in a positive light. Violent storms, decaying animals, dirty water, and dark places often elicit dislike, anxiety, fear, and avoidance which would fall into this category (Kellert et. al, 2008, p.228).

> "Undefiled nature is being replaced by a defiled nature of landfills, junkyards, strip mines, clear-cuts, blighted cities, six-lane freeways, suburban sprawl, polluted rivers, and superfund sites, all of which deserve our phobias" (Orr, 1994, p.134).

## the biophilic city

> *"Going outside is actually a more normal, ordinary activity in a dense city because there it's an indivisible element of daily life"*
>
> *–David Owen (Beatley, 2011, p.85).*

In the book, Biophilic Cities: Integrating nature into urban design and planning, Beatley (2011) writes about what the city that takes biophilia into consideration looks like, and how it is beneficial in an urban context. He believes that every city must make more of an effort to "acknowledge, design within, and connect with the unique physical and ecological contexts in which they sit (p.26). When cities were first founded, it is likely that they were influenced by the natural topography of the land, a proximity to water for transport and drinking, but as development continues this has slowly been lost and forgotten (Beatley, 2011, p.26). In order to make

the transition to a biophilic city, the underlying natural forms that once existed must be brought back or reclaimed. “A biophilic city is a city with abundant nature and natural systems that are visible and accessible to urbanites” (Beatley, 2011, p.17). These natural qualities should be integrated into the everyday environments that people use regularly without making a conscious effort to visit. They should not be something that is viewed from a distance; the experience of hearing, smelling, and feeling is just as important as seeing (Beatley, 2011, p.36). This can be achieved not only by maintaining, restoring, and repairing the natural areas that already exist within cities, but to ensure that nature is designed into each new development project (Beatley, 2011, p.45). By weaving natural areas into all parts of the city, it creates the opportunity for a connection to nature to be effortless which will encourage people to use outdoor spaces more frequently (Beatley, 2011, p.65).

In doing this though, we must all rethink the way that parks and green spaces are used. Beatley (2011) thinks that by imagining these spaces with a degree of wildness we will begin to view our outdoor green space as more than just grass, benches, and standardized play equipment (p.89). This could come to include reimagining spaces as simple and underutilized as the areas between building, streets, and other hard paved surfaces as opportunities to incorporate natural wildness (Beatley, 2011, p.91). Streets, perhaps, provide the largest opportunity to begin reimagining what our cities could be. Instead of creating streets primarily for the circulation of cars and traffic, they could be rethought as areas that "harbor native plants and biodiversity, that collect and treat stormwater, and where pedestrians can experience intimate contact with nature as part of their daily routine (Beatley, 2011, p.99). Louis Wirth recognizes that the characteristics of a city influence the way

city residents live their life. He also pointed out that people have not always lived in cities and that "the influences it exerts upon the modes of life should not be able to wipe out completely the previously dominant modes of human association" (Verheij et. al., 2008, p.309).

> "A biophilic city is at its heart a biodiverse city, a city full of nature, a place where in the normal course of work and play and life residents feel, see, and experience rich nature – plants, trees, animals" (Beatley, 2011, p.45).

## biophilic design

Biophilic design is the conscious effort to translate what we understand to be biophilia into the design of the built environment. This can be difficult due to both our limited knowledge surrounding humans' need to associate with nature and how we interpret what we do know into ways of approaching the design of the built environment (Kellert et. al, 2008, p.3). "We need to find a way to make vibrant and beautiful places in resonance with a nature we once knew: places that engender human health and well-being in both tangible and intangible ways" (Brown, 2011, p.107). Kellert has made the argument that it is the "local, everyday nature" we need. This will be one of the challenges of making a shift in how we perceive cities, and recognizing that there is already nature all around us, we just need to make it more of a focus in the landscape of cities and start to pull it back in (Beatley,

2011, p.15). Designing cities with a focus around the natural environment to benefit well-being of residents is not a new concept. During the nineteenth century a partnership was formed between landscape designers and physicians to create an urban vision that combined environmental health and aesthetics. This dualism largely informed the design of large urban parks, military encampments, hospitals, schools, rural cemeteries, and early suburbs from 1840-1880 (Martensen, 2011, p.27). Olmsted and Vaux made it an aim of their designed landscapes to ensure a harmony between the environment and the human body. Olmsted believed that "harmony was not something that one willed into being; instead parks had to be designed so that harmonious perceptions could arise spontaneously" (Martensen, 2011, p.34). This connection is often impeded by the presence of vehicles, which often make people feel uneasy or unsafe, and was an area of concern for Olmsted.

figure 9  Curry Place pedestrian mall

They separated pedestrians from vehicles by designing “separate roadways and grade changes to prevent unwanted and dangerous encounters between pedestrians, carriages, and horseback riders without having people use conscious judgement” (Kellert et. al, 2008, p.282). The opportunity to rethink yards, streets, and alleys presents itself with the increasing importance placed on managing stormwater in urban design using low-impact development techniques. Kellert et. al. (2008) argue that “streets must be reconceived as not only infrastructure for the conveyance of cars and traffic, but as places that harbor native plants and biodiversity, that collect and treat stormwater, and where pedestrians can experience intimate contact with nature as part of their daily routine” (p.282). Not only does incorporating the treatment of stormwater runoff in design aid in the health of the environment, it brings water into the site and aids in reconnecting us with this

natural element. “The sounds of water, the sights, smells, and tactile sensations of water, are indeed life-enhancing and ought to be viewed as an essential element of any urban neighborhood” (Kellert et. al, 2008, p.282). This may also urge us to rethink the green spaces that already exist around us and reimagine how they function or what they might be.

Enticing people to leave the comforts of their homes and to go and explore the outdoors is a challenging part of planning and design. Investing in ways of making safer and more interesting amenities for cyclists and pedestrians will encourage people to use the outdoor environment more frequently (Kellert et. al, 2008, p.284). Tyson (1998) also made the arguments that a coordination between the design of buildings and landscapes can work to draw people’s interests outside by creating views to the outdoors (p.7). Drawing people into his parks was also a

key aspect of Olmsted's designs; this was because he felt that the experience of visiting a park was enhanced by being in the presence of others (Martensen, 2011, p.34). Watching people in public spaces is one of human being's favorite pastimes. This can be explained because "the movement has the same rhythmic pattern as fish in benign environments and is every bit as fascinating" (Kellert et. al, 2008, p.231).

It is important to understand what it is about the natural environment that creates a sense of pleasure, well-being, and engagement when designing biophilic landscapes. Additionally, the way in which people interact with the environment, be it passive or active, also affects the impact it will have on experience and well-being (Tyson, 1998, p.10). This brings to light that understanding the behavioral relationship people have with their physical surroundings is a critical

part of designing biophilic landscapes (Tyson, 1998, p.14). Biophilic design can be better explained when it is broken down into two dimensions: naturalistic and vernacular. The naturalistic or organic dimension is the "shapes and forms in the built environment that directly, indirectly, or symbolically reflect the inherent human affinity for nature" (Kellert et. al, 2008, p.5). The vernacular, or place-based dimension is the "buildings and landscapes that connect to the culture and ecology of a locality or geographic area" (Kellert et. al, 2008, p.6). In order to further explain the two dimensions, they have been broken down by Kellert et. al. (2008) into six biophilic design elements: environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, and evolved human-nature relationships (p.6). Environmental features refers to characteristics of the natural world such as color, water, air, sunlight, plants,

animals, natural materials, views and vistas, fire, habitats, and ecosystems. This design element requires that these characteristics be used in the built environment as they are easily recognized and identified with the natural environment (Kellert et. al, 2008, p.6). From looking at a large body of research we have come to learn that water, large trees, flowers, and rich vegetation are important elements (Kellert et. al, 2008, p.227). "Growing evidence indicates that intermediate fractal structures (neither too simple nor complex) are generally preferred, whether in natural or built elements and scenes. Clouds, waves, parks with scattered trees, and many woody plants and trees are all intermediate fractal forms in nature" (Kellert et. al, 2008, p.233). Salangaros and Masden support this statement by arguing that environments that incorporate these fractal features are neurologically nourishing. They say that this is because they have the ability to reconnect people

with the environments and elements they biologically prefer. Fractal features are thought to be preferred because "human beings connect physiologically and psychologically to structures embodying organized complexity more strongly than to environments that are either too plain or which present disorganized complexity" (Kellert et. al, 2008, p.233). Natural shapes and forms refer to representations of natural features in a symbolic way, avoiding the use of straight or hard lines. These are not usually found within the landscape environment, but on the exterior or interior of buildings and can be referred to as biomimicry (Kellert et. al, 2008, p.8). Biomimicry is known as "the act of learning from nature, borrowing designs and strategies that have worked in place for billions of years" (Kellert et. al, 2008, p.28). Natural patterns and processes differ from this in that it is the incorporation of actual properties found in natural environment, instead of an abstract representation.

This includes sensory variability, information richness, age, change, growth and efflorescence, central focal points, patterned wholes, bounded spaces, transitional spaces, linked series and chains, integration of parts to wholes, complementary contrasts, dynamic balance and tension, fractals, and hierarchically organized ratios and scales (Kellert et. al, 2008, p.9). Certain spatial characteristics, such as "views to the horizon, provision of refuge and protection, and a sense of enticement that provokes exploration" are important qualities in a biophilic landscape (Kellert et. al, 2008, p.228). Light and space refers to both the presence and absence of light, and the effects that it has on a space, and likewise the space on the light (Kellert et. al, 2008, p.11). Place-based relationships refers to "the successful marriage of culture with ecology in a geographical context." This addresses the human need to relate to and control the natural environment and exploit it for gain of our species

in the form or resources and security (Kellert et. al, 2008, p.12). The last, evolved human-nature relationships, refers to the "fundamental aspects of the inherent human relationship to nature: prospect and refuge, order and complexity, curiosity and enticement, change and metamorphosis, security and protection, mastery and control, affection and attachment, attraction and beauty, exploration and discovery, information and cognition, fear and awe, reverence and spirituality" (Kellert et. al, 2008, p.13). While keeping these six biophilic design elements in mind, Tyson asserts that it is critical to realize that "often it is the little things that can make a big difference" (Tyson, 1998, p.7). He simplifies the way we can look at biophilic design by reminding us that human beings have always been, and still are, part of the larger created world and that it is intended for us to coexist in this world (Tyson, 1998, p.8).

## part two: everyday wellness and the environment
## introduction

Significant amounts of research have gone into exploring the impact of landscape design on the therapeutic process by looking at the recovery rate of patients in hospitals. It may be time that research looks beyond medical environments and begins to find an understanding of the impacts of psychological well-being on different groups of people in different environments. Current research is beginning to take a closer look at the "underlying explanations of how the landscape does affect the well-being of people who come into contact with nature" (Tyson, 1998, p.14). In the last two centuries it is increasingly becoming the case that providing parks and preserving wildness for public use must be supported by a justifiable cause. "The idea that exposure to nature fosters psychological well-being, reduces

the stresses of urban living, and promotes physical health has formed part of [this] justification" (Kellert & Wilson, 1993, p.73). Psychoneuroimmunology is one of the branches of science that studies the connections between psychological states and the nervous, endocrine, and immune systems. The research being conducted in this field tells us that "mind-body interactions are so ubiquitous that it may no longer be possible to refer to body and mind as separate entities" (Martensen, 2011, p.14). This means that our emotional and mental health may be significantly affected by our physical health, safety and welfare and could impact our ability to find pleasure in recreation, work productively, or form relationships (Martensen, 2011, p.14). It has been found that people who are in good psychological health are better equipped to handle various environmental stressors due to their well developed adjustment capabilities and self confidence. This results in these people

making better choices in regards to their environments. On the other hand, those people that are not in good psychological health may be more likely to make poor environmental judgements based on their inability to handle certain environmental stressors. People in poor psychological health seem to be found in places such as hospitals, prisons, workplaces, or schools where people are forced to surrender control (Kopec, 2006, p.60). "When we consider psychological health in the context of design, we must include both the positive approach, identifying those design attributes that promote health and well-being, as well as the traditional approach, focusing on people`s disorders to alleviate them" (Kopec, 2006, p.60).

In recent design practices, humans have become increasingly separated from the natural world. We have seen a huge transformation and degradation of natural systems, and we may soon reach a time where these systems no longer

figure 10  courtyard along Dysart Road between Parker Building and Machray Hall

exist on their own (Kellert et. al., 2008, p.5).

> "If we speak of a healthy community, we cannot be speaking of a community that is merely human. We are talking about a neighborhood of humans in a place, plus the place itself: its soil, its water, its air, and all the families and tribes of the nonhuman creatures that belong to it. What it more, it is only if this whole community is healthy... [and] the human economy is in practical harmony with the nature of the place, that its members can remain healthy and be healthy in body and mind and live in a sustainable manner" –Wendell Berry (1994) (Martensen, 2011, p.13).

When approaching design, it is important to keep both human health in mind and

the health of the planet. Human beings rely, to a certain extent, on the natural environment and its processes for their own personal well-being, both mentally and physically. Conversely, the health of the environment depends on the importance humans place on it; in order for people to make environmentally responsible decisions they must be in a healthy state mentally and physically.

## stress and well-being

When a person faces a situation that challenges them or threatens their well-being, they may respond psychologically, physiologically, or often with certain behaviors (Kellert & Wilson, 1993, p.100). This process is referred to as stress. The psychological aspect consists of cognitively assessing the situation, or responding with negative emotions such as fear, anger, sadness, or other coping mechanisms. The physiological component includes bodily responses such as cardiovascular, skeletomuscular, and neuroendocrine responses. These types of response mobilize the individual for coping or dealing with the situation. The term coping refers to "emphasizing the psychological, social, material, and other resources that people use in their efforts to meet environmental demands, as well as the various strategies that they adopt to deploy their resources (Kellert et. al.,

2008, p.134). Within the scientific world, stress has been used as "a psychological precursor of illness, as a result of any number of conditions, or as a catchall for anxiety reactions, discomfort, and the like" (Baum et al., 1982, p.15). According to the World Health Organization (W.H.O.), health is not only the absence of disease it is also a state of optimal physical, mental, and social well-being (Kopec, 2006, p.101). The W.H.O. includes these aspects because daily stress levels are derived from social, physical, and biological situations which all affect our responses (Kopec, 2006, p.102). The aftermath of responding to a stressor may result in a decline in frustration tolerance, and lower task performance (Ulrich et al., 1991, p.202). This is to say that "the effects of stress outlive the stressor: our physical and psychological responses continue even after the stressful event or experience has ended" (Kopec, 2006, p.102). It has also been found that if the human

body must continually cope with specific stressors over an extended period of time there is the potential for permanent damage to the circulatory, cardiovascular, gastrointestinal, and hormonal systems (Kopec, 2006, p.102). In other cases, it may be possible that stressful situations can improve human performance, as long as it only lasts for a short period of time and is mildly stressful. However, for the purposes of this practicum, as Kellert and Wilson (1993) also did in their work, stress will be looked at as a "primarily negative condition that should be mitigated over time to prevent detrimental effects on psychological well-being, performance, and health" (p.100). The theoretical basis of the perspective on stress is that a persons' ability to adapt may be compromised when they are continuously faced with heavy demands. Mental fatigue can also be experienced as a result of stress. This is when a person becomes worn down and their capacity to direct attention

figure 11  south riverbank

is compromised; their attention becomes easily shifted to the environment instead of on what needs to be done. When a person is in this state of mind they are more likely to take risks, be impulsive and impatient. They become irritable, have difficulty absorbing information, and are more likely to make errors (Kaplan, 1998, p.17). Various interventions may be used to reduce the weight of these demands in order to prevent these negative effects from occurring (Kellert et. al., 2008, p.134). The entire process of stress is comprised of perceiving a threat, coping with it, and adapting to it. We experience this process on a daily basis; we are constantly adapting to sudden or gradual changes of our surroundings (Baum et al., 1982, p.15). There are also different types of response to stress. Bioemotional reactions to stressful environments "can result in a wide range of physiological responses, which can result in stress related illnesses such as increased heart

rate, high bloodpressure, ulcers, and migraine headaches" (Kopec, 2006, p.102). Another type of stress response is behavioral, including aggression, withdrawal, and compulsion, and in extreme cases lead to violence, delusions, or psychosis (Kopec, 2006, p.102).

Aside from the general use of the term, stress is also central to the relationship between people and their surroundings (Baum et al., 1982, p.15). One type of stress that will be of particular focus is environmental stress. Environmental stress refers to "the demands from the environment that challenge adaptation, as well as the changes that take place in people as they face those demands with the resources that they have available" (Kellert et. al., 2008, p.134). The growing interest in this area has seen a rapid accumulation of evidence showing that, in large groups of people, environmental stressors such as crowding, community

noise, and air pollution, can bring forth high amounts of stress (Ulrich et al., 1991, p.201). People are sensitive to their surroundings, and are often exposed to what are called external stressors. These are variables from the physical environment, such as noise, temperature, crowding, and over- or under- stimulation (Kopec, 2006, p.102). Specific to psychological distress, air, odor, noise pollution, and the perception of being at risk come from the environment. These are referred to as ambient stressors "because they are chronic, non-urgent, physically perceptible, and limited to a particular environment" and are known to slowly wear away humans' ability to cope (Kopec, 2006, p.103).

An increasing amount of evidence of stress based on the environment is found in research conducted surrounding the health differences between residents in urban and rural conditions. Recent UN reports show that 50 percent of the

population resides in the urban environment and is only expected to increase to 75 percent by the year 2030 (Verheij et al., 2008, p.307). This creates the argument towards the importance of understanding the impacts the urban environment has on peoples health and well-being. According to these findings, "urban residents are more frequently and more severely confronted with stressors than rural residents, resulting in higher levels of psychiatric morbidity" (Verheij et al., 2008, p.311). A study that was conducted in The Netherlands found that the availability of green space might be an important factor in explaining urban-rural health differences (Verheij et al., 2008, p.311). In a different study done by Janssen-Janssen et al. (2001) it was found that there was an 18 percent increased chance of experiencing a 'less than good' health status if a person lived in the most urban areas. It was clear that in comparison to those who lived in rural areas, people in the most urban

areas feel less healthy. This health difference seems to intensify in respect to mental health problems; in the most urban areas the probability of mental health problems was twice as high as in the most rural areas (Verheij et al., 2008, p.308). There are two main hypotheses that are brought forth in the writing surrounding the urban-rural health differences: the breeder and the drift hypothesis. The breeder hypotheses suggests that these health differences are a result of exposure to environmental factors that are specifically related to cities, such as pollution, busy traffic, poor housing quality, and lower levels of health service provision" (Verheij et al., 2008, p.310) as well as behavior such as smoking and excessive drinking. The drift hypothesis suggests that these health differences are caused by selective migration. The important aspect to take away from the results of this research is that "urban living is more stressful, in spite of all possible mechanisms of coping

figure 12  Red River on north side of campus

with psychological overload" (Verheij et al., 2008, p.310).

The belief that a connection to nature promotes physical and psychological wellness is not a new concept; it dates back approximately two thousand years in both Western and Asian cultures (Kellert et al., 2008, p.89). A significant amount of research has found that a close proximity to nature can foster well-being and enhance people's ability to function. This includes views of nature and the ability of these views to be related to greater physical and mental health (Kaplan, 1998, p.2). Well-being is defined as "an umbrella-term that includes experiences of positive emotional states and processes ranging from short-term to long-term, from current positive feelings to habitual dispositions. It encompasses pleasurable effect as well as general life satisfaction" (Cervinka et al., 2012, p.380). conducted experimental studies that found that a connection to nature was closely related

with a positive effect and the ability to cope with life problems (Cervinka et al., 2012, p.380). Ulrich et al. also conducted studies that consistently found "in well over 100 studies of recreation experiences in wilderness and urban nature areas [that] stress mitigation is one of the most important verbally expressed perceived benefits" (Kellert & Wilson, 1993, p.49). Cervinka et al. (2012) outline four ways that nature, ranging from urban nature to wild nature, positively influences health and well-being, both directly and indirectly. They are recovery from stress and attention fatigue, encouragement to exercise, facilitation of social contact, and provision of opportunities for personal development and a sense of purpose (p.381). A positive correlation is found between connectedness to nature and well-being, psychological well-being, and vitality (Cervinka et al., 2012, p.384). Research has also found that nature has the ability to reduce stress, enhance a positive mood,

and improve cognitive skills and academic performance (Beatley, 2011, p.4). It is also seen that those with a connectedness to nature as well as other positive traits in their surroundings are provided with "a broadened range of coping options against stressors and furthermore, increased resilience against disease" (Cervinka et al., 2012, p.385). In other research it has been found that when living near to open spaces, people reported fewer social and health problems. Open space in these terms even refers to restricted amounts of vegetation; grass and a couple of trees have been correlated with enhancing coping and adaptive behavior (Kellert et al., 2008, p.4). It is important to note that in this case these findings were true independent of income, level of education, and location of residence. People living in communities that are in close proximity to nature have more positive valuations of nature, superior quality of life, greater neighborliness, and a stronger sense of place

than those communities that are not (Kellert et. al., 2008, p.4). Referring back to the benefits of views of natural features, Kaplan (1993) found that "office workers with a window view of nature reported lower frustration and higher life satisfaction and overall health" (Kellert et. al., 2008, p.98). The work of Peter Groenewegen (2006) surrounds the idea of green space in relation to people's health and well-being by coining the term vitamin G, where the 'G' stands for the green space around us (p.2). In his research he conducts field studies, instead of experimental studies, where he looks to confirm "the relationship between the amount and type of green space in peoples living environment and their health, well-being, and feelings of safety, to study the mechanisms behind this relationship, and to specify the implications for policy making" (Groenewegen et al., 2006, p.2). He finds that not only does living in an aesthetically pleasing environment offer relief from

stress, it may also enhance well-being by increasing satisfaction, attachment, and a sense of responsibility. These areas have also been thought to facilitate informal social interaction, which results in social cohesion by strengthening social ties. This is thought to positively influence feelings of safety and well-being. Additionally, feelings of anger, frustration, and aggression have the potential to be decreased when exposed to natural environments (Groenewegen et al., 2006, p.3).

The way that people perceive their environments significantly affects the way one will feel about that environment. Kopec (2006) identifies five types of personal impression that influence environmental perceptions: environmental descriptions, judgement of beauty, emotional reactions, environmental meaning, and risk safety. Environmental descriptions allow us to pinpoint specific aspects of an environment, such as different features or attributes, which will continue to

stand out in our minds even after we leave. Judgement of beauty is different for each individual person that enters a space, which varies depending on our culture, preferences, or experiences. It is important to note that what may appear to be aesthetically pleasing to one person could be displeasing to another. However, there are found to be two aspects of beauty that seem to be consistent over time and throughout different cultures. These are the ability to see for distances and the amount of visual depth, which is the spatial relationship between objects in an environment. Emotional, or affective reactions are the less intense reactions to an environment that tend to be constant and cumulative. "Environmental factors, such as noise and pollution, combine with our individual sociability factors and our desires for arousal to influence our perceptions of environmental desirability. Once our threshold has been exceeded, we will likely react negatively to that

environment" (Kopec, 2006, p.61). Environmental meaning develops over time as we become more familiar with an environment. It begins when we start to identify with a certain environment and as a result we form attachments. They become the places that we self-identify with, "defining ourselves according to our own personal experiences and tangible components that represent and symbolize our places in the world (Kopec, 2006, p.61). The last, risk of safety, "refers to whether an individual perceives danger from crime, accidents, or physical hazards within an environment" (Kopec, 2006, p.61). These perceptions comprise many of the terms that we use in design, such as place identity, sense of place, and place attachment. Place identity refers to the way that people integrate a place into their own identities or senses of self. "A place with which we identify generally provides a sense of continuity, helps to reinforce self-identity and self-esteem, enables

figure 13  junction of Chancellor Matheson Road and University Crescent

us to get things done, and provides either a sense of individuality or a sense of belonging" (Kopec, 2006, p.62). A sense of place is when a person develops a level of comfort with a place and they feel safe within it; this usually translates into a sense of belonging for people. This happens when a person's history merges with a setting and forms a sense of place (Kopec, 2006, p.62). Place attachment is known as the person's bond with both the social and physical aspects of a place. When a person's identity becomes a part of a place, they have deep meaning for people, and as a result these places become restorative environments. Kopec (2006) identifies three elements that aid in attaching people to places in a way that affects their well-being: their personal characteristics and behaviors, the availability of facilities, opportunities and resources, and a sense of belonging (p.62).

## restorative environments

Restorative environments "emphasize the process through which people restore the resources that they have depleted in meeting environmental demands, and in particular the characteristics of environments that promote restoration of the depleted resources (Kellert et al., 2008, p.134). Theories surrounding the restoration perspective recognize that a person may still need periodic restoration even when they have a sufficient amount of resources available to them to feel secure when facing environmental demands. It is inevitable that a person's resources will become somewhat depleted when they are actively sustaining social relationships, pursuing goals, playing and creating, and participating in the activities that push our lives beyond simply surviving. In order to efficiently continue to perform activities while adapting to one's environment, interventions that enhance

opportunities for restoration must be in place in order to restore these resources more readily, quickly, and completely (Kellert et al., 2008, p.134). The importance of restorative environments has been recognized for centuries; early humans identified their responses to restorative environments as a major advantagedue to recharging physical energy, rapid reduction of stress responses following an encounter with a dangerous threat, and a decrease in aggression following a hostile interaction with another person. It is also thought that a capacity for restorative responding would increase the chance of survival due to the promotion of recovery from fatigue and other possible adverse effects following a demanding situation (Kellert & Wilson, 1993, p.98). It may be necessary to note that the terms stress recovery and restoration are used interchangeably; however, restoration is "a broader concept that is not limited to stress recovery situations or to recovery

from excessive physiological arousal and negatively toned emotional excitement [or] anxiety, but could also refer to recuperation from understimulation or prolonged boredom" (Kellert & Wilson, 1993, p.100).

Social scientists have taken an interest in the restorative effects of nature and have predicted that stressed individuals will find an encounter with most unthreatening natural settings to have stress reducing qualities, which differs from many urban environments which have been found to hinder recuperation (Ulrich et al., 1991, p.205). Effects of restoration can be identified through emotions, as well as physiological aspects such as heart rate, blood pressure, and muscle tension (Kellert et. al., 2008, p.137). The effects of nature in the urban environment have been noted as far back as times in ancient Rome, where it has been documented that they "valued contacts with nature as a contrast to the noise, congestion, and

other stressors of the city" (Ulrich et al., 1991, p.204). During these times it was also believed that exposure to natural elements, such as trees and water, fostered psychological well-being and restoration from the stresses of living in an urban setting (Ulrich et al., 1991, p.204). This has been demonstrated in a study which revealed that participants showed improved psycho-physiological attention restoration and stress recovery following a walk in nature, whereas no improvement was shown in subjects walking in urban settings (Cervinka et al., 2012, p.381). Kaplan (1998) suggested in his writing that "moving through natural areas is one of the most restorative of activities" (p.89). This may be due to the strong attention-holding properties of natural environments and processes, which play a vital role in stress restoration (Ulrich et al., 1991, p.206).

Research has also found that views from a window looking out on to a

figure 14  patio at Max Bell Centre

natural setting can have restorative benefits (Kaplan, 1998, p.76). This has led to the belief that the aesthetic experience of nature may be a significant factor in restoration (Groenewegen et al., 2006, p.3). When compared to urban or built environments that are void of nature, unthreatening natural landscapes tend to promote faster and more complete restoration (Kellert & Wilson, 1993, p.106). This is a consistent finding in both lab and field studies; within three to five minutes significant physiological restoration can be recognized, primarily in heart and electrical brain activity, blood pressure, and muscle tension (Kellert et. al., 2008, p.91).

> "Views from indoors onto nature can support micro-restorative experiences that interrupt stress arousal or the depletion of attentional capacity. Similarly, when moving through the

> environment from one place to another, passage through a natural setting may provide a respite that, although brief, nonetheless interrupts a process of resource depletion. Frequent, brief restorative experiences may, over the long run, offer cumulative benefits" (Beatley, 2011, p.5).

It has been anticipated that viewing these unthreatening natural scenes would result in a decrease in physiological arousal followed by a more positively toned emotional state and comparatively high levels of attention (Ulrich et al., 1991, p.209). One of the most notable landscape architects to have initially addressed the restorative qualities of landscape was Frederick Law Olmsted. He wrote about the stresses associated with cities and job demands, and also made the argument that viewing nature is an effective way to produce restoration or recovery from

these types of stresses (Ulrich et al., 1991, p.204). His ideas surrounding this theory formed an important part of his justification for providing pastoral parks and other nature within cities and preserving wilderness for public use (Ulrich et al., 1991, p.204). Olmsted maintains that for those experiencing stress, "viewing nature employs the mind without fatigue and yet exercises it; tranquilizes it and yet enlivens it; and thus, through the influence of the mind over the body, gives the effect of refreshing rest and reinvigoration to the whole system" (Ulrich et al., 1991, p.204). He also wrote that when a person is exposed to a natural view, 'the attention is aroused and the mind occupied without purpose" (Ulrich et al., 1991, p.206). This is how it is suggested that natural views restore mental fatigue; people respond with involuntary attention or fascination to nature (Ulrich et al., 1991, p.206). Restoration from mental fatigue also requires that a person be tuned into a

place other than the source of the fatigue, also called 'being away' (Kaplan, 1998, p.18). This is defined as the "distancing of oneself from day-to-day routine work pressure or other negative situations" (Lau & Yang, 2009, p.56). That is not to say, however, that the space must be far away. Convenient and nearby natural settings are an important aspect in lightening directed attention fatigue (Lau & Yang, 2009, p.56). Being away is one of three requirements for a restorative environment for those suffering from directed attention fatigue that Kaplan outlined. The other two are: fascination and compatibility (Lau & Yeng, 2009, p.56). Fascination refers to the natural features in an environment that entice people, such as flora, fauna, water, and the play of light, as well as natural processes such as succession, predation, and survival (Kaplan, 1998, p.20). Compatibility refers to the "interaction between human beings and natural elements" where people function with less effort and

achieve better mental benefits in natural environments (Lau & Yang, 2009, p.56).

Another perspective on stress and environments is addressed in the question of whether different non-extreme, everyday physical environments have varying effects on fostering or impeding stress recovery. It is important to understand whether encounters with some types of everyday environments hinder recovery (Ulrich et al., 1991, p.202). Kellert et al. (2008) outline several environmental qualities that may elicit negative responses, hinder restoration, or worsen stress. They are the "predominance of hardscape rather than nature, intrusive urban or mechanical sounds, crowding, and ambiguous or abstract art and design features that are readily interpreted in multiple ways and may elicit negative reactions in some stressed [users]" (p.98).

## comfortable environments

> "There is little question about the capability of humans to tolerate thermal extremes. There is concern, however, about the cost of such tolerance, for there are demonstrable effects of exposure to abnormally high or low ambient temperatures. These effects include physiological adaptation, changes in performance, and influences on social behavior" (Bell & Greene, 1982, p.75).

In the beginning stages of this practicum while exploring varying ideas surrounding the biophilia hypothesis, the field of climate engineering became of a certain interest. Transsolar Climate Engineering, with offices in Stuttgart, Munich, and New York, was founded in 1992 in Germany. This firm seeks to "improve the built environment's impact on the environment while maintaining the highest indoor and

outdoor comfort" (Lauster & Olsen, 2008, p. 3). They work collaboratively on projects around the world from the earliest stages of design with clients, architects, mechanical engineers, and other consultants to bring a dimension of fundamental thermodynamics and physics. By being involved in the design process, they aim to reach a solution where local conditions, material, and mechanical systems are all integrated into a system that will aid in controlling the climate to reduce operating costs while increasing the comfort for people inhabiting the space. Brown (2011) touches on this same concept and believes that this approach "may offer a richer, more sensuous experiential dimension" to the designed environment (p.91). He recognizes that we are so often confined to "conventionally lit, hard-surfaced, climate-controlled interiors" and fears that our senses are beginning to fade, but that this approach may keep the visual, tactile, acoustic, and thermal cues alive that

are our connection to natural processes (Brown, 2011, p.91). With every project, Transsolar ensures the consideration of daylight, natural ventilation, air quality and temperatures, acoustics, and the well-being of people. They enjoy the challenge of responding to unfamiliar climatic conditions and new user demands, while maintaining a high level of respect for both people and nature (Lauster & Olsen, 2008, p. 3). An example of a new challenge for Transsolar was the Manitoba Hydro downtown office. They identified Winnipeg as the coldest city in the world with a population over 500,000, but it is also the sunniest place in Canada with the hottest and most humid summers. The city experiences varying temperatures at a range of 70 degrees Celsius throughout a year, dropping to below -35 during the winter months and above 35 during the summer (Lauster & Olsen, 2008, p.22). A concern for the natural environment surfaced within Transsolar with the 1998 Living

Planet Report released by WWF, which outlined the impact of human activity on the natural world. A decade later a new report confirmed fears that human beings are using the earth's resources at a rate faster than they can be renewed, indicating that since 1961, humanity's ecological footprint has more than tripled. This means that "our footprint now exceeds the world's ability to regenerate by about 25%" (Lauster & Olsen, 2008, p. 5). One of the largest contributing factors to this phenomenon is the way that humans generate and use energy. We rely so heavily on fossil fuels to meet our increasing energy demands that greenhouse gas emissions currently make up half of our global footprint (Lauster & Olsen, 2008, p. 5).

Temperature plays a large role in how comfortable a person will be within a space. It has been noted that "when the heat produced by a person is in balance with the heat they dissipate, they will feel comfortable" (Lauster &

figure 15  riparian area north side of campus

Olsen, 2008, p.9). However, there is more than just the physical component to feeling comfortable; there are obvious psychological factors related to weather which can be determined by expectation or adaptation to certain conditions that determine how comfortable a person will be. It has been found that if people are able to influence their own environment they will more readily adapt to a wider range of temperature and humidity (Lauster & Olsen, 2008, p.9). In regards to temperature, we tend to attribute comfort primarily to air temperature, and although important, radiant temperature is equally as important. This is defined as "the mean temperature of all surrounding surfaces" (Lauster & Olsen, 2008, p.10). It is more energy efficient to control the radiant temperature than it is the air temperature; this can be done by using materials with a low emissivity coefficient, such as stainless steel (Lauster & Olsen, 2008, p.10). They also take sound into consideration

when designing comfortable human environments. As previously mentioned, our emotions and orientation play a role in how we perceive the environment. Transsolar recognizes this as well in that "the sense of hearing is an important precondition for communication and orientation, and it determines our emotions considerably" (Lauster & Olsen, 2008, p.30). Generally, people prefer natural sounds to technical ones; this can be attributed to the drastic difference between the two types of sound, and while natural ones are characterized in a positive manner, technical or synthetic sounds at the same sound level are perceived as noise (Lauster & Olsen, 2008, p.29-30). Access to daylight is also a key component to the project that Transsolar is involved in. Research conducted by the Lawrence Berkeley National Laboratory has found "that access to daylight has the highest correlation to the productivity of people, with increases of 15-50%" (Lauster &

Olsen, 2008, p.40). Brown (2011) argues that we need to be "put back in touch with daylight's full spectrum, embracing the loose logic of passive solar heating and natural ventilation, reconnecting with the world outside, enjoying designs that promote views for everyone to experience weather, seasons, and views, [so that] we may once again benefit from proximity to the natural world" (p.91).

Physical features of a designed site, such as materials and vegetation, are also a priority in creating comfortable human environments. Different materials have varying physical aspects that will impact the environmental quality of a space. The thermal conductivity of a material impacts its insulation performance; porosity will affect the absorption and desorption of moisture; reflectivity will affect the material's ability to reflect and transmit light. All of these factors will have an influence on a space (Lauster & Olsen, 2008, p.49). It is also important to recognize the

many benefits to having trees and other vegetation nearby, such as indirect health benefits for both people and the environment. Trees reduce the pollutants in the air, such as ozone, nitrogen dioxide, and particulate matter. As well they lower greenhouse warming by carbon dioxide fixation during photosynthesis; "one hectare of forest can remove 10 to 15 tons of carbon dioxide from the air each year, and approximately half the dry weight of wood is carbon" (Kellert et. al., 2008, p.115). Trees help to shade buildings which reduce the demand for air conditioning, and therefore energy demands; additionally they shade exterior spaces which protect people from the sun and reduces the concentration of heat over sidewalks, streets, and parking lots which will lessen the urban heat island effect (Kellert et. al., 2008, p.115). Pötz (2012) writes that "districts with large amounts of vegetation or surface water can be up to ten degrees cooler than heavily bricked or concrete

urban areas. Trees have a favourable effect in the microclimate due to their shade and by the fact that the ground below them is heated less" (p.32).

The public right of way is an undervalued space that, with the right techniques and design considerations, can provide considerable ecological and human health benefits. It is an area where there is great potential to treat stormwater runoff, by "using landscaped or bioengineered structures in roadway medians or sidewalks" (Brown, 2011, p.94). Vegetated surfaces have the ability to absorb significant amounts of water, which reduces the need for water to be drained off a site (Pötz, 2012, p.32). We also have the opportunity to enhance the walkability of these areas by introducing plant diversity in higher density to the streetscape (Brown, 2011, p.94). Increasing the presence of water and other natural features within the urban context has been an active effort for cities around the world, such

figure 16 Curry Place

as Singapore, London, Berlin, and Amsterdam. By making this a priority in the design of our cities, it aids in the protection of what little existing vegetation and water we still have, as well as improving quality of life and economic value (Pötz, 2012, p.31).

## designing for wellness

In designing environments that address the well-being of visitors on a site, the designer must keep in mind the relationship between stress and social interaction. "Environmental designs that increase the predictability of interactions make those interactions easier to control and hence reduce stress" (Bell & Greene, 1982, p.161). Bell and Greene (1982) suggest that there are two ways of increasing predictability: reducing the number of potential users of a space to more easily

predict who will be encountered, and to relate the design of a space to the social system to make the outcome of interactions more predictable (p.161). Another way designers can influence stress in an environment is effecting wayfinding and spatial orientation in the way a space is designed. "Increasing evidence suggests that we make important self-assessments based on our performance in wayfinding and spatial orientation (Bell & Greene, 1982, p.162). Studies have also shown that gardens that contain lush foliage, flowers, water, grassy spaces with trees or large shrubs, combined with a degree of spatial openness, and nature sounds will effectively alleviate stress (Kellert et al., 2008, p.98). In the urban environment, exposure to high volumes of traffic is common; studies have shown that traffic is usually assessed as negative or stressful (Ulrich et al., 1991, p.210). To achieve a restorative effect within a busy city, it is important that there be opportunities for

close contact with natural elements and spaces; this gives a sense of being away. In fact in the majority of studies on urban parks or other urban natural settings, stress restoration was one of the key perceived benefits (Kellert & Wilson, 1993, p.101).

> "An urban park ordinarily does more than provide residents with a place to escape from their everyday demands, one that is quieter and less hectic than other outdoor urban space; it also provides pleasing distractions that pull visitors' thoughts away from the demands they face, helping them to renew a depleted capacity to direct attention, overcome negative emotions, and wind down physiologically" (Kellert et. al., 2008, p.135).

A study conducted by Maas et al. (2006) found similar results; that the natural

environment is more than just a luxury good. They believe that developing and maintaining green space should be more of a central focus in a country that is seeing its green space quickly disappear (Verheij et al., 2008, p.312). It is also important to keep in mind when designing the landscape that people become uneasy when they cannot navigate their way through a space. As Kevin Lynch noted in his work, "the very word 'lost' in our language means more than simple geographical uncertainty; it carries overtones of utter disaster" (Bell & Greene, 1982, p.163). For many people, spatial orientation is extremely important, or else they may become anxious and panicky (Bell & Greene, 1982, p.167). This can be mediated by use of effective signage. Various studies show that when effective signage is present subjects reported increased comfort, decreased crowding, and significantly less stress, confusion, and anger (Bell & Greene, 1982, p.163).

## wellness and the university

> "We can develop the kind of first-hand knowledge of nature from which real intelligence grows. This means breaking down walls made by clocks, bells, rules, academic requirements, and a tired indoor pedagogy. I am proposing a jail break that would put learners of all ages outdoors more often" (Orr, 1994, p.52).

In environments where people must relinquish control, such as hospitals, workplaces, prisons, and schools, it is common for people to experience symptoms of poor physical health (Kopec, 2006, p.60). An increasing amount of pressure is constantly put on students at the university level; this type of stress has been known to affect mental health (Lau & Yeng, 2009, p.57). Additionally, students are

required to work intensively for extended periods of time, especially near the end of a semester, which can lead to directed attention fatigue (Lau & Yeng, 2009, p.56). The high levels of stress of students and staff in a post-secondary environment suggests that understanding the restorative effects of natural space throughout the campus may be beneficial in campus landscape design (Lau & Yeng, 2009, p.55). "Nearly a century's worth of research shows that the learning process is enhanced by abundant natural elements, adequate personal space, and minimal noise levels" (Kopec, 2006, p.202). Lau and Yeng (2009) believe that universities have the opportunity to promote and protect the health of students, staff, and the neighbouring community through landscape by creating health-conducive working, learning, and living environments (p.57).

"For modern urban dwellers, suffering a daily routine of pressure,

deadlines and the eyesores of the concrete jungle, the existence of natural parks and other open spaces of varying scale is appreciated and these places are cherished for their role in soothing the senses and providing venues for leisure activities" (Lau & Yeng, 2009, p.55-6).

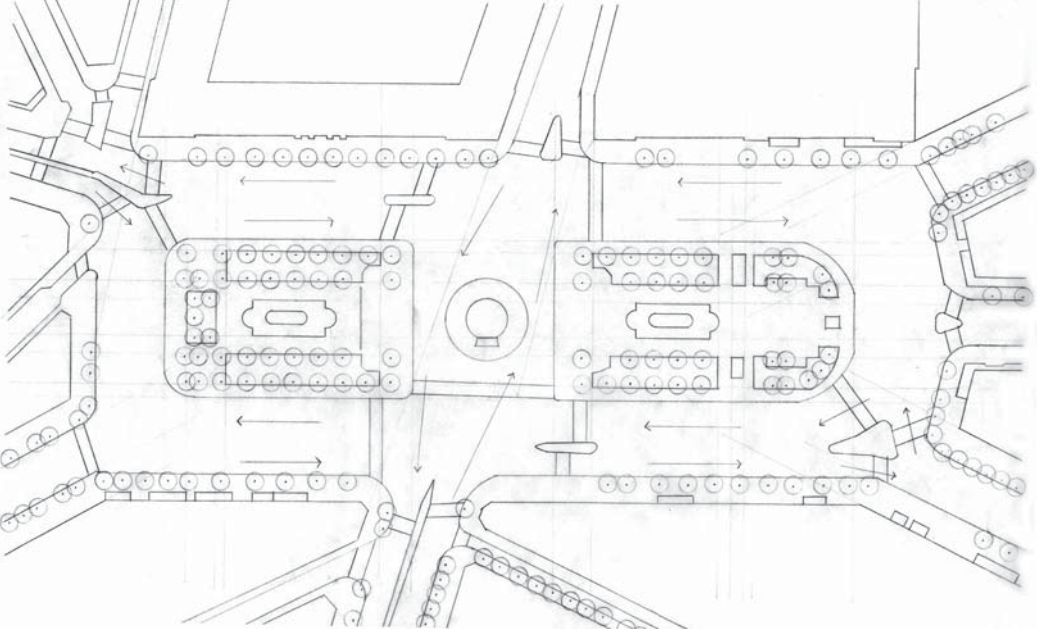


figure 17 Plan of Place de la Republique before design.

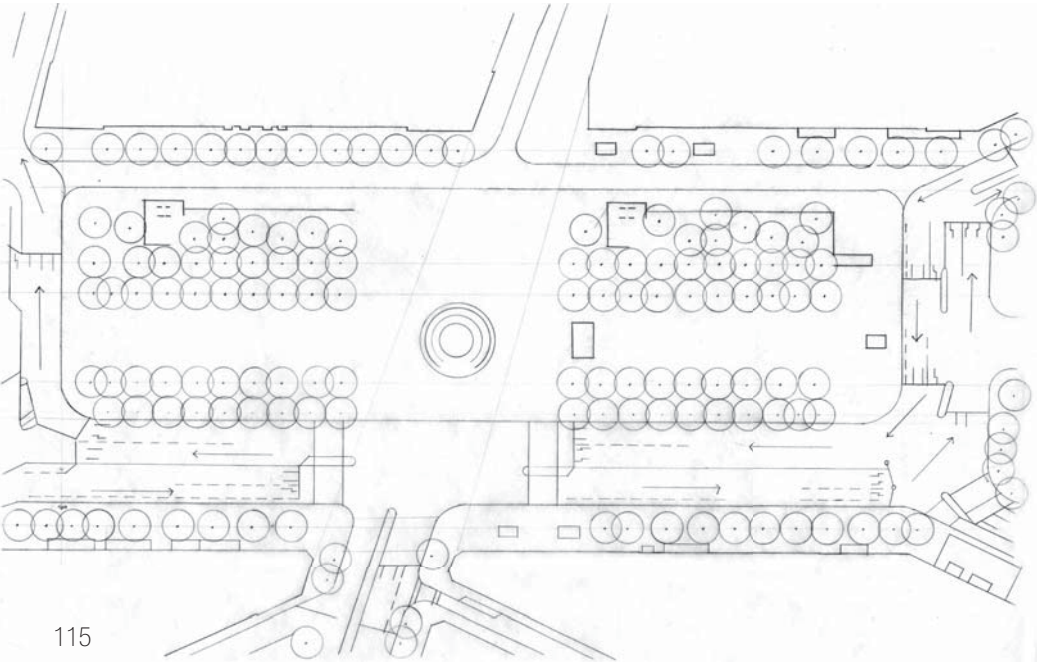


figure 18 Plan of Place de la Republique after design.

chapter four
precedent studies

## place de la republique
## paris, france

Place de la Republique is a square located in Paris France where the third, tenth, and eleventh districts meet, as well as being the intersection of seven major roadways. Central to the square is one of Paris's major monuments, the statue of the Republic. It currently acts as the central feature of a traffic roundabout, flanked by two separate squares. The separation created by the heavily used traffic routes makes the monument nearly impossible to come into contact with by pedestrians, causing it to be viewed primarily from a distance.

Before the redevelopment of Paris led by Haussmann in the mid 19th

century, Place de la Republique was not used as a pedestrian square. It was originally named Place du Chateau d'Eau, or Water Tower, after a fountain located at the centre of the square by Girard. Haussmann expanded the square and emphasized its importance by interrupting the Boulevard du Temple, and moving the fountain to the Grande Halle where it still sits today. The fountain was then replaced with the Statue de la Republique which was sculpted by the Morice brothers and inaugurated on July 14, 1885. The statue prominently displays two important Republican symbols: Marianne and the lion, as well as twelve figures representing the most significant events in the history of the Republic (Place de la Republique, 2012).

Place de la Republique was originally intended to be a pedestrian square that celebrates one of Paris's major monuments. However, traffic domination and

figure 19 existing conditions

figure 20 proposed design

obscure pedestrian pathways have begun to deter visitors from the square and the identity of the space has dissolved simply to a traffic circle. This became apparent to the City of Paris and a design competition was held and awarded to Trevelo & Viger-Kohler Architectes. In order to fully understand the design issues of the space, TVK engaged in walking tours of the space with local residents and came to the realization that what was lacking was an appeal to the space and the surroundings (Potz, 2012). They proposed "to create a vast public space reserved for pedestrians and cyclists and to create a connection to the square at the north-east border" (Rosenberg, 2011). This would be achieved by eliminating traffic at the intersection of Faubourg du Temple and Yves Toudic and extending the space to this point (Rosenberg, 2011).

Joining TVK in the design of the space were landscape architects Martha

figure 21  Place de la Republique existing conditions

figure 22  Place de la Republique existing conditions

figure 23  Place de la Republique existing conditions

Schwartz and Areal, structural and traffic engineers, Associated Transportation Engineers (ATE), and climate engineers, Transsolar. Transsolar was brought on board the project to build a strategy that would improve urban comfort while diminishing the phenomenon of urban heat islands (Transsolar Climate Engineering, 2009). Their input on the project would ultimately guide the main principles of the project, which were to "reinforce the presence of greenery and produce a unified landscape with maximum area - let the sun penetrate and position the pedestrian pathways in the areas that receive the most sunlight - let the warm summer winds penetrate for better aeration of the city and for the dilution of pollutants, and block the uncomfortable cold winter winds" (Rosenberg, 2011). These principles were addressed by Transsolar by maximising the proportion of trees and plants, expanding the dense vegetation on the site to an area of 12,000$m^2$ out of the total

figure 24  Place de la Republique design perspective

figure 25  Place de la Republique design perspective

figure 26  Place de la Republique design perspective

20,000$m^2$ space. This creates shaded areas of cool in the summer, while in the winter months still allowing the sun to penetrate to the ground for warmth below the canopy. Wind flow through the site was analysed to naturally ventilate the space in summer diluting pollution as well as strengthening the cooling mass effect during the summer months. Additionally, expanding the space available to pedestrians by 50 percent and giving priority to pedestrians and public transportation reduces traffic and noise within the space, creating a more comfortable space for people to visit (Transsolar Climate Engineering, 2009; Potz, 2012).

> "Place de la Republique plays a special role in the public life in Paris, not only through its size or for its representative and symbolic role, but also by its location in the metropolis, it is potentially one of the major monuments of Paris" (Transsolar Climate Engineering, 2009).

Understanding how Transsolar is able to manipulate the climate in an outdoor urban setting is important when designing pedestrian oriented spaces. Creating a comfortable environment will make the space more appealing to visitors during all seasons. This is an approach that would be well suited in a climate zone such as Winnipeg, where there is high heat and humidity during the summer months and extreme lows in temperature and windchill during the winter months. Promoting comfortable exterior spaces in this type of environment may encourage the use of the outdoors even when the weather is not ideal. Place de la Republique is also a prime example of redirecting traffic in an established area in order to create a more pedestrian friendly space. In North America, and especially in cities where we experience extreme weather conditions, higher priority is placed on the motor vehicle and less on the pedestrian. Analysing precedents that address this

issue can help us to understand how these same principles can be applied in urban environments.

## university of pennsylvania
## philadelphia, pennsylvania

The University of Pennsylvania, located in Philadelphia, is known as being one of the world's most attractive urban campuses. In 2009 the university released a Climate Action Plan which outlined their sustainability objectives. The goal of this plan is to "make climate change and sustainability part of the curriculum and educational experience for all students and the Penn community, create and maintain a sustainable campus by: increasing green space, decreasing building energy consumption through design and renovations, improving the environmental quality of interior and exterior spaces, increasing education and awareness of sustainable design, leverage the extensive network of subway, bus, trolley, regional rail, car-sharing, and bike systems to reduce single-occupant auto use to less than 50% of

commuters, while investing in a quality pedestrian campus environment" (University of Pennsylvania, 2012). Following this plan as well as the City of Philadelphia's Greenworks goals for the region, the university unveiled Penn Connects, the award-winning campus development plan that is steering Penn's commitment to a healthy built environment. The plan pulls from the organizational framework established in the 2001 campus development plan and is based on a planning analysis of the opportunities and constraints of the eastern expansion areas of the campus. Penn Connects does acknowledge some of the other initiatives that are already underway, such as the annual reinvestment in existing buildings and infrastructure, a new campus-wide stormwater management master plan, and the transportation plan (University of Pennsylvania, 2012). The key features of this initiative are to "establish new connections and gateways between the campus, center city, and

the neighboring communities, concentrate mixed-used, dense development at strategic locations by taking advantage of existing transportation hubs, create a new signature urban park that includes recreational and athletic amenities, provide new public gathering spaces and pathways to link the core campus with the newly acquired land to the east, and establish a university presence along the Schuylkill River Corridor" (University of Pennsylvania, 2012). The plan also sets out some more specific urban design goals such as developing streets with active street level uses, extending a street to provide a convenient north-south access route and to engage new development opportunities, and creating a new pedestrian bridge (University of Pennsylvania, 2012).

The University of Pennsylvania is home to many achievements in planning, landscape design, and architecture. Their dedication to these disciplines shows in

the Penn Connects plan. The landscape strategy increases the amount of campus green space and uses site-adapted indigenous tree and shrub species. Already in the last 20 years the university has removed close to five acres of pavement to create parks and gardens, and has planted about 5,000 trees. The plan orients new buildings in response to solar and natural ventilation, and recommends LEED certification for all new buildings, to minimize the use of natural resources, reduce energy use, improve indoor environmental quality, and mitigate burdens of new buildings on the ecosystem. However, this type of thinking is not a new concept at Penn, over the past 25 years many projects have incorporated principles of reducing runoff, permeable paving systems, native plant material and the re-use of landscape materials. They have managed to salvage and re-use almost 40,000 square feet of pavers during this time (University of Pennsylvania, 2012).

The University of Manitoba does not differ greatly from the context of the University of Pennsylvania. Both campuses are situated within residential neighborhoods, along major traffic routes, and are surrounded by a river corridor. Additionally, both are expanding portions of the campus, as well as integrating new development within the previously established areas. However, Penn is being much more thorough in approaching planning and making a real effort to achieve the goals that they have set out over the last twenty years. The University of Manitoba could adopt some of the initiatives and ways of thinking that Penn is using as a precedent in how they continue to move forward with development.

figure 27  Artists' Backyard ompleted construction

## the artists' backyard
## raleigh, north carolina

*"In a constantly shifting environment, the opportunity to make a tangible, permanent impact can be rare"*

–James Ryals, North Carolina State University

The Landscape Architecture 500 class taught by Andrew Fox, an assistant professor of landscape architecture in the College of Design at the North Carolina State University, has undergone a challenge to participate in a design-build studio to redesign the areas around Syme and Turlington Halls. The first project that was seen from concept to construction was a rain garden outside Syme Hall completed in May 2010. The success of this project captured the attention of Campus Housing, which led to the partnership of Housing and the class in designing a five-

year plan for similar projects elsewhere on campus (Ryals, 2011). Fox is quoted as saying, "Based on the success of that project – the amenity it created, and the ecological and environmental function it served – University housing saw a real benefit to its purpose, and a successful partnership was born from that experience" (University Housing, 2011). Under this partnership, the first project was to be the Artists' Backyard, a "pocket park" between Turlington and Owen Halls, which was originally a stretch of mulch between the two buildings (Holmes, 2012).

The spring and summer classes of 2011 would be the group to undertake this particular project named the Artists' Backyard after the adjacent Arts Village living/learning community (Holmes, 2012). The students spend the first five weeks planning and researching. That would be followed by a five-week construction period in which the students would spend 10-12 hours a day installing the works.

figure 28 Site before construction

figure 29 Completed construction

figure 30 Completed construction

This hands-on experience tends to be the first opportunity many students have to work so intimately with a project and see the entire design process through from start to finish (Ryals, 2011).

The site was chosen as it is a major student thoroughfare and become the surrounding residences are frequent stops for visitors and new students on campus. There were many apparent issues on the site that needed to be addressed through the intervention, such as the need to mitigate significant erosion and flooding while also protecting two century-old Shumard Oaks (Holmes, 2012). The goal of this project, like the first, is to provide opportunities to study stormwater movement in an urban setting, as well as "to use low-impact design principles to build ecologically friendly, attractive common areas around the dormitories" (Ryals, 2011). They are achieving this by utilizing low impact development techniques to slow, capture

and cleanse water on site, as well as repurposing 15 tons of flagstone from the campus that was headed for the landfill. Universal accessibility is also important to the success of the project, which is addressed by the pathway that connects Cates Avenue to the site following ADA standards. The site is also intended to serve an educational purpose, to teach visitors about sustainable design and landscape management practices as well as the value of landscape architecture (University Housing, 2011; Holmes, 2012). "Other examples of best practices included the development of three large bioinfiltration cells, use of structural and compost-amended soils, installation of permeable pavements, use of various air excavation techniques to protect the oaks, installation of a cistern, design of hydro-zoned plantings, construction of infiltration/recharge wells to the native saprolite soil substrate, creating of interpretive signage, and the development of numerous

figure 31 Final Master Plan

rain-powered water features" (Holmes, 2012).

This project is an example of "how small spaces can make big moves toward creating community value and protecting the environment" (Holmes, 2012). This project is an example of a university utilizing the professional programs within their faculties and providing students an opportunity to step outside the classroom and apply their knowledge to a real-world project. It is a learning experience that few students will have the privilege of undertaking before they graduate and begin their professional degrees. Tim Luckadoo, Associate Vice Chancellor for Student Affairs explains "It really fits in with what we want to do here in terms of living and learning. We want our students who live on campus to learn in and explore their surroundings" (Ryals, 2011).

## nationwide children's hospital
## columbus, ohio

Nationwide Children's Hospital is one of the most prominent pediatric health care and research institutes in America. They have recently constructed a new 2.1 million square foot hospital tower and research building, making it the largest pediatric expansion project in U.S. history. The hospital is a high traffic-volume facility, and is expected to see at least one million patient visits within the first year. This began on June 20, 2012 when it was first opened to the public (Holmes, 2012). OLIN was hired to design the surrounding 6.5 acre campus and healing gardens, the most significant portion being the 4 acre Children's Garden. They worked on a multidisciplinary team which included FKP Architects, local landscape architects MSI-KKG, engineers EMH&T and Trans Associates, environmental designers Ralph

Appelbaum and Associates, and Horton, Lees, Brogden Lighting Design (Holmes, 2012). OLIN's design creates a vibrant setting that serves the needs of the campus while creating accessible space for surrounding neighborhoods. It was envisioned that the healing environment would reach beyond the campus. Laurie Olin explains, "The project expands the principles of therapeutic gardens to the entire healthcare campus as neighboring community. Nationwide Children's Hospital is a pioneer in its field in that the hospital has created something for people beyond just its own patients" (Holmes, 2012).

The largest portion of the site was dedicated to a Children's Garden which includes a series of special spaces: a moonlight garden that extends the use of the site into the evening, tot lawn, the entry bosque, a running lawn, a storyteller's garden, and an interactive play area (MKSK Studios, 2012; Holmes, 2012).

figure 32 Nationwide Children`s Hospital site plan

Plantings of lemon and chocolate mints, wild thyme, fluffy lamb's ear, cone flower, and colorful snapdragon come together to create a sensory-rich maze, while plants with toxic leaves or berries were intentionally excluded for the safety of the garden's visitors. Above a two-level subsurface parking garage is an intensive green roof which comprises 2 acres of the Children's Garden (MKSK Studios, 2012).

Creating a sense of continuity between the interior and exterior spaces was also key in the design, which is fully realized in the dining courtyard, which connects the hospital tower to the landscape by using natural materials and flora. "The dining courtyard is a tranquil area under a dappled canopy of Locust trees and vertical plantings of Virginia Creeper vine, which creates a feeling of woodland surround" (Holmes, 2012).

Sustainability was also important to the design of the site, incorporating

rainwater collection, storage and re-use with a one-million gallon, below-grade vault which holds the run-off for use as irrigation water. As well, permeable surfaces throughout the campus were increased by almost 2.5 acres. The main entrance avenues have also been re-graded to better integrate utility corridors and introduce biofiltration rain gardens, which help absorb and filter stormwater runoff (Holmes, 2012).

The hospital is located directly adjacent to Livingston Park which has been extended into the gathering spaces of the campus to create a cohesive park setting along the entire southern perimeter. Livingston and Parsons Avenues act as the main entryways into the site, and have been transformed into "grand canopied civic boulevards with an allee of London Plane trees and new disease resistant American Elms, new sidewalks, brick crosswalks, and bicycle lanes" (Holmes, 2012). Defining

the entry into the hospital campus along Parsons Avenue is a luminous 'Grove of Light' which consists of a series of illuminated vertical masts.

This project is a large-scale landscape which facilitates visits from millions of patients each year, and thousands of families. This space reaches out to hospital visitors, the surrounding neighborhoods, and adjacent park. The Nationwide Children`s Hospital park does not solely focus on healing aspects of the landscape, but also how it can be of use to non-patient visitors, which is important when dealing with a space that doubles as a public park.

> "The merits of nature as a positive distraction are supported by research as indicating that viewing nature scenes tended to reduce stress; subjects' moods in offices were more positive when plants were present; viewing a fish aquarium reduced

anxiety among patients waiting for dental surgery; and patients recovering from gall bladder surgery who had a view into trees had fewer post-surgical complications, and needed fewer injections of strong narcotic pain drugs than matched patients viewing a brick wall. These and many other studies linking a view of nature with physiological measures indicating a reduction in stress and improved health outcomes provide strong support for access to gardens and natural areas in healthcare environments" (Copper Marcus, 2009, p.64).

# chapter five

## site analysis | the university of manitoba

### introduction

The site analysis was approached in two ways: through personal experience and observation, and a collection of data through research of literature and documentation of the Campus. The goal of the site analysis was to gain a general understanding of the history, existing processes, and physical characteristics of the Fort Garry Campus. This would allow for the identification the opportunities that the Campus presents to design biophilic environments.

# history

The University of Manitoba was established in 1877 with the amalgamation of St. Boniface College, St. John's College, and Manitoba College in response to a need for a standard, post-secondary educational system in the province. In 1907 the University combined with the Manitoba Agricultural College, towards which the Manitoba government allotted most of the post secondary education budget. At this time the Agriculture College was at a location in Tuxedo, and by 1910 it was clear that a new location was going to have to be found to accommodate the expansion of the University. Riverside Park, the current Fort Gary Campus, was chosen as the relocation site. This comprised 680 acres in a bend of the Red River (Bumsted, 2001, p.9).

Before World War I, the design of the campus followed the typical collegiate

style: Neoclassical buildings axially arranged, set into a park-like landscape. The campus plan at this time was designed to allow for moderate expansion without spilling out into the rural surrounds. This is when construction of the Administration building, Tache Hall, and three other buildings was completed to house the home economics and agricultural programs, as well as the resident population of 500 students. Further development of the campus was put on hold in 1914 when World War I began, during which time Professor Arthur A. Stoughton designed a master plan for the campus, which ultimately was never adopted. He planned for access to the campus along the north, west, and south sides of the campus, and any additional buildings were to be constructed concentrically along a central axis extending from the Administration building, and housing around the perimeter adjacent to the river (Bumsted, 2001, p.10).

After the War, from 1915-1939, during the great depression, the campus saw very little construction, with the exception of the Arts building, Tier, and the Science building, Buller. As well, the Federal Department of Agriculture and the Province of Manitoba leased land on the campus to establish a research station and laboratory (Bumsted, 2001, p.11). In 1940-1949, during World War II and afterwards, the University saw a shift in its campus and community into military service. There was a series of temporary huts built along the south side of the campus, a drill hall and indoor rifle range, and temporary housing; however, it was all destroyed in the flood of 1950. Construction during the 1950s was concentrated around the quadrangle, with the expansion of Engineering, and new barns to serve Plant Science, Soil Science, and the Provincial Veterinary Lab (Bumsted, 2001, p.11). During the 1950s the campus saw rapid expansion with the relocation

figure 33  Chancellor's Hall

of the major colleges and the undergraduate program to Fort Garry. As well, the Elizabeth Dafoe Library, Agricultural Research building, Fetherstonhaugh High Voltage lab, and the school of Architecture were constructed. During this construction period, each individual building took on its own architectural style, challenging the original design intent of a classically composed campus (Bumsted, 2001, p.12). To maintain the pedestrian scale of the campus, development from 1960-1980 was concentrated around the Administration building at the core of the campus. The relocation of Agriculture's animal and experimental crop research to Glenlea enhanced the overall pedestrian environment by forcing all automobile traffic to the periphery. During this time Isbister, Allen, Park, and Armes buildings were constructed. It was also during this time that a new master plan concept was proposed by Professor Dennis Wilkinson, in which the configuration of buildings

was suggested to link multiple smaller scale buildings to form several outdoor courtyards (Bumsted, 2001, p.12). Also, in response to the 1967 PanAm games, the stadium, athletic fields, and new athletic facilities were constructed. As well the campus saw the development of University and St. Andrew's Colleges and their respective residences, the School of Fine Arts, Music, Pharmacy, Education, and Animal Science, and Fletcher Argue, Duff Roblin, and Robson Hall. In an effort to strengthen the formal approach at the entrance of the campus, in 1964 the gates were constructed at Pembina Highway (Bumsted, 2001, p.12).

Robert Allsopp`s campus plan (1970) sought to consolidate the campus both programmatically and physically with the provision for increased north-south linkages through the central campus (Bumsted, 2001, p.12). A major shift at the Fort Garry campus was seen during the 1970s with the transformation of its context

from rural parkland to a sprawling suburban residential neighbourhood. In 1972, University Centre was constructed to accommodate student services, offices, and conference facilities. This, along with the construction of the Frank Kennedy Athletic Centre, interrupted the formal, axial approach to the Administration building, cutting through the Avenue of Elms. Since this time the Fresh Water Institute, Machray Hall, Max Bell, Wallace, Drake, and Investors Group Athletic Centre have all been added to the Fort Gary campus (Bumsted, 2001, p.12).

The current campus has become increasingly fragmented, with the additions and modifications to various buildings over the years. Bumsted maintains that "as demands for further expansion and development increase, the historic urban patterns must be carefully considered within the context of a diverse academic environment" (Bumsted, 2001, p.13). In recent years the University

figure 34  Sidewalk along Freedman Crescent

of Manitoba Fort Garry campus has gone from a primarily academic institution to offering a range of services for students, faculty, and the surrounding community. The development of Smart Park was intended to facilitate an interaction between the university and industry, to promote growth of new firms in Manitoba, and to foster economic development (Bumsted, 2001, p.14). "Heading into the 21st century the University of Manitoba Rort Garry Campus identifies itself both as a distinct community, as well as a participant and a leader in global constituencies" (Bumsted, 2001, p.14).

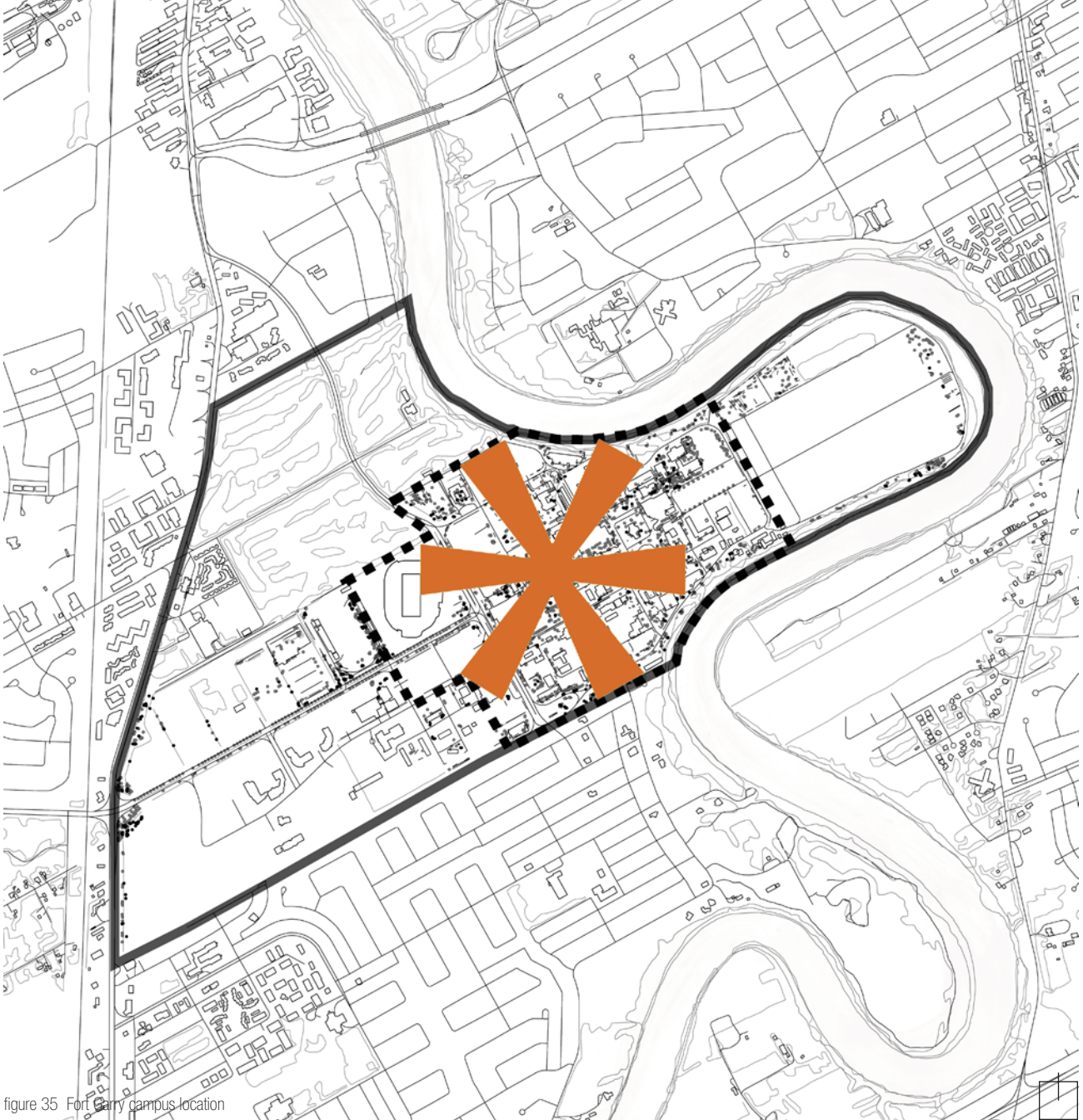


figure 35 Fort Garry campus location

# location

The University of Manitoba Fort Garry Campus is located in south Winnipeg along Pembina Highway. It is encompassed by the Red River on the north, south, and east sides of the campus. The Fort Garry campus is 233-hectares and is comprised of over 60 major buildings. Adjacent to the campus is the Smartpark Research and Technology Park which works in collaboration with the University to foster "university-industry research and development with 30 of Canada's most innovative companies" (Bumsted, 2001, p.2). The University of Manitoba Fort Garry Campus provides an opportunity to explore how biophilic design may be implemented in a post-secondary educational environment. The focus of this project will be in the core of the campus, exluding Smartpark, the point lands, and Southwood Golf Course.

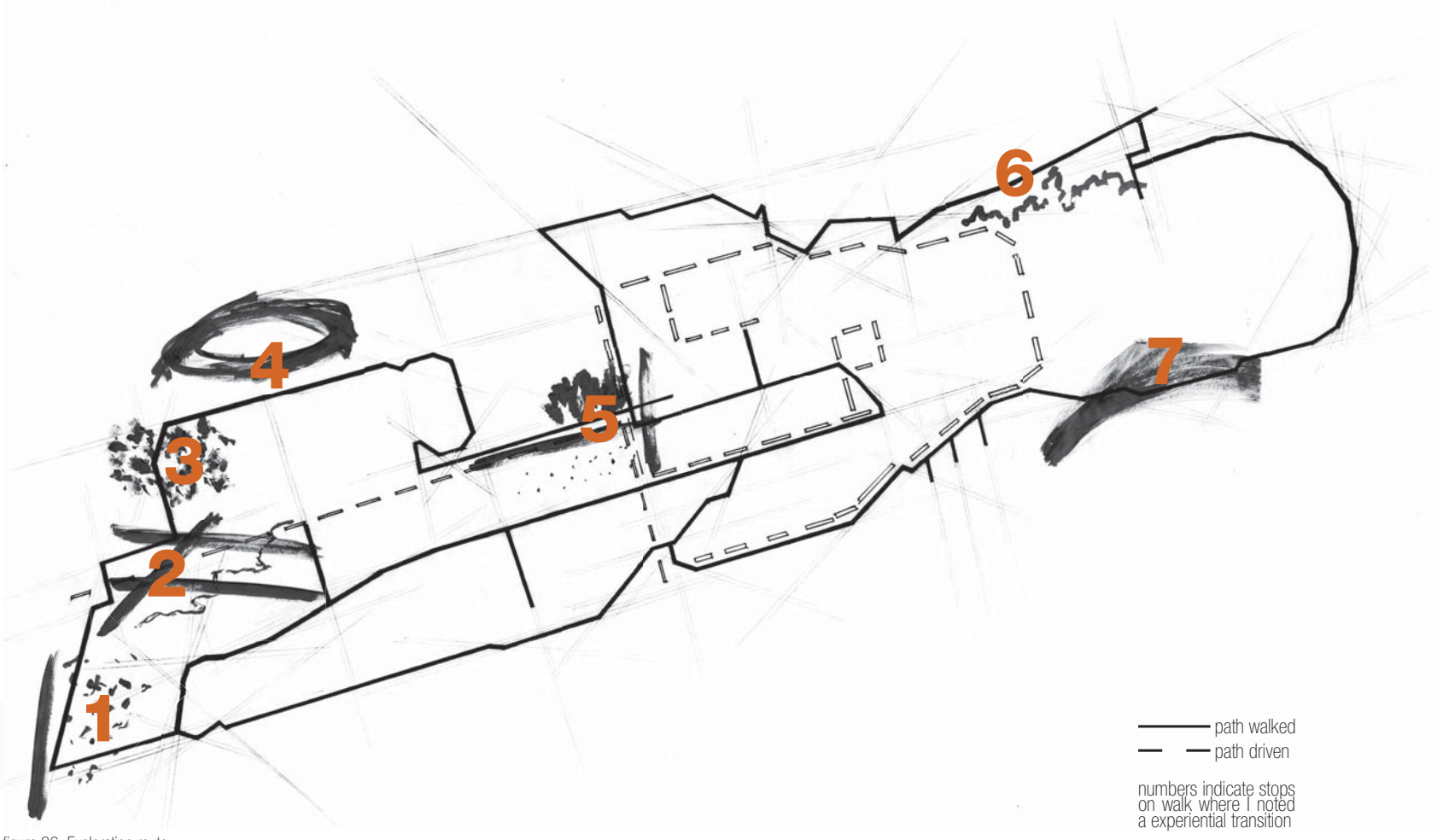



figure 36 Exploration route

## walking the site

During spring and summer 2012, over a series of different days, I took various walks around the University of Manitoba Fort Garry Campus. The path I followed was never planned and I recorded my journey when I was finished for the day. My goal was simply to experience the site. I wanted to experience the site before I began any of my research about the campus and biophilia to remove the chance of channeling my experience. I tried to become aware of how I was feeling, and note when I felt my emotions change and try to recognize the cause of the change. I found myself stopping in different spots to rest, reflect, or just be, however, not always for a positive reason. Gestural drawings were used to visually express my emotions in some of these areas. I found after a while that I would experience similar emotions in different spaces around the campus. I identified seven variations of emotions I experienced while walking and driving the campus grounds.

**1** neglected. chaotic. exposed. traffic. barrier. unused. waste.

**2** barrier. traffic. isolated. lost. confused. loud. noise. uncomfortable.

**3** chaotic. garbage. dirty. neglected. trespassing. awkward.

peaceful. cozy. relaxed. wonder. awe. beautiful. safe. enclosed. **4**

traffic. construction. noise. barrier. uncomfortable. dangerous. **5**

weird. creepy. unsafe. neglected. trespassing. disconnected. **6**

away. small. peaceful. tranquil. relaxed. safe. beautiful. wonder. **7**

figures 37-43

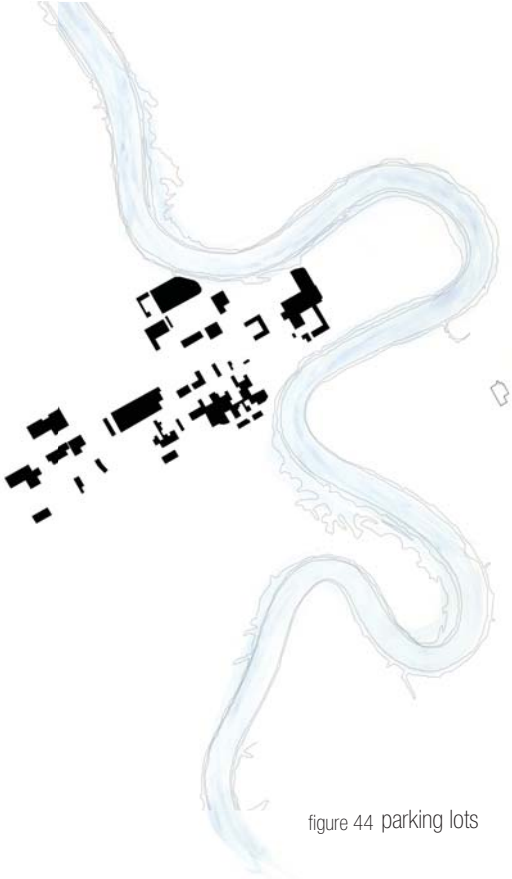


figure 44 parking lots

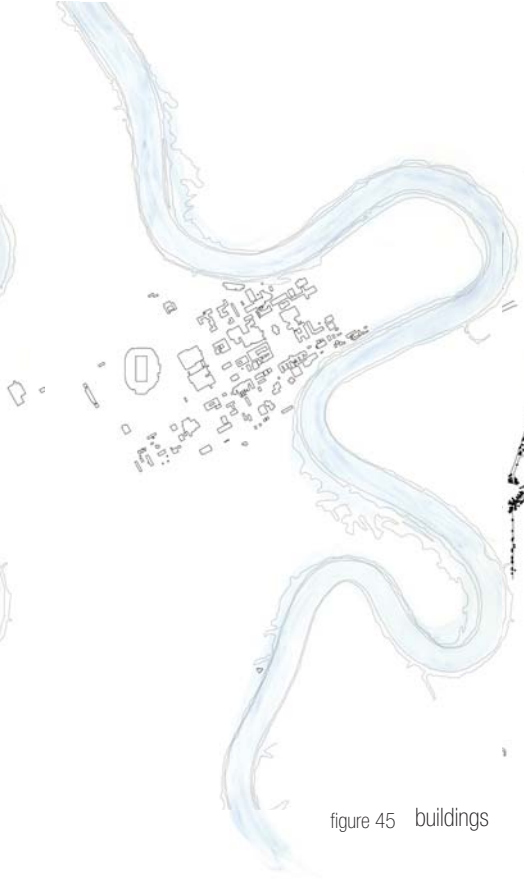


figure 45 buildings

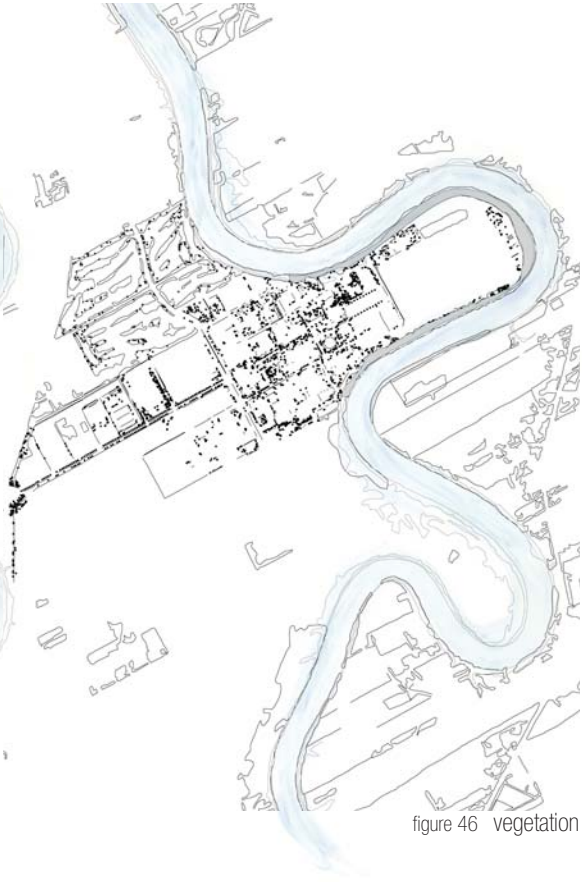


figure 46 vegetation

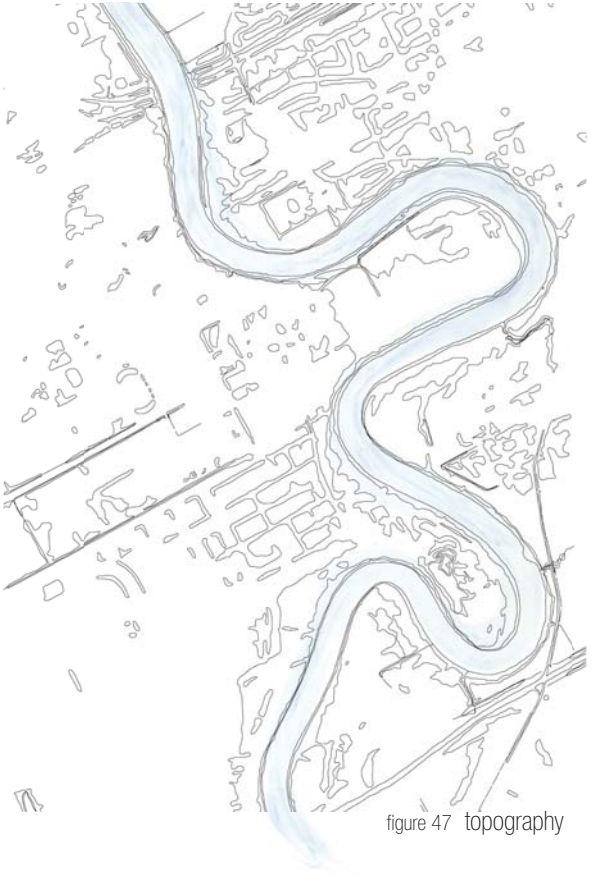


figure 47 topography

## physical features

The University of Manitoba Fort Garry campus is covered largely by paved parking lots and buildings, but still maintains a fairly full tree canopy throughout the site. There are currently 30 parking lots on campus that are all large, expansive surface parking areas, and one multi-level parkade adjacent to the Helen Glass Centre for Nursing and University Centre. The topography of the campus remains primarily flat as the land pulls away from the river bank. There are several dykes that have been contructed throughout the site to protect the campus from the flooding of the Red River in the spring (Manitoba Land Initiative, 2012). A detailed analysis of vegetation on the Campus will follow.


figure 48 road network


figure 49 vehicular

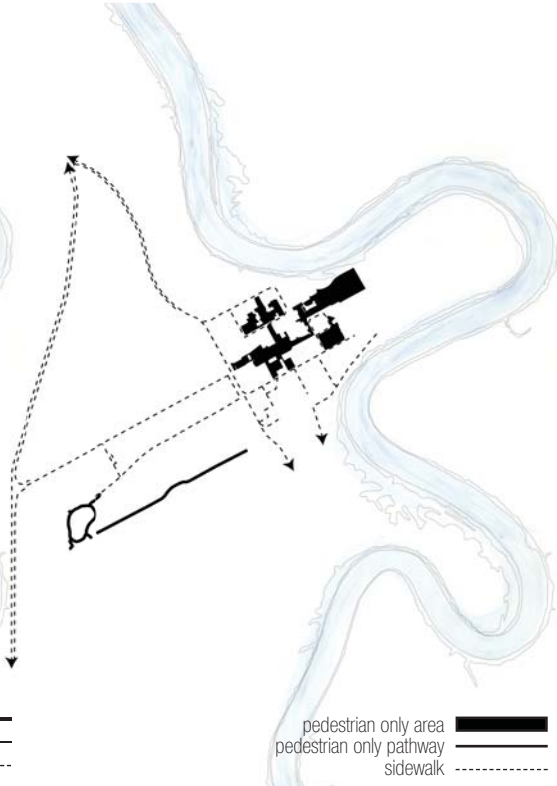



figure 50 pedestrian

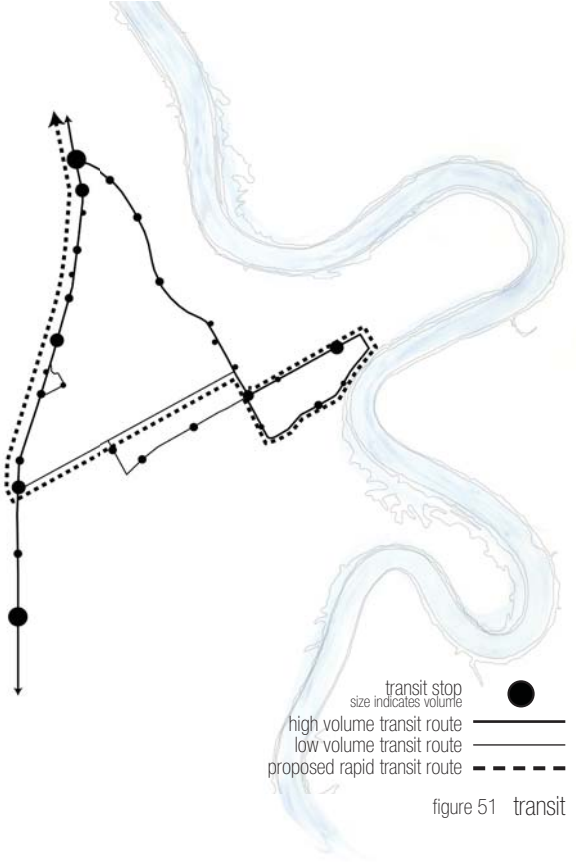



figure 51 transit

## circulation

The Fort Garry campus is enclosed by two major highways to the north, Bishop Grandin Boulevard, and to the west, Pembina Highway, and by the Red River to the east. This only allows for two main entrances into the campus along the west side, and an additional three minor entrances extended from the adjacent residential neighbourhoods. High volumes of private vehicular traffic travel through the campus, and this is currently the most efficient way to traverse the site. Pedestrians primarily share thoroughfares with motor vehicles, with a few pedestrian-only areas found between buildings, and the newly constructed pedestrian mall running parallel to Dafoe Road. Winnipeg Transit University Station is located within the core of the campus, and there are seven other stops throughout the campus (Winnipeg Transit, 2012).

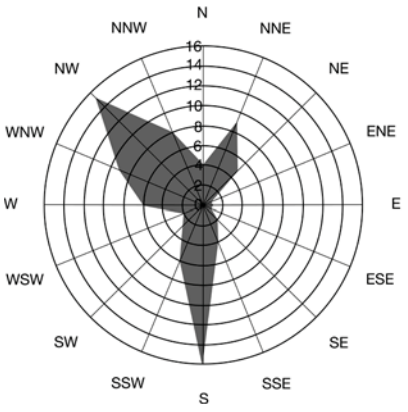



figure 52 wind rose winter

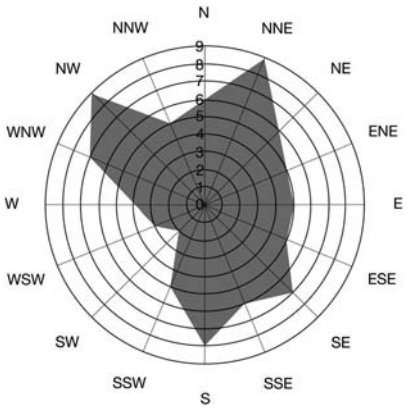



figure 53 wind rose spring

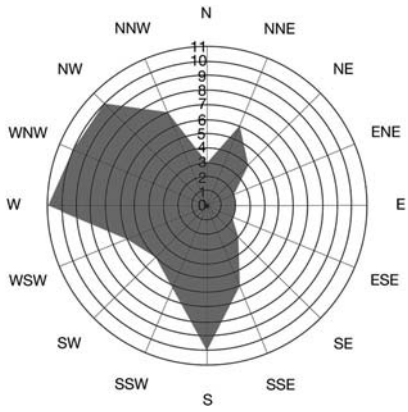



figure 54 wind rose summer

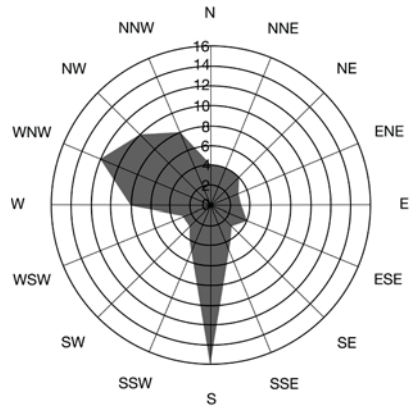



figure 55 wind rose fall


figure 56 dominant wind direction

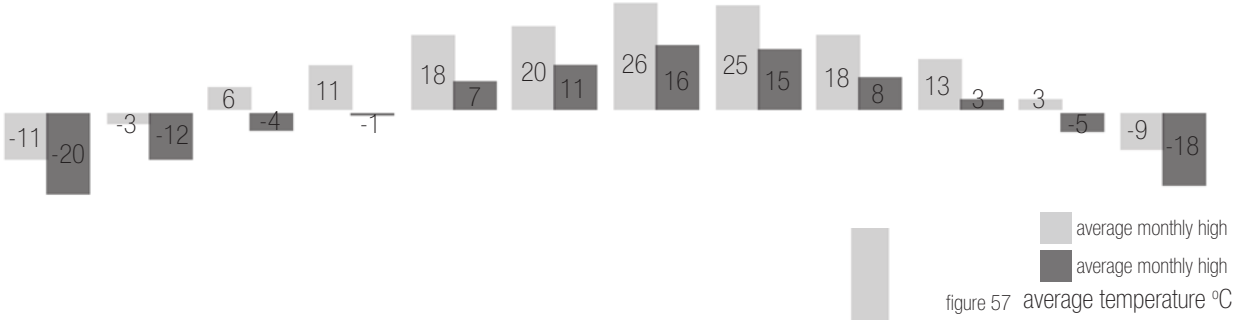



figure 57 average temperature °C

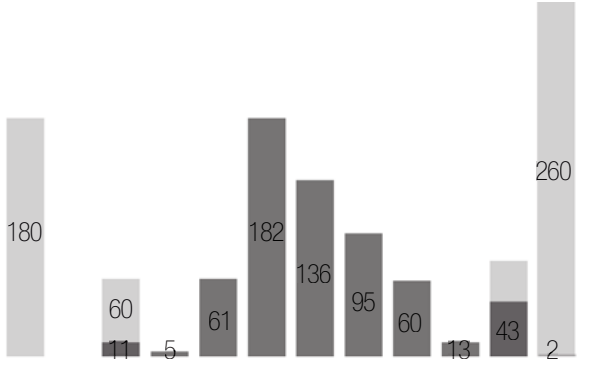



figure 58 average precipitation mm

## climate

The City of Winnipeg experiences an extreme range in temperature throughout the year with an average high of 26 degrees Celcius in the summer and low of -20 degrees Celcius in winter. High volumes of snow are seen during the months of December and January, and the highest amount of rain during the month of June. Winnipeg is known to be a very windy city, with the prevailing winds primarilty from the south throughout the year. (Winnipeg Airport, 2012).

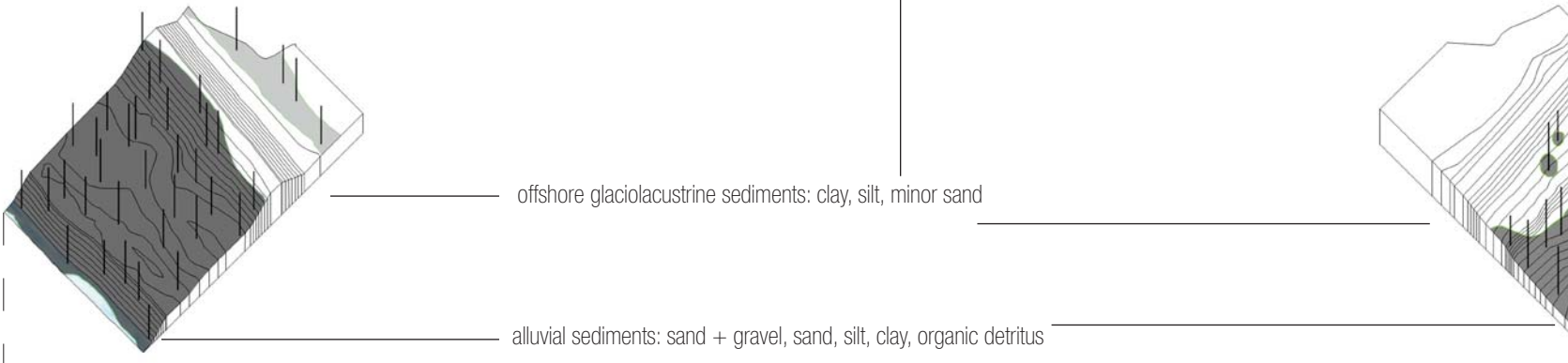
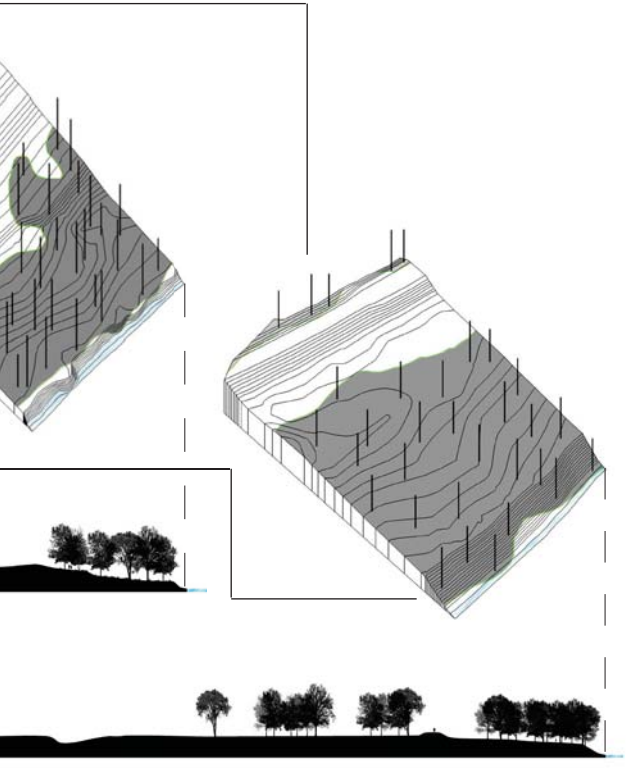



figure 59 Section north-south through point lands

figure 60 Section east west through point lands



## riverbank composition

Sections were taken through The Point Lands of the campus to analyze the changes of the river bank along the south, east, and north sides of the campus, and how it affects the composition of the vegetation on the banks at each side of The Point. The top section shows the north and south banks, while the bottom section shows the east bank. Soils in the riparian zone are sandy clay loam, with high levels of moisture in March and April. Moderate moisture can be expected for most of the year due to rainfall. On the south bank of The Point, large volumes of soil have been deposited which has resulted in buried root systems and is contributing to the decline of the vegetation in this area. The 1997 flood brought the most recent deposition to the south bank (Mumby's Tree Service, 2000, p.1).

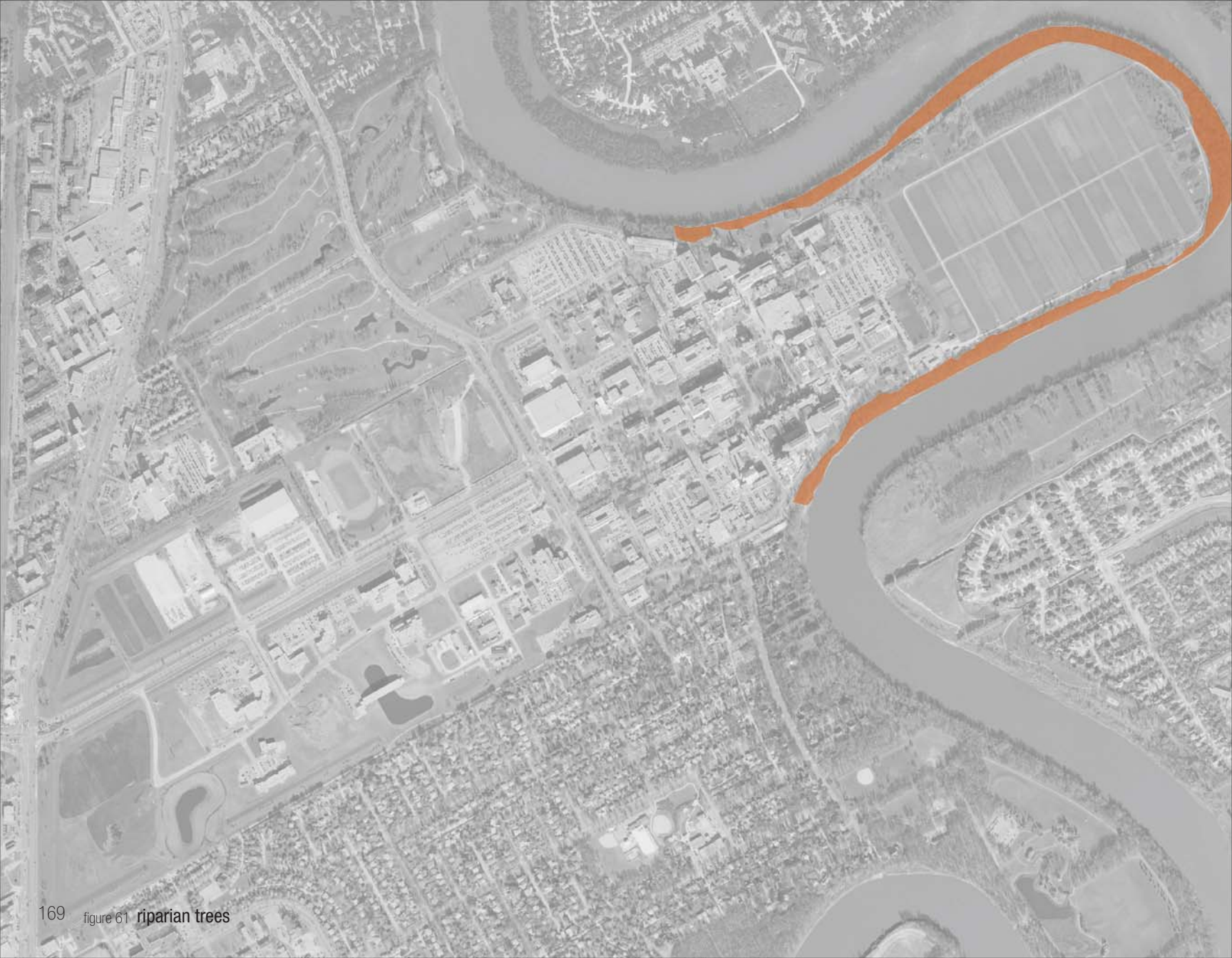


 figure 61 riparian trees

## vegetation | riparian zone

In 2000 the riparian area around The Point Lands was inventoried for the following: structure, crown class, soil type, soil moisture, obstructions to trees, condition of trees, number, average age, average height, average diameter at breast height of the trees, species of shrubs present, percent canopy cover, cavity tree habitats, and forest regeneration. The structure is comprised primarily of Green Ash and American Elm and is primarily unevenly aged. Approximately half of the stands have co-dominant crown classes made up of Manitoba Maple, Bur Oak, Basswood, American Elm, and Green Ash (Mumby's Tree Service, 2000, p.1). The average age of the mature stands is approximately 85 years, whereas the younger stands range from 25-60 years. The total shrub cover ranges from 15-47%, on the south side seeing dominant species of Dogwood, Saskatoon, Grape, and Bittersweet, and the north adding to this with Current, Viburnum, Hawthorn, and Lilac. The canopy cover in winter is 40-65%, and during the summer months it sees an increase of 15-20% (Mumby's Tree Service, 2000, p.2).

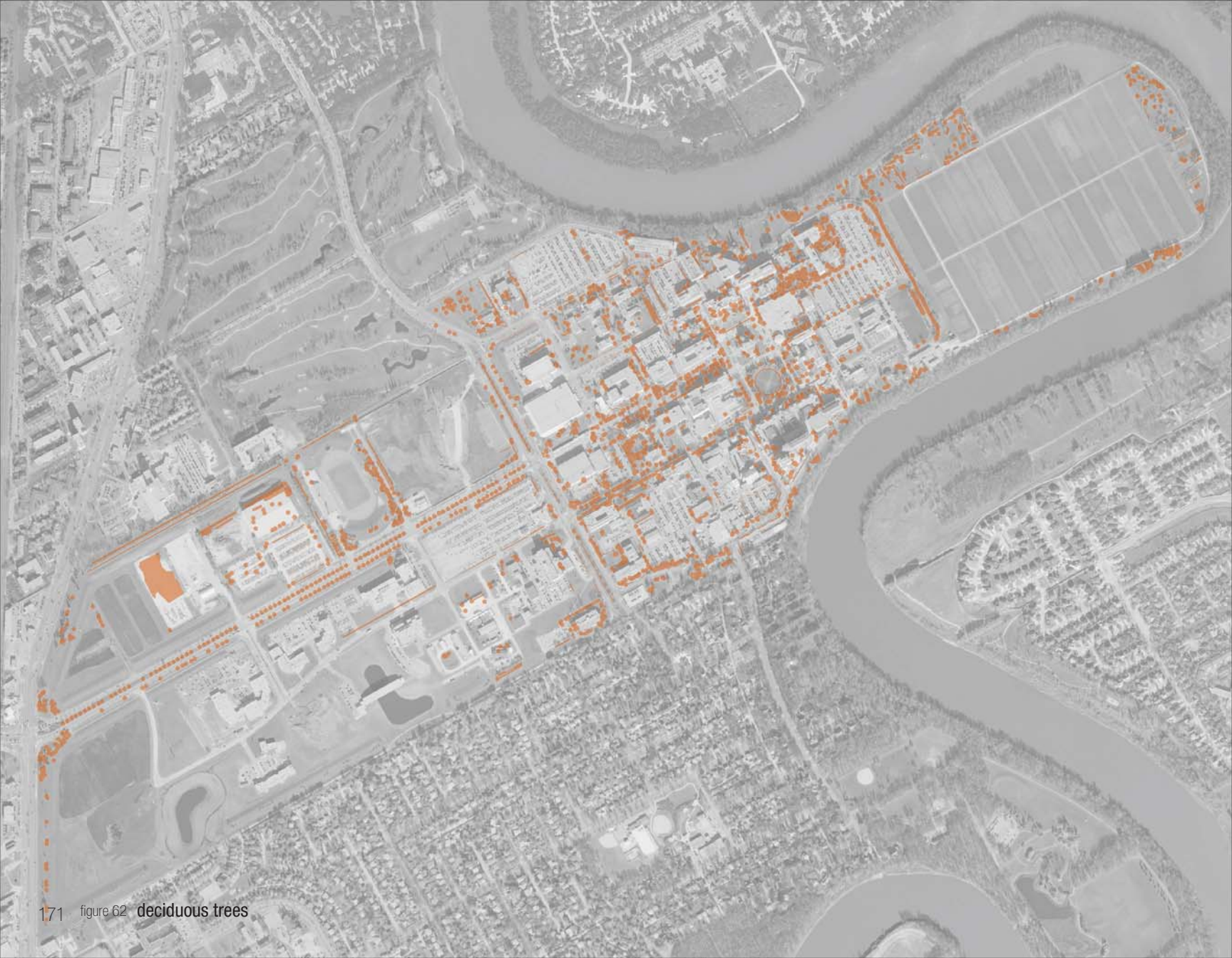


 figure 62 deciduous trees

## vegetation | trees

Between March 17 to April 14, 2000, a trees inventory was conducted for the University of Manitoba Fort Garry Campus by Mumby's Tree Service. They took a complete inventory of all the trees, shrubs, and shrub beds on the Campus. The purpose of the inventory was to determine the numbers in each category, species composition, health, management requirements, and the value for landscape on the Campus. They used Global Positioning System Equipment to locate each of the trees (Mumby's Tree Service, 2000, p.1).

The inventory includes 7,6000 trees comprised of 63 different species, 80% of which were deciduous. 77% of the total species was comprised of ten abundant species, listed in figure 63. They found there to be 1970 individual deciduous trees and 609 deciduous tree rows, and 435 individual coniferous trees and 175 coniferous tree rows (Mumby's Tree Service, 2000, p.2).

 figure 63 coniferous trees

The value of the trees on the Fort Garry Campus state an excess of $6.5 million, the highest valued trees being the American Elm. Unfortunately, many of the trees, primarily the elm and willow, are either reaching maturity or have been affected by disease and require removal. The degraded condition of these trees brings the value of the trees on Campus down by 25% of the total potential (Mumby's Tree Serive, 2000, p.3).

An inventory of the shrubs on Campus counted a total of 231 shrubs comprised of 33 different species. The ten most frequent shrub species make up 75% of the total. A listing of these species, both individual shrubs and dominant shrubs in shrub beds can be found in figures 64 and 65 (Mumby's Tree Service, 2000, p.5-6).

## abundant tree species

| Species | Number | % of Total |
|---|---|---|
| Green Ash | 1281 | 16.9 |
| Golden Willow | 763 | 10.1 |
| Basswood | 656 | 8.6 |
| American Elm | 642 | 8.5 |
| White Spruce | 558 | 7.4 |
| Siberian Elm | 554 | 7.3 |
| Colorado Spruce | 495 | 6.5 |
| Scots Pin | 415 | 5.5 |
| Amur Maple | 290 | 3.8 |
| Crabapple-Rosybloom | 218 | 2.9 |
| Total | 5872 | 77.4 |

figure 64 (Mumby's Tree Service, 2000, p.2)

A complete listing of the Mumby's Tree Service inventory for the University of Manitoba Fort Garry Campus can be found in Appendix I-III.

## dominant shrub in shrub bed

| Species | Number of Beds |
|---|---|
| Red Osier Dogwood | 33 |
| Common Lilac | 27 |
| Cotoneaster | 26 |
| Common Caragana | 24 |
| Alpine Currant | 22 |
| Honeysuckle | 22 |
| Horiz Juniper | 19 |
| Savin Juniper | 17 |
| Mugo Pine | 16 |
| Viburnum | 15 |
| Total | 221 |

figure 65 (Mumby's Tree Service, 2000, p.5)

## abundant individual shrub species

| Species | Number |
|---|---|
| Common Lilac | 43 |
| Red Osier Dogwood | 40 |
| Honeysuckle | 29 |
| White Cedar | 13 |
| Cotoneaster | 9 |
| Ground Juniper | 8 |
| Savin Juniper | 8 |
| Other | 8 |
| Common Caragana | 7 |
| Red Elder | 7 |
| Total | 172 |

figure 66 (Mumby's Tree Service, 2000, p.6)




figure 67

## flooding

The Red River experiences flooding on an annual basis, with the most notable floods in the last 60 years being in 1950, 1997, and 2009. The detrimental effects of Red River flooding have been signficantly reduced due to the construction of the Red River floodway. Shown here is how the University of Manitoba Fort Garry campus may be potentially impacted by flooding. The floodway line is the area that is annually inundated by flooding when the floodway gates are closed. The floodway fringe line is the extent of water in the case of a major flood (Manitoba Government, 2012).

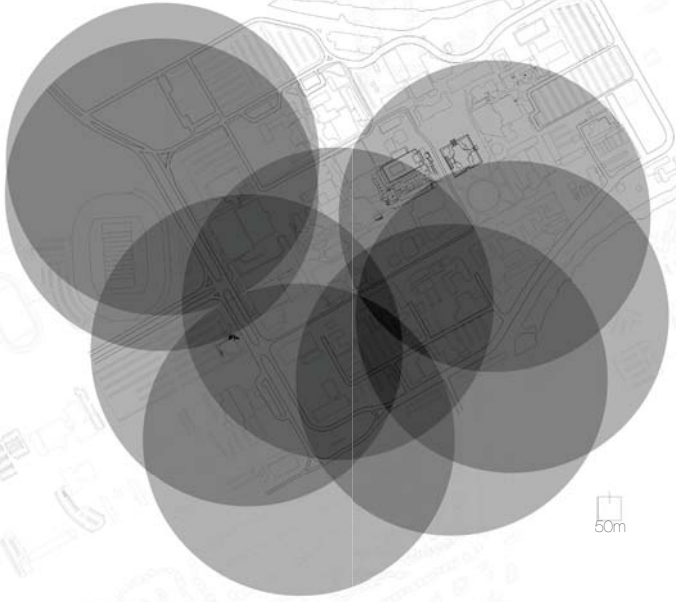



figure 68 existing transit stops + 5-minute walk radius

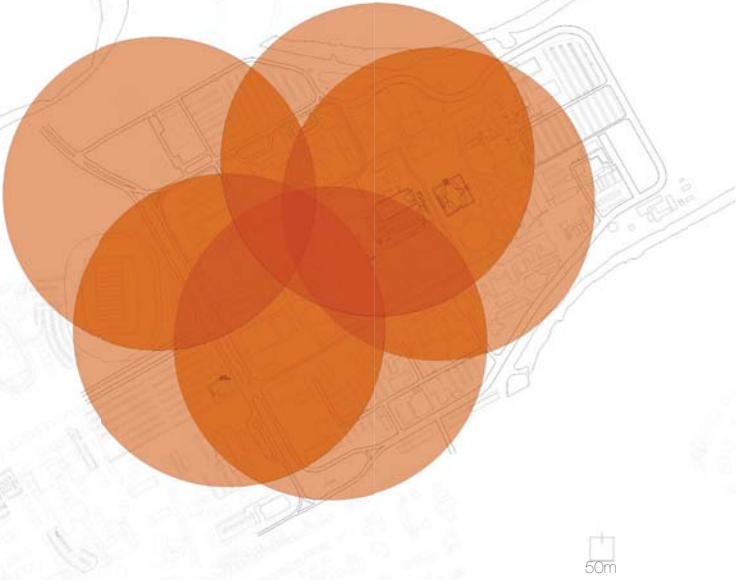



figure 69 proposed transit stops + 5-minute walk radius

## 5-minute walk radius | transit

Through the analysis of how people and traffic move throughout the site, I came to find that there are significant gaps on the north and east portions of the campus that did not provide convenient access to transit. The current number of stops and the route of the busses through the site proves to be inefficient. Shown here is how the new proposed transit route reduces the number of stops from the current 8 to 5 while covering a larger footprint of the campus core more efficiently. With the new bus route, the northern portion of the campus becomes more walkable from public transit without compromising service to the rest of the campus. Underutilized bus routes along the existing route have been removed and stops have been relocated to more convenient, high pedestrian traffic areas.

pedestrian movement



figure 70

## articulation of the campus

An analysis of the site was conducted through various drawings lain over site maps of the campus. The line drawing extends lines from each edge of any physical features throughout the site, bringing to light the strong grid that exists on the campus, and which every building and road follows. The grid shows the intensity of articulation of the physical features of the Campus. A ten metre buffer zone was drawn around each of the buildings, creating zones of opportunity for potential plantings. Pedestrian traffic was visually measured and articulated through freehand drawing from important nodes around the campus highlighting the pedestrian movement throughout the campus grounds. Overlaying the various drawings revealed areas of opportunity and started to inform the layout of the design and plantings.

# chapter six

## design | biophilic design framework

## introduction

The site analysis reveals several areas of opportunity throughout the campus. The current circulation of traffic impedes pedestrian movement throughout the campus and creates a dangerous environment, suggesting that private vehicles be re-routed to the perimeter and removed from the interior of the Campus. Public transit is currently inconvenient and inefficient which presents the opportunity to make transit more user friendly to visitors of the Campus. With a large number of trees on the Campus reaching maturity, there is the opportunity to re-forest the campus and significantly increase the canopy. As well, there is no access to the surrounding Red River, which is a key natural element within the City of Winnipeg, however, underutilized. Proposed are a set of strategies for the Fort Garry Campus to improve circulation and increase the tree canopy. Other areas of potential opportunity have been identified for future biophilic intervention.


potential connection to river
via pedestrian pathway
dysart road
sanderson centre
university crescent
new transit priority route
one lane traveling east bound
one lane parkade access
ralph campbell road
transit station
administration + university centre
pedestrian + cyclist only
access to vehicular traffic removed
transit priority route
one lane traveling west bound
potential connection to river
via pedestrian pathway
chancellor matheson road
transit station
chancellor matheson
at university crescent
50m
proposed transit route



figure 71

## strategy | circulation

The new one-way transit priority route was developed through the core of the campus, eliminating all other vehicular traffic within the core and concentrating it to the perimeter of the campus. This still allows vehicles access to the parking lots located around the periphery while creating a pedestrian oriented center, allowing students, staff, and visitors the opportunity to move about the campus freely and comfortably. Two new stations have been proposed at the Administration and University Centre buildings, and the junction of University Crescent and Chancellor Matheson Road. This provides more convenient and central access to some of the key buildings on campus, as well as more direct access to the underground tunnel system. Emergency and service vehicles will maintain access to all buildings on campus.

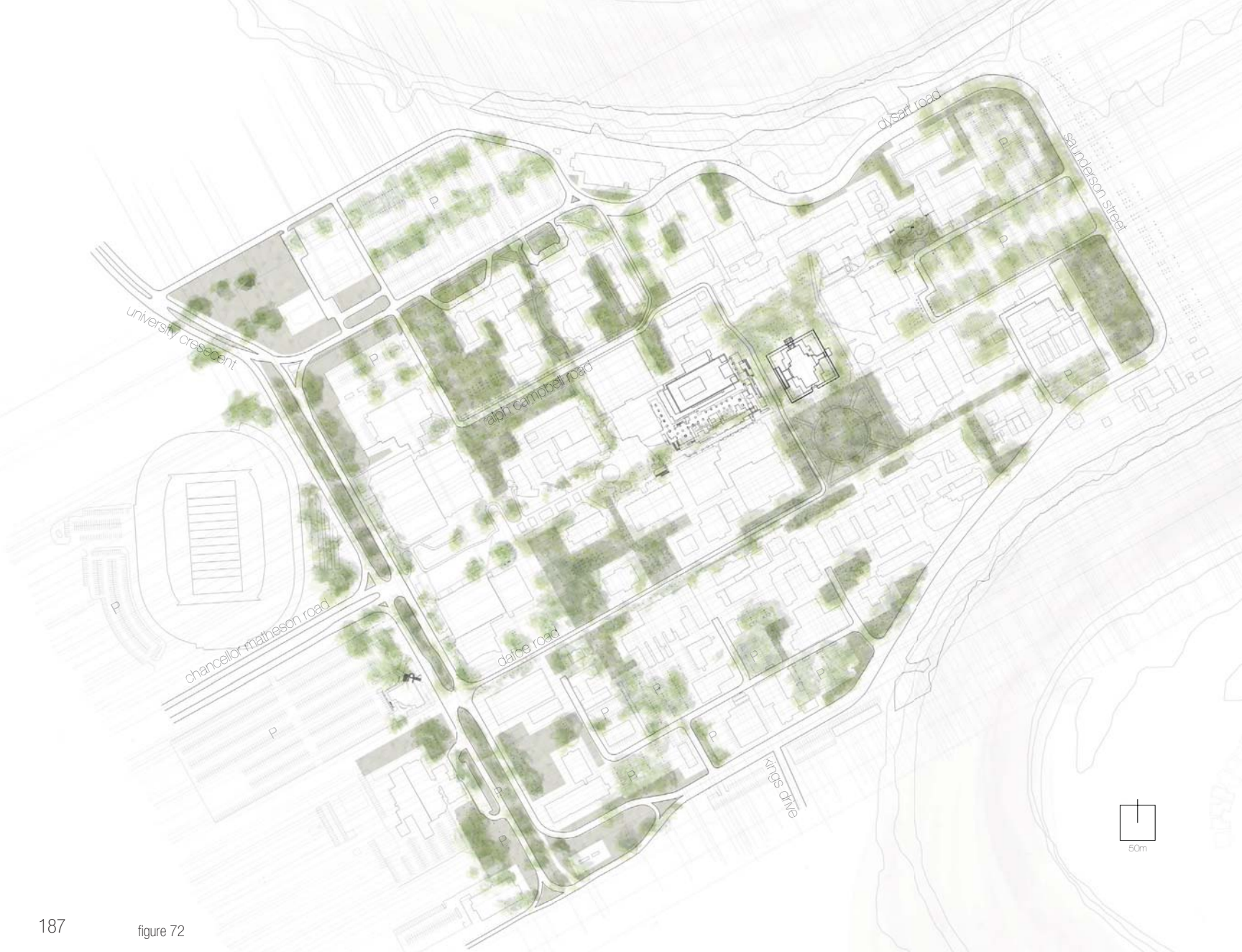

university crescent
ralph campbell road
chancellor matheson road
dafoe road
kings drive
d'arcy road
saunderson street
P
50m



figure 72

## strategy | re-forestation

The campus is enclosed by the Red River and a rich riparian zone, which has been lost within the campus core. I am proposing and ecological restoration by reintroducing the riparian system back into the campus by planting riparian species. The plantings will follow the same strong grid that the current campus follows. This will also inform the densities of the forest by planting a tree at each intersection of the lines of the grid. The ground plane will transition from paved to vegetated understorey, informed by areas of high traffic pedestrian movement. The groundcover in the understorey areas will be allowed to naturally reclaim itself, however, with maintenance, the shrub layer will be removed to allow for views through the spaces and provide a feeling of comfort and safety for pedestrians. A ten metre buffer has been extended from each of the buildings, so they appear throughout the campus as though they are situated in clearings in the forest. This buffer has left several exposed areas amongst the buildings, providing the opportunity for open lawn areas for people to lie out in the sun.

*Picea glauca*
white spruce
18m tall x 6m wide

Ulmus americana
'Lewis + Clark'
prairie expedition elm
18m tall x 12m wide

*Quercus macrocarpa*
bur oak
18m tall x 12m wide

*Fraxinus pennsylvanica*
green ash
16m tall x 10m wide

*Apocynum androsaemifolium*
spreading dogbane
june-september

*Aster simplex*
small blue aster
august-october

*Beckmannia syzigachne*
slough grass
june-july

*Carex spp.*
sedge
april-june

*Convolvulus sepium*
wild morning-glory
july-september

*Deschampsia caespitosa*
tufted hairgrass
june-september

*Phalaris arundinacea*
reed canary grass
june-july

*Smilacina stellata*
star-flowered solomon's-seal
may-june

*Smilax herbacea*
carrionflower
may-june



figure 73

*Acer negundo*
manitoba maple
13m tall x 12m wide

*Tilia americana*
Basswood
16m tall x 10m wide

*Bidens frondosa*
common beggarticks
july-october

*Menispermum canadense*
yellow parilla
june-july

*Thalictrum venulosum*
veiny meadow-rue
may-august

## proposed vegetation

### tree species

A mixed planting of white spruce, Prairie Expedition elm, bur oak, green ash, manitoba maple, and basswood will be introduced into the campus. The species have been sourced from the existing riparian zone around the campus, with the exception of the American elm. Due to the presence of Dutch elm disease, the Prairie Expedition elm will planted as a replacement for its resistance to the disease.

### understorey species

The understorey species have been sourced from the surrounding riparian zone, selecting only the native species. The understorey areas will be allowed to naturally reclaim the spaces, changing the composition of the plantings.




figure 74 Plan

## detail one | re-forestation, pedestrian and transit priority

### dafoe road + school of music

The proposed transit corridor reduces Dafoe Road down to a single lane, expanding the pedestrian area to create a more comfortable environment for people to traverse. The reduced amount of traffic traveling along Dafoe Road will give the pedestrian priority and allow for uninterrupted movement through the area.

figure 75 Perspective facing east on Dafoe Road


figure 76 Section




figure 77 Plan

## detail two | re-forestation, pedestrian and transit priority

## administration + university centre transit station

The removal of vehicles from the surround of the Administration building creates the opportunity for the celebration of the iconic building and reduces the chaos around the entrance to University Centre and Dafoe Library. The new transit station location provides more central access to key buildings on campus as well as the underground tunnel system.

figure 78 Perspective facing north towards Administration

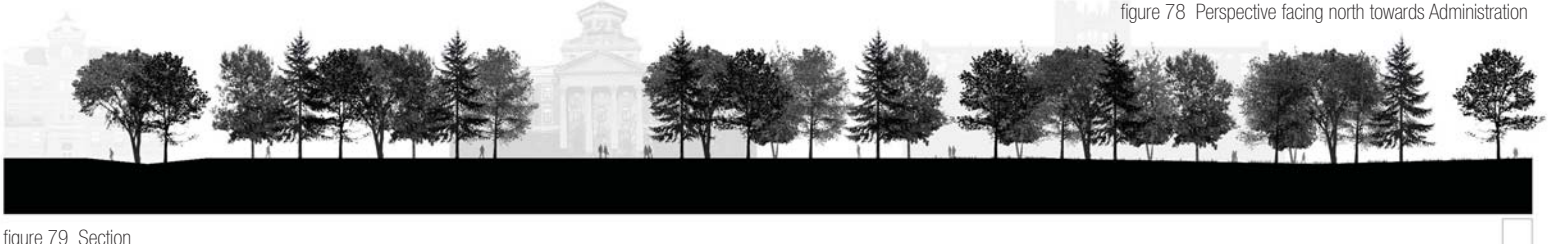



figure 79 Section




figure 80 Plan

## detail three | re-forestation

## east campus parking

The eastern portion of the campus core will see the expansion of vehicular traffic to four lanes to accommodate the increased volumes of traffic from the concentration to the perimeter. The presence and scale of the large parking areas will appear to be reduced from the presence of the newly planted forest areas, as well as providing added shelter from the elements for people as they move to and from their vehicles.

figure 81 Perspective facing north towards parking lot


figure 82 Section

## biophilic design at the university of manitoba

The design of the strategy for the University of Manitoba Fort Garry Campus was apprached as a restorative environmental design, a biophilic design approach that fosters beneficial contact between people and nature in modern landscape. One of the basic dimensions of biophilic design is the naturalistic dimension, which is apparent through both direct and indirect experience throughout the site. Within the Campus Core contact with nature will require human input to survive, whereas in surrounding riparian area contact with nature is unstructured and self-sustaining (Kellert et al., 2008, p.5).

The basic dimensions of biophilic design, as mentioned earlier, are broken down into six biophilic design elements. Present in the proposed strategy are environmental features, natural patters and processes, light and space, place-based relationships, and evolved human-nature relationships.

Environmental features is the use of well-recognized characteristics of the natural world in the built environment, such as water, air, sunlight, plants, animals, natural materials, and views (Kellert et al., 2008, p.6). By reintroducing the riparian environment back into the Campus Core these natural elements will be part of the everyday landscape. Natural patterns and processes incorporates properties found in nature into the built environment, such as change, growth, central focal point, and transitional spaces (Kellert et al., 2008, p.9). The plantings will provide constant change and growthing within the campus, and the framework they follow provides various transitional spaces as one moves through the Campus, and makes key buildings, such as the Administration Building, a central focus. Light and space incorporates natural light, filtered and diffused light, and light and shadow (Kellert et al., 2008, p.11). The varying spacing of the planting of the trees will create variations within the tree canopy, which will allow for a change in light throughout the Campus. Place-based relationships is when the connection of people to palces

reflects an inherent human need to establish territorial control, which “during the long course of our species’ evolution facilitated control over resources, attaining safety, and achieving security” (Kellert et al., 2008, p.12). By planting the trees on the same grid as the buildings on Campus,, and removing private traffic within the Campus Core, it provides visitors a sense of control in their environment, and pedestrians and feeling of safety. Finally, evolved human-nature relationships are the fundamental aspects of the inherent human-nature relationship, such as order and comlpexity, curiosity and enticement, attraction and beauty, and exploration and discovery (Kellert et al., 2008, p.13). Once again the framework of the plantings provides a sense of order, while the changing ground plane from paved to pervious creates complexity, and maintaining views throughout the campus allows for curiosity, exploration, and discovery.

# chapter seven
# conclusion

"We are learning more every day about the benefits to health and well-being of a connection to nature in daily life, including hospitals, schools, offices, suburban neighborhoods, and high density urban housing" (Kellert et. al, 2008, p.227). For years, various groups of people, from philosophers to scientists, have tried to rationalize how human life is enriched by the natural world and how a lack of a relationship with nature may lead to a less satisfactory existence. The biophilia hypothesis suggests that the dependence we have on nature extends beyond a simplistic material need. We also require an association with nature for aesthetic, intellectual, cognitive, and spiritual meaning (Kellert & Wilson, 1993, p.20). The more knowledge we gain in regards to biophilia and how it can be used in the

figure 83  south riverbank

design of urban environments, the more we will come to realize that nature is an essential part of our lives, not an option (Beatley, 2011, p.3). Unfortunately, until the theory of biophilia becomes more widely understood in our culture, we will continue to exploit what little natural environment we have left for resources and pollute it with our technologically dominated lifestyles (Kellert & Wilson, 1993, p.5). We are living in a time where the term "green" has become a buzz word, and to a certain extent we have forgotten an important aspect of the concept. It has become so focused on, and reduced to, energy efficiency, which is still a critical issue that needs to be addressed, that the "life-enhancing and wonder-expanding dimensions of nature itself" has been neglected (Beatley, 2011, p.16). This begs the question: why? As Orr (1994) suggests, human beings are in denial of the trap we have set for ourselves. We believe that every issue may be solved or addressed

by technology and money, and although to an extent these things can help, we are faced with a problem rooted in mind, will, and spirit. Orr believes that we will remain in a state of denial until something like a "worldwide ecological perestroika, predicated on the admission of failure" occurs (Orr, 1994, p.145). He further describes this realization of failure as:

> "the failure of our economics, which became disconnected from life; the failure of our politics, which lost sight of the moral roots of our commonwealth; the failure of our science, which lost sight of the essential wholeness of things; and the failures of all of us as moral beings who allowed these things to happen because we did not love deeply and intelligently enough" (Orr, 1994, p.145).

Once we have come to this realization, people will begin to see that nature must

be reintroduced into our everyday environments, and any surviving nature must be restored. Local ecology should be intertwined with the economy and life patterns, and the use of motor vehicles reduced and our ties to commercial culture loosened (Orr, 1994, p.147). "A biophilic city is a city abundant with nature, a city that looks for opportunities to repair and restore and creatively insert nature wherever it can" (Beatley, 2011, p.2). We need to make the places that we live the areas of our escape, relaxation, and pleasure. The opportunity is there, it just needs to be embraced.

"Re-energizing our symbiotic relationship with nature in an urbanizing landscape is perhaps one of the most pressing needs and potent opportunities of our time" (Brown, 2011, p.95). It is becoming increasingly important that we recognize and understand that the design of our external environments affects not

only the health of the environment but equally the health of its users. Technology is rapidly advancing and our world is beginning to see struggles in order to keep up to the demands we place on it to maintain this type of lifestyle. We also face a time where an increasing number of people prefer to be within the confines of an interior, climate-controlled environment. By providing exterior spaces that address these issues we will alleviate the environment and allow it to regenerate, as well as entice people to go outside and reconnect with nature. The well-being of both humans and nature have the chance to be significantly impacted in a positive way by the environments we design.

opposite page: figure 84  south riverbank

## list of figures

figures 1-16: photo taken by author.

figures 17-18: drawn by author.

figures19-26: photos from Trevelo & Viger -Kohler.

Copyright permission granted February 5, 2013

figures 27-31: photos from Andrew Fox.

Copyright permission granted March 1, 2013

figure 32: drawn by author.

figures 33-34: photo taken by author.

figure 35-36: drawn by author.

figure 37-43: photos taken by author.

figures 44-51: drawn by author. Information from Manitoba Land Initiative, 2012.

figures 52-58: drawn by author.  Information from Winnipeg Airport, 2013.

figures 59-60: drawn by author.

figures 61-63:  drawn by author. Information from University of Manitoba Campus Planning, 2013; Manitoba Land Initiative, 2012.

figures 64-66: Mumby's Tree Service, 2000.

figure 67: drawn by author.  Information from University of Manitoba Campus Planning, 2013.

figures 68-72: drawn by author.

figures 73: photos taken by author.

figure 74-82: drawn by author.

figures 83-84: photo taken by author.

## references


Appleton, J. (1975). The experience of landscape. London, New York: Wiley.

Baum, A., Singer, J., and Baum, C. (1982). Environmental stress. Cambridge Cambridgeshire New York: Cambridge University Press.

Beatley, T. (2011). Biophilic cities: integrating nature into urban design and planning. Washington, DC: Island Press.

Bechtel, R. & Churchman, A. (2002). Handbook of environmental psychology. New York: J. Wiley & Sons.

Brown, H. (2011). Restorative commons: creating health and well-being through urban landscapes. Newtown Square, PA: USDA Forest Service, Northern Research Station.

Bumsted, J. (2001). A networked community – University of Manitoba campus plan. Winnipeg, MB.

Cassidy, Robert. (2009). Transsolar Climate Engineering: Moderating The Design Process. Retrieved June 2, 2012 from http://www.bdcnetwork.com/transsolar-climate-engineering-moderating-design-process

Campbell, L. & Wiesen, A. (2011). Restorative commons: creating health and well-being through urban landscapes. Newtown Square, PA: USDA Forest Service, Northern Research Station.

Cervinka, R., Röderer, K., Hefler, E. (2011). Are nature lovers happy? On various indicators of well-being and connectedness with nature. Los Angeles: Sage Publications.

Cooper Marcus, C. (2009). Gardens and health. International Academy for Design Health. Retrieved April 1, 2013 from http://www.designandhealth.com/uploaded/documents/Publications/Papers/Clare-Cooper-Marcus-WCDH2000.pdf

Groenewegen, P.P., van den Berg, A., de Vries, S., Verheij, R. (2006). Vitamin G: effects of green space on health, well-being, and social safety. BMC Public Health: 6:149.

Holmes, D. (2012). The Artists' Backyard: Phase 1. Retrieved November 10, 2012 from http://worldlandscapearchitect.com/?p=10869.

Holmes, D. (2012). New Campus & Healing Gardens for Nationwide Children's Hospital. Retrieved November 12, 2012 from http://worldlandscapearchitect.com/new-campus-healing-gardens-for-nationwide-childrens-hospital-columbus-usa-olin/.

Kaplan, R. (1998). With people in mind : design and management of everyday nature. Washington, D.C: Island Press.

Kellert, S., Heerwagen, J.H., Mador, M.L. (2008). Biophilic design : the theory, science, and practice of bringing buildings to life. Hoboken, N.J: Wiley.

Kellert, S. & Wilson, E. (1993). The Biophilia hypothesis. Washington, D.C: Island Press.

Kopec, D. (2006). Environmental psychology for design. New York: Fairchild.

Lau, S. & Yeng, F. (2009). Introducing healing gardens into a compact university campus: design natural space to create healthy and sustainable campuses. Landscape Research, 34:1, 55-81.

Lauster, M. & Olsen, E. (2008). High comfort low impact. Stuttgart: fmo publishers.

Maas et. al. (2006). in Verheij, R.A., Maas, J., Groenewegen, P.P. (2008). Urban-rural differences and the availability of green space. Los Angeles: Sage Publications.

Manitoba Government. (2012). Manitoba flood facts. Retrieved November 27, 2012 from http://www.gov.mb.ca/flooding/historical_facts.html

Manitoba Land Initiative. (2012). Manitoba Land Initiative digital maps. Retrieved June 21, 2012 from http://mli2.gov.mb.ca/

Martensen, R. (2011). Restorative commons: creating health and well-being through urban landscapes. Newtown Square, PA: USDA Forest Service, Northern Research Station.

MKSK Studios. (2012). Nationwide Children's Hospital. Retrieved November 12, 2012 from http://www.mkskstudios.com/projects/nationwide-childrens-hospital-columbus-ohio.html

Mumby's Tree Service. (2000). Riparian forest inventory: University of Manitoba Fort Garry Campus. Retrieved from University of Manitoba Campus Planning.

Mumby's Tree Service. (2000). Tree inventory: University of Manitoba Fort Garry Campus. Retrieved from University of Manitoba Campus Planning.

Orr, David. (1994) Earth in mind : on education, environment, and the human prospect. Washington, DC: Island Press.

Place de la Republique. (2012). Travel France Online. Retrieved November 21, 2012 from http://www.travelfranceonline.com/Paris/Place_de_la_Republique.html.

Pötz, H. (2012). Groenblauwe netwerken voor duurzame en dynamische steden = Urban green-blue grids for sustainable and dynamic cities. Delft: coop for life.

Rosenberg, A. (2011). Place de la republique/TVK. ArchDaily, Retrieved October 25, 2012 from http://www.archdaily.com/108481

Ryals, J. (2011). Students build landscape legacy. Retrieved November 10, 2012 from http://www.ncsu.edu/features/2011/09/students-build-landscape-legacy/.

Transsolar Climate Engineering. (2009). Redevelopment of la place de la republique. Retrieved October 25, 2012 from http://www.transsolar.com/download/e/pb_republique_paris_e.pdf

Transsolar Klima Engineering. (2012). Transsolar Klima Engineering. Retrieved June 2, 2012 from http://www.transsolar.com/

Tyson, M. (1998). The healing landscape: therapeutic outdoor environments. New York: McGraw-Hill.

Ulrich, R., Simons, R., Losito, B., Fiorito, E., Miles, M., Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. Journal of Environmental Psychology, 11, 201-230.

University Housing. (2011). “The Artists’ Backyard” Takes Shape on NC State’s Central Campus. Retrieved November 10, 2012 from http://ncsu.edu/housing/article.php?id=264.

University of Pennsylvania. (2012). PennConnects. Retrieved November 1, 2012 from http://www.pennconnects.upenn.edu.

Verheij, R.A., Maas, J., Groenewegen, P.P. (2008). Urban-rural differences and the availability of green space. Los Angeles: Sage Publications.

Wilson, E. (1984). Biophilia. Cambridge, Mass: Harvard University Press.

Wilson, E. (1996). In search of nature. Washington, D.C: Island Press.

Winnipeg Airport. (2012). Windfinder. Retrieved July 9, 2012 from http://www.windfinder.com/windstats/windstatistic_winnipeg_airport.htm

Winnipeg Transit. (2012). Winnipeg Transit. Retrieved July 9, 2012 from http://winnipegtransit.com/en

# appendix I

## number + composition of trees on campus

| Species | Number | % of Total |
|---|---|---|
| Green Ash | 1281 | 16.9 |
| Golden Willow | 763 | 10.1 |
| Basswood | 656 | 8.6 |
| American Elm | 642 | 8.5 |
| White Spruce | 558 | 7.4 |
| Siberian Elm | 554 | 7.3 |
| Colorado Spruce | 495 | 6.5 |
| Scots Pine | 415 | 5.5 |
| Amur Maple | 290 | 3.8 |
| Crabapple-Rosybloom | 218 | 2.9 |
| Balsam Poplar | 208 | 2.7 |
| Manitoba Maple | 149 | 2.0 |

| | | |
|---|---|---|
| Silver Maple | 137 | 1.8 |
| Shubert Chokecherry | 129 | 1.7 |
| Black Ash | 109 | 1.4 |
| Bur Oak | 103 | 1.4 |
| Mancanna Ash | 90 | 1.2 |
| Red Stem Willow | 85 | 1.1 |
| Russian Olive | 74 | 1.0 |
| Other | 73 | 1.0 |
| Paper Birch | 64 | 0.8 |
| Japanese Tree Lilac | 54 | 0.7 |
| Dropmore Linden | 48 | 0.6 |
| Northwest Poplar | 38 | 0.5 |
| Hawthorn | 34 | 0.4 |
| Laurel Leaf Willow | 29 | 0.4 |
| Tower Poplar | 29 | 0.4 |

| | | |
|---|---|---|
| Columnar Aspen | 28 | 0.4 |
| Sharpleaf Willow | 23 | 0.3 |
| Tamarack | 20 | 0.3 |
| Siberian Crabapple | 16 | 0.2 |
| Daphne Willow | 14 | 0.2 |
| Other | 14 | 0.2 |
| White Willow | 12 | 0.2 |
| Amur Cherry | 11 | 0.1 |
| Balsam Fir | 10 | 0.1 |
| European Mt. Ash | 9 | 0.1 |
| Japanese Elm | 9 | 0.1 |
| Cistena Cherry | 9 | 0.1 |
| Pear | 8 | 0.1 |
| Manchurian Ash | 7 | 0.1 |
| American Mt. Ash | 5 | 0.1 |

| | | |
|---|---|---|
| Little Leaf Linden | 5 | 0.1 |
| Hackberry | 5 | 0.1 |
| Red Elder | 5 | 0.1 |
| Plains Cottonwood | 5 | 0.1 |
| Swiss Stone Pine | 5 | 0.1 |
| Texas Buckeye | 4 | 0.1 |
| Ironwood | 4 | 0.1 |
| Corktree | 4 | 0.1 |
| Red Pine | 4 | 0.1 |
| Black Spruce | 4 | 0.1 |
| Ponderosa Pine | 4 | 0.1 |
| Water Birch | 3 | 0 |
| Buckthorn | 3 | 0 |
| Prairie Cascade Willow | 3 | 0 |
| Yellow Buckeye | 2 | 0 |

| | | |
|---|---|---|
| Butternut | 2 | 0 |
| Mayday | 2 | 0 |
| Jack Pine | 2 | 0 |
| Montgomery Spruce | 2 | 0 |
| Chokecherry | 1 | 0 |
| Trembling Aspen | 1 | 0 |
| | | |
| Total | 7590 | |

## appendix II

### number of shrub beds + dominant shrub

| Dominant | Number of beds |
|---|---|
| Red Osier Dogwood | 33 |
| Common Lilac | 27 |
| Cotoneaster | 26 |
| Common Caragana | 24 |
| Alpine Currant | 22 |
| Honeysuckle | 22 |
| Horiz Juniper | 19 |
| Savin Juniper | 17 |
| Mugo Pine | 16 |
| Viburnum | 15 |
| Ground Juniper | 14 |
| Spirea | 14 |

| | |
|---|---|
| White Cedar | 14 |
| Dwarf Lilac | 12 |
| Cinquefoil | 10 |
| Shrub Rose | 6 |
| False Spirea | 6 |
| Golden Flow Currant | 3 |
| Red Elder | 3 |
| Chokecherry | 2 |
| Tatarian Dogwood | 2 |
| Rocky Mount. Juniper | 2 |
| Ninebark | 2 |
| Prairie Almond | 2 |
| Russian Almond | 2 |
| Saskatoon | 2 |
| Sumac | 2 |

| | |
|---|---|
| Clematis | 1 |
| Clove Currant | 1 |
| Cistena Cherry | 1 |
| Pagoda Dogwood | 1 |
| Variegated Dogwood | 1 |
| Yellow Twig Dogwood | 1 |
| Golden Elder | 1 |
| False Spirea | 1 |
| Flowering Plum | 1 |
| Gooseberry | 1 |
| Hazelnut | 1 |
| Mockorange | 1 |
| Nanking Cherry | 1 |
| Dbl. Flowering Plum | 1 |
| Snowberry | 1 |
| | |
| Total | 334 |

# appendix III
## number + composition of shrubs

| Species | Number |
|---|---|
| Common Lilac | 43 |
| Red Osier Dogwood | 40 |
| Honeysuckle | 29 |
| White Cedar | 13 |
| Cotoneaster | 9 |
| Ground Juniper | 8 |
| Savin Juniper | 8 |
| Other | 8 |
| Common Caragana | 7 |
| Red Elder | 7 |
| Mugo Pin | 7 |
| Chokecherry | 5 |

| | |
|---|---|
| Viburnum | 5 |
| Nanking Cherry | 4 |
| Prairie Almond | 4 |
| Apline Currant | 3 |
| Rocky Mt. Juniper | 3 |
| Dwarf Lilac | 3 |
| Ninebark | 3 |
| Shrub Rose | 3 |
| Willow | 3 |
| Buckthorn | 2 |
| Buffaloberry | 2 |
| Tatarian Dogwood | 2 |
| Flowering Plum | 2 |
| Cinquefoil | 1 |
| Pagoda Dogwood | 1 |

| | |
|---|---|
| American Elder | 1 |
| Golden Elder | 1 |
| Mockorange | 1 |
| Saskatoon | 1 |
| Spirea | 1 |
| Total | 231 |