GREEN INGRAINED: A SUSTAINABLE APPROACH TO MOUNTAIN RESORT DEVELOPMENT

By

CODY ALAN PERATT

B.S., University of Nebraska, 2006

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture
College of Architecture, Planning, and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2009

Approved by:

Major Professor
Katie Kingery-Page

Copyright

Abstract

Currently, about 15-20 percent of the worldwide tourist industry, or 70-90 billion dollars can be accounted for annually by mountain tourism (Price et al. 1997). The base of mountain tourism lies within the profound natural features of the surrounding mountain landscape. Therefore, maintaining clean cool air, dramatic variations in topography, and scenic beauty of both the physical and cultural landscapes are imperative. The following project addresses the issue of designing a sustainable mixed use community within the broader context of a top rated mountain resort.

Within the last decade as public awareness of green practices has increased, so has the public's knowledge of terms such as LEED (Leadership in Energy and Environmental Design), sustainability, and mixed-use development. Starting in 1995 a sustainable visioning plan emerged for the future development of the Greater Wasatch in Utah. The project, titled Envision Utah Quality Growth Plan, has been widely recognized as one of the country's most successful efforts to involve the public in regional visioning. The proposed addition to Park City Mountain Resort in the Wasatch Front has been fueled by a desire to create an ecologically, socially, and economically sustainable mixed-use development.

The Envision Utah Quality Growth Plan and a precedent study in Whistler, combined with literature by Peter Calthorpe, Sherry Dorward, and Ian McHarg, provided the foundation for a sustainability assessment framework. The framework is applied to test the sustainable viability of existing resorts, as a guide for the design of resorts, and as a tool for comparative analysis between mountain resorts.

The result is a conceptual master plan for Park City, Utah that employs the use of stormwater and architectural best management practices, recycled materials, mixed use design, alternative forms of energy, and an efficient public transportation system.

Click Here for Masters Report

ingrained:

A Sustainable Approach to Mountain Resort Development

- kansas state university + college of architecture planning and design + masters report + cody peratt -

Acknowledgements:

I wish to sincerely thank Katie-Kingery Page and Lee Skabelund for all of their help throughout the entirety of this project. Without their assistance I could not have succeeded. I also want to thank Bruce Erickson for providing base information and valuable design advise over the past year. Lastly, I want to thank my parents for pushing me daily to reach my fullest potential.

Abstract:

Currently, about 15-20 percent of the worldwide tourist industry, or 70-90 billion dollars can be accounted for annually by mountain tourism (Price et al. 1997). The base of mountain tourism lies within the profound natural features of the surrounding mountain landscape. Therefore, maintaining clean cool air, dramatic variations in topography, and scenic beauty of both the physical and cultural landscapes are imperative. The following project addresses the issue of designing a sustainable mixed use community within the broader context of a top rated mountain resort.

Within the last decade as public awareness of green practices has increased, so has the public's knowledge of terms such as LEED (Leadership in Energy and Environmental Design), sustainability, and mixed-use development. Starting in 1995 a sustainable visioning plan emerged for the future development of the Greater Wasatch in Utah. The project, titled Envision Utah Quality Growth Plan, has been widely recognized as one of the country's most successful efforts to involve the public in regional visioning. The proposed addition to Park City Mountain Resort in the Wasatch Front has been fueled by a desire to create an ecologically, socially, and economically sustainable mixed-use development.

The Envision Utah Quality Growth Plan and a precedent study in Whistler, combined with literature by Peter Calthorpe, Sherry Dorward, and Ian McHarg, provided the foundation for a sustainability assessment framework. The framework is applied to test the sustainable viability of existing resorts, as a guide for the design of resorts, and as a tool for comparative analysis between mountain resorts.

The result is a conceptual master plan for Park City, Utah that employs the use of stormwater and architectural best management practices, recycled materials, mixed use design, alternative forms of energy, and an efficient public transportation system.

table of contents

PCMR

Figures + Tables

Background Research

Figures

Tables

Inventory and Analysis

Figures

Tables

Programming

Figures

Tables

Design

Figures

Tables

Appendix I

Figures

Appendix II

Tables

Appendix III

Figures

Tables

Introduction

Introduction:

Tourism and ecotourism is the world's largest industry. As available lands and resources continue to decrease, the impact of these resorts on the environment have increasingly become more visible. In order for resorts to economically survive and remain viable in the future, drastic changes to the design, creation, and operation must be undertaken.

The following project explores the important symbiotic relationship between the resort industry and the eco-regions in which they are located. A thorough examination of examples of 'green' built resorts, and a regional visioning process result in a sustainability assessment framework. The framework acts as a guiding force in which all design decisions are based.

The project site located in Park City, Utah consists of an addition to an existing 3300 acre resort. Site boundaries include the existing 12 acre parking lot for Park City Mountain Resort. Because of major improvements to the city's public transportation system before the 2002 Winter Olympic Games, Park City Mountain Resort no longer has the need for such expansive surface parking.

Extensive analysis of existing conditions and variables are taken into account and addressed through design decisions. The result is a mountain resort that enhances the surrounding environment and natural systems, creates educational opportunities to showcase Park City's rich historical past, promotes the socio-economic diversity of Park City, creates a walkable community, and can be economically absorbed by the revenues produced by the development.

The design is then evaluated using the sustainability assessment framework and compared with the results of a similar project. The comparison highlights successes and pitfalls of each. Ultimately, this project demonstrates options for how mountain resorts can viably interact with their surrounding environment in the future.

Dilemma:

How can a landscape architect assess the sustainable viability of existing mountain resorts, and use the information gained to aid in design decisions of the development of new resorts in mountain eco-regions?

Thesis:

The environmental, social, and economically sustainable design principles established in the Envision Utah Quality Growth Plan provide the framework for an assessment of built and proposed mountain resorts. The assessment framework can then guide the design of a sustainable mountain resort development in Park City, Utah.

Literature Review

With the new millennium has come a resurgence in awareness of the environment and human's interaction with the environment. Areas of industry and commerce that once paid little attention to development principles are now utilizing green practices and striving for LEED (Leadership in Energy and Environmental Design) level certifications. Within the last decade, as public awareness of green practices has increased, so has the public's knowledge of terms such as LEED, sustainability, and mixed-use development. There has been a demand to develop everything from neighborhoods to high class resorts as efficient and environmentally sensitive models of living.

Sustainability is one of the fundamental words of the green movement that shows up time and time again with multiple variations of the definition. For the following literature review sustainability will be defined as, "the process of meeting the needs of the present without compromising the ability of future generations to meet their own needs through balancing a community's social, environmental, and economic factors (Coalition for Utah's Future 1997)." This definition was derived from the Envision Utah Quality Growth Plan and will act as the lens through which all conclusions will be examined.

The Envision Utah Quality Growth Plan was a group effort, financed by a not-for-profit organization made up of private and public sector leaders (Wood 2006, 63). The project was initiated in 1995 and based in Salt Lake City, Utah. It has been widely recognized as one of the country's most successful efforts to involve the public in regional visioning. It has received some of the nation's most prestigious land planning awards such as: The Urban Land Institute's Award for Excellence, the Alliance for Regional Stewardship's Bold Recognition Award, and the American Planning Association's Daniel Burnham Award (Wood 2006).

One of the goals of the planning process was to engage and educate the public to influence growth patterns of the Greater Wasatch Area (comprised of a ten county area). During their process approximately 20,000 people contributed to the development of a cohesive regional vision. Because of their efforts the region has built two light-rail lines, broken ground for 44 miles of commuter rail, and planned approximately 250 miles of additional rapid transit (Wood 2006). The principles of sustainability and development that have been created by the visioning process will act as a guide in examining mountain resort development.

Resort development and ecotourism is important to the worldwide economy and its reliance on the natural environment. Most resorts are constructed in areas of the world considered as fragile eco-regions. It is therefore important to maintain the viability of these eco-regions as human presence is increased. Currently, tourism and ecotourism is the world's largest industry. With a global turnover of more than 444 billion dollars annually, it exceeds the combined Gross National product of the 55 poorest countries of the world (Price et al. 1999).

Tourism of mountains is often based on the profound features associated with the mountain landscape. Among these features are clean, cool air, dramatic variations in topography, and the scenic beauty of both the physical and cultural landscapes. Within the mountain environment there are many diverse natural landscapes, resources, local traditions, and lifestyles (Price et al. 1997).

Mountains are a mecca for species diversity with highly varying climates from the base to the peak. Mountains often have temperate zones at the base, alpine conditions further up, and are topped with an arctic tundra of glacial ice present year round. It is estimated that Mount Kinabalu in Sabah has 4,000 plant species, more than one-quarter of all plant species of the entire United States (Price et al. 1997).

Mountains offer health and wellness benefits and activities that focus on contemplation and meditation. Mountains also provide attractions for extreme sport enthusiasts in both the winter and summer months. Currently, about 15-20 percent of the world wide tourist industry or 70-90 billion dollars can be accounted for annually by mountain tourism (Price et al.1997).

With the foundation of mountain tourism being rooted in the natural environment, it is important to foster growth while limiting damage to the mountain as a resource. As more people visit and move to mountainous regions worldwide, “They (mountains) are in danger of becoming international playgrounds, with consequent threats to their particular economic, social, and cultural environments (Price et al. 1999, 4).”

Currently, there are many opportunities in the field of mountain resort development and redevelopment for sustainable practices. Older resorts are undergoing renovations in order to maintain their competitive edge against existing resorts and year-round destination resorts. For example, mountain resorts such as Brian Head in southern Utah and Mammoth Mountain in California are both undergoing large-scale redevelopments in order to remain competitive with each other (Kozloff 2006).

Within recent years there have been three reasons for green and sustainable development in the hospitality industry: Consumers are attracted to green design and energy-saving features, the approval process can be expedited, and projects can gain support from the environmentally conscious community (Green Residences 2006).

The newfound awareness of mountain resort’s dependence on the environment has brought about the realization of the grave consequences the destruction of mountain resources would mean to the resort industry. It is estimated that a rise in temperature of two degrees Celsius in Switzerland would result in a 1.7 billion dollar loss in winter sports revenue to the country (Price et al. 1999). Rising temperatures in arctic climates also promise danger to access networks through the melting of permafrost, the destabilization of rocks and scree, and an increase in the frequency of landslides and mud flows.

From these facts, a few questions arise:

How can tourism coexist with and contribute to sustainable mountain development?

How can tourism assist in fostering a community’s sense of place?

How can mountain resort communities provide for year round activity without degradation to the natural systems?

and

How can mountain resorts provide communities in which a socially diverse society is represented?

The Envision Utah Quality Growth Development Plan is used as a framework in providing guiding principles for subsequent analysis of “resort communities.” Throughout this project mountain resorts will be considered communities because, according to Sherry Dorward, “Even though they are not full-service communities, resorts are useful models for community design (Dorward 1990, 13).”

Many mountain resorts owe their roots to reasons other than tourism. Most resort areas were originally developed as a result of the potential yield of the mountain’s available and abundant natural resources. Whether from activities such as mining, ranching, or forestry, few of these communities would continue to exist today without the tourism industry.

Mountain resort communities must consider the larger picture in terms of growth and development. By doing so, they will address and potentially solve, many of the issues that resorts face today including: transportation, housing, open space, identity, and others. Focused in the background of many mountain resort developments are dedicated groups that strive to ensure the viability of the communities in which they exist. Aside from the Envision Utah Plan, Colorado has it’s own visioning board established with the Pitkin County and Aspen group. In northern California, the Tahoe Regional Planning Agency is present (Kozloff 2006).

Literature Review

The following literature review examines the three components of sustainability (ecology, society, and economy) and how they relate to mountain resort communities.

Ecology

New resorts bring with them the prospect of many new people, roads, and infrastructure. They are often built on former farming and ranching land. The subsequent impervious surfaces (rooftops and paving) increase runoff and add increased discharge to riparian streams. Since most residents and visitors of mountain resorts will drive to these destinations, the added traffic causes increased congestion and pollution. It is no wonder the additions of such developments are the subject of controversy. In order to achieve ecological sustainability, mountain resort developers must be cognizant of the consequences of altering the natural environment. Resorts must be situated in order to preserve identified sensitive lands, and protect the viability of the existing hydrology, wildlife, vegetation, and climatic elements of the environment.

According to the Envision Utah Development Plan, "Sensitive land includes any area in which development is either not appropriate or must be approached with care to ensure there is no long-term loss to property or human life." It also refers to areas with exceptional ecological, open space or agricultural value (Coalition for Utah's Future 1997)." Types of sensitive lands include natural hazard zones and agricultural areas. Natural hazard zones are areas which present a danger to humans when land is developed.

Environmentally sensitive areas are important to the ecology and natural systems of an area. If developed upon, sensitive ecological networks may be compromised. Conversely, open space and agricultural lands hold cultural, aesthetic or economic value that will be lost if developed upon. According to Tirman, methods to combat the consumption of valuable sensitive lands would be to, "Acquire and preserve open space, promote regional environmental protection, and through protection and enhancement initiatives (Tirman 2006, 80)."

Another strategy practiced in areas of valued resources such as mountainous regions, is cluster development. Communities attempt to preserve sensitive lands through a practice of low density zoning. Development clustering is effective in preserving large continuous tracts of land that are highly valued either for their resources, intrinsic properties, or aesthetic appeal.

Transfer of Development Rights preserve sensitive lands by allowing for higher densities in areas that would not otherwise be possible within the current zoning limits. By utilizing Density Transfers a property owner has the right to the same number of units and allowable uses, but the units are transferred from identifiably more sensitive lands to less sensitive ones (Coalition for Utah's Future 1997).

Hydrology is the driving system of the mountain environment. It provides and sustains life while physically shaping the land through erosion. "Water is perhaps the only element in the mountain setting that can compete visually with the landform (Dorward 1990, 42)." It is therefore highly important to preserve water resources through efficient practices and conservation.

For example, Utah's greater Wasatch Area is comprised of the Jordan River, Utah Lake, and Weber Basin and will need 481,000 acre-feet more water per year by 2050 to sustain their current levels (Coalition for Utah's Future 1997). The Utah Division of Water Resources has determined that commercial, industrial, and institutional water-use is the area of greatest waste; and therefore has the potential for the greatest amount of savings (Coalition for Utah's Future).

Mountain resort communities have the unique opportunity through best management practices to conserve valuable water resources and limit their impact to hydrological systems. Water can be conserved by mountain resorts through a variety of large landscape conservation programs and incentives. Methods to mitigate

the amount of water used for the landscape include: Providing information on climate-appropriate landscape design and drought resistant planting materials, planting plants with like water requirements, matching plant's cultural requirements, use of native and low water-use plants, use of organic mulches to aid in moisture retention, use of high input turf areas only where practical or for effect, use of secondary (non-potable) irrigation, and efficient irrigation in comparison to a plant's evapotranspiration rates. Sources of information for water saving landscaping can be obtained from The Center for Water-Efficient Landscaping at www.cwel.org (Coalition for Utah's Future 1997).

Conservation of valuable water resources in the mountain environment has benefits to the ecological network by providing wildlife habitat, filtering water, providing storm retention areas, and allowing for the recharge of groundwater. In areas where development might infringe or fragment existing wetland corridors, a practice called wetland banks can be utilized.

The implementation of a wetland bank is the process of creating new wetland areas in larger contiguous tracts where small insignificant wetlands previously existed. The larger wetlands are more viable because of their size and continuity.

Besides the environmental benefits from water conservation, there are also economic advantages from the delayed costs of capital improvement upgrades, reduced impacts from sewage or wastewater flows, and conservation of energy (Coalition for Utah's Future 1997).

Along with water conservation, soils are a critical component to a successfully sustainable mountain resort development. Soil classifications should be analyzed based on their chemical and physical characteristics. Information about the suitability and vulnerability of the landscape can be obtained from soil classifications. Soil classifications provide information that assist in the prevention of future damages caused by natural events such as floods or landslides. Hazards to the ecology, land, and humans are present in areas where there has been little regard to recognizing sensitive lands (Coalition for Utah's Future 1997)

The most devastating and sudden hazards affecting developments in the mountain environment is that of avalanches. Though most avalanches occur in remote regions of the mountains, they are still a very real danger to visitors and residents of mountainous areas. Avalanche zones are identified in three major parts; the starting zone, track, and runout zone. Avalanche danger is most common on slopes in the range of 30 to 45 degrees, but are not restricted within these limits. Avalanches occur most often on grass covered, lee sided slopes on the north mountain face. Extensive site grading or vegetation removal can increase the probability of an avalanche. Many times avalanche activity is subtle and will require that a snow specialist survey any intended sites for development (Dorward 1990).

Whenever possible, developments should take place on already disturbed land. Parking can be placed directly below building footprints, making efficient use of already disturbed land, as well as ultimately, a better use of land than surface parking areas (Tirman 2006).

Sensitive lands are also identified by their vegetative characteristics. Mountain environments are unique in the fact that alpine plants tend to grow more slowly than those at lower elevations. Vegetation grows slower because of thin air, low humidity, extreme temperature fluctuations, short growing seasons, and less fertile soils (Dorward 1990). It is important then, to preserve as much existing vegetation as possible when developing mountain resorts. Areas of old growth forest must be identified and protected. Where developments take place, trees and vegetation should be planted in order to off set the removal of vegetation during construction.

Vegetation in urban settings also experience specific challenges. Trees in the urban environment die and are sometimes not replaced due to lack of funding or manpower. Trees that previously provided shade and protection from the elements are no longer

present. Trees in the urban environment, or in this case, the resort setting provide for healthy and safe environments by contributing to; clean air and water, increased property values, moderation of temperatures, lessened energy demands, reduction of erosion and storm water runoff, establishment of wildlife habitat, and offer year round enjoyment (Coalition for Utah's Future). According to the Envision Utah's Growth Development Plan, shading of buildings can potentially result in energy savings of 10-40%, while strategically placed windbreaks can save as much as 20% energy use. Also, one acre of trees provides enough oxygen to support 18 people and will absorb the amount of carbon dioxide produced by a car driving 26,000 miles per year (Coalition for Utah's Future 1997).

Trees in mountain resort environments have undisputable advantages, but it must also be recognized that along with them are inherent problems and dangers. Trees are living organisms with specific requirements and potential litter issues. Litter problems are minimized though proper selection and placement of tree species. Even healthy trees drop limbs or break in unusual circumstances like heavy snow, ice, or strong winds (Coalition for Utah's Future). Slow growing tree species should be selected because their stronger wood is resistant to breakage. Common fast growing species such as Siberian elm, boxelder, and willows should be avoided.

Energy conservation in the development and operation of resort communities is an important element in maintaining the profitability of the industry. Buildings within the development should be situated to have passive solar southern exposure (Tirman 2006).

There are also significant gains to be made in energy conservation during the construction phase of resort development. Research by Australia's Commonwealth Scientific and Industrial Research Organization showed that materials used in the construction of an average household contain about 1,000 gigajoules of embodied energy, which is equal to about 15 years of operational energy (Coalition for Utah's Future 1997). The use of recycled building materials has the potential to save about 95% of the embodied energy of the materials (Coalition for Utah's Future 1997).

Alternative forms of energy have emerged as a plausible alternative for mountain resorts. Since some resorts are located in very remote areas, wind energy could act as a viable option. This alternative will work if it is allowed within the local zoning, there is no easy access to existing utility lines, and the finances can absorb the long-term investments of the supporting infrastructure. Because wind energy utilizes large windmills that will not be visually desirable on mountain tops, another alternative such as geothermal energy might be better utilized.

The benefit of geothermal energy is that it takes advantage of the natural heating and cooling properties of the earth.

Photovoltaic panels, which capture energy from the sun are also a viable option. Photovoltaic panels provide efficient energy with no moving parts, are non-polluting, and require no extension of power lines.

Another opportunity for alternative energy, as mentioned earlier, would be passive solar. In Utah, 50-70% of the total heating is achievable with these systems if designed properly (Coalition for Utah's Future 1997).

As effective and efficient construction and operation techniques become increasingly "greener", a demand for LEED Certification has emerged. "LEED is a third-party certification program and the nationally accepted benchmark for design, construction, and operation of high performance green buildings. LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings' performance. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality (United States Green Building Council)."

Cheakamus Crossing, a resort community in Whistler, British Columbia

is one of only 20 Canadian developments designated as a pilot project for the LEED-ND (Leadership in Energy and Environmental Design- Neighborhood Development). LEED-ND currently sets the highest standards for neighborhood design development (Ogilve 2008). It has been documented that communities that reflect the principles of energy sustainable design benefit by more citizen involvement in community affairs, increased interaction between citizens, and a greater sense of community (Coalition for Utah's Future 1997).

Society

The social component of sustainability is equally important as the ecological components, in achieving total sustainability for mountain resort communities. Factors such as identity, culture, and diversity are necessary for maintaining the desired outcomes of resort developments. Challenges in these types of developments include increased traffic, threats to open space, and character of the community. There is the constant struggle to provide affordable housing for people in the service industry that are the backbone of the resort. "Since their business depends on available housing for these workers, many resorts have collaborated with local governments to provide rental and ownership units for people at the lower end of the income scale (Holtzman 2006, 83)."

Surprisingly, real estate remains a resort's largest revenue generator (Kozloff 2006). "Today, changes in the mountain resort industry and in consumer tastes are having a dramatic effect on local real estate values, forcing resort developers and civic leaders to plan carefully to control the pace of change" (Holtzman 2006, 82). In the 1990's housing in Utah went from one of the least expensive housing markets in the western United States to one of the highest (Coalition for Utah's Future 1997). This is especially true in areas surrounding mountain resorts. There is a constant struggle to maintain affordable housing because the income of service industry employees is relatively low. According to the Federal Department of Housing and Urban Development (HUD), no more than 30 percent of a person's income should be spent on housing (Coalition for Utah's Future 1997).

Methods of combating unaffordable housing include: The creation of specific housing for employees, creating more housing choices where there is demand for it, and at costs that are affordable for the resident. In recent years the amount of restricted housing has become increasingly progressive (Hotlzman 2006).

To battle housing shortages in Crested Butte, developers have called for 15% of new developments over a certain size for restricted wage housing (Holtzman 2006). In Summit County, Utah it is required that enough housing be built to serve at least 20% of the employees generated by new projects (Holtzman 2006, 85). Developers of the 2010 Olympic Athlete Village have the ambitious goal of providing housing for up to 75% of Whistler employees post Olympic Games (The Resort Municipality of Whistler).

An integral component of livable communities is good design, especially when faced with providing significantly more dense and inexpensive housing types. An opportunity to provide a more permanent population of resort communities is prevalent in the practice of renting out owned condos in order to prevent "cold beds." Fractional ownership is a way to acquire ownership of a second home without as much of a financial investment. Fractional ownership removes the hassles of upkeep while allowing the owner to capture appreciation upon resale.

According to Tom Ward of Jess Reid Real Estate in Park City, "A two-bedroom membership unit that sold for $70,000 in February 2005 recently sold for $105,000 (Kozloff 2006, 48)." Providing a development with a variety of housing types from studio apartments to single family homes, allows for less land consumption and can serve as the structural framework for a walkable community that supports public transit use (Coalition for Utah's Future 1997).

Literature Review

Providing housing for diverse incomes can help to maintain the community's existing cultural identity. In the age of globalization it is important to maintain the community's identity, their need to meet the desires of the consumers, and to distinguish themselves from other resorts. Jackson Hole, Wyoming is an example where the local airport was once adorned with ranchers, their saddle bags, and the occasional skier. The town was spotted with elk antlers and wooden sidewalks. Now the streets are fronted with chain stores such as the Gap and Rocky Mountain Chocolate Factory. Fast Food chains now line the road all the way to the mountain (Kozloff 2006). Attractive mountain towns that are rich in history such as Park City, Utah; or Telluride, Colorado (Both originally mining towns) need to balance promoting economic development without losing their quaint charm. There is a constant vicious cycle of tourists coming to resort towns to escape the doldrums of their everyday lives. With the tourists come their dollars and the business chains are quick to follow (Kozloff 2006).

Conversely, other new North American winter destinations are in areas with no historical populations. Through immigration over the years local communities have emerged, increasingly wishing to influence development policies. This is important because social sustainability includes the possibility of guaranteeing local identity and culture. Resorts are filling the void by acting as a catalyst for community involvement in the design process. (Price et al. 1999). Without an existing identity, resort developments run the risk of presenting a false or unwanted identity.

By taking resort design further and utilizing walkable design principles, the resort can share in the environmental, social, and economic values of walkable communities. Walkable communities allow residents to live and grow in the same community as they move through life's cycles. There is less demand for creation of new infrastructure and it allows for people to live close to recreation, shopping, and work (Coalition for Utah's Future 1997). In Walkable communities the commercial village often becomes the center of attraction, as in Park City Utah's The Canyons. Here lodging, condos, restaurants, retail, along with ice skating, heated outdoor pools, and other amenities are clustered around the base of the mountain (Holtzman 2006, 83). Clustering allows for activity other than day recreation. There is more diversity in terms of shopping and restaurants.

The principles of walkability can be used for a variety of developments. It can be used for infill within existing areas such as downtowns, for new growth on the urban fringes, or for freestanding new towns. The following are some guides to characteristics that should be applied to a walkable mountain resort community.

Walkability Recommendations for Design (see Table 1.1 "Block Standards for Walkability") as adapted from the Envision Utah's Quality Growth Plan (Coalition for Utah's Future 1997)

1. Place transit stops and stations in the core.
2. Use "traffic calming" to narrow streets, slow traffic and improve the pedestrian experience on existing streets.
3. Create a pedestrian area on wide, traffic-heavy streets by changing to a boulevard design.
4. On street parking should be provided to act as a buffer between traffic on the road and pedestrians on the sidewalk.
5. Sidewalks should be wide with extensive tree plantings and the additions of landscaped street center medians.
6. The dominance of parking lots should be minimized by the infilling of edges with smaller buildings that face the street.
7. Building fronts should face the street with off-street surface parking located behind or on the side of buildings.
8. The core should be near the center of the walkable area, surrounded by higher intensity uses.

	Town Center	Village Center
Mixed-Use Blocks	15-40% of Center	15-40% of Center
Mix of Uses		
30-80% retail, cinema, or hotel required each block, 20-70% other.	Retail, Services, Restaurants, Office, Cinema, Grocery, Hotel, Residential, Civic, Park/Plaza	Grocery, Local-Serving Retail and Services, Restaurants, Gas Stations, Professional
Maximum Block Size	7 acres	7 acres
Minimum FAR	FAR: 0.4	FAR: 0.3
Minimum Frontage	65% of each street	65% of each street
Parking Ratio	3 spaces: 100 sf.	3 spaces: 100 sf.
Building Height	2-10 story	1-3 story
Commercial Blocks	0-30% of Center	0-30% of Center
Allowable Uses	Office, Retail (10% Max.)	Office, Retail (10% Max.)
Minimum FAR	7 acres	4 acres
Minimum Frontage	FAR: 0.4	FAR: 0.3
Parking Ratio	3 spaces: 100 sf.	3 spaces: 100sf.
Building Height	2-10 story	1-3 story
Residential Blocks	30-75% of Center	40-75% of Center
Allowable uses	Apartments, Condos, Townhomes, Duplexes, Bungalows	Apartments, Condos, Townhomes, Duplexes, Bungalows, Small lot single family
Maximum Block Size	3 acres	3 acres
Density Range	7-50 du/ac.	7-25 du/ac
Minimum Frontage	65% of each street	60% of each street
Parking Ratio	1.5 spaces/unit	1.5 spaces/unit
Building Height	2-5 story	1-3 story
Civic Blocks	10% of Center	10% of Center
Allowable Uses	Parks, Recreation, Civic, Day Care	Parks, Recreation, Civic, Day Care
Maximum Block Size	3 acres	3 acres

Table 1.1 Block Standards for Walkability (Coalition for Utah's Future 1997)

9. The core should act as the focal point for the community and provide convenient access to shops, restaurants and community oriented services.
10. The core should comprise about 5-40% of the land area of the walkable district.
11. A ½ mile walk constitutes the outer limits of a walkable community with a higher concentration occurring within 1/4 mile radius (see figure 1.1 Walkable Districts)
12. Street facing buildings should have at least 50% windows with no blank walls for more than 30 linear feet.
13. Building structures should frame the street with at least 60% of the street frontage having buildings within ten feet of the front of the property line.
14. Parking lots should be no more than 300 spaces each and should provide one shade tree for every six parking stalls spread uniformly throughout the area (Coalition for Utah's Future 1997).

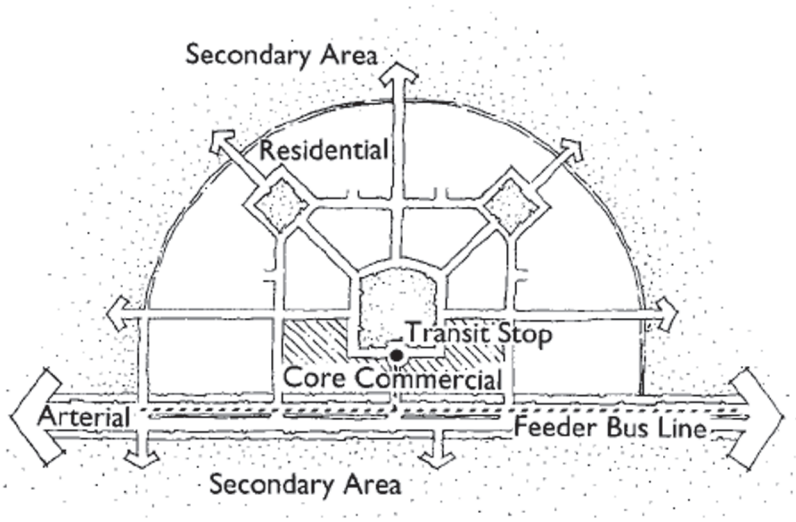
Literature Review

Another important element of social sustainability is measured by the aesthetic character of the place and the success of the design in order to manipulate views and draw user emotions. It is important to recognize the dynamic mountain landscape as unique to the place and to play off these elements as a combination of sensory appeals, cultural traditions, and personal histories. When designing in the expansive mountain environment it is necessary to counteract the intimidating natural surroundings through elements in the resort that set human scale. They should consist of both built and natural elements that include canopies, screens, and enclosures. “The inhuman dimensions of the mountains both exalt and dwarf [man’s] individuality. He stands, often in precarious verticality, at the cleft or narrows, not in the open agora… His horizon is a wall, where the sea is a gate flung open by the light- George Steiner (Dorward 1990, 47).”

There are also transportation challenges that are faced by mountain resort communities that may be alleviated through the application of walkable principles. By providing an efficient public transportation system, mountain resorts may combat the “one road in- one road out” problem. “To deal with this congestion, viable transit options are an absolute necessity (Kozloff 2006, 83).” Aspen and Pitkin County, in conjunction with the Roaring Fork Transit Agency (RFTA), provide a commuter bus line that services park and ride lots along the entire length of the highway leading in and out of the City of Aspen. The public transportation numbers of Aspen rival those of major US cities (Kozloff 2006). The highly efficient public transportation system limits the need for workers and visitors to drive into the city. The result is a reduction in congestion, pollution, and the need for parking. Park City, Utah is unique in the fact that so many of its visitors fly into Salt Lake City. Shuttles transport visitors 40 miles up the mountain to the resorts. Because of the efficient shuttle service, less than half the visitors arrive by personal car (Holtzman 2006).

Another trend that has developed in mountain communities is the influx of young urbanites seeking action and new experiences that are presented by the mountain (Price et al. 1999). Mountains are not just ski attractions anymore. Canyoneering, hydrospeed, bungee-jumping, hang-gliding, and snowboarding are all mountain trend sports that developed in the mid to late 90’s (Price et al. 1999). Even newer on the sports scene is dirt boarding, a combination of skateboarding and snowboarding practiced on the mountain during the summer months.

Resorts can create or challenge their current identity by hosting such extreme sporting events as the Summer or Winter X Games. The X Games is an event held annually which is similar to the Olympics, only focused on extreme sports such as Motocross, Snowmobile X, and Superpipe.



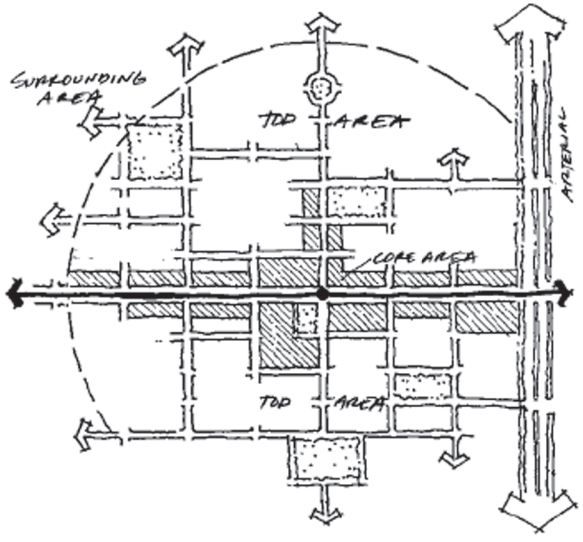


Figure 1.1 Walkable Districts (Calthorpe 1993)

Literature Review

Economy

The transition and invention of new mountain activities has brought with it many revenue increasing opportunities. Conversely, with so much emphasis placed on the environmental characteristics of sustainability, the economic factors often get overlooked.

As the ski industry found itself stagnating in the late 80's and 90's, resorts found it profitable to join with and act as developers. Developers created the concept of designing a resort that reflected a sense of community. These new resorts were places where people could experience a year round playground in which they could shop, dine, live, and play all without leaving the resort (Holtzman 2006).

Mega events such as fairs, festivals, and other cultural or sporting events have gained increasing importance in the mountain tourism industry within previous years. The hosting of events such as the X Games, Olympics, or other festivals have shown short term gains with long term profit loss. It is perceived that high profile events such as the Olympics are associated in high regards to modernization, tourist development, and economic growth. Historically though, speculation, negative environmental impacts, under utilized sport facilities, and tremendous public debt are all too often the common results of these events (Price et al. 1999). The Olympic Games held in Innsbruck, Austria in 1964 and again in 1976 were shown to have only a small effect on tourism and hospitality development of the area. Lillehammer, Norway demonstrated indications that the Olympics had a positive impact, with tourist overnight stays up 14% for the two years proceeding the Games. Overall, at a cost of over 1 billion dollars to host the Games, the economic cost is highly disproportionate to the economic gains (Price et al. 1999).

Other options for mountain resort communities to maintain their profitability would be through the previously mentioned technique of fractional ownership. Fractional ownership allows for multiple ownership of the same property on a time share basis. The multiple owners do not have to worry about property upkeep or maintenance and can have the luxury of owning a second property for a fraction of the cost. The benefit to the community is that the beds can be rented out on a weekly/nightly basis. This allows the beds to be continually occupied either by a fractional owner or by daily or weekly guests (Kozloff 2006). It is necessary for the resort to maintain a constant influx of visitors because it is that which drives their economy.

Intermountain connections have also been recently utilized as the "mega resort" concept. In order to draw more visitors, resorts are teaming up to provide lift tickets that can be used at multiple resorts. These resorts are either physically connected through an intricate network of ski trails on the mountains, or provided shuttles between the resorts. The idea of mountain

interconnections is an established trend in Europe connecting numerous mountains in one mega resort. The practice has been utilized in the Alps of Italy, France, and Austria. It has been noted that this might be the next big trend in the United States as a marketing technique to provide for seemingly endless terrain. In Utah, Alta and Snowbird resorts have a combined ticket with physical access to both mountains through the newly opened Mineral Basin. Studies have also shown that it would be possible to link Park City Mountain Resort, Deer Valley, and the Canyons in Park City, Utah. The concept of interconnections can help to alleviate the need to drive between mountains and in turn reduce traffic and pollution while providing further economic revenue (Kozloff 2006).

The increase in awareness of the environment and human's interaction with that environment will continue to play a major role in the future of mountain resort planning. As older resorts are remodeled and added to, developers will realize the social, environmental, and economic advantages of constructing sustainably. By creating resorts through walkable design principles and good design, they will promote diversity while increasing visitor numbers.

The Coalition for Utah's Future has made great headway in the general community's visioning process. By practicing green principles and working towards minimizing visitors' impact on fragile ecosystems, tourism will be able to continue it's dominance as the worlds leading industry.

Previously examined components of the literature, as well as the Envision Utah Quality Growth Plan have been compiled into an assessment framework for mountain resort development. The assessment will serve to measure the success or failure of a resort's sustainability. Individual components of the assessment will be used to guide the design for improvements to Park City Mountain Resort.

Process

Ecology	Physiography and Natural Systems	Wildlife	Animal Migratory Routes	None	5		Wildlife Value
				Minimal	3		
				Extensive	1		+
		Solar Aspect	Surface Aspect Analysis	SW, S, SE	5		Solar Aspect Value
				E, W, Flat	3		
				NW,N,NE	1		+
		Slope	Surface Slope Analysis	2-5%	5		Slope Value
				< 2%	3		
				>5%	1		+
		Pre Development Vegetation	Old Growth Forests	0%	5		Pre Dev. Value
				<30%	3		
				>30%	1		+
		Post Development Vegetation	Use of Natives	All Native Planting	5		Post Dev. Value
				Like Irrigation Requirements	3		
				No Consideration	1		+
		Hydrology	Hydric Soils	Not Hydric	5		Hydrology Value
				Somewhat Hydric	3		
				Very Hydric	1		+
		Existing Land Use	Type of Development	Brownfield	5		Land Use Value
				Greyfield	4		
				Greenfield	1		+
		Cut vs. Fill	Balance of Cut vs. Fill	<5% Difference	5		Earthwork Value
				5-15% Difference	3		
				> 15% Difference	1		
	LEED Certification		Level of LEED	Platinum	5	*****	LEED Value
				Gold	4		
				Silver	3		
				Certified	2		=
				None	1		

0	Total Ecological Sustainability Value
0.00	Ecological Sustainability Average

Table 1.2 Sustainability Assessment Framework (Cody Peratt 2008)

Society

Walkability	Recreation	Distance to Recreation	1/4 mile	5	Recreation Value
			1/2 mile	4	
			1 mile	3	+
			>1 mile	1	
	Civic	Gathering/ Open Space	1/4 mile	5	Transportation Value
			1/2 mile	4	
			1 mile	3	
			>1 mile	1	+
	Retail/Commercial	Shopping	1/4 mile	5	Transportation Value
			1/2 mile	4	
			1 mile	3	
			>1 mile	1	+
	Transportation	Distance to Public Transportation	1/4 mile	5	Civic Value
			1/2 mile	4	
			1 mile	3	
			>1 mile	1	+
	Transportation	Types of Routes within 1/2 mile	Highway	5	Retail Value
			Major Street	4	
			Neighborhood Street	3	
			Trail	1	+
Diversity	Housing Types/ Costs	Diverse Options	High Mix of Housing Types	5	Diversity Value
			Two Housing Types	3	
			Single Housing Type	1	+
Aesthetics	Intrinsic Qualities	Desired Views of Natural Features	Mountain Peaks and Water	5	Intrinsic Quality Value
			Mountains or Water	3	
			Neither	1	+
Aesthetics	Open Space	Usable Open Space	10-20%	5	Open Space Value
			21-40%	3	
			<10% or >40%	1	+
Historical	Relationships	Expression of Historical Connections	High Level of Expression	5	Historic Value
			Hint of Expression	3	
			No Expression	1	=

0	Total Social Sustainability Value
0.00	Social Sustainability Average

Process

Economy

Proximity	Proximity to Population Centers	Attract Outside Income	1 mile	5	Proximity Value
			1-10 miles	4	
			10-30 miles	3	+
			>30 miles	1	
Mixed-Use	Variety of Uses	Commercial, Residential, Recreation	High Level of Mixture	5	Use Value
			Some Mixed-Use	3	
			No Mixed-Use	1	+
Transportation	Interconnections	Types	Ski In/Out	5	Interconnections Value
			Free Shuttle	3	
			Shuttle for Fee	2	
			Must Drive	1	+
Development Cost	Economic Feasibility	Ability to Pay Off Development	Through Increased Revenue	5	Economic Feasibility Value
			With Help from Tax Dollars	3	
			Not Feasible to Pay Off	1	+
Development Cost Over Time	Economic Feasibility	Temporal	<20 Years	5	Economic Feasibility Value
			20-30 Years	3	
			>30 Years	1	=

0	Total Economic Sustainability Value
0.00	Economic Sustainability Average

Total Ecological, Social, and Economic Average	0.00

Process

The process model pictured left (Table 1.2) is the culmination and integration of the literature previously reviewed. Ultimately, it is envisioned as a framework to guide the design process while serving as a quick reference in measuring sustainability. The assessment model will be utilized to examine components of sustainability in the mountain environment either during the design phase, or used to measure the success of already constructed developments. The three components of sustainability were further broken down into subcategories and ranked according to criteria obtained through reviewed literature. Each sustainability component is measured independently, then all three are averaged together for the total sustainability assessment. The maximum achievable score is a 5.0, which would be considered the most sustainable.

Ecology

Within the ecological sphere of sustainability were the subcategories of physiography and natural systems, cut vs. fill, and LEED certification. Physiography and natural systems were further broken down to include wildlife, solar aspect, slope, pre-development vegetation, post-development vegetation, hydrology and existing land-use.

Wildlife

The criteria for wildlife is based upon the presence of animal migratory routes and founded heavily on principles from the Envision Utah Quality Growth Plan. Rankings for animal migratory routes are None, Minimal, and Extensive. Maintaining current animal migratory routes are important in the ecological balance as human influence is spreading to areas once considered remote. If the proposed development does not impede on any animal migratory routes it receives a rating of five; minimal intrusion warrants a score of three, and extensive intrusion receives a one.

Solar Aspect

Areas sloping to the south, southwest, and southeast will receive more passive solar gain and therefore be more conducive for ambient heating during the winter. These areas will receive a rating of five. Areas that are sloping east, west, or are flat will receive a rating of three; while areas sloping northwest, north, and northeast will receive a rating of one.

Slope

If the area of interest already has slopes that are conducive for development then less site grading will be required. Areas with slopes between 2-5% are conducive for most site developments and therefore receive a score of five. Overall slopes of less than 2% will attribute to difficulty in achieving positive drainage away from structures and receive a score of three. Conversely, average slopes of greater than 5% will require extensive grading and receive a score of one.

Pre-Development Vegetation

Maintaining existing vegetation is an important component to limiting impact on surrounding natural systems. Old growth forests in particular are an important feature to the mountain landscape and should be preserved as much as possible. The rankings for this subgroup were determined from the NRCS's soil survey criteria.

Post Development Vegetation

Use of native vegetation on site is important in limiting the use of valuable water resources as well as minimizing the use of synthetic chemicals. If a design calls for, or the development utilizes all native plantings then it receives a score of five. Likewise, if supplemental irrigation can be limited to areas where there are like water requirements then it will receive a score of three. Conversely, if the use of native plantings were disregarded it will receive a score of one.

Hydrology

Limiting construction in existing stream corridors is extremely important in achieving an environmentally sustainable development. The methodology in ranking hydrology was to examine the site's soils. Soils are classified by the NRCS Soil Survey as; not hydric, somewhat hydric, or very hydric. These categories were adopted in my process framework and ranked accordingly.

Current Land-Use

Current land-use was examined as a means of measuring a site's potential for sustainable development. If the development is proposed on an existing Brownfield site, then there will be considerable opportunities for natural systems improvements. If the proposed development is a Greenfield, then there will be more opportunities to degrade the current natural ecosystem network.

Cut vs. Fill

A design that carefully balances cut and fill is significant not only in environmental terms, but in regards to cost. A design that balances cut and fill with less than 5% excess of either, receives a score five. If cut and fill is balanced within the range of 5-15% it receives a score of three, and if it requires 15.1% or more cut or fill then it receives a score of one.

LEED Certification

In recent years LEED has become the industry measure of sustainability. Therefore, it would seem unfit to leave this component out of the Sustainability Assessment Framework. LEED certification is not the only measure of sustainability, but it will allow for a quick snapshot assessment of a development or design. The rankings for LEED certification were derived from the levels provided by the United States Green Building Council.

Society

The societal component of sustainability was subdivided into the four categories of walkability, diversity, aesthetics, and historical relationship.

Walkability

In the assessment framework, walkability is broken into types and distances to; recreation, open space, commercial areas, and transportation. Criteria for the rankings were determined by the Envision Utah Quality Growth Plan and literature by Peter Calthorpe.

Diversity (Housing)

A large component of social sustainability is dependent upon the dynamic mix of the people that will use the space, as well as those that live there. In this instance, very diverse housing types/cost include a design having a mix of single family dwellings, multi-family dwellings, and high density housing. Somewhat diverse housing options would have two of these three represented, while no diversity would be consistent with only one housing choice available.

Aesthetics

This category is focused on the issue of intrinsic qualities and desirable views of natural features. According to Sherry Dorward, the two most important natural features in which views must be maintained are those of the mountain and water (Dorward 1990). The assessment framework ranks designs maintaining views of both the mountain and water as a five, one of those as a three, and none as a one.

Open Space

It is important to include a mix of open space within the site itself. Rankings for percentages of open space were derived from Table 1.1 on page 17 (provided by the Envision Utah Quality Growth Plan).

Historical Connection

A historically represented site/ design would include statues and signage that educate the users of previous uses and historical events of the area. A somewhat historical connection would be consistent with an implied but not physically representative design.

Economy

Like the ecological and societal components of sustainability, the economic component was also subdivided. The economic sector was broken into the variables of proximity, mixed-use, transportation, sources of revenue, long-term economic feasibility.

Proximity

Proximity refers to the distance the development is from existing population centers. The closer the development lies to existing areas of large populations, the easier it will be to support the commercial components of the development.

Mixed-use

Mixed-use refers to the type of businesses and activities within the development itself. A highly mixed-use development will consist of commercial, residential, and recreational elements. A somewhat diverse development will include two of the previously stated three. Likewise, a development with no variety of uses will receive a score of one in the sustainability assessment framework.

Mountain Interconnections

The ratings for mountain interconnections were derived from Harry Kozloff's article Ten Trends Affecting Mountain Resorts (Kozloff 2006, 83).

Development Costs (Economic Feasibility)

This category was divided into two subcategories examining the ability to pay off the loan for the development, and the time required to pay off the loan. If the development will be paid for solely through increased revenues, then it received a score of five. Also, if the loan will be paid within 20-30 years it would also be considered economically sustainable.

inventory + analysis

Inventory + Analysis

Park City Mountain Resort

-Olympic-Mountain- Resort- Community- Sustainable- Livable-

Project Name: Park City Mountain Resort Village
Location: Park City, UT
Landscape Architect: Cody Peratt
Design Initiation: Spring 2009
Size: 12 acre mixed-use development
Client: Park City Mountain Resort

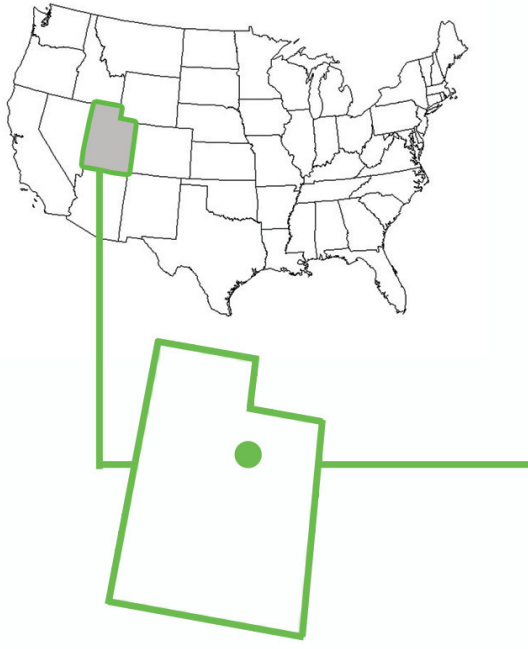


Figure 2.1 Park City Location Key (Cody Peratt 2008, Adapted from the Utah GIS Portal)

Inventory + Analysis

Location

The project site is located at the base of Park City Mountain Resort in the Wasatch Mountain Range in Park City, Utah (Fig. 2.1- Park City Location Key). Currently, Park City Mountain Resort consists of approximately 7 acres of developed land, 12 acres of parking lot, and 3300 acres of mountainous terrain. The proposed additions are to occur predominantly within the twelve acres of parking lot. The site is bounded by the mountain to the west, Silver King Road to the north, Empire Ave. to the east, and Manor Way to the south. Lowell Ave. runs north through the site and intersects with Silver King Road. Because the site is designated as a Brownfield development, there are specific opportunities and challenges in creating a sustainable community. A careful examination of existing conditions, opportunities, and limitations are conducted in the following inventory and analysis. Specifically examinations of the potential ecological, social, and economic sustainability components will be considered important.

First examined are existing ecological characteristics of the site including sensitive lands, watersheds, soils, slope, shade, climate, and native plants. Since the site currently exists as a parking lot, there are no identified sensitive lands on site. There are however, important tracts of land adjacent to and surrounding PCMR. Located to the west is the 3300 acres of mountainous terrain consisting of three distinctly visible peaks. Park City Municipal Golf Course is situated directly north of the site. There is also a significant amount of open recreation space located four blocks to the east of the resort. This open space contains a trail network, baseball, and soccer fields. During the design phase it will be imperative to recognize the importance of providing connections to all three of these open spaces. Also, the alignment of structures and views should be situated toward the aesthetic mountain and golf course landscapes (Fig. 2.2).

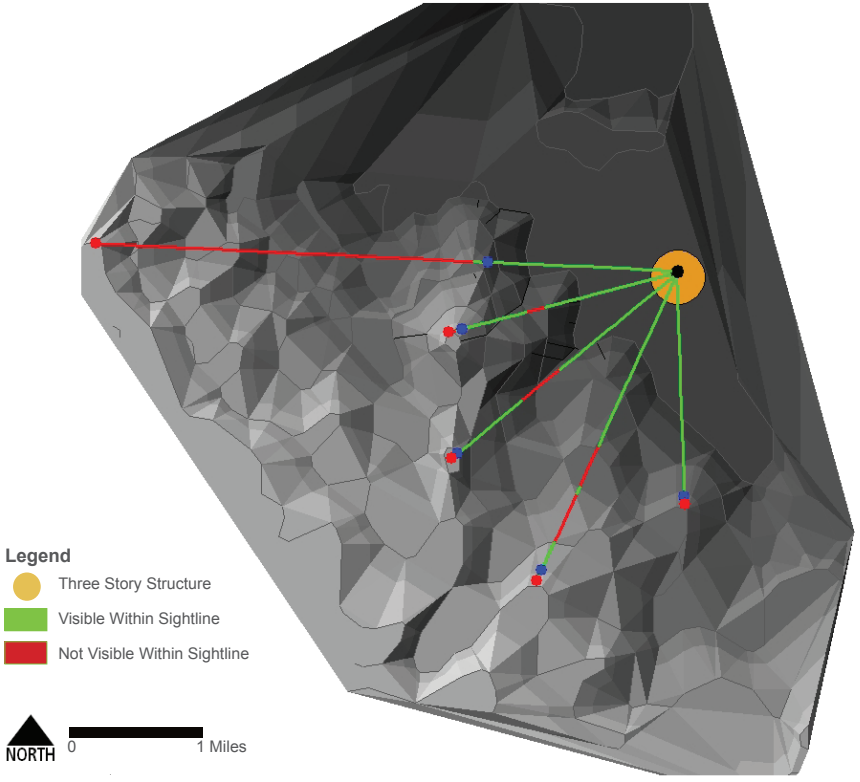


Figure 2.2 PCMR Sightlines (Cody Peratt 2008, Adapted from the Utah GIS Portal)

Sightlines

Figure 2.2 demonstrates the visual sightlines from a three story structure positioned on the site. It reveals which portions of the mountain are not visible from the site. It also establishes positions on the mountain where views of the development would or would not be possible. The sightline furthest to the north shows that the peaks of Alta and Snowbird (northwest of Park City) would not be visible from the base of PCMR.

Watersheds

The site is located within the East Canyon Creek Watershed and receives water coming down the east face of the mountain (Fig. 2.3). There is a piped water network that picks up the majority of this water before it reaches the site. Stormwater then runs below ground, across the western edge of the site before entering a stream on the other side of Silver King Road (Fig. 2.4). The stream corridor then runs to a retention pond on the grounds of the Park City Municipal Golf Course. It is important not to increase the amount of stormwater that will be flowing onto the golf course. There is also an opportunity to daylight the underground pipe and implement bioremediation techniques and stormwater best management practices.

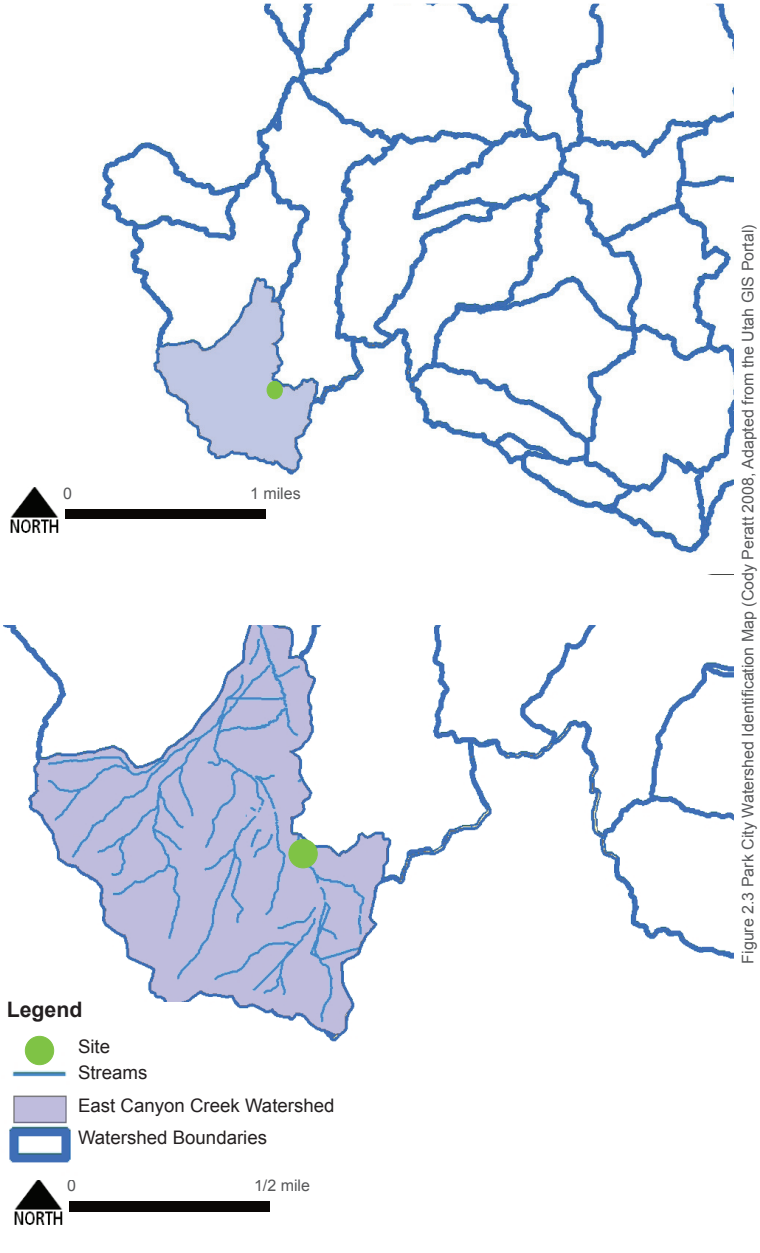


Figure 2.3 Park City Watershed Identification Map (Cody Peratt 2008, Adapted from the Utah GIS Portal)

Figure 2.4 PCMR Stream Location Map (Cody Peratt 2008, Adapted from the Utah GIS Portal)

Soils

Soils on site consist of the Manila-Ant Flat Loams and the Manila Henefer Complex (Fig. 2.5). The soils analysis demonstrates that soil properties are limiting for structures with basements and aquifer-fed ponds. It is limiting due to a high shrink-swell potential, shallow depth to bed rock, as well as an increased depth to water table. The soils have a near neutral pH of 6.7 which is not limiting for vegetation. Soils on site are not hydric and do not present any riparian limitations. The site is also somewhat limited for a pond reservoir because of the shallow depth to bedrock (Figs. 2.6-2.10).

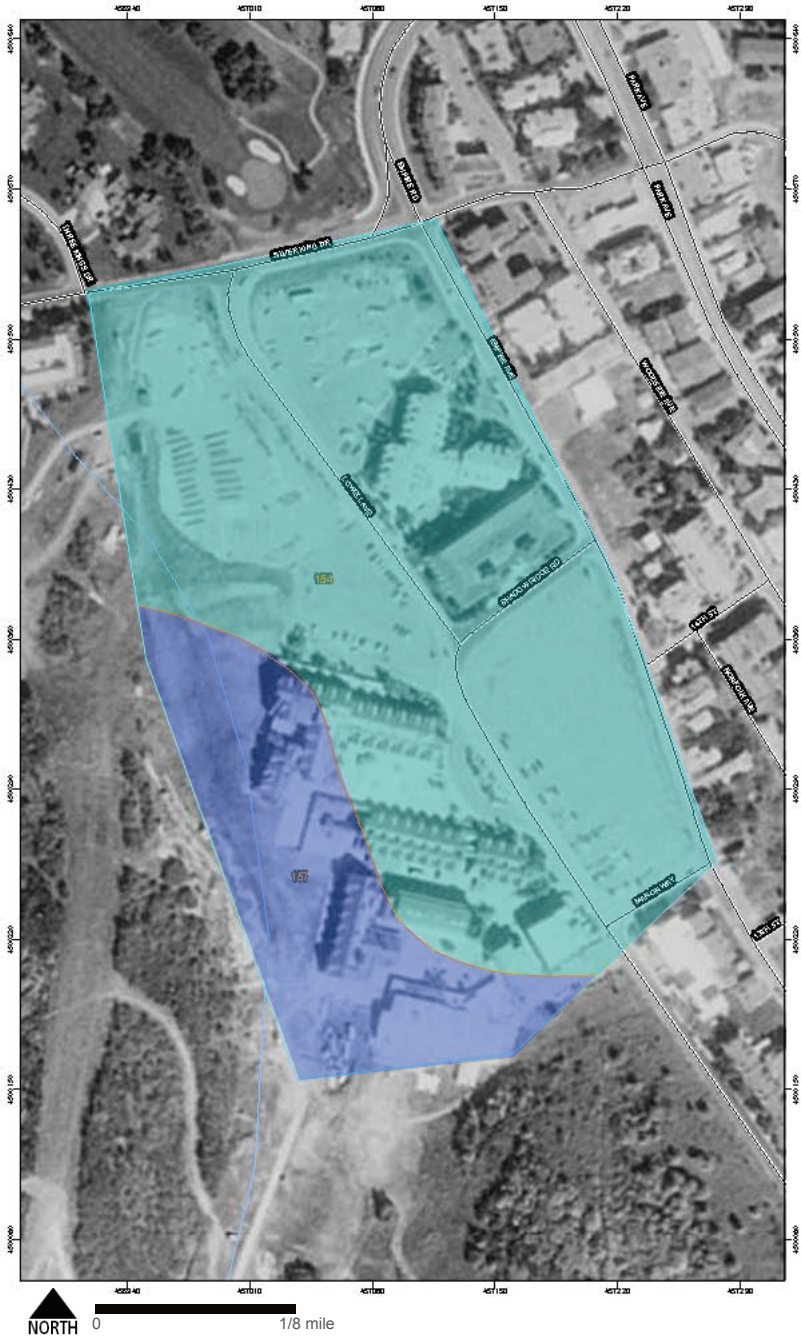


Figure 2.5 PCMR Soils Identification (Cody Peratt 2008, Adapted from NRCS Web Soil Survey)

Figure 2.6 (Cody Peratt 2008, Adapted from NRCS Web Soil Survey)

Structures with Basements

Figure 2.7 (Cody Peratt 2008, Adapted from NRCS Web Soil Survey)

Aquifer-Fed Ponds

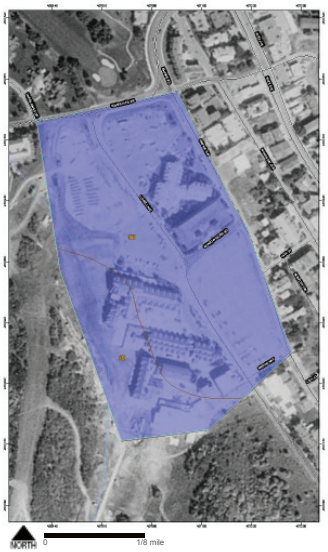


Figure 2.8 (Cody Peratt 2008, Adapted from NRCS Web Soil Survey)

6.7 pH

Legend

- Severely Limited
- Somewhat Limited
- Not Limited

Figure 2.9 (Cody Peratt 2008, Adapted from NRCS Web Soil Survey)

Pond Reservoir

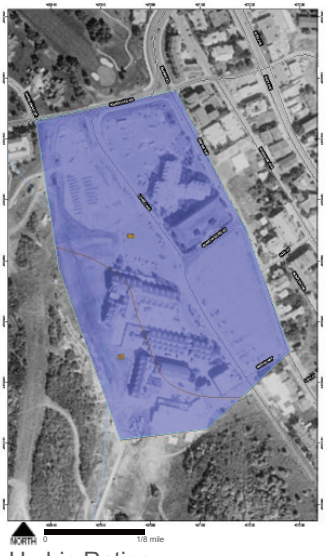
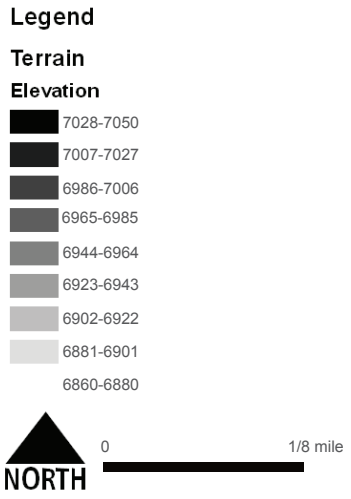


Figure 2.10 (Cody Peratt 2008, Adapted from NRCS Web Soil Survey)

Hydric Rating

Elevation

Slope and aspect also present a few challenges and opportunities for the design of PCMR. Currently, there is approximately 40 feet of grade change across the site from existing portions of PCMR to both Silver King Road and Empire Ave. The extensive change in grade should allow patrons to easily ski downhill from existing portions of PCMR to the proposed development. In order to get skiers back up the mountain, the addition of a new chairlift near the northeast corner of the site may be beneficial. The grade change also presents an opportunity for dramatic views created by maximizing variations in topography (Fig. 2.11).



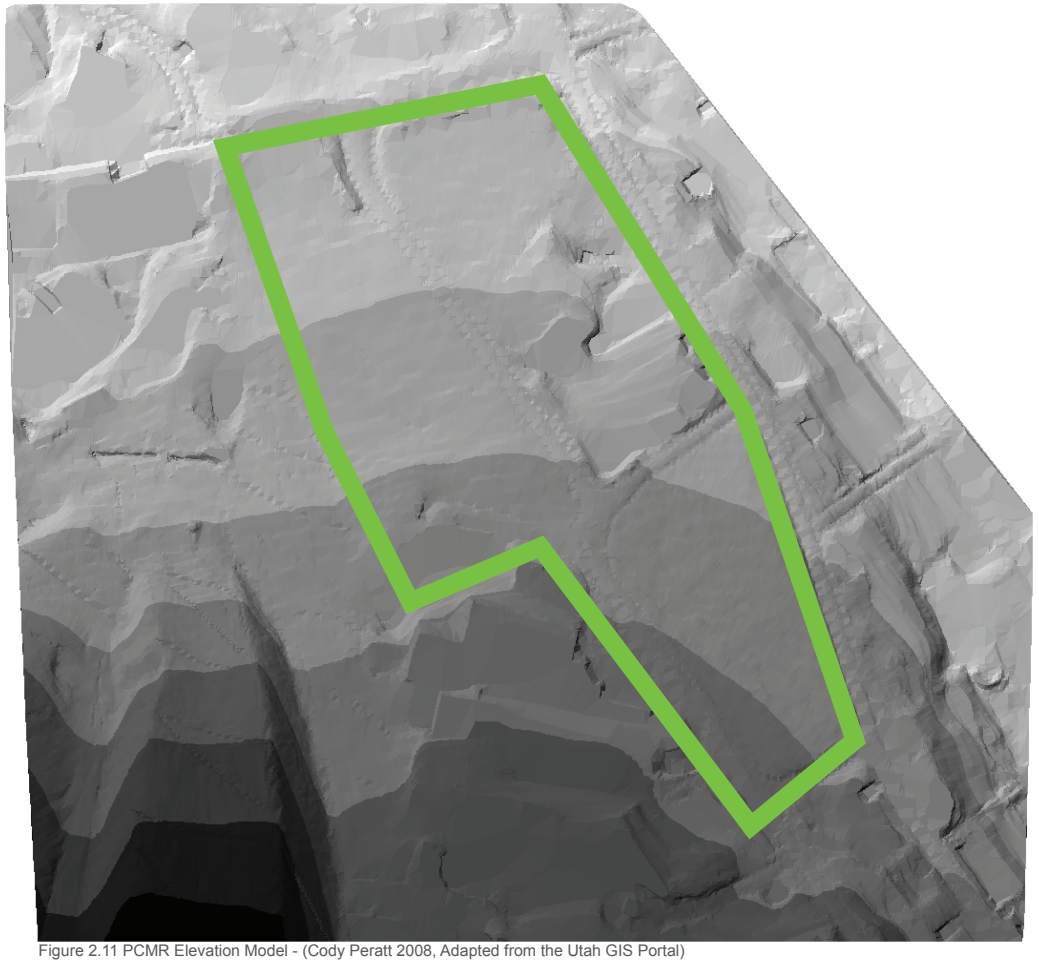


Figure 2.11 PCMR Elevation Model - (Cody Peratt 2008, Adapted from the Utah GIS Portal)

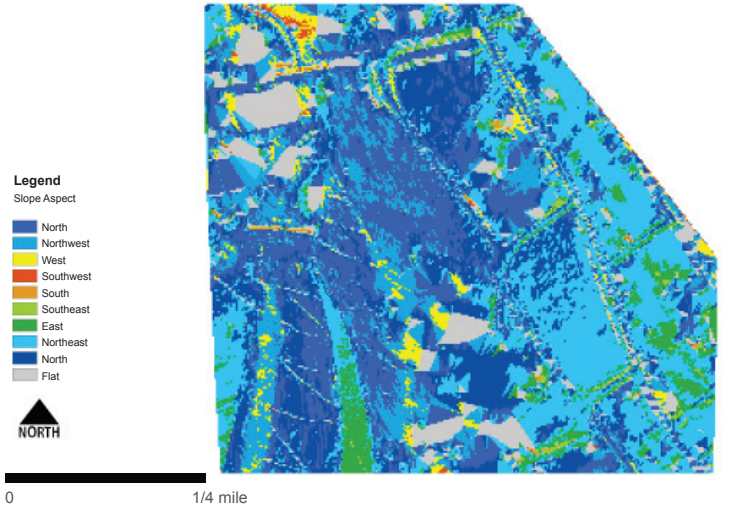


Figure 2.12 PCMR Slope Aspect Model- Not to Scale (Cody Peratt 2008, Adapted from the Utah GIS Portal)

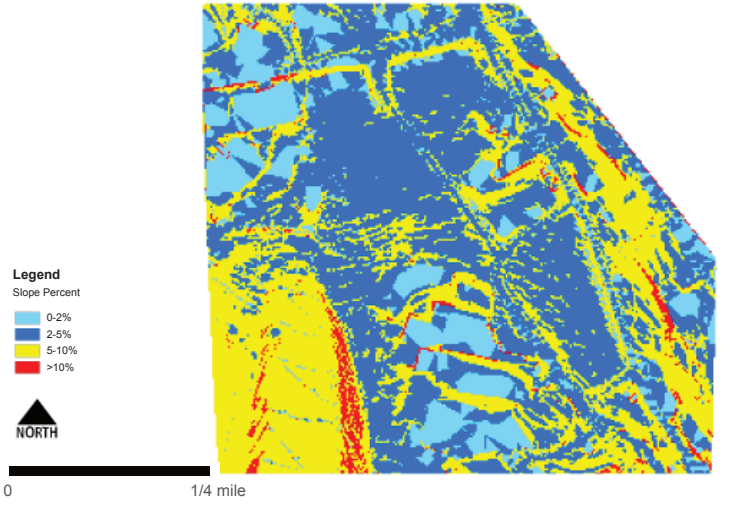


Figure 2.13 PCMR Percent Slope Model- Not to Scale (Cody Peratt 2008, Adapted from the Utah GIS Portal)

Slope Percentages

The slope percentage diagram (Fig. 2.12) shows the predominant slopes on site between the range of 2-5%. Steepest grades are located around the perimeter of the site. Grades in these areas will require the most adjustments where pedestrians will be entering the site. Structures on site will be designed to tuck into the slope in order to minimize grading.

Slope Aspect

The slope aspect diagram (Fig. 2.13) shows the majority of the site sloping to the north and northeast with a decreased potential for passive solar gain. The development architecture should compensate for slope direction in order to maximize passive solar heating and cooling.

Climate

Climate is another important component to factor into the design of Park City Mountain Resort. The climate of Park City is consistent with many mountain cities. Its temperatures are regularly below the national average (Fig. 2.14). In the winter months, average daytime temperatures are around 10 to 20 degrees at the base, and considerably cooler up the mountain. Conversely, in the summer the temperature rarely gets above 80 degrees. The low humidity also makes the region feel cooler and is appealing to more people during summer months. Park City receives considerably less precipitation than the rest of the U.S. during the summer. The average amount of rainfall for June through August is approximately three and a half inches. During the winter months, though, Park City receives about 32" of precipitation. The 32" of precipitation equates to about a ten to twelve foot base of snow on the mountain. Park City receives most of its cloudy days in the winter when the majority of the precipitation occurs.

Park City's climate and topography promotes outdoor activities. The long, snowy winters allow for skiing both early and late into the season. Outdoor ice skating rinks are open from November to early April. Because Park City has lower temperatures and humidity than Salt Lake, many people travel up the mountain to access local golf courses. Mountain biking is also made more enjoyable by the lower temperatures and humidity.

Because of extremely cold winters, plants must be cold hardy to zone 4-5 and able to flourish with the decreased number of frost free days. The design should utilize native plant material that will be able to survive with the limited amount of precipitation during the summer. The physical structure of native plants will also be more adapted to the amount of snow fall and decrease the potential for damage to the plants. The plants listed in Table 2.1 presents a compilation of plant materials that would be considered native to the Greater Wasatch Front. Additional native plants are listed in Appendix II. These plants would be appropriate options for low-input planting designs as well as potentially providing wildlife habitat. Plants listed would not require additional chemical applications or supplemental irrigation to survive.

.

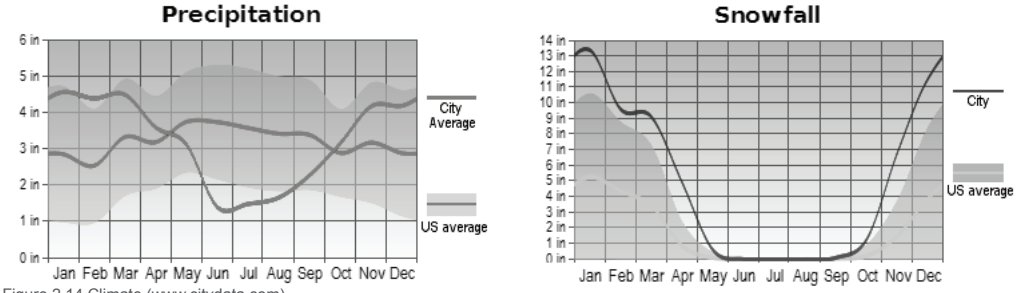
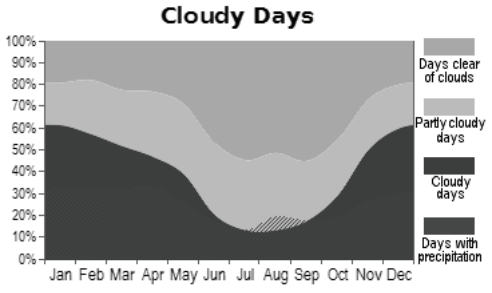
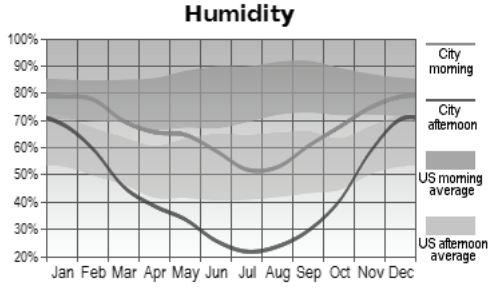


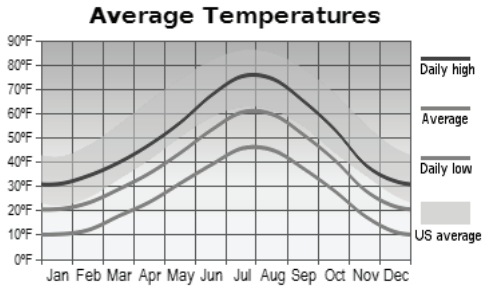
Figure 2.14 Climate (www.citydata.com)

Grasses	Perennials		Shrubs and Trees	
Andropogon scoparius Little Bluestem	Achillea millefolium Yarrow	Guara lindheimeri Guara	Acer glabrum Rocky Mountain Maple	Fraxinus anomala Singleleaf Ash
Bouteloua gracilis Blue grama	Agatache cana Agastache	Liatris punctata Liatris	Acer grandidentatum Bigtooth Maple	Gueterrezia sarothrae Snakebush
Buchloe dactyloides Buffalograss	Asclepias tuberosa Butterfly Milkweed	Linum perenne Blue Flax	Amelachier utahensis Utah Serviceberry	Holodiscus dumosus Rock Spirea
Oryzopsis hymenoides Indian Ricegrass	Berlandiara lyrata Chocolate Flower	Mirabilis multiflora Desert Four O'Clock	Amorpha nana Dwarf Indigo Bush	Juniperus scopulorum Utah Juniper
Stipa comata Needlegrass	Callirhoe involucrata Poppy Mallow	Oenothera caespitosa Evening Primrose	Artemisia sp. Saltbush	Mahonia fremontii Fremont Barberry
	Cryptantha humilis Cryptantha	Oxytropis lambertii Crazy Pea	Ceanothus sp. Ceanothus	Mahonia repens Creeping Oregon Grape Holly
	Delosperma 'Starburst' Starburst Iceplant	Penstemon sp. Penstemon	Celtis reticulata Western Hackbery	Philadelphus microphyllus Little-leaf Mockorange
	Echinacea purpurea Purple Coneflower	Penstemon Leonardii Leonards Penstemon	Cercocarpus intricatus Little-leaf Mountain Mohogany	Pinus edulis Pinyon Pine
	Eriogonum sp. Buckwheat	Perovskia atriplicifolia Russian Sage	Cercocarpus montanus Birch-leaf Mountain Mohagany	Pinus Flexilis Limber Pine
	Gaillardia aristata Blanket Flower	Sedum sp. Sedum	Ceratoides lanata Winterfat	Purshia mexicana Cliffrose
	Geranium viscosissimum Sticky Geranium	Shaeralcea sp. Globe Mallow	Chamaebatiaria millefolium Fernbush	Rhus glabra cis-montana Dwarf Smooth Sumac
	Gilia aggregata Scarlet Gilia	Stanleya pinnata Prince's Plume	Chrysothamnus nauseosus Rabbitbrush	Rhus trilobata Oak-leaf Sumac
		Zinnia grandiflora Desert Zinnia	Ephedra viridis Mormon Tea	Salvia dorii Dorii Sage
			Fallugia paradoxa Apache Plum	Shepherdia rotundifolia Silver Buffaloberry
			Forestiera neomexicana New Mexican Privot	Sorbus Scopulina Western Mountain Ash

Table 2.1 Wasatch Native Plants (Cody Peratt 2008, Adapted from www.wasatchcommunitygardens.org)







Shade Study

Shade is an important component to inventory for aesthetic purposes, gathering space considerations, and planting requirements. Shade will provide a nice resting or gathering space in the summer, but may become icy in the winter. Fig. 2.15-2.18 show the shade patterns of the surrounding structures throughout the day. The sun angles for the study were derived from a location in the Rocky Mountains on January first. January first was used because it is during the peak of the winter ski season. The study revealed that when patrons arrive to the site in the morning, the east side of the structures will be lit and inviting. Conversely, when it is time to leave the mountain in the late afternoon, the east side will be heavily shaded. Shade patterns will need to be more thoroughly addressed once structures are designed and placed.

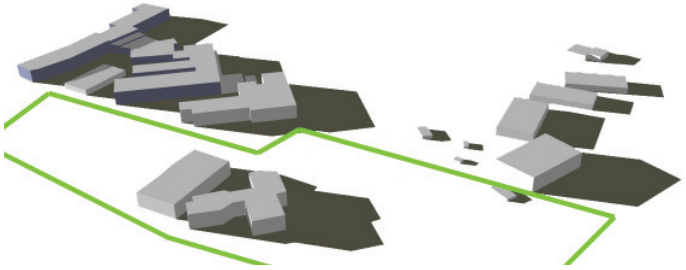


Figure 3.16 Shadow Study of Existing Structures 9 AM (Cody Peratt 2008)

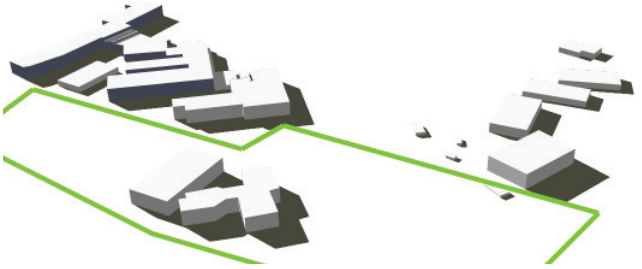


Figure 3.17 Shadow Study of Existing Structures 11 AM (Cody Peratt 2008)

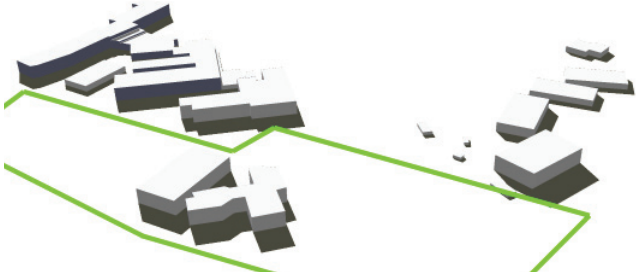


Figure 3.18 Shadow Study of Existing Structures 1 PM (Cody Peratt 2008)

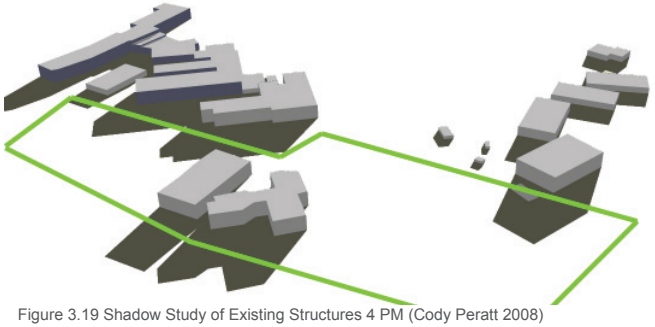


Figure 3.19 Shadow Study of Existing Structures 4 PM (Cody Peratt 2008)

Legend

Site Boundary

Human Character

In order for the proceeding design to be socially sustainable, it has been determined that certain components must be examined further. These components include: Character and identity, diversity, mixed use, and walkability. Park City has both a unique human and architectural identity. Thousands of people come to Park City each year for festivals, recreation, and relaxation.

In areas surrounding Park City, residents live off the land in their small farming and ranching communities. Because of the limited water resources, farmers predominately grow alfalfa and other hay. Most of the hay that is grown, is in turn fed to livestock. According to the Utah State University Extension Office, some of the major classes of livestock in the Greater Wasatch include cattle, sheep, lamb, and mink. The rich agricultural history of the region is celebrated each July and August during the Oakley Rodeo and Summit County Fair (Fig. 2.19).

As with many resort destinations, numerous people also call Park City their second home. These people travel to the mountain town for weekends and special events. The city puts on several events throughout the year in order to draw seasonal visitors. In July, the Triple Crown Softball World Series is held there, as well as the Park City International Music Festival. During the fall, events such as the Park City Arts Festival, Fidelity Investments Jazz Festival and the Miner's Day Parade Celebration lend to a vibrant atmosphere. Many celebrities also come to the city once a year for the annual Sundance Movie Festival. During this time, the city is exceptionally full of life. Fine restaurants and shops must be able to cater to the needs of the celebrities while maintaining their quaint mountain charm.

Park City was the host of the 2002 Winter Olympic Games (Fig. 2.20). Preparations for the Olympics resulted in large improvements to the infrastructure and public transportation system of the city. The left over training facilities are utilized year round and draw professional athletes during the summer who need to stay in top physical shape. Professional skiers and snowboarders are hired by PCMR to test and suggest changes to terrain parks (Fig. 2.21).

The mountain terrain and vibrant city also attracts a large amount of extreme sports enthusiasts. Surrounding mountains contain miles of extreme cycling trails and ski runs. Bungee jumping, skate parks, rock climbing, and hang-gliding are all activities throughout the summer. The city puts on a marathon and cycling festival in which thousands participate. The city has openly embraced extreme athletes and the culture they bring with them. Vibrant art can be found throughout the city and adorn large ramps on the mountain terrain (Fig. 2.22).

Park City Mountain Resort has a very diverse workforce. Since most employee jobs are seasonal and available from late November to early March, a majority of the workforce is from South America. Students from countries like Chile and Argentina

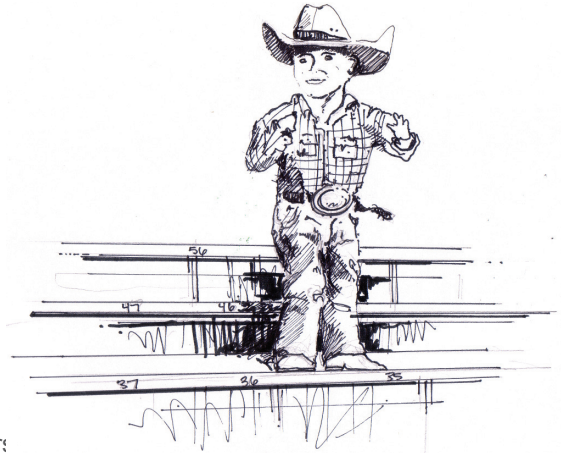


Figure 2.19 Park City Cowboy (Cody Peratt 2008)

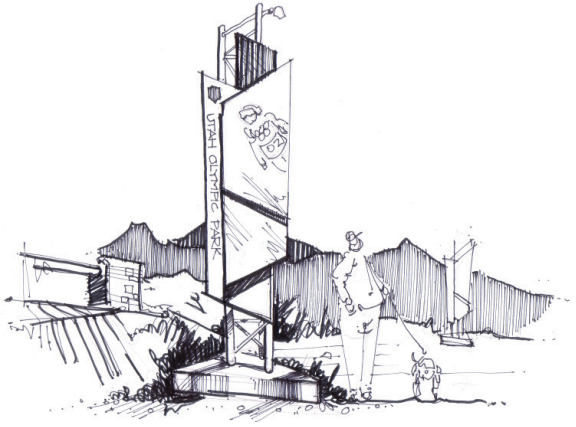


Figure 2.20 Olympic History (Cody Peratt 2008)

Figure 2.21 Snowboard Culture (Cody Peratt 2008)

come to the resort in order to work over their summer break. Foreign student workers bring with them their own music and culture, adding to the diversity of the mountain town.

The design for additions to PCMR should take into account and relate to the rich historical past of the town. Landscape should allow for education and reflection of the once prevalent mining industry. Monuments on site should relate to the Olympic presence and local art should adorn the site. Spaces within the resort should allow room for extreme sport elements like temporary skate parks or rail jam events. Shops and restaurants should be able to accommodate the expectations of everyone from residents to celebrities.

Figure 2.22 PCMR Snowboard Ramp Art (Cody Peratt 2008)

Architectural Character

A study of the architecture prevalent in Park City reveals three predominant forms. The first of these is vernacular architecture reminiscent of the mining era. The second type, wood timber construction, is typified by the log cabin. The third, modern mountain structures, emphasize the use of concrete and glass, with wood accents. Fig. 2.23-2.27 are sketches from Main Street in downtown Park City. The image to the right (Fig. 2.24) is of one of the original mining structures of the town. The old mining facility can be seen from the top of the Thaynes Chairlift at the Park City Mountain Resort.

Figure 2.23 Park City Architecture (Cody Peratt 2008)

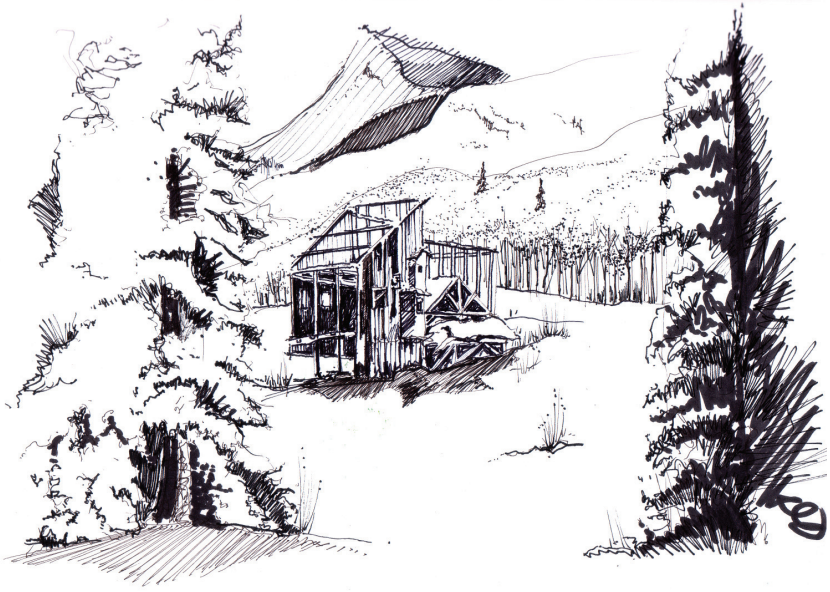


Figure 2.24 Thaynes Chairlift (Cody Peratt 2008)

Figure 2.25 Park City Aerial (Cody Peratt 2008)

Figure 2.26 Upper Main Street (Cody Peratt 2008)

Figure 2.27 Main Street (Cody Peratt 2008)

Mining Era

This architectural style was predominately used in commercial building construction and is often found along an old western town's Main Street. The use of raised wooden sidewalks and covered front porches provide protection from the elements while allowing shoppers to stay clear of the streets. Faux facades front the structures supplying ample room for business signs. The large building fronts give the perception the structures are larger than they really are.

Windows in this type of architecture are simple and rectangular. Windows typically occupy approximately 20-30% of the building front.

Since structures from this era are constructed entirely of wood, the exteriors are often left unpainted and the color palette is dominated by earth tones (Fig. 2.28-2.33).

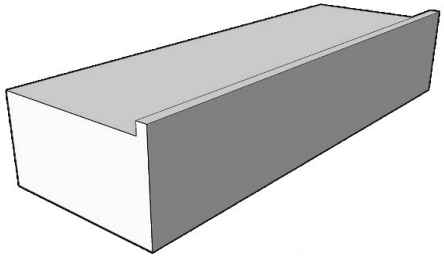


Figure 2.28 Vernacular Volumetric (Cody Peratt 2008)

Figure 2.29 Vernacular Architecture (www.legendsofamerica.com)

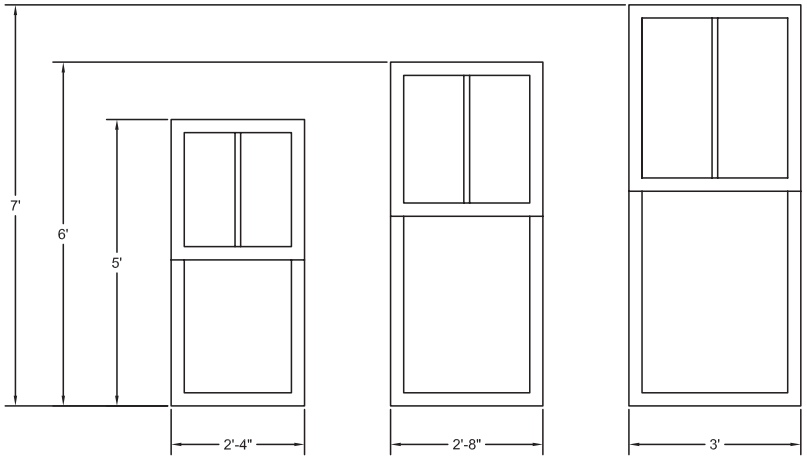


Figure 2.30 Window Sizes (Gindroz et. al.)

Figure 2.31 Window Percentage (Cody Peratt 2008)

Figure 2.32 Arch. Materials- Siding (www.cypresssiding.com)

Figure 2.33 Color Palette 1 (Cody Peratt 2008)

Log Timber Construction

The second type of architecture that dominates the landscape of Park City is that of traditional log cabin construction. This type of architecture is characterized by large timbers one to three feet in diameter. Fig. 2.36 shows how the debarked timbers are notched to allow the logs to fit close together minimizing gaps.

Similar to the vernacular structures on Main Street, log construction is comprised almost entirely of wood. These structures are also often left unpainted allowing the natural colors of the wood to prevail. Windows sizes and occurrence are similar to the previous architectural typology. Large round fieldstones are used for the foundation and chimney, or as a decorative veneer (Fig. 2.34-2.40).

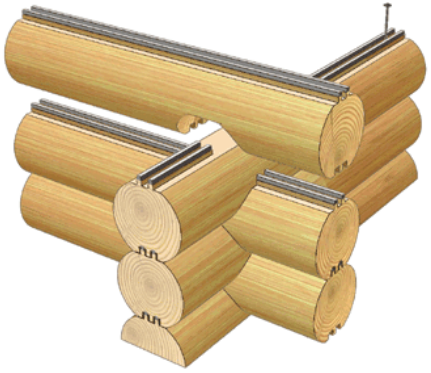


Figure 2.34 Log Construction (www.inthesmokymountains.com)

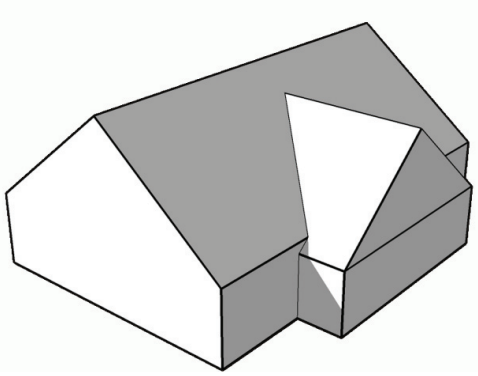


Figure 2.35 Log Home Volumetric (Cody Peratt 2008)

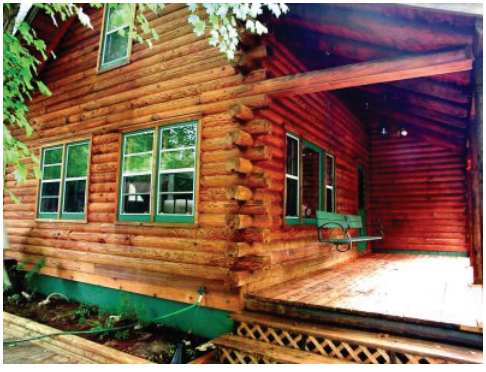


Figure 2.36 Log Home (www.cariboo.bc.ca)

Figure 2.37 Window Percentages (Cody Peratt 2008)

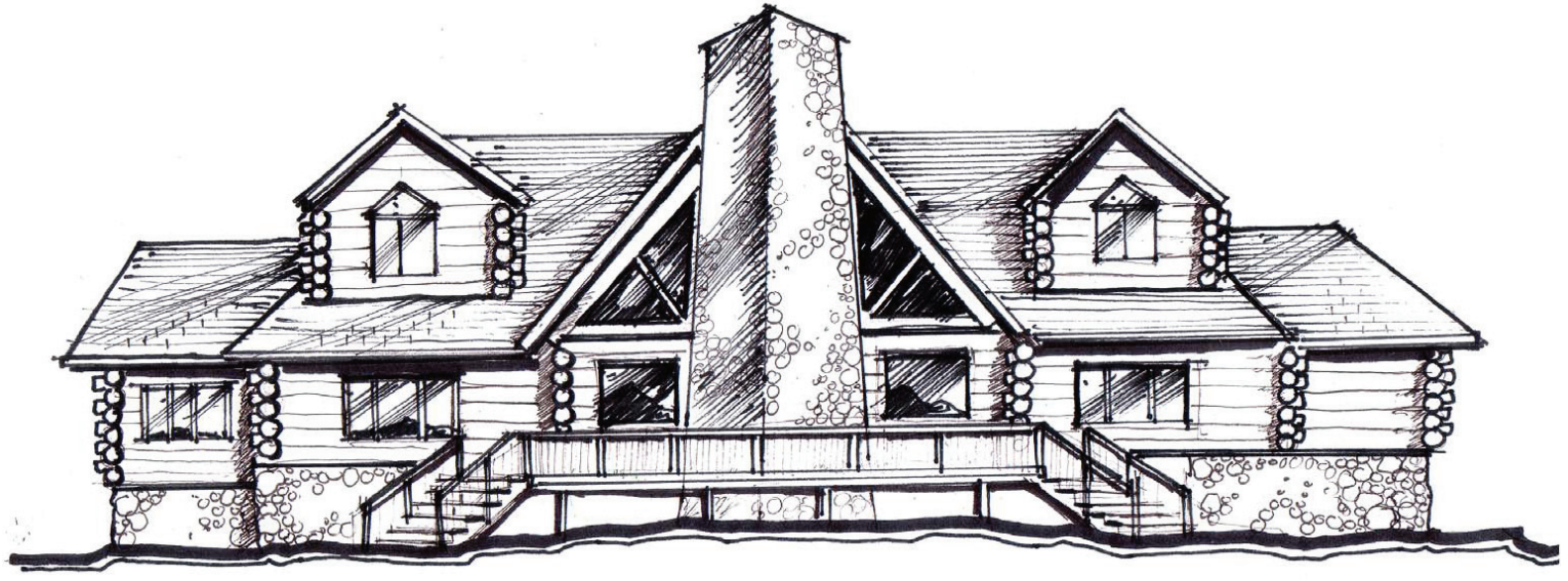


Figure 2.38 Log Home Sketch (Cody Peratt 2008)

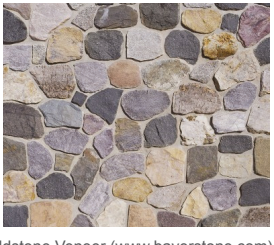


Figure 2.39 Fieldstone Veneer (www.bayerstone.com)

Figure 2.40 Color Palette 2 (Cody Peratt 2008)

Modern Mountain Structures

Figures 2.41 and 2.43 show the character of some existing structures constructed recently in the mountain environment. This architectural style has similar traits to both the vernacular mining town architecture and log cabin structures, with an introduction of modern building techniques and materials. Structures still utilize wood, but the number, size, and frequency of timbers are greatly reduced. Also, the introduction of metal and cut stone (as opposed to fieldstone) accents allow for the visual monotony of uniform materials to be broken up.

A major difference between this type of architecture and those previously examined, is the high percentage of facade space devoted to windows. In the two previous types of architectural styles, windows occupied between 10-40% of the external surface area. Conversely, windows in modern mountain structures occupy up to 90% of the building facade, providing reflections of the sky and surrounding landscape. The diverse window shapes and sizes result in a color patterning of the facade. The color palette is similar to the two previous architectural types, with the addition of blue as a result of reflections in the oversized window panes (2.41-2.49).

Figure 2.41 Modern1 (www.news.architecture.sk)

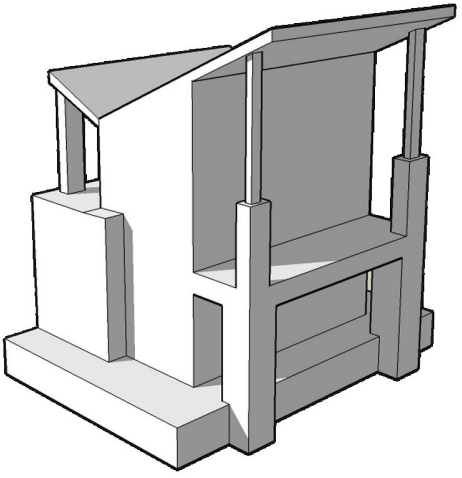


Figure 2.42 Modern Volumetric (Cody Peratt 2008)

Figure 2.43 Modern 2 (www.news.architecture.sk)

Figure 2.44 Window Percentage 3 (Cody Peratt 2008)

Figure 2.45 Modern Residential (Cody Peratt 2008)

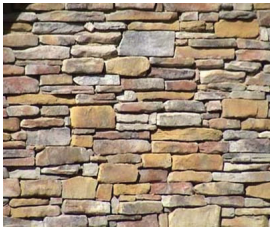


Figure 2.46 Cut Stone (www.bayerstone.com)

Figure 2.47 Cut Stone 2 (www.bayerstone.com)

Figure2.48 Metal (www.featurepics.com)

Figure 2.49 Color Palette 3 (Cody Peratt, 2008)

Walkability

Creating a walkable design within the surrounding mountain community is an element that was determined to be important for social sustainability. A walkable resort combined with a variety of uses results in a community in which people can live, work, and play. Fig. 2.50 illustrates the walkable connections within the greater context of Park City. Walkable components examined include distances to; medical services, grocery, existing transit stops, open space, walking trails, and biking options. The diagram shows that all of the examined components are accessible in a 1/2 mile radius from the center of PCMR, or a 10 minute walk.

Currently, two transit stops service the site. One transit stop is located on the south end of PCMR along Lowell Ave., and the other along Empire Avenue. A third transit stop is located just northeast of PCMR. This stop services homes within Park City Municipal Golf Course and the adjacent commercial district. The proceeding design should identify the ideal location for another transit stop within the site.

Two grocery stores are located near the site but will be most easily accessed through the public bus service. Park City's public transportation system runs from 6:10 a.m. to 2:10 a.m. during peak seasons.

It is imperative for the master plan to implement clear pedestrian connections to neighboring green space. ADA accessible walks should allow users to traverse the site with ease. Non ADA accessible walks should be kept to a minimum and provide users with a clear alternative route.

Bike trails and routes should meet at strategic locations where existing trails converge with the site. The diagram (Fig. 2.50) shows two spots where mountain bike trails come down the mountain to the site. These areas may be good locations for the introduction of a new chairlift.

Within the site it is important to recognize any existing nodes or barriers. Connections to where people gather and the existing volumtrics of the spaces should be mimicked in the design. Figures 2.51-2.56 illustrate the location of specific nodes, exceptional sightlines, bordering facades, open stretches, and vertical elements on site.

The three identified significant types of pedestrian spaces (Nodes, Corridors, and Plazas) are shown in Figure 2.57.

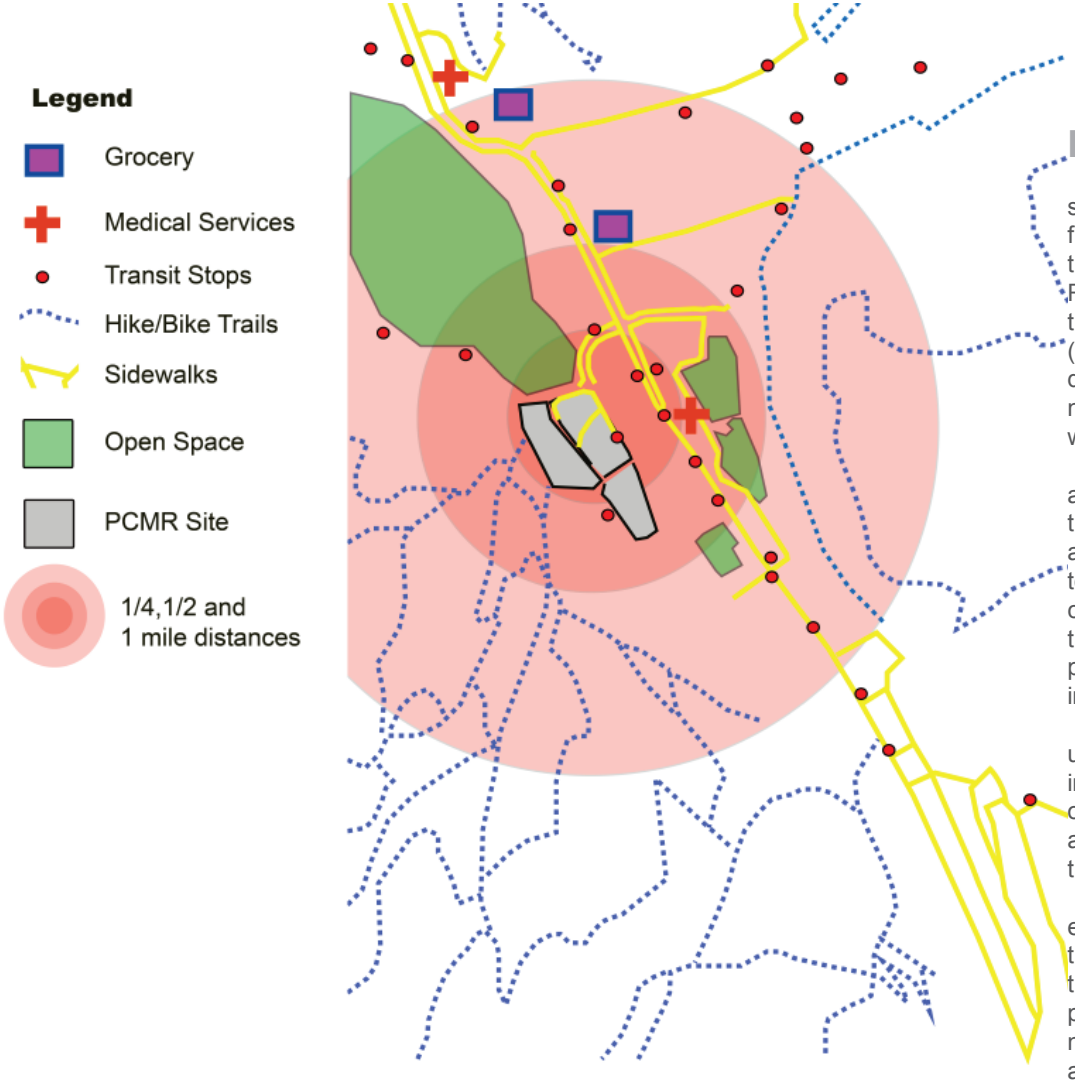


Figure 2.50 PCMR Walkability Map (Cody Peratt 2008)

Economic Projections

The concept of economic sustainability is based on PCMR being able to financially support the proposed additions to the resort. According to Park City Mountain Resort, they expect to finance the additions through the sale of residential units on site (Erickson, 2008). The financial balance is dependent upon the ability to sell the critical number of units at a cost that people are willing to pay.

According to the financial assessment study conducted by PCMR, the residential units will need to be sold for approximately $800 per square foot in order to sustain the developments construction costs. The resort is accruing the money through a loan on a 20 year term. The master plan should include a variety of sizes of units in order to appeal to more buyers.

The resort also intends to make up some of the capital investments through increased number of lift tickets and leasing of new commercial space. The resort anticipates upwards of a million people to visit the resort during the 2009 season.

Affordable housing for the resort employees is a goal of PCMR and currently there is no housing available specifically for them. Seasonal workers receive about $10 per hour of work and must commute from neighboring communities. Smaller, efficiency apartments may be subsidized by the resort to provide housing for its employees on site.

Inventory + Analysis

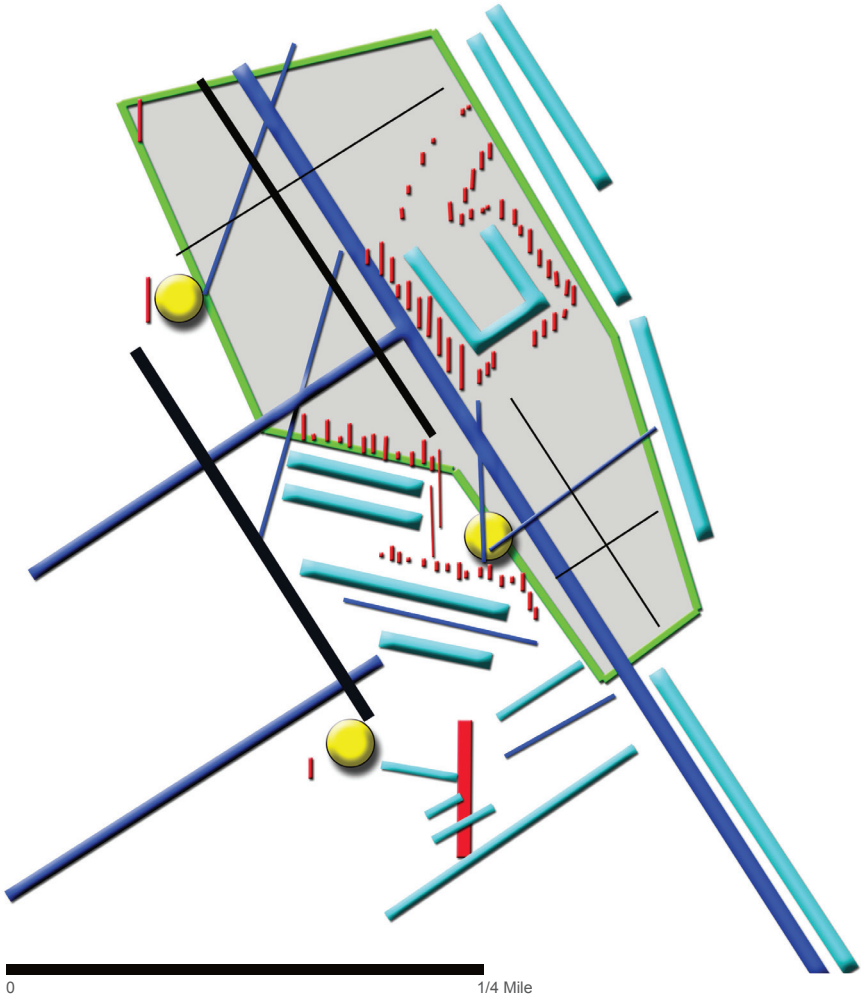


Figure 2.51 Connections and Nodes (Cody Peratt 2008)

Figure 2.52 Fire Pit (Cody Peratt 2008)

Nodes- Pedestrian nodes on site are areas of high traffic volume adorned with statues, monuments, and firepits. The design of proposed central spaces should be located within near proximity to existing nodes on and off site.

Figure 2.53 PCMR Entry Plaza (Cody Peratt 2008)

Sightlines- The preservation of visual lines to landmarks creates coherent spaces with familiar patterns. Visual connections must be maintained throughout design.

Figure 2.54 Facades (Cody Peratt 2008)

Facades- Interesting fascades, colors, textures and other elements in the landscape break up the homogeneity and allow for uniformity through variety.

Figure 2.55 Mountain View (Cody Peratt 2008)

Open Stretches- Open, expansive stretches of land allow for the borrowed landscape and create spaces that seem larger than they really are. Wide stretches of open area are denoted by a black line.

Figure 2.56 Vertical Elements (Cody Peratt 2008)

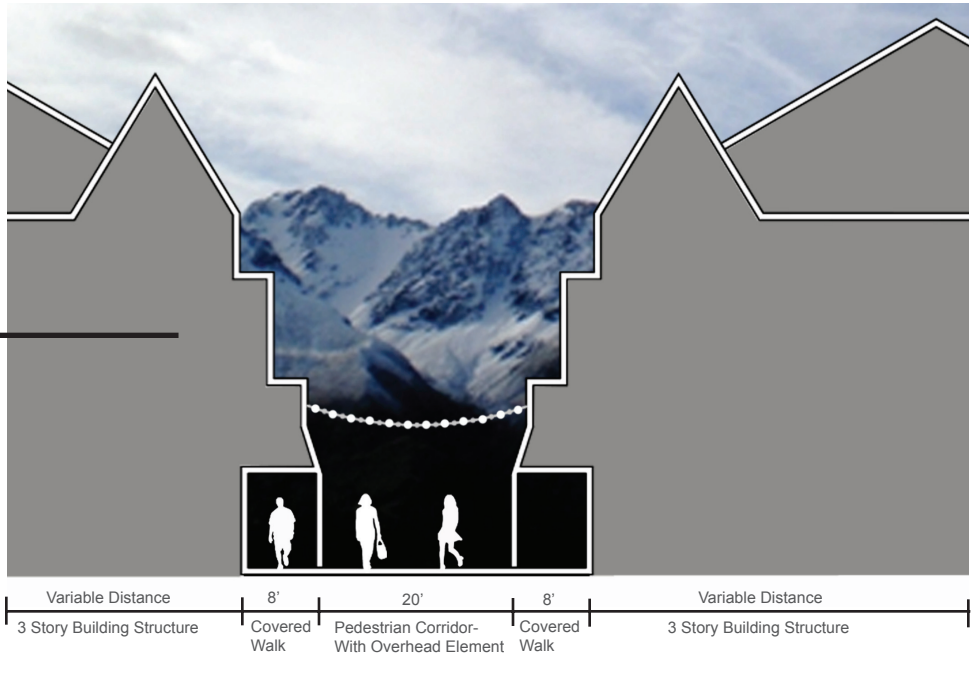
Vertical Elements- Vertical elements increase the scale of the landscape by utilizing the overhead volumetric space. Important vertical elements on site serve as landmarks and are denoted with a red line.

Nodes

Corridors

Plazas

Within Park City Mountain Resort, three significant types of pedestrian spaces have been identified (Nodes, Corridors, and Plazas). Figure 2.57 shows the standard dimensions of these three types of spaces within the existing resort. Designed pedestrian spaces in the addition to the resort should reflect similar dimensions, volumes, and scale.



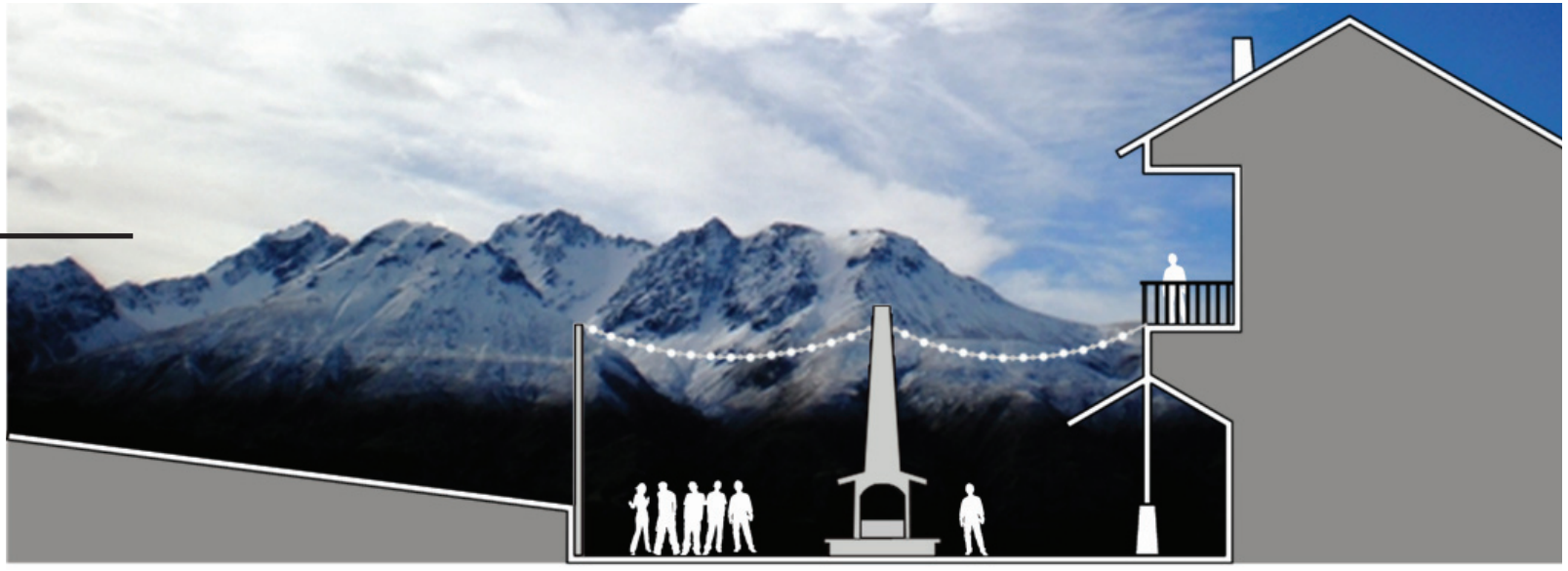


Figure 2.57 PCMR Standard Spatial Dimensions- Not to Scale (Cody Peratt 2008)

Inventory + Analysis

Approximately 12 acres of parking lot- The vast parking surface is no longer required resulting in a potential to utilize the concrete as a re-use source material.

Lowell Ave. currently runs through the site and it is important to keep this vehicular connection in proceeding designs.

Current Drop-off and Transit Stop- This spot should act as the catalyst point for the rest of the development. It is currently the junction of arrival activity on site.

Surrounding Neighborhood- The surrounding neighborhood is comprised of a mixed-use residential/commercial district that could potentially draw more commerce to the development.

Existing Development- this is the existing portion of PCMR. There should be both an implied and physical connection to the existing structures and amenities provided within.

The blue dots identify the three main entrances to the site. The entrance from the north the closest access point from Highway 224 and is most heavily utilized by people coming from Salt Lake. This entrance should act as a focal point and may utilize some sort of vertical element.

The limited vegetated open space on site allows for great improvements. Larger more contiguous tracts of open space are required in the design for public gathering, use, and enjoyment.

Existing condos/apartment complex- Scheduled for demolition. The structure provides an opportunity for the housing of workers during the development construction.

The site will require shielding from the bitter cold northwest winds. Vegetative windbreaks or strategic building placement will minimize the volume and velocity of winter winds.

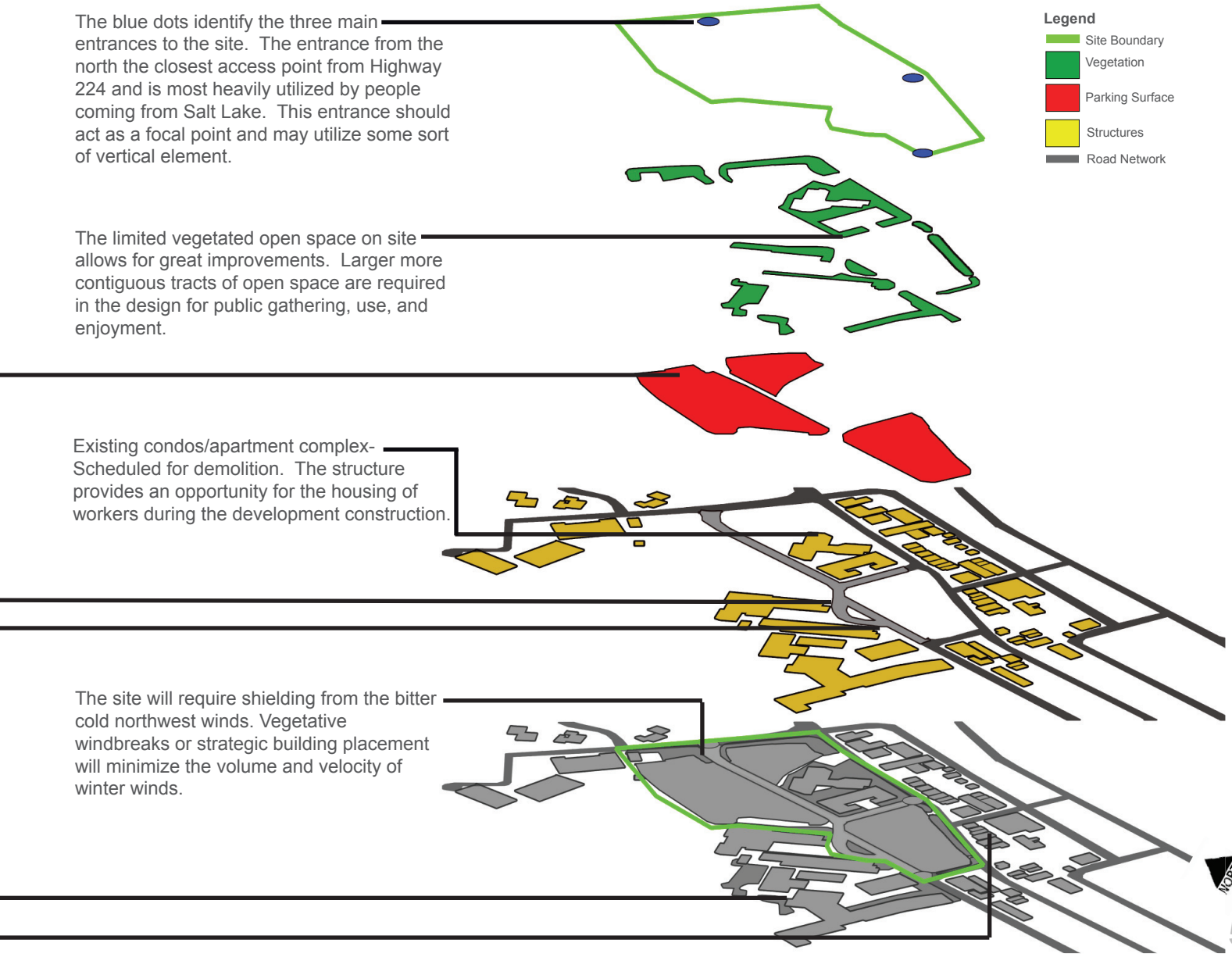


Figure 2.58 Analysis Summary Diagram (Cody Peratt 2008)

programming

Goals + Objectives

The goals and objectives for the project were determined through a combination of the literature review and precedent study, as well as information gathered from the site analysis and contact with the client. The goals and objectives will guide the programming process.

Goal:

Design a resort community that will follow the ecological, social, and economically sustainable design principles established by Envision Utah.

Goal:

Design the development to enhance the surrounding environment and natural systems.

Objectives:

- Daylight riparian corridors
- Use alternative forms of energy
- Design a variety of storm water BMPs
- Use of 100% native plants
- No landscape irrigation
- Re-use of recycled materials
- Use of Local source materials

Goal:

Create educational opportunities that showcase Park City's rich historical past.

Objectives:

- Provide educational signage and monuments recognizing Park City's connection to the Olympic Games and mining.

Goal:

Provide a design that will promote the socio-economic diversity of Park City.

Objectives:

- Design a variety of housing options at a varying scale of costs
- Provide housing for at least 20% of PCMR employees
- Provide for activities and use throughout the entire day and into the night
- Design for open space to be utilized to hold special events and gatherings
- Provide for cultural mix of extreme sports, local traditions, and elegant expectations of visitors.

Goal:

Insure development aesthetics conform to the desires of the client.

Objectives:

- Landscape design and architecture should reflect a contemporary mountain style
- Maximize and control views within the site and into the broader mountain landscape

Goals + Objectives

Goal:

Create a design that can be economically absorbed by the revenues produced by the development.

Objectives:

- Provide accommodations for the anticipated 1,000,000 visitors annually to Park City Mountain Resort
- Provide recreation opportunities year round as opposed to just during the ski season
- Provide a mix of commercial activities including shopping, dining, and entertainment
- Create a unique atmosphere that will attract outside income

Goal:

Create a walkable resort within the broader context of the mountain community.

Objectives:

- Provide a system of connected roads or paths in the design
- Provide clear and efficient transportation routes (ie, bike lanes, signage, transit stops, and pedestrian corridors)
- Connect with the existing transportation system
- Provide limited day parking
- Provide recreation, housing, shopping, and dining within the same development

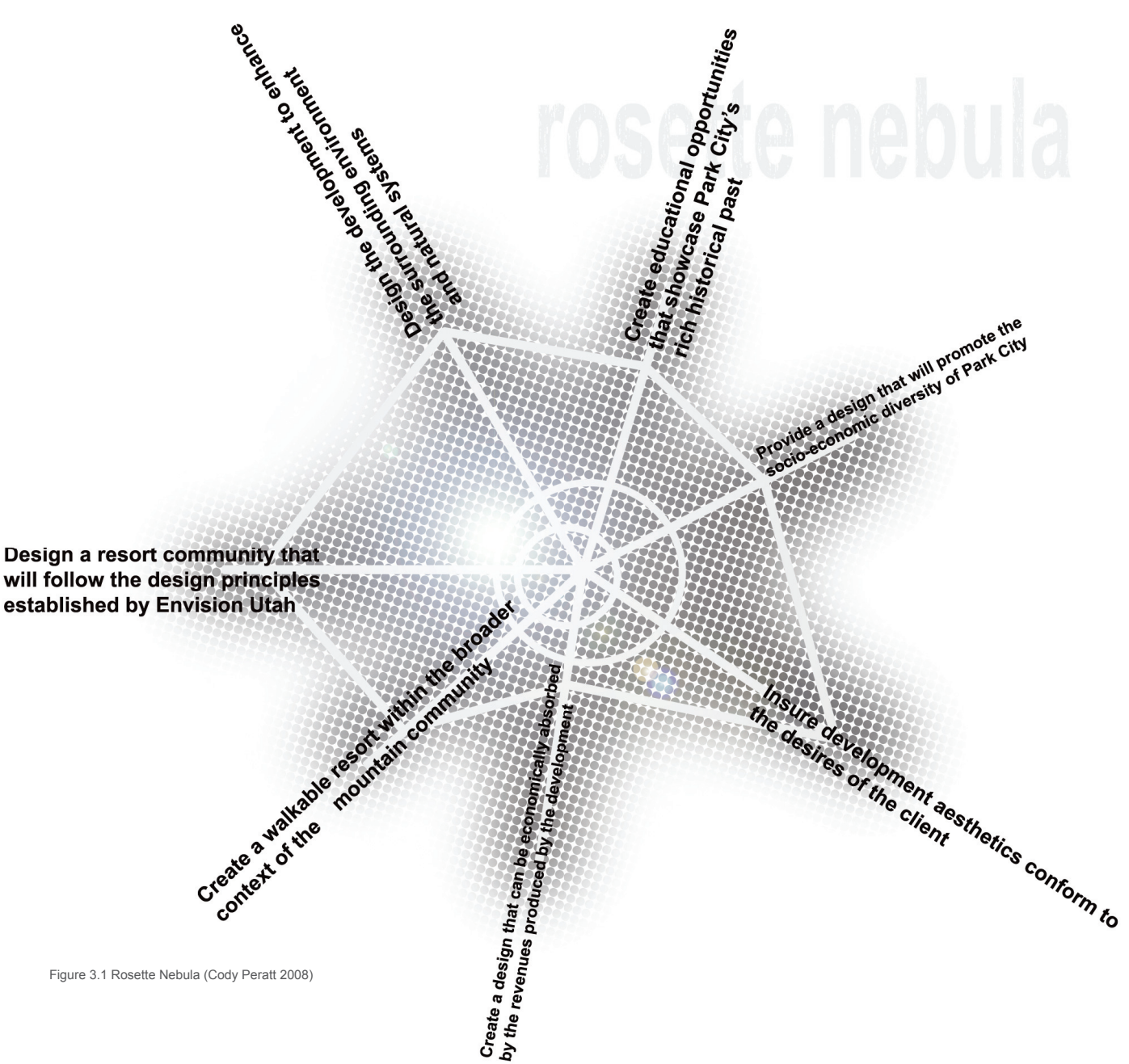


Figure 3.1 Rosette Nebula (Cody Peratt 2008)

Programming

Programming Matrix

A programming matrix adapted from William Pena was used as a framework for guiding the programming process (Table 3.1). The matrix was used to compile and sort the information gathered thus far into a clear illustration of the project's requirements. The data used to fill the matrix was taken from the client's needs and desires, my personal goals and objectives, and from sustainable guidelines set forth in the developed sustainability assessment framework.

	Goals	Facts	Concepts	Needs	Problem
Function					
People	Provide for anticipated increased visitors	Anticipated increase to 1,000,000 visitors annually	Indoor/outdoor relationship	Literal and implied connections to the surrounding land and socialscape	Relationship of built to natural environment
Activities	Provide activities for a variety of uses including entertainment, shopping, dining, recreation, and living	Highest number of visitors during ski season (Late November- Early April)	Mountain Connection	Equipment storage and changing areas	Visitors as opposed to residents will shape design needs or vice versa
Relationships	Allow for overlap use of spaces throughout the day	Less need for surface parking because of efficient and highly used public transit system	Large outdoor gathering area for events/concerts	Outdoor space requirements	
Circulation	Directs efficient movement throughout the site with a major focal gathering point	Requirement to provide housing for at least 20% of PCMR employees	Walkable/ Transit Oriented Design	Commercial requirements	
	Amenities within close proximity to mountain lift system	Surrounding street ROWs must remain intact		Required square footage of commercial and residential space	
	Shopping situated in order to utilize day visitor shopping	Lowell Avenue must match at property line			
	Accessibility to the base with clear and simple transit options and walkability	Need for multiple types of commercial activities			

Programming

	Goals	Facts	Concepts	Needs	Problem
Form					
Site	LEED Certification	12 acre site	Bioswales	Durable materials	Limited size of site
Environment	Native Plantings	Currently a parking lot	Green Roofs		
Quality	Storm water BMP's	PCMR cannot abandon investment to Legacy Lodge	Pervious Paving	Green Building Design Requirements	Building heights must reflect current volumetrics
Social Interaction	Balance of open and built space	Residential Neighborhood located adjacent to the site	Underground Parking	Dynamic spaces that can adapt to a variety of uses (day vs. night/ summer vs. winter)	Land is not being utilized to fullest potential
	Utilizing the "borrowed" Landscape	Site currently serviced by free public transportation	Views of Golf Course and Mountain accentuated	low input landscape materials	
	Connections to the Mountain, Light, and Weather	Site is physically located at the base of the mountain	Daylight riparian corridor flowing through the site		
	Architecture consistent with mountain culture, materials, and the past.	Need for some surface/day parking	Use of all native plantings in designed environment		
	Principles of Walkability adhered to				
	Provided housing for employees		Wide mix of housing in modern architectural style		
	Mix type and cost of housing				

	Goals	Facts	Concepts	Needs	Problem
Economy					
Ability to Recover Costs	Maintain the financial stability of the Park City Mountain Resort	Owned by Park City Mountain Resort	Keep initial economic investments feasible	Year round income	Cost of initial funding
Operating Costs	Alternative forms of energy	Park City Mountain Resort is financially sound	Utilize increased tax revenue to supplement costs	Public and private cooperation	High economic costs of BMPs
Life Cycle Costs	Utilize existing infrastructure opportunities	Increased visitors will benefit the City and the resort through added commerce and tax revenue		Government Approvals	
	Use of high quality, long lasting materials			Energy budget	
	Benefit to Neighboring Golf Course			Estimated operating costs	
	Collaboration between the public and private sectors				

	Goals	Facts	Concepts	Needs	Problem
Time					
Past	Purposeful and well designed reflections of past uses and activities of the site/city	Park City founded on Silver Mining	Play off of the fact that the opportunity for this project was the result of decreased need for parking due to extremely efficient public transportation	Statues and figures that relate to the past, present, and future	Still some need for current use as parking lot
Present	Be cognisant of the principles set forth in the Envision Utah Community Growth Plan	Park City hosted the 2002 Winter Olympics	Connection of the past to the future of the site		
Future	Set precedent as sustainable mountain resort for future development in the area	Community desire for City-wide sustainability	Phasing	Construction Schedule	Implications with changes in economy
	Construction time frame				

Table 3.1 Programming Matrix (Cody Peratt 2008, Adapted from William Pena)

Hotel/Condo Requirements

Background market studies conducted by Park City Mountain Resort has determined that the resort development should include approximately 370 housing units. The development should have 300 two bedroom units, 15 luxury suites, as well as 55 efficiency apartments reserved for employees. It has been determined that the new development, including the existing portion of PCMR, will require a total of 1,550 parking stalls. Additionally, PCMR will require at least 40,000 sq. ft. of retail and restaurant space in the development (Fig. 4.2-4.3).

Figure 3.2 Programming Elements Arrangement (Cody Peratt 2008, Adapted from OHH)

Programming Requirements

+ Residential
  - 15 units @ 2,000 sq. ft.
  - 300 units @ 1,500 sq. ft.
  - 55 units @ 750 sq. ft.

+ Retail
  - 40,000 sq. ft.

+ Parking 1,550 stalls

Phasing

+ 3 Phase Project
+ 100-150 units per phase
+ Capital Costs borrowed on a 20 year note

Estimated Costs

+ Parking Structure
  - $30,000/ Parking Stall
+ $5 million for infrastructure

Recovery

+ Units sold for $800-$1,000 per sq. ft.

Table 3.2 Programming Requirements (Cody Peratt 2008, Information from Park City Mountain Resort)

Figure 3.3 Typical Retail Dimensions (Cody Peratt 2008, Adapted from OHH)

Hotel/Condo Volumetrics

Architectural floor plans for hotels and condominiums come in a variety of shapes and sizes. Fig. 3.4 explores two common shapes of a hotel/condo structures that are positioned with specific intended views of natural elements. Fig. 3.5 and 3.6 show common space requirements and relationships between activities within the structure. Fig. 3.7 is an example of three different shapes and sizes of possible hotel rooms.

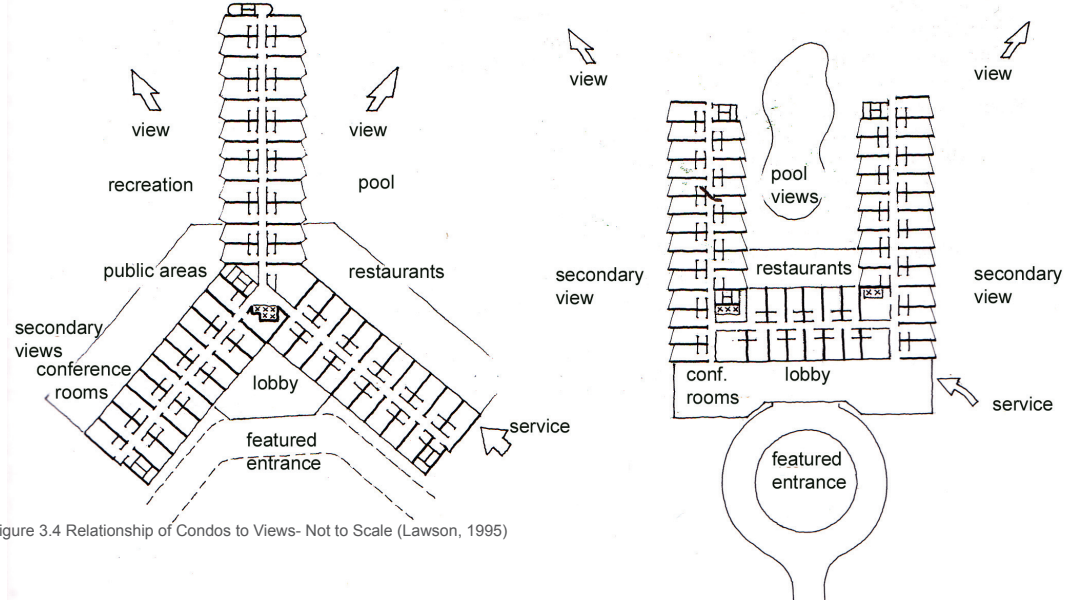


Figure 3.4 Relationship of Condos to Views- Not to Scale (Lawson, 1995)

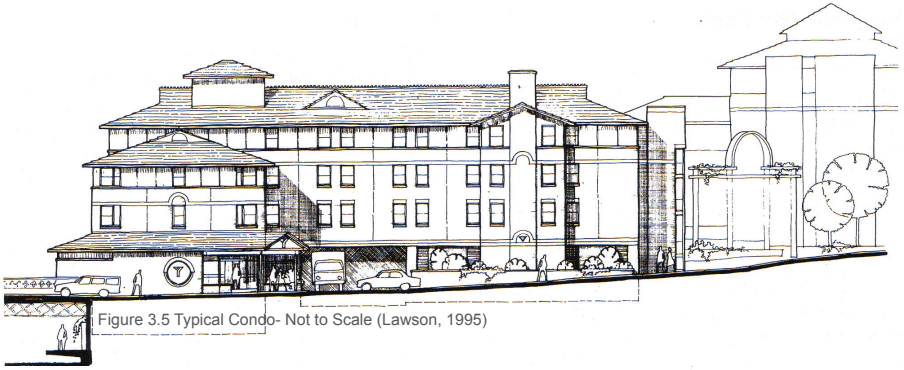


Figure 3.5 Typical Condo- Not to Scale (Lawson, 1995)

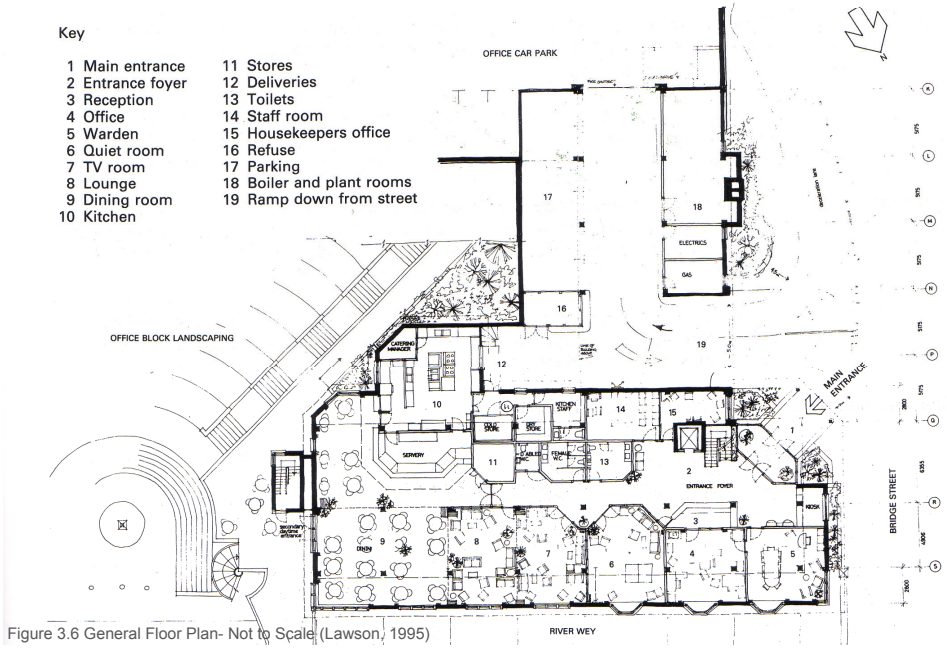
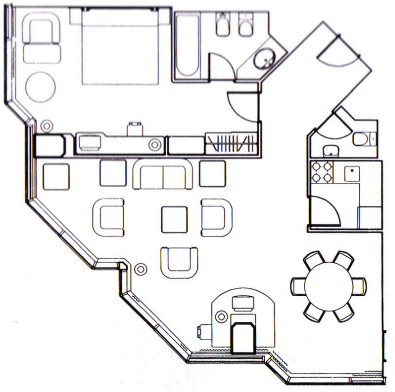
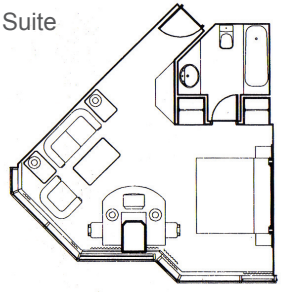


Figure 3.6 General Floor Plan- Not to Scale (Lawson, 1995)

Senior Suite



Junior Suite



Standard Guest Room

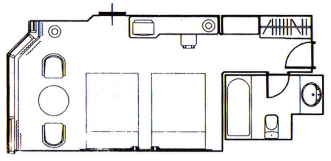


Figure 3.7 Room Floor Plans- Not to Scale (Lawson, 1995)

Modern Mountain Architecture

Park City Mountain Resort would like the proposed development to be designed in a modern mountain architectural style. As examined in the inventory and analysis, modern mountain architecture is consistent with small timber materials used sparingly, as opposed to traditional mountain architecture. Contemporary mountain structures have a large percentage of glass with cut stone and metal used as accents. The structures themselves utilize geometric forms balanced through variety in departing angles and sizes. The images below are examples of existing contemporary mountain architecture in Park City (Fig. 3.8-3.11).

Figure 3.8 Contemporary Mountain Architecture (Erickson 2008)

Figure 3.9 Contemporary Mountain Architecture (Erickson 2008)

Figure 3.10 Contemporary Mountain Architecture (Erickson 2008)

Figure 3.11 Contemporary Mountain Architecture (Erickson 2008)

Programming Map

The residential, commercial, and parking requirements are diagramed here according to their required areas. The following diagrams establish the size relationships between programmed elements at multiple floor scenarios (Fig. 3.12-3.15). The construction of residential, commercial, and parking requirements in the single story scenario is not feasible because programmed elements take up more space than the 12 acre site. The four story scenario would allow for most efficient land use while at the same time fitting the 4-5 story architectural volumetrics of existing portions of PCMR.

Residential
Commercial
Parking
PCMR Site Boundary

Residential
300 units @ 1500 sf
15 units @ 2000 sf
55 units @ 750 sf
total= 521,250 sf

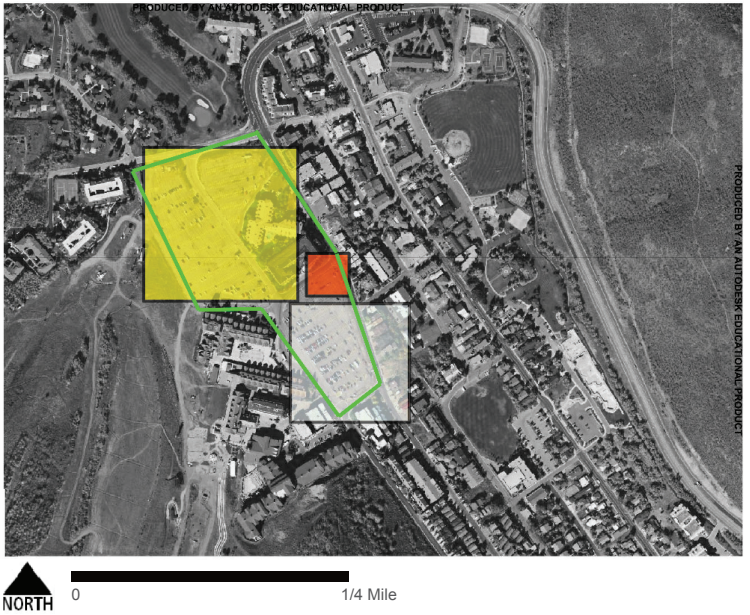
Retail
40,000 sf

Parking
1550 stalls @ 310,000 sf

Volumetrics

Figure 3.12 Height Ratios (Cody Peratt 2008)

Figure 3.13 One Story Space Requirements (Cody Peratt 2008, Adapted From Utah GIS Portal)



One Floor

Figure 3.14 Two Story Space Requirements (Cody Peratt 2008, Adapted From Utah GIS Portal)

Two Floors

Figure 3.15 Four Story Space Requirements (Cody Peratt 2008, Adapted From Utah GIS Portal)

Four Floors

design

PCMR

Conceptual Design

The additions to Park City Mountain Resort are intended to act not only as an icon for the resort, but for the Park City community as a whole. The project design veers away from the traditional mountain resort representation and should be utilized as a model for sustainable living. Project goals for sustainability include: enhancement of the surrounding environment and natural systems, creation of educational opportunities to showcase Park City's rich historical past, promotion of the socio-economic diversity of Park City, creation of a walkable resort within the broader context of the entire mountain community, and creation of a design that can be economically absorbed by the revenues produce by the development.

Through effective stormwater management, use of native plantings, and energy conservation concepts; PCMR is able to lessen its carbon footprint and minimize its impacts on the surrounding environment. Mixed use design, adaptability of spaces, and multiple types of housing provide an environment where visitors and residents converge in life activities. Young professionals jump on their bikes and head to work less than a mile away. Retired couples spend the morning golfing then stroll the walking trails traversing the resort. Visitors from Salt Lake drive the 40 miles to Park City for the unique shopping experience at the resort and end up staying for dinner and live

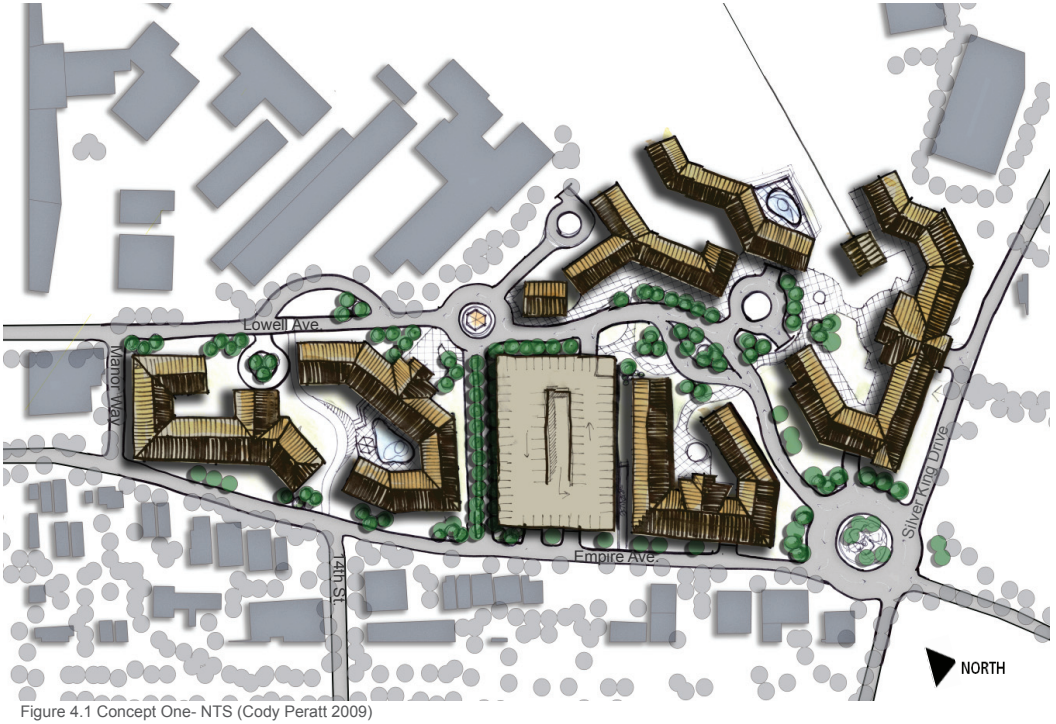


Figure 4.1 Concept One- NTS (Cody Peratt 2009)

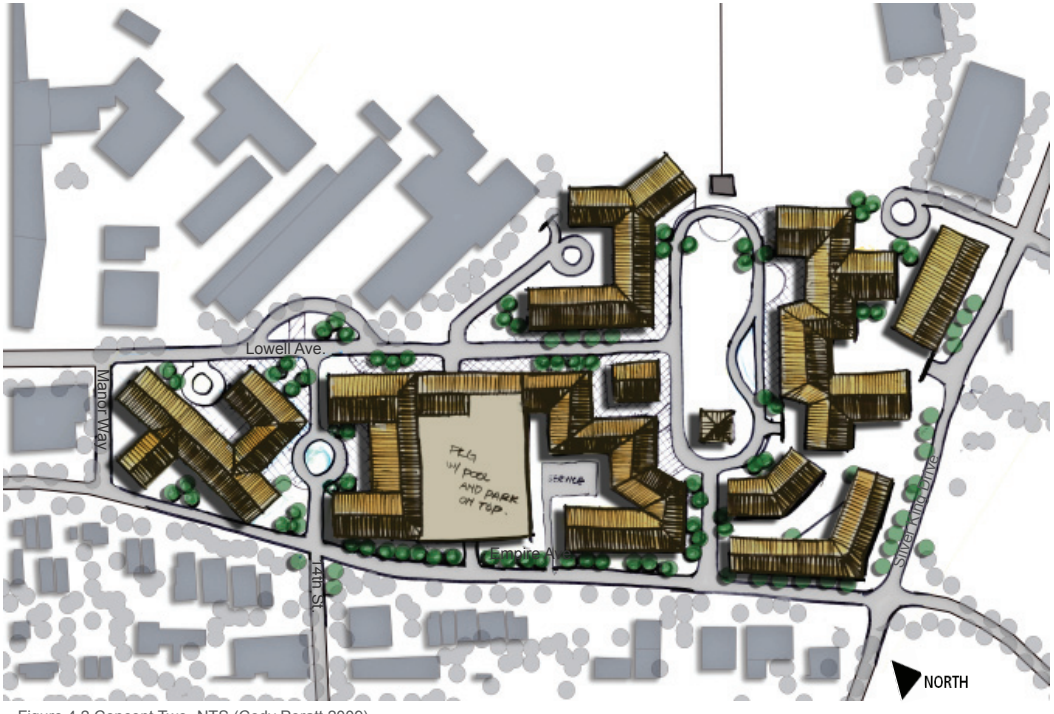


Figure 4.2 Concept Two- NTS (Cody Peratt 2009)

music. Through the additions to PCMR, the once existing tired parking lot has transformed to an active sustainable community.

Initially, three distinct concepts were developed in order to achieve the goals previously addressed. The concept's success in achieving the goals, varies from one another. Concept one places heavy emphasis on the alignment of Lowell Ave. (running through the site). This plan relocates the junction of Lowell Avenue and Silver King Drive to a roundabout on the northeast corner of the site. The roundabout results in a powerful convergence of Lowell Avenue, Empire Avenue, and Silver King Drive. The resulting space in the interior of the roundabout provides for a strong focal point welcoming users to the site. Site inventory and analysis has identified this corner as the dominant pedestrian and vehicular entry point to the site. A secondary pedestrian entrance is located at the junction of Empire Ave. and 14th Street. At this point, 14th Street transforms from a predominately vehicular road, to a strictly pedestrian thoroughfare. The pedestrian walkway both visually and physically connects pedestrians traversing up 14th Street, through the site, into existing portions of PCMR.

Design

Concept one attempts to fulfill the determined parking requirements through a combination of subsurface parking structures and one above ground parking structure (Fig. 4.1). The centrally located above ground parking structure is highly visible, providing parking that is readily available for day-use visitors. The subsurface structures are intended to be utilized predominately by longer term visitors/ permanent residents of Park City Mountain Resort. It is intended that once the vehicles are parked below ground, visitors and residents will walk to their desired destination or utilize the free public transportation system servicing both PCMR and the rest of Park City.

The newly defined mixed-use retail core is positioned along the northern edge of the site with the intention of drawing users through the development from existing portions of PCMR. The retail core includes the addition of another chairlift to service skiers and snowboarders who make their way downhill to this portion of the site.

Concept two involves the complete realignment of Lowell Ave. and incorporates a large looping interior road, eventually exiting onto Empire Avenue (Fig. 4.2). The looping road spatially defines a central green space bordered by buildings. Structures surrounding the open space include retail on the bottom floor, with resort offices and residential on the second and third floors. The resulting large, central space is highly adaptive and provides for year round enjoyment. The green space is utilized by visitors and residents for recreation and relaxation. Special events put on by the resort community, such as concerts, fairs, and festivals take place here.

As with concept one, this concept utilizes both subsurface and above ground parking structures. In this concept, the above ground parking garage is once again centrally located to service not only the additions to PCMR, but existing portions of the site. The garage is wrapped along the south and west sides by retail and residential units in order to mask the dominating visual characteristics of the parking structure. It is still highly visible along Empire Ave., in order to promote the use of the structure by day-use visitors. This concept extends 14th Street into the site and provides for an alternative vehicular entrance to PCMR, as well as a pedestrian connection to the neighborhood to the east.

Concept three emphasizes the potential for stormwater quality enhancement through the introduction of a major bioswale (Fig. 4.3). The bioswale results from the daylighting of an underground storm sewer that collects water running down the mountain. It allows for the stormwater system to become visible and act as an educational piece, while at the same time providing for higher quality stormwater and a connective habitat corridor.

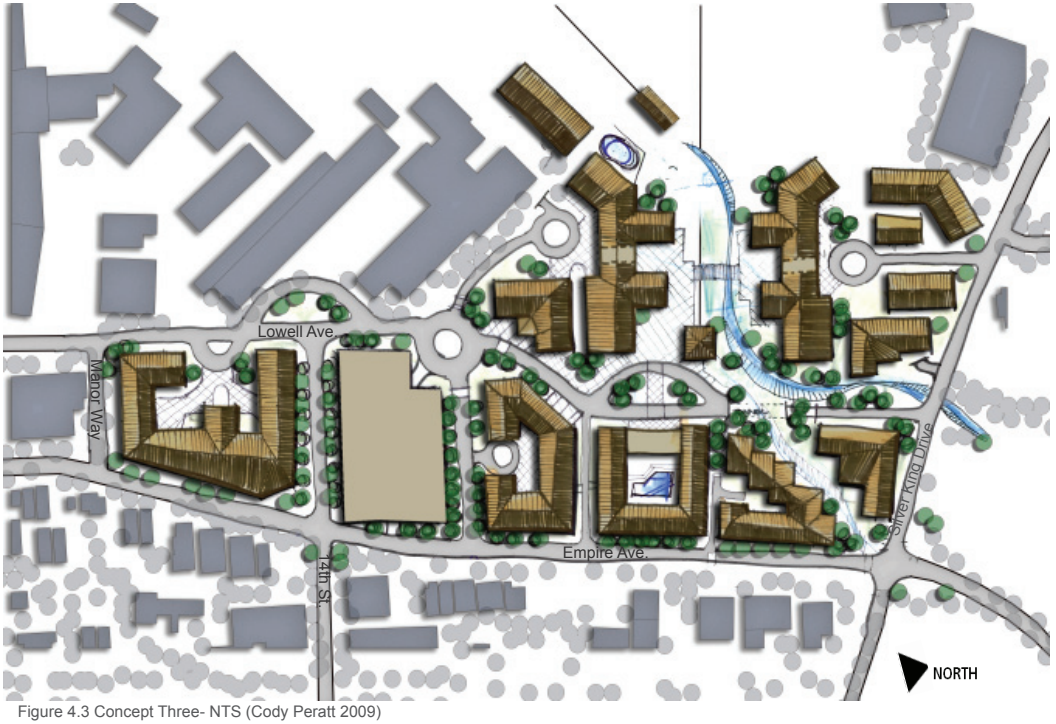


Figure 4.3 Concept Three- NTS (Cody Peratt 2009)

Concept three creates a highly permeable site for both pedestrian and vehicular traffic. As with concept two, this concept continues 14th street into the site. Existing access just to the north is maintained, while Lowell Ave. remains relatively unadjusted. The highly permeable site resulted from the attempt to create and preserve connections with the existing portions of PCMR, the community to the east, the mountain to the west, and the golf course to the north. The importance of the pedestrian experience is reflected in the introduction of a pedestrian bridge over Lowell Ave. creating uninhibited movement through the site.

Once again, a large central core of mixed use structures anchors the development. The core straddles the introduced bioswale and provides a focal water feature. A bridge connects the two plazas in the central core creating a north south axial relationship. This relationship balances the east-west axial relationship created with the resort headquarters/gondola on the eastern edge of the core and the directed views of the mountain to the west.

Like the other two concepts, concept three utilizes a large above ground parking garage servicing both existing PCMR amenities as well as newly designed features. Conversely, a more secluded residential district emerges in the northwest corner of the design. The district acts as a link between the golf course community to the north and the resort.

Master Plan

The previous three conceptual designs demonstrate my attempt to satisfy the underlying project goals and objectives and were each successful to varying degrees. The final result is a product of the merging of the three conceptual designs into a plan that adequately expresses principles of ecological sustainability, walkability, mixed-use, and economic feasibility (Fig. 4.4). The final master plan borrows the best ideas from the previous concepts through the enhancement of stormwater quality, utilization of a power core of activity, subterranean parking, coherent circulation patterns, as well as connections on and off site.

The designed development addresses ecological sustainability by accommodating to any adjacent sensitive lands, improving the hydrological systems network, minimizing energy needs through the use of architectural BMPs, and the attempt to balance cut and fill.

As previously described in the literature review, “Sensitive lands include any area in which development is either not appropriate or must be approached with care to ensure there is no long-term loss to property or human life.” It also refers to areas with exceptional ecological, open space, or agricultural value (Coalition for Utah’s Future 1997). The designed master plan takes into account sensitive lands identified in the preceding site analysis. The site previously existed as a twelve acre parking lot and did not hold any significant cultural, agricultural, or ecological importance. Conversely, the golf course adjacent to the site and the mountain peaks to the west were identified as holding desirable aesthetic values. The aesthetic values were addressed by directing views both to the mountains and the golf course.

Additionally, it is imperative to insure any water leaving PCMR is of the upmost quality, because the Park City Municipal golf course receives stormwater run-off from the resort.

LEGEND
1. Single Family Residential
2. Gondola House and PCMR Offices
3. Chairlift
4. Mixed Use Retail Core
5. Wellness/ Recreation Center
6. Condo/ Apartment Housing
7. Townhomes
8. Retail Power Core
9. Pedestrian Bridge
10. Entry Garden
11. Landform Garden
12. Olympic Reflection Garden

Figure 4.4 Master Plan (Cody Peratt 2009)

Ecological Design Characteristics

Enhancement of stormwater quality and surrounding natural systems networks are accomplished through a series of 5 unique stormwater BMPs (level spreaders, bioswales, raised planters, curb cut planters, and pervious pavement) and the use of all native plantings (Fig. 4.5-4.7). Stormwater BMPs act to move snowmelt and stormwater through a sequence of interconnecting elements before the water makes its way either to the golf course retention pond just north of the site, or the city sewer system.

Level spreaders are utilized on the western edge of the site in order to slow water running off the mountain, and promote deep percolation to recharge underlying groundwater. The level spreaders attempt to decrease the amount of surface water that will flow directly onto the 12 acre site. Water that overflows or bypasses the level spreaders will be directed to the bioswale to the north. This bioswale also collects water from a daylighted storm sewer collecting runoff from the mountain. Swale vegetation collects and removes large particulates and sediments before connecting with the golf course retention pond to the north.

As water runs off existing portions of Park City Mountain Resort, it is collected in sub watershed 10 (Figure 4.6) When the collected water reaches the critical point, it enters a drain and exists across Lowell Ave. into the newly designed portions of PCMR. The interconnected series of bioswales transport the water downhill towards Empire Ave., to the final detention area at the northeast corner of the site.

Meanwhile, stormwater and snow melt makes its way off the roofs in the power core retail area into a network of raised planters. Drain spouts dump water directly into the raised planters where it fills, creating small rain gardens. If the water level increases to the designed capacity, it then enters a drain and is directed to the large green utility space located in the center of the power core. The change in grade directed down towards the northeast, concentrates water flow as it then progresses through a series of swales and detention areas. Ultimately, it once again makes it to the water feature at the junction of Empire Ave. and Silver King Drive.

Sidewalks running the perimeter of the site are constructed of pervious pavement in order to collect water that did not have the chance to make it any of the other stormwater BMPs. Pervious pavement was not considered feasible in locations other than on the periphery, because of the desire to keep water from percolating down to the parking structures located below.

Plants located within and immediately surrounding the stormwater BMPs have been selected in order to thrive in situations of hydrological extremes. During the spring when water levels are high from snowmelt, the soil surrounding the BMPs may be completely saturated. On the other hand, in late August the vegetative material must be able to withstand limited amounts of water. For this reason, plants such as; Asclepias tuberosa (butterfly milkweed), Iris spp., Monarda odoratissima (little bee balm), and Salvia officianalis (garden sage) were chosen as possible specimens.

Butterfly milkweed will flourish with the increased precipitation in the spring and produce a yellow/orange inflorescence attractive to butterflies and other beneficial pollinators. Iris and garden sage will also do well with the increased spring moisture and flourish in the dry summer. Little bee balm will provide summer interest with its spiked red inflorescence. Meanwhile, the butterfly bush will provide a taller natural looking backdrop for the swales.

Since not only water quality but water quantity is of concern, all plantings on site are either native, or water-wise ornamentals. These plants do not require the use of any supplemental irrigation and will therefore conserve available water resources in the area. Buchloe dactyloides (buffalo grass) is well adapted to the drier climates of the mountain west and will be used as the dominant turf grass. Buffalo grass only requires mowing once or twice a year to maintain a tidy look. The one drawback to buffalo grass is that it takes longer to green up in the spring, and goes dormant earlier in the fall.

Plant materials used in the bioswale corridors are also limited to native and water-wise species. Some recommended perennials include; Achillea millefolium (yarrow), Schizachyrium scoparium (little bluestem), Andropogon gerardii (big bluestem), Sorghastrum nutans (Indian grass), Festuca ovina (blue fescue), as well as a variety of native penstemons. Big bluestem spreads through the production of thick rhizomes that have the ability to hold soil and will be beneficial in preventing erosion.

Design

Within the design are numerous areas where exposed rock is the main focal element. Chosen plant material fits within the stone cracks and provides visual interest. Sedum spurium (two-row stonecrop), a low-growing succulent does well in rocky conditions and produces small red inflorescence. Other non-invasive ornamentals such as creeping sedum, basket of gold, and purple rock cress will also provide sensory interest.

In addition to proper plant selection, planting beds will be mulched with organic wood chips. Wood mulch is acquired from the chipping of branches during the clearing of unwanted or invasive woody species on the ski park. The organic mulch will slow the drying out of soil through evaporation. It will also slowly decompose, acting as an organic fertilizer. This breakdown will supply the plants with needed nutrients. Park City Mountain Resort will also utilize integrated pest management (IPM) as an effective and more sustainable technique of ridding weeds and harmful bugs.

The combination of stormwater best management practices and water-wise plantings work to successfully capture and slow down water as it moves through the site. The once existing parking lot devoid of plant material has been transformed into an educational system of hydrology.

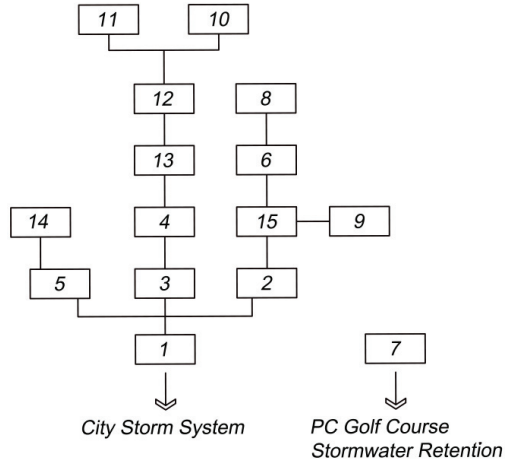


Figure 4.5 Watershed Flow (Cody Peratt 2009)

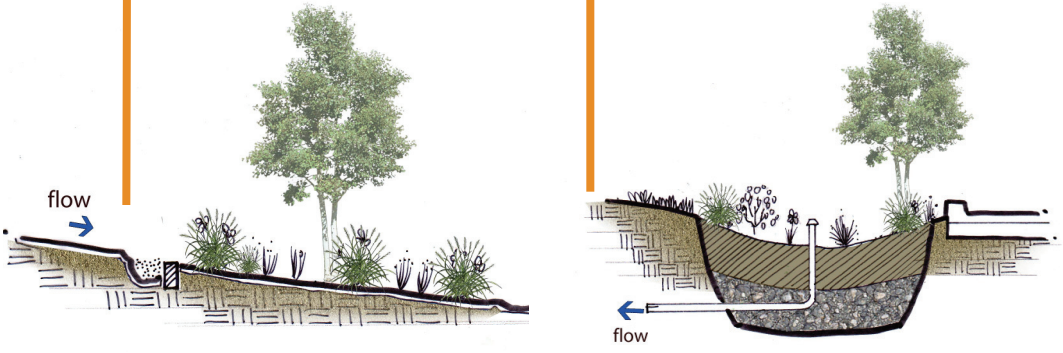
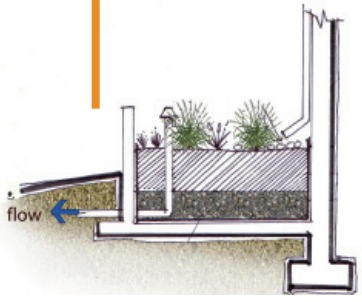
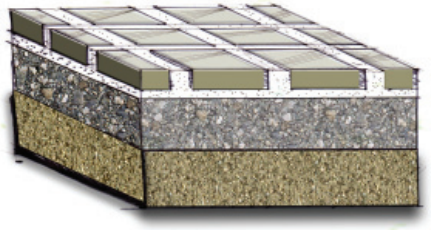
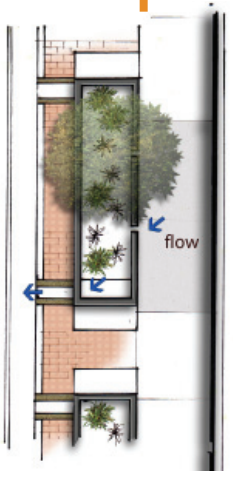


Figure 4.7 Utilized Stormwater BMPs (Cody Peratt 2009, Adapted From Portland Bureau of Environmental Servives 2008 Stormwater Management Manual)

Figure 4.6 Watershed Boundary and BMP Location- Not to Scale (Cody Peratt 2009)







Design

Conservation of energy and natural resources is accomplished through the implementation of green building practices and green architecture. Buildings on site utilize a variety of techniques in order to obtain viable energy (Fig. 4.8). PCMR structures exploit the use of solar panels positioned on the south and southwest facing rooftops in order to capture the most amount of solar energy possible. The solar panels will not supply enough energy to sustain the community, but will offset the amount of electricity required from the grid. Secondly, energy use is offset through the purchase of energy credits from the Spanish Fork Wind Farm located 50 miles south of Park City. Additionally, low-flow toilets, Energy Star rated appliances, and efficient lighting continue to conserve water and energy.

Heating and cooling demands are lessened through the use of geothermal pipes, passive solar, and thermal massing techniques. Geothermal pipes supply the development with airflow consistently around 50 degrees. Also, buildings on site are designed with overhangs and nearby deciduous vegetation that provide shade in the summer, while allowing sunlight to the building's interior during the winter. Thick concrete walls packed internally with alfalfa hay, provide heating and cooling through the principles of thermal massing. Radiant energy is blocked and absorbed into the walls throughout the day keeping the structure cool inside. The stored heat is then released and radiated back into the structure at night when temperatures drop. The combination of geothermal, passive solar, and thermal massing will greatly reduce the heating and cooling demands of the resort.

If the interior of the residence becomes cold in the evening, units are equipped with a wood burning fireplace. Wood is collected by the resort from the thinning and removal of unwanted vegetation on the 3300 acres of mountainous terrain owned by the resort. The wood is then stockpiled and made available for residents and visitors free of charge.

Conservation of energy also occurs during the construction process, through the use of local source materials. The 12 acres of concrete parking lot that previously made up the site will be removed, broken down, and recycled. The recycled concrete is then utilized to construct the walls and foundations of structures. The alfalfa hay used as insulation in the walls comes from neighboring farming and ranching communities.

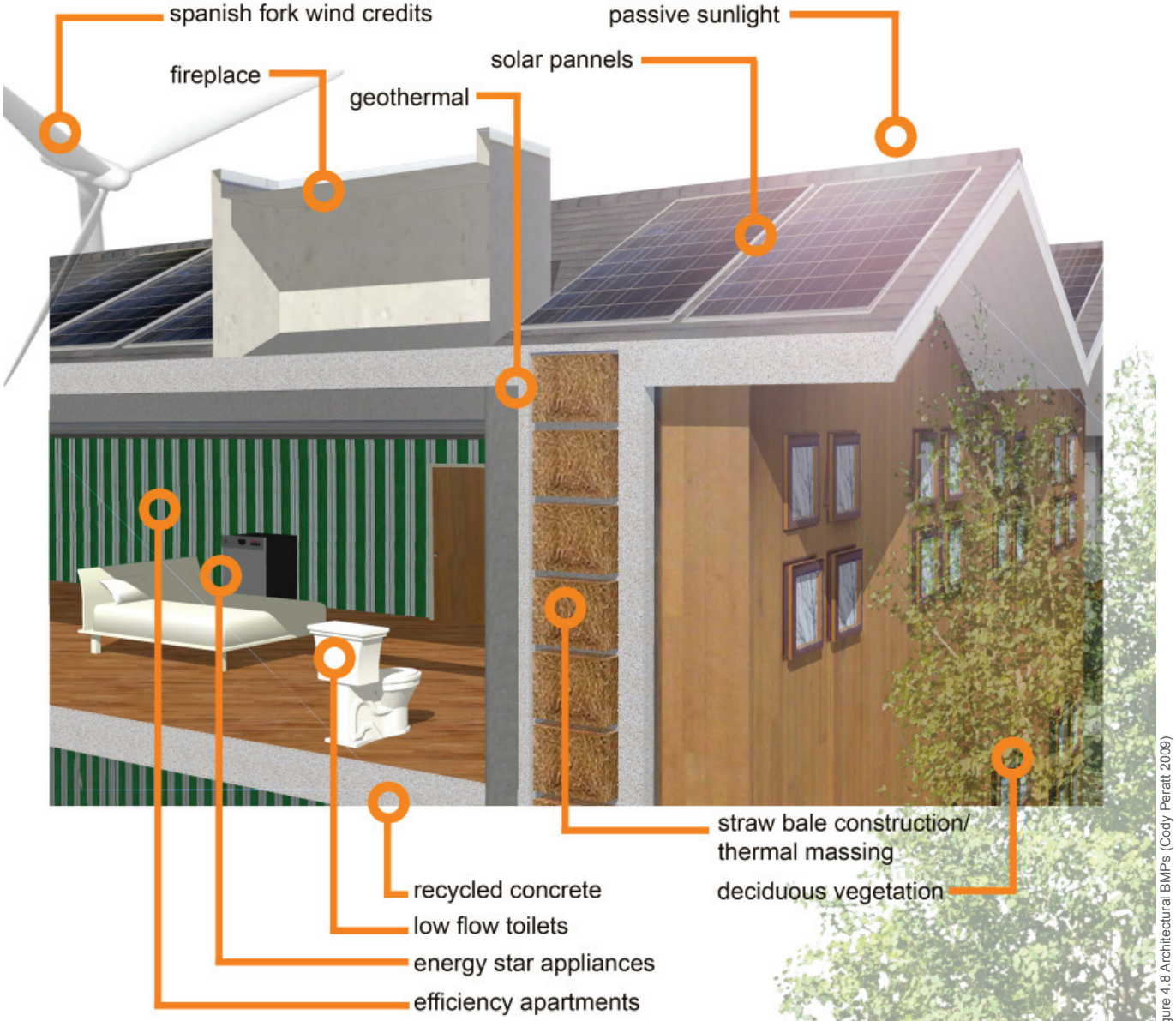


Figure 4.8 Architectural BMPs (Cody Peratt 2009)

Lastly, energy and resources are conserved during the construction process through an attempted balance of cut and fill. The initial grading for subsurface parking garages results in approximately 45,704 cubic yards of cut (Fig. 4.9). After the parking structures are completed, the rest of the site grading results in 29,392 more cubic yards of cut and 64,856 cubic yards of adjusted fill (with a compaction factor of 1.1) (Fig. 4.10). The difference between cut and adjusted fill is approximately 10,000 cubic yards of cut (Table 4.1 Preliminary Earthwork Calculations). The excess cut is comprised mostly of stone and is ground down and used for aggregate in the concrete used on site.

Environmental elements of conservation of sensitive lands, intact natural ecosystems, water quality improvements, and energy conservation attribute to the environmental sustainability of PCMR. Views of open mountain terrain to the west and the golf course to the north have been preserved, while the designed riparian stream attempts to create a connective habitat corridor through the site. Stormwater BMPs slow the flow of water, allow percolation to the water table below, and remove particulates before water moves off site. Supplemental water use is minimized through the implementation of all native plantings and the use of low-flow toilets within structures. The conservation of energy occurs during the construction process by utilizing local source materials, recycled concrete and stone from grading of the site, and balance of cut and fill. The structures are designed to require less operational energy through the use of energy efficient appliances, passive solar, geothermal, and thermal massing techniques. Energy is produced for the site through the use of photovoltaic panels positioned on the roof in combination with wind energy from the Spanish Fork Wind Farm south of Park City.

Figure 4.9 Parking Structure Grading- NTS (Cody Peratt 2009)

Table 4.1 Preliminary Earthwork Calculations (Cody Peratt 2009)

Earthwork Estimations (Initial Parking)

Cut Factor (1.00)	Fill Factor (1.10)
Cut Volume (unadj.)-	45,704 cu. yards
Cut Volume (adj.)-	45,704 cu. yards
Fill Volume (unadj.)-	N/A
Fill Volume (adj.)-	N/A

Earthwork Estimations (Preliminary Grading)

Cut Factor (1.00)	Fill Factor (1.10)
Cut Volume (unadj.)-	29,392 cu. yards
Cut Volume (adj.)-	29,392 cu. yards
Fill Volume (unadj.)-	58,960 cu. yards
Fill Volume (adj.)-	64, 856 cu. yards

Difference- 10,240 cu. yards cut

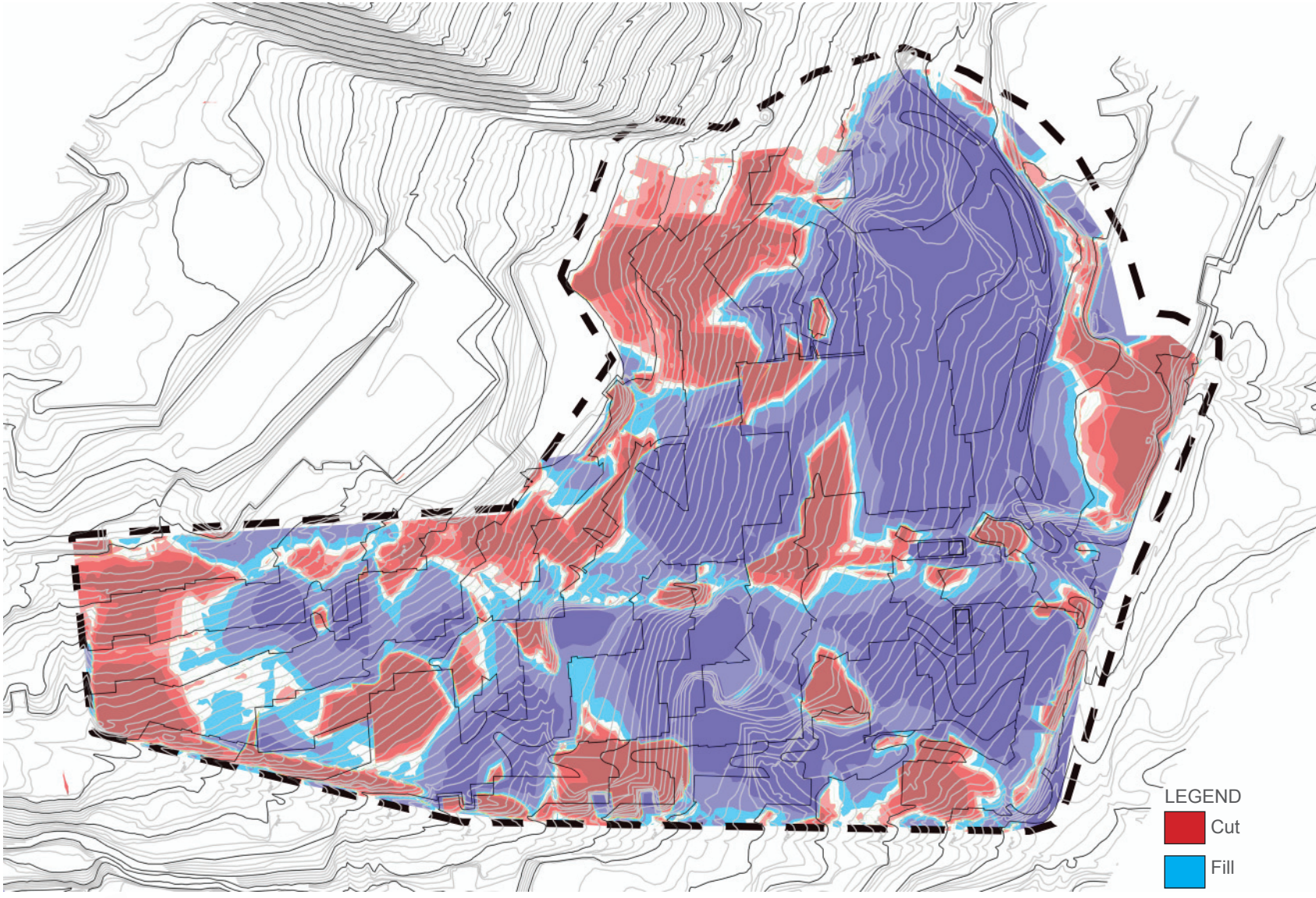


Figure 4.10 Preliminary Site Grading (Cody Peratt 2009)

Social Design Characteristics

In order to accomplish the goals of social sustainability, the design employs numerous techniques to reflect the identity of Park City and the mountain culture. Diversity of activities and people are accomplished through mixed use, active open space, and multiple types of housing. Emphasis of the principles of walkabilility promotes the dominance of the pedestrian experience in the landscape and the use of multimodal transportation. Short blocks and transit stops, combined with minimal road crossings encourage the visitor to relinquish the car and either walk or use public transit.

The identity of Park City and of the mountain people who live there are expressed through a variety of architectural and design elements present within the design of Park City Mountain Resort. Architectural components prevalent in the Mountain West are utilized to present a type of architecture that is cognizant of the past while aesthetically looking to the future (Fig. 4.12). Structure colors consist of an earth tone color palette in order to blend with the mountain backdrop and emphasize views rather than the architecture itself. Wood timber accents visually slice through the concrete façade, similar to striations of geological layers below. Cut stone acts as a grounding element, visually connecting structures to the earth. A large percentage of windows provides the residents with natural lighting and views to dramatic spaces in the landscape and mountains in the distance.

A sequence of reflective landscape spaces and educational signage provide cues to Park City's rich historical past. The central courtyard in Figure 4.11 contains three representative council rings reflecting Park City's Olympic importance in the 2002 Winter Games. The smaller rings are representative of the two original pillars of the Olympic Games (Sport and Culture). The larger ring represents the third pillar of "Environment" that was adopted in 1994 by the Olympic Games Committee. The council ring includes a sculptural element and a brief history/overview of goals of the Games based practices on environmental conservation.

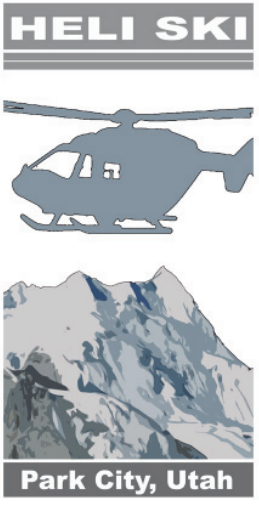
When Park City was originally founded in the 1860's, everyday life was an adventure. Today, Park City has grown up considerably but there is still plenty of excitement. Signs and way finding elements express the importance of mountain culture, activity, and art in the lives of Park City residents (Fig. 4.13). Signs and banners throughout PCMR emphasize the numerous types of activities offered by the resort community as well as throughout the entire city.

The dominant water feature within the vehicular entry roundabout includes a towering sculptural element that merges past, present and future. The element includes a 25 foot tall sculpture comprised of recycled mining equipment salvaged from the mountain terrain to the west. The sculpture

Figure 4.11 Detail Plan- Southern Portion of Site (Cody Peratt 2009)

Figure 4.12 Perspective- Empire Ave. Pedestrian Entrance (Cody Peratt 2009)

Figure 4.13 Signs and Site Features (Cody Peratt 2009)



is sunken into large granite slabs exposed during construction. Native vegetation encompassing the water demonstrates the bioremediation efforts currently in place by the resort, while vertical light elements represent the bright future of the community.

Landscape design reflects the importance of the mountains by taking full advantage of the topographical change offered on site (Fig. 4.12). As pedestrians access PCMR from 14th Street, they are greeted with a snaking path similar to the neighboring mountain roads. Landform adjacent to the path rises out of the earth like the three visible peaks in the background. The mounds have steeper slopes facing Empire Avenue, with jagged stones protruding from the base. They are meant to look as if the Wasatch Fault has shifted, leaving a disjointed landscape behind. The protruding granite slabs provide visitors flat places to sit and converse while leaning against the soft vegetative mounds. Lastly, taller native grasses wind along the path much like the taller vegetation found within mountain valleys. The resulting space provides the impression of a fluid continuous landscape from the resort in the foreground to the mountains behind.

An important objective within the goal of social sustainability includes increasing the diversity of people and activities present. Park City Mountain Resort currently attracts a range of people, from South American student workers to weekend visitors. In order to accommodate the needs of the residents and visitors to PCMR, the design incorporates a range of housing accommodations. Fifty five resort subsidized efficiency units will provide housing for approximately 110 seasonal and permanent workers. Twelve, 2000 square foot, single family residential units adjacent to the golf course create the feel of a suburban residential district (Fig. 4.14). Smaller, three story townhomes front Empire Avenue acting as a transition between the residential neighborhood east of the resort and the resort itself. Within the interior portions of the resort, a combination of luxury suite living and efficiency condos provide living at a cost affordable for many lifestyles. Providing housing for people of different incomes, wants, and needs allows the resort to offer refuge to young urbanites, wealthy second home owners, families, artists, and extreme sport enthusiasts in one place.

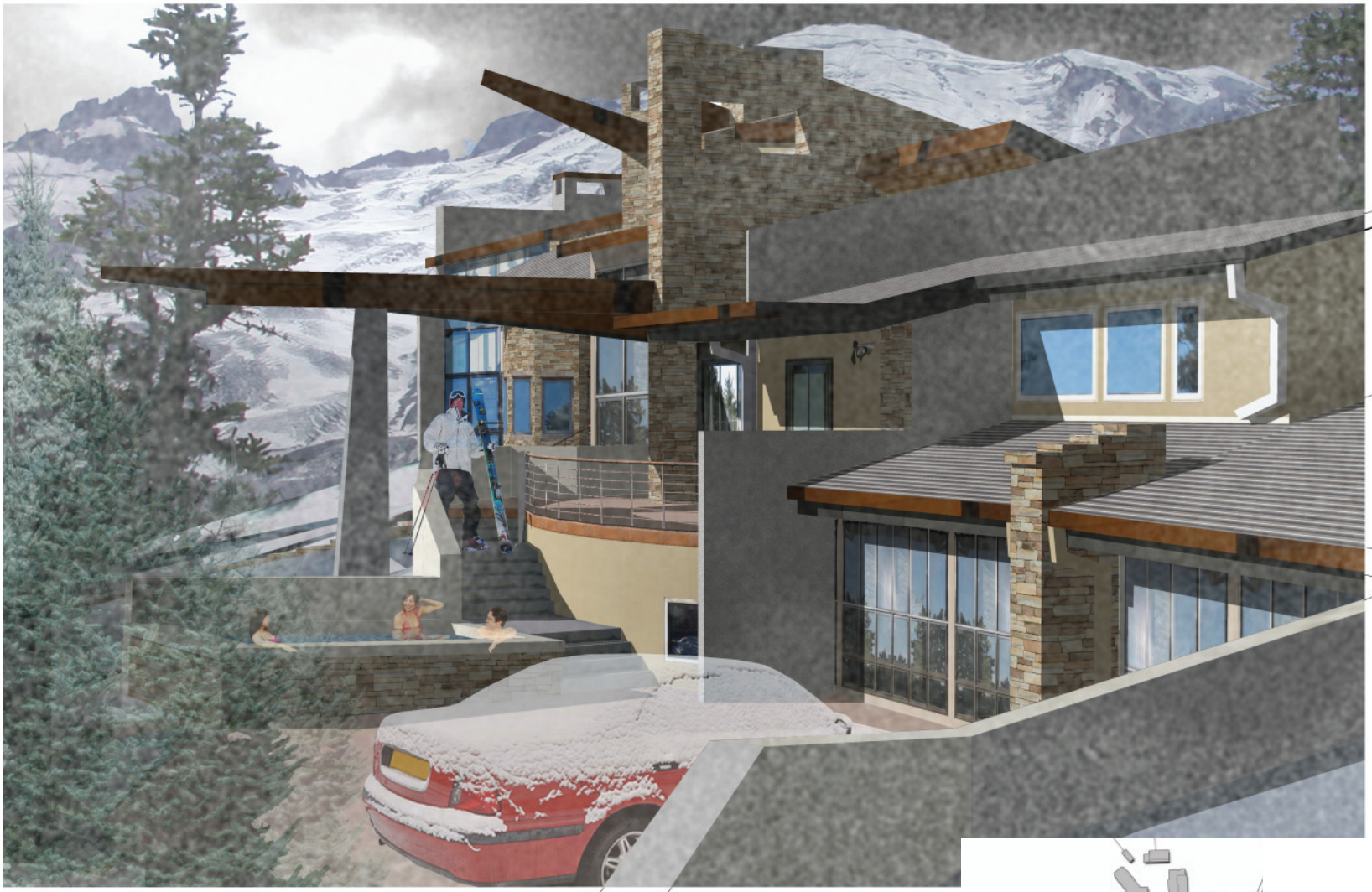


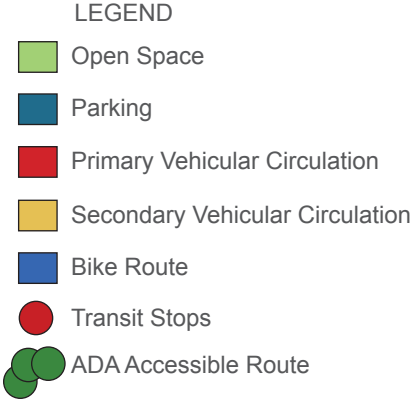
Figure 4.14 Perspective- Single Family Residential (Cody Peratt 2009)

Additionally, providing access to housing and activities on and off site is provided through the implementation of a coherent road and trail system. PCMR is envisioned as a community where the motorized personal vehicle is not required. Public transit service runs door to door from Salt Lake City Airport to PCMR. Once on site pedestrians utilize free busses, the ADA accessible trail network, or use bike lanes and cycle trails.

If coming to PCMR by car, vehicles will follow highway 224 through town, onto Empire Ave. and enter the site from the east (Fig. 4.15). Once on site, parking garages have the capacity to provide service for 1350 vehicles in subsurface parking structures. Access to the parking structures are provided through seven separate entrance/exits points throughout the site. Additionally 150 extra on street parking stalls are provided in the neighboring community to the east.

City busses pick up residents and visitors throughout Park City, Deer Valley, and The Canyons. They make two stops at PCMR and one at the corner of Empire Ave. and Hwy 224. Buses service each stop once every 20 minutes and run from 6:10 a.m. to 2:10 a.m. daily during peak seasons. Busses arrive to the site by turning up Silver King Drive and entering PCMR from the north onto Lowell Avenue. A transit stop is located adjacent to the central power core retail area along the outer edge of the roundabout. The stop comfortably provides enough room for up to six busses. Busses then head south to the existing PCMR transit stop and continue their loop back to Highway 224.

A network of streets with bike lanes connects green spaces surrounding PCMR and extends to the inner portions of the resort. Cars and bikes share the road providing uninhibited travel around and through the site (Fig. 4.16-4.18). Challenging mountain bike trails join with roads and sidewalks at critical points where the mountain terrain meets the development. The gondola and new chairlift accommodate cyclists by transporting the bike and rider up the mountain during the summer months, providing urban to wilderness riding in minutes.



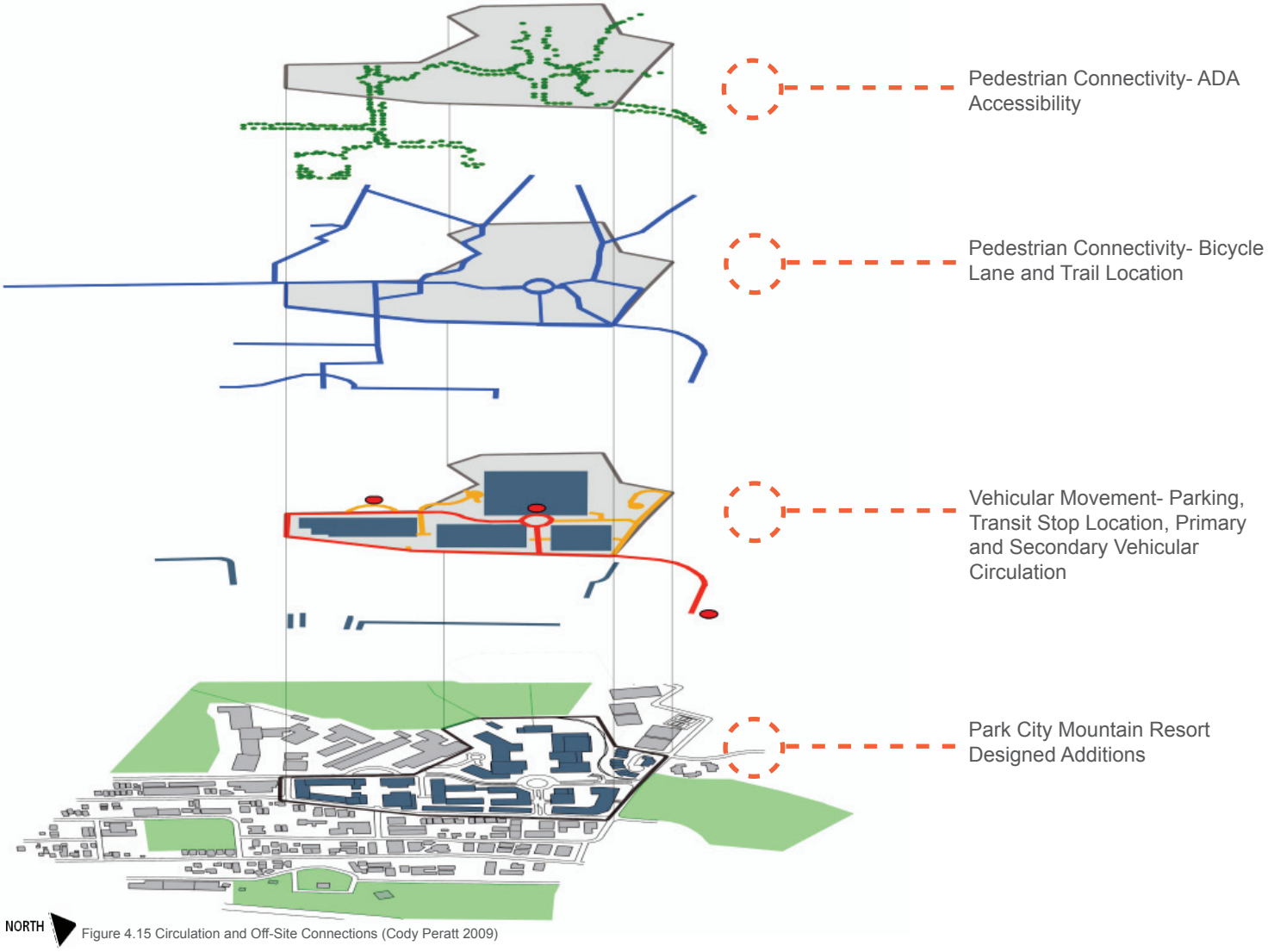


Figure 4.15 Circulation and Off-Site Connections (Cody Peratt 2009)

Design

Clear consideration of pedestrian access and mobility through the site is expressed through the attempt to minimize road crossings, highly visible crosswalks, and multiple ADA accessible routes (Fig. 4.15-4.19). The importance of the pedestrian user at both the junction of 14th St. and Empire Avenue, as well as at the northeast corner of the site was expressed in the site analysis. The goal of emphasizing the importance of these two critical points was achieved by embracing the pedestrian experience while entering the site. 14th Street carries pedestrians from the recreation fields and park to the east. It extends into the site as a purely pedestrian traffic way after crossing Empire Ave. The pedestrian is greeted with an artful, informative, and interesting set of landform elements as they traverse the ADA accessible walk toward the heart of the resort.

Figure 4.16 Section- PCMR Ave. NTS (Cody Peratt 2009)

Figure 4.17 Section- Empire Ave. NTS (Cody Peratt 2009)

Figure 4.18 Section- Lowell Ave. NTS (Cody Peratt 2009)

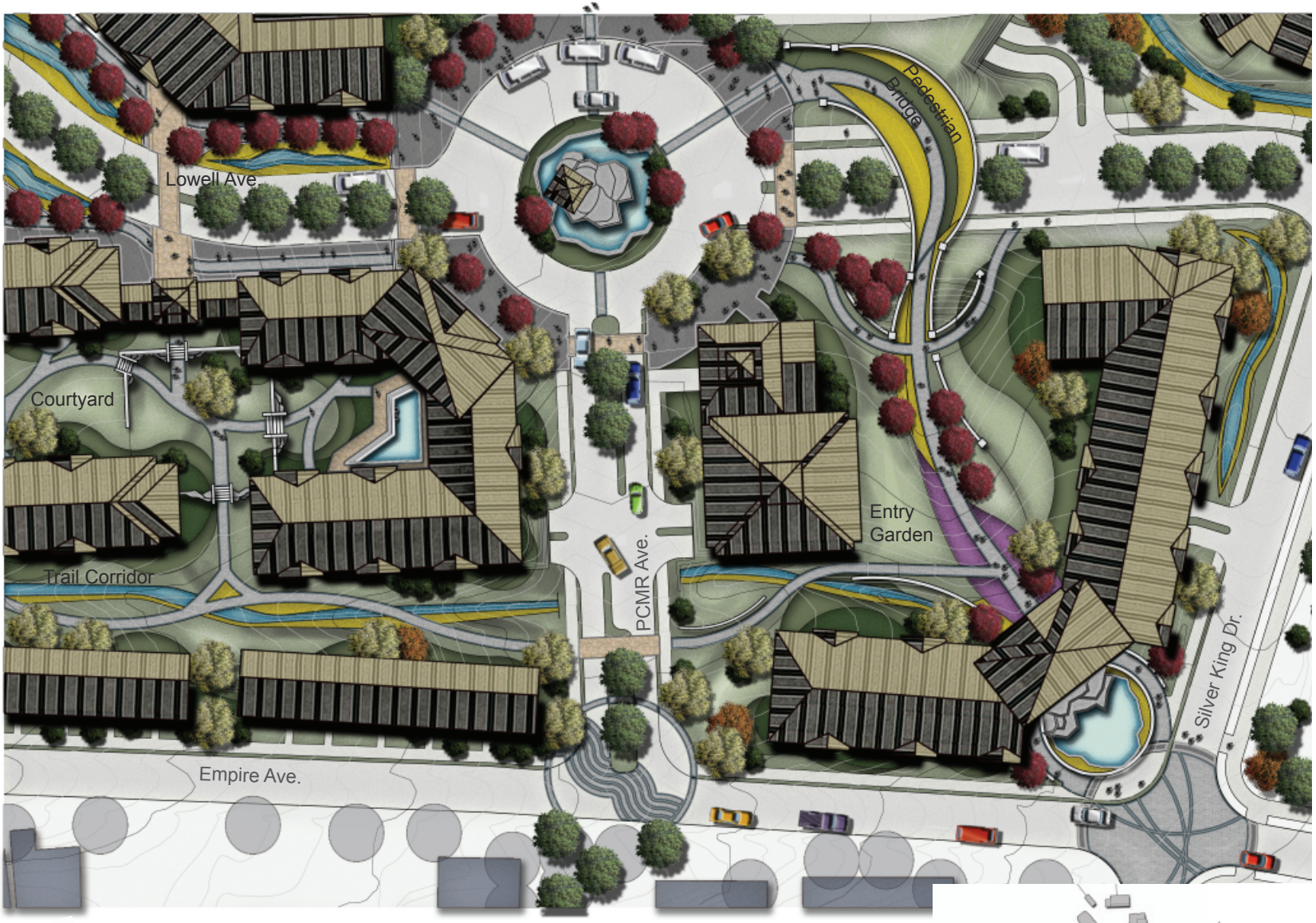
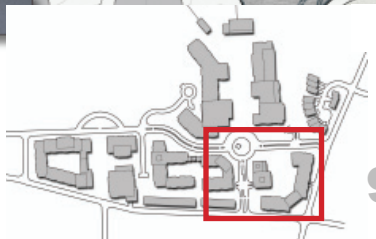


Figure 4.19 Detail Plan- Northeast Corner of Site (Cody Peratt 2009)



Design

The corner of Silver King Drive and Empire Ave. implores a large water feature resulting from effective stormwater management on site (4.20). A dominant structure, cascading water feature, and a change in paving pattern welcome the pedestrian traveler. Once on site, pedestrians catch a glimpse of the retail/recreation core of the site. They then have the choice to either follow the trail along the bioswale or proceed toward the retail power core. (Fig. 4.21) If the pedestrian decides to follow the route to the power core, they are engaged by brilliantly colored purple (ex. hardy ice plant and gayfeather) and yellow orange flowers (ex. sundrops and blanket flower) offset from the walk. The pedestrian then meets up with a bridge, crossing Lowell Ave. and spilling into the central core of activity (Fig. 4.22). The pedestrian bridge allows for quick and safe access without hindering the flow of vehicles during periods of increased traffic, such as after special events. In winter, the trail and bridge system allow cross-country skiers to access the golf course ski tracks adjacent to the site.

As discussed in the literature review, the idea of mixed use provides the opportunity to create an environment in which residents can live, work, and play without ever leaving the resort community. The design for Park City Mountain Resort incorporates multiple facets of mixed use design. The resort includes: low, mid, and high density residential units, buildings with retail first floor and residential above, restaurants, green space, a community wellness center, and offices for the resort headquarters.

Figure 4.20 Perspective- Northeast Corner of Site (Cody Peratt 2009)

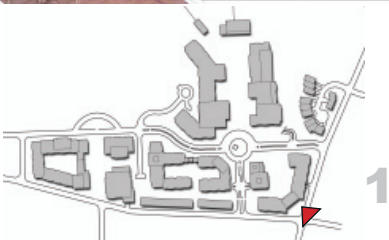
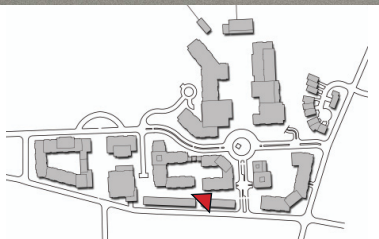


Figure 4.21 Perspective- Residential Corridor (Cody Peratt 2009)



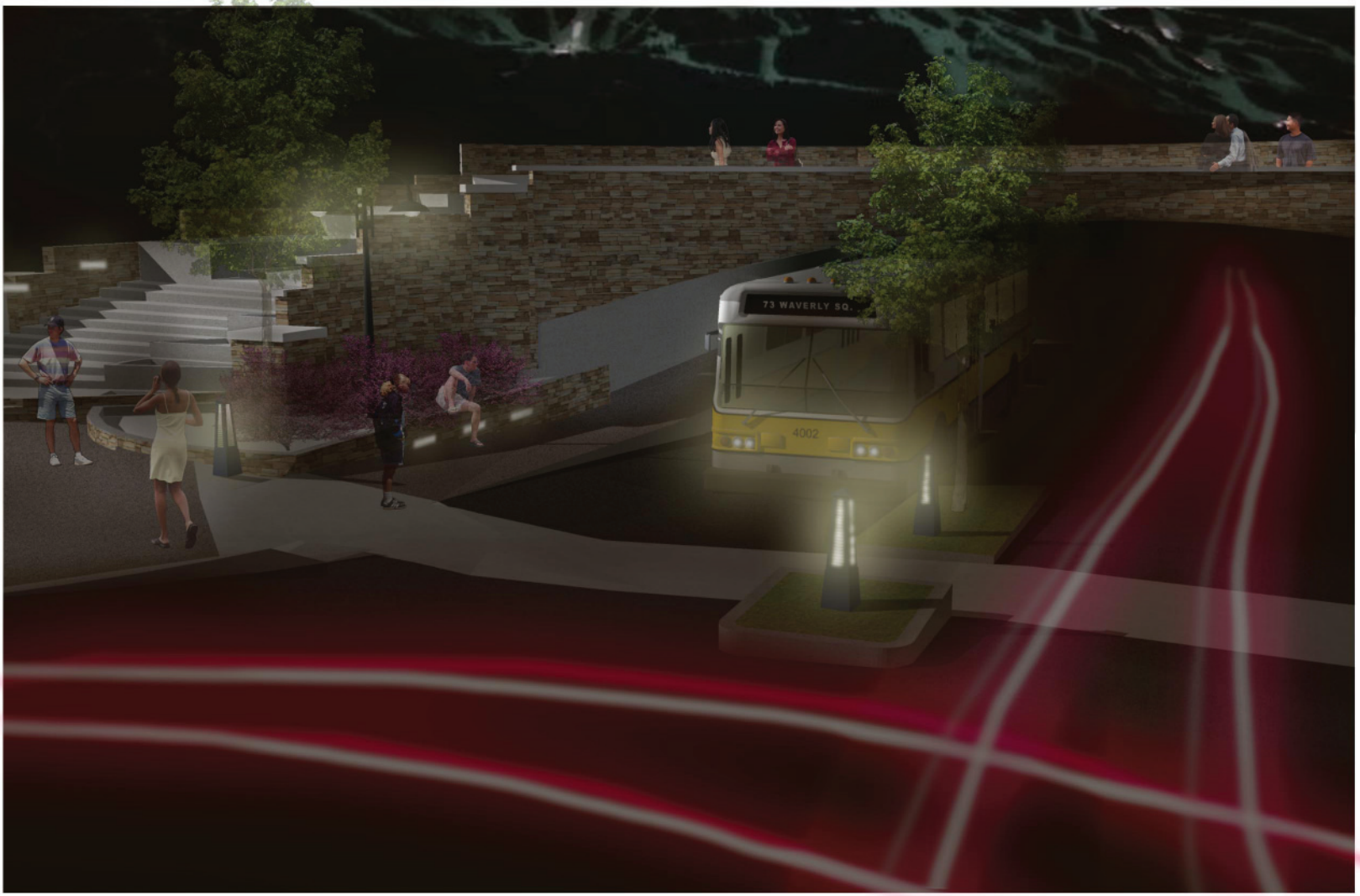


Figure 4.22 Perspective- Pedestrian Bridge (Cody Peratt 2009)

The majority of activity and excitement occurs in the central core of PCMR (Fig. 4.24). The power core as it has been referred to throughout this chapter is bounded on both the north and the south by the two largest additions to the development. The structural make-up of the buildings includes retail and restaurants on the first floor with residential on the upper three levels.

The power core is spatially anchored to the west by the iconic gondola house. This structure includes the office for lift tickets, second floor patio, and a restaurant (Fig. 4.25). The building also houses an enclosed gondola providing mountain access for skiers. The gondola is open to the public for reasons other than skiing or snowboarding. Visitors can ride the gondola to the top of the mountain, take in the breathtaking views of Park City below, and come right back down without ever being exposed to the elements. The entire west side of the structure is encased in windows, which allows it to act as a large greenhouse. Plants adorn the inside of the building year round, blending the indoors and out. The building provides a warm place for spectators to have a cup of coffee and watch their friends and family ski or snowboard throughout the day. The west side of the structure incorporates a 50 foot high climbing wall that is transformed to a temporary ice wall during the winter (Fig. 4.26).

To the southeast of the gondola house sits a large fire pit that continuously burns throughout the day. Skiers can take a break from mountain activities and warm up by the fire until they are ready to once again take on the challenges provided by the mountain. The fire pit also serves as a way finding element or meeting point. The fire pit visually sits on the fringe of the resort and acts as a transition between the emotional security of the built environment, and the rugged mountain wilderness to the west.

The same is true for the pool to the south. The heated pool, open year-round, is once again located on the fringe of the resort community. The change in topography surrounding the pool deck conceals it from skiers while providing directed views to a mountain peak to the southwest.

The east side of the power core is anchored by a wellness center that has been gifted to the community. The wellness center is open to all residents, visitors, and the public. The wellness center includes cardio and weight equipment, indoor basketball courts, physical trainers and houses the resort medical offices. Staff at the wellness center treat minor cuts and bruises, sprains, and broken bones.

South of the central roundabout, retail continues to occupy the first floor of the structures on both sides of the street. The retail corridor extends southward until it meets with the retail plaza of the existing portions of the resort. The shopping and living experience mimics that of a traditional Main Street, while providing a seamless connection to existing portions of PCMR (Fig. 4.23).

NORTH

Figure 4.23 Land Use- NTS (Cody Peratt 2009)

LEGEND

- Recreation
- Civic
- Commercial
- Mixed Use
- Single Family Residential
- Apartments/Condos

NORTH 0 80 feet

Figure 4.24 Detail Plan- Power Core (Cody Peratt 2009)

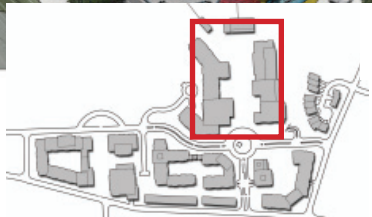


Figure 4.25 Perspective- Power Core (Summer) (Cody Peratt 2009)

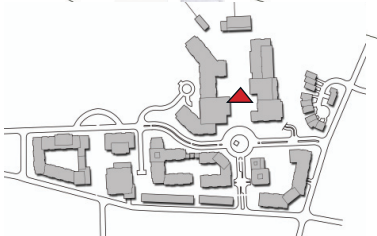


Figure 4.26 Perspective- Power Core (Winter) (Cody Peratt 2009)

The power core plaza is successful in providing a versatile active space that acts as a junction of life for residents and visitors. Shoppers and diners spill out of stores and restaurants to take in the fresh mountain air while traversing the walks. The large green open space collects and cleanses stormwater before directing it to the bioswale that cuts through the space. During the summer the green space is utilized by residents practicing yoga or playing ball. In the winter the space is flooded and frozen to create an outdoor ice rink. Plant material within the plaza is placed in large planters and substituted according to the season. In the summer months, flowering ornamental trees fill the plaza planters and are switched out with dwarf evergreens in the winter. Whatever plants are not currently being used outdoors are stored in the gondola house and wellness center. The planters allow the space to become even more versatile by allowing vegetation to be moved in the instance of a special event (Fig. 4.27-4.28).

PCMR fulfills the goals of creating a socially sustainable community through a variety of carefully thought out and implemented design elements. The design reflects the history of Park City and the people who lived there through a series of reflective spaces and informative monuments. Visitors and residents learn about the founding of Park City as a mining town, the importance of the ski industry, its Olympic history, and the geological make-up of the Wasatch Front Range. Diversity of activities and people are accomplished through mixed use, active adaptable open space, and a variety of housing types. Emphasis on the principles of walkability is reflected in the connective bike and walking trails on site. The public transportation system servicing Park City and the resort community allows users to eliminate the use of a personal car and enjoy the mountain community through alternative means.

Economic Design Characteristics

As expressed in the literature review, the financial success of mountain resorts is often a variable component that gets overlooked when examining sustainability. The sometimes insurmountable capital costs of resort construction become a mountain of challenges to overcome in itself. As the ski industry found itself stagnating in the 80's and 90's, resorts found it profitable to join with or act as developers (Tirman 2006). PCMR is designed on the concept of reflecting community, in which the costs of the resorts can be absorbed through the sale of residential units and retail bays. Fractional ownership allows people to make the resort their second home without the large financial commitment. A variety of activities promote people to come and live in the resort

for amenities other than those related to the mountain. Also, PCMR puts on special events and festivals in order to regularly draw visitors to the site. By creating a design that can be implemented with minimal implications to existing portions of the resort, PCMR will be able to stay open and unaffected while additions are constructed.

PCMR will accrue a loan to pay for the initial capital costs of improvements to the resort community and will be financed on a 20 year note. The resort will offset the costs through home sales, increased visitor presence, and retail consumption. Home and condo sales within the resort will be sold for approximately $800 per square foot. Of the 380 units constructed during the additions to PCMR, 325 will be available to the public. The other 55 will be subsidized and reserved for employees of the resort. The 325 units available to the public include 445,000 sq. feet of livable space. At $800 a square foot, the resort will see a return of 356 million dollars with the sale of residential units alone. The resort master plan required minor adjustments to the original program in order to provide more residential units with smaller physical footprints. More single room or studio apartments will be desirable and more affordable for young professionals and couples without children. The number of on site parking stalls was able to be decreased because of the promotion of the site as a walkable community. Additional on-street parking opportunities were identified within the adjacent neighborhood and allowed for approximately 150 more stalls. At an estimated cost of $35,000 per stall for underground parking costs, (Erickson 2008) the resort saved approximately 6 million dollars in construction costs.

By creating a resort that doubles as a community, it is anticipated that the people living there will provide the financial base in order to keep the community running year round. In combination with the anticipated 1,000,000 seasonal visitors (Erickson 2008) the mixed use development should flourish. PCMR's location, between the historic Main Street and Park City's central business district will act as an intermediary stop between the two. Shopping, restaurants, and activities not available in either of the two create a destination. Mixed use provides a variety of activity throughout the day and into the night. This creates a full day experience as opposed to traditional single-use ski areas.

Park City Mountain Resort also has the added benefit of the amount of activities and festivals that already occur within the city. Park City is the host to multiple arts, music, and film festivals, a marathon, cycling race, and rodeo. PCMR is home to the FIS Freestyle Ski and Snowboard Championships and will host the Winter X Games. The newly designed central plaza provides an adaptive space that will be used to host activities such as summer concerts and rail jam events. Rail

Figure 4.27 Perspective- Power Core (Concert) (Cody Peratt 2009)

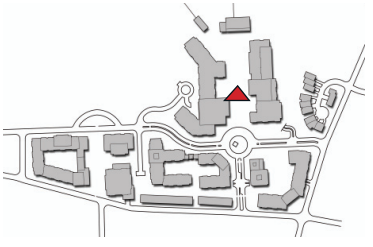


Figure 4.28 Perspective- Power Core (Rail Jam) (Cody Peratt 2009)

jam events are smaller activities not requiring mountain terrain. These events will draw users and spectators as well as entertain those visiting PCMR to shop or dine. Another technique that the design utilizes to combat the financial burden is a coherent phasing/ staging plan.

The design for the additions of PCMR allows for as little disruption to existing facilities as possible during the construction stages of development. By constructing the development in four distinct phases, PCMR will be able to utilize Lowell Avenue's existing road alignment and one of the existing condo units for as long as possible (Fig. 4.29).

During phase one, the northernmost condo unit scheduled to be demolished will be removed. The southern condo unit will be transformed into temporary PCMR worker housing and construction worker housing during project operations. The subsurface parking structure beneath the existing condo units will be retrofitted to fit the new design, and all new underground parking structures will be constructed. During this phase, Lowell Ave. will continue to be open and accessible to the public.

Phase two involves both the realignment of Lowell Avenue and the construction of the majority of new structures. The new condo units along the south portion will be completed, continuing to leave the one existing condo building. The gondola house and new lift are constructed, as well as the majority of structures within the power core. The east wing of the southern power core building will not be added at this point, in order to insure that it is not damaged during adjustments to Lowell Avenue. The eight single family residential units in the northwest corner of the site will be completed, with the other three to come in subsequent phases. The wellness center and units in the northeast corner will then be completed simultaneously to the road work. Lowell Avenue will be adjusted to meet up with Silver King Road 50 feet east from where it currently connects. The new entry from Empire Ave. will then be completed as well as the pedestrian bridge and roundabout features. All entry points to underground parking will then be constructed. The road connecting Empire Ave. to existing portions of PCMR will now be closed at this point.

With road adjustments complete and the majority of construction done, the condo unit housing construction workers will be demolished and removed. Meanwhile, the east wing of the southern power core structure will be constructed, as well as the remaining single family residential homes.

Lastly, the remaining townhomes along Empire Ave. and the condo units to the west will be finished; marking the completion of infrastructure. Final touches to grading and landscape amenities such as hardscape, stormwater BMPs, water features, and plantings will occur during phase four.

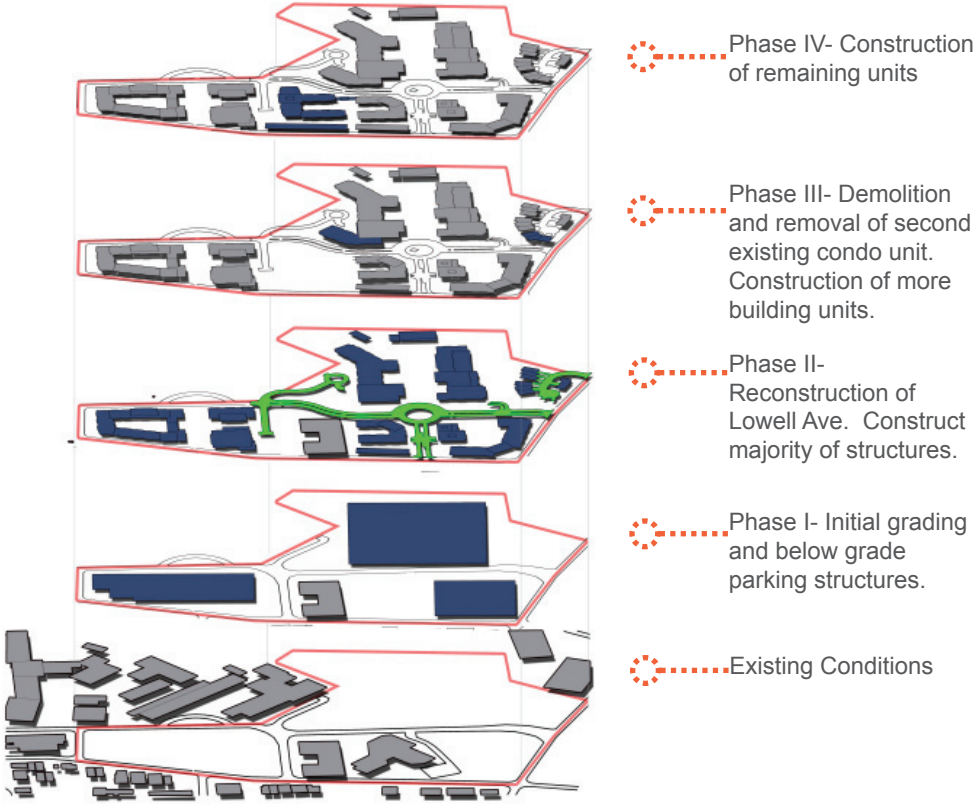


Figure 4.29 Perspective- PCMR Phasing Diagram) (Cody Peratt 2009)

Workers, visitors, and busses will be able to access PCMR during the entirety of construction. This will allow the resort to stay open the entire time and allow it to function with minimal financial implications.

As previously expressed, the financial success of mountain resorts is often a component that gets overlooked when examining the sustainability of a site. Park City Mountain Resort has taken a proactive approach to dealing with the economic challenges by veering away from traditional resort design and instead developing a community in which people live, work, and play. The sale of residential units alone will produce considerable capital gains in order to pay for some of the improvements. The newly established residential base in combination with the expected rise in number of visitors to PCMR, provides for an active community. The location of PCMR, between historic Main Street and the central business district allows the resort to be a link between the two. Creative mixed use design allows for activity at all times and seasons, promoting more than just a traditional ski hill. Additionally, regularly scheduled events draw even more people to the site and promote excitement within the entire Park City community. An effective and coherent phasing plan allows for PCMR to function at near full capacity while improvements are made to the site.

Park City Mountain Resort

Ecology	Physiography and Natural Systems	Wildlife	Animal Migratory Routes	None	5		Wildlife Value
				Minimal	3		
				Extensive	1		+
		Solar Aspect	Surface Aspect Analysis	SW, S, SE	5		Solar Aspect Value
				E, W, Flat	3		
				NW,N,NE	1		+
		Slope	Surface Slope Analysis	2-5%	5		Slope Value
				< 2%	3		
				>5%	1		+
		Pre Development Vegetation	Old Growth Forests	0%	5		Pre Dev. Value
				<30%	3		
				>30%	1		+
		Post Development Vegetation	Use of Natives	All Native Planting	5		Post Dev. Value
				Like Irrigation Requirements	3		
				No Consideration	1		+
		Hydrology	Hydric Soils	Not Hydric	5		Hydrology Value
				Somewhat Hydric	3		
				Very Hydric	1		+
		Existing Land Use	Type of Development	Brownfield	5		Land Use Value
				Greyfield	4		
				Greenfield	1		+
		Cut vs. Fill	Balance of Cut vs. Fill	<5% Difference	5		Earthwork Value
				5-15% Difference	3		
				> 15% Difference	1		
	LEED Certification		Level of LEED	Platinum	5	*****	LEED Value
				Gold	4		
				Silver	3		
				Certified	2		=
				None	1		

Park City Mountain Resort	30	Total Ecological Sustainability Value
	3.75	Ecological Sustainability Average
Whistler, British Columbia	34	Total Ecological Sustainability Value
	3.77	Ecological Sustainability Average

Society	Walkability	Recreation	Distance to Recreation	1/4 mile	5
				1/2 mile	4
				1 mile	3
				>1 mile	1
		Civic	Gathering/ Open Space	1/4 mile	5
				1/2 mile	4
				1 mile	3
				>1 mile	1
		Retail/Commercial	Shopping	1/4 mile	5
				1/2 mile	4
				1 mile	3
				>1 mile	1
		Transportation	Distance to Public Transportation	1/4 mile	5
				1/2 mile	4
				1 mile	3
				>1 mile	1
		Transportation	Types of Routes within 1/2 mile	Highway	5
				Major Street	4
				Neighborhood Street	3
				Trail	1
	Diversity	Housing Types/ Costs	Diverse Options	High Mix of Housing Types	5
				Two Housing Types	3
				Single Housing Type	1
	Aesthetics	Intrinsic Qualities	Desired Views of Natural Features	Mountain Peaks and Water	5
				Mountains or Water	3
				Neither	1
	Aesthetics	Open Space	Usable Open Space	10-20%	5
				21-40%	3
				<10% or >40%	1
	Historical	Relationships	Expression of Historical Connections	High Level of Expression	5
				Hint of Expression	3
				No Expression	1

Recreation Value
+
Transportation Value
+
Transportation Value
+
Civic Value
+
Retail Value
+
Diversity Value
+
Intrinsic Quality Value
+
Open Space Value
+
Historic Value
=

Park City Mountain Resort	43	Total Social Sustainability Value
	4.78	Social Sustainability Average
Whistler, British Columbia	41	Total Social Sustainability Value
	4.55	Social Sustainability Average

Economy

Proximity	Proximity to Population Centers	Attract Outside Income	1 mile	5	Proximity Value
			1-10 miles	4	
			10-30 miles	3	+
			>30 miles	1	
Mixed-Use	Variety of Uses	Commercial, Residential, Recreation	High Level of Mixture	5	Use Value
			Some Mixed-Use	3	
			No Mixed-Use	1	+
Transportation	Interconnections	Types	Ski In/Out	5	Interconnections Value
			Free Shuttle	3	
			Shuttle for Fee	2	
			Must Drive	1	+
Development Cost	Economic Feasibility	Ability to Pay Off Development	Through Increased Revenue	5	Economic Feasibility Value
			With Help from Tax Dollars	3	
			Not Feasible to Pay Off	1	+
Development Cost Over Time	Economic Feasibility	Temporal	<20 Years	5	Economic Feasibility Value
			20-30 Years	3	
			>30 Years	1	=

Park City Mountain Resort	25	Total Economic Sustainability Value
	5.00	Economic Sustainability Average
Whistler, British Columbia	12	Total Economic Sustainability Value
	4.00	Economic Sustainability Average

NOTE ****** See Explanation in Supplementary Text

Table 4.2 PCMR Sustainability Assessment Test (Cody Peratt 2009)

Park City Mountain Resort	Total Ecological, Social, and Economic Average	4.51
Whistler, British Columbia	Total Ecological, Social, and Economic Average	4.10

Sustainability Assessment

In order to further validate the viability of the design, the Sustainability Assessment Framework developed earlier is now applied to PCMR (Table 4.2). The test has already been applied to the precedent study of Cheakamus Crossing in Whistler, BC and can be found in Appendix III- Precedent Study. The development in Whistler is currently under construction, and has been praised by the design community as a model of sustainable development. The development is designated as a pilot project for the LEED-ND, (Leadership in Energy and Environmental Design- Neighborhood Development) which currently sets the highest standards for neighborhood design development. By comparing the two assessments, some of the successes and pitfalls of both designs are made more readily visible.

Cheakamus Crossing was originally chosen as a precedent study because of the similarities between it and the project in Park City. Where Park City was the host to the 2002 Winter Olympic Games, Whistler is host to the 2010 Winter Olympics. Both projects have similar goals in becoming models for sustainable living, and both are located on current brownfield sites. Like Cheakamus Crossing, the assessment model was applied to the designed master plan for Park City Mountain Resort, and the results have been compared. Though both projects received considerably high marks on the assessment (Whistler-4.10/5.00 and PCMR-4.51/5.00), there were specific criteria where the two diverged.

Both designs recognize the important ecological considerations of the surrounding context and attempt to limit their impact on neighboring ecosystems. Whistler received a lesser score in the hydrology subcomponent because it's location is in an area that is classified as "somewhat limited" by hydric soils. The site is located within the flood plane of the Cheakamus River basin. PCMR, on the other hand, is not limited by hydric soils.

Both projects presented a rich level of historical connection through reflective landscapes, signage, and monuments. PCMR is closer to existing population centers, which will provide for a more successful walkable community. The site for Cheakamus Crossing is located on the fringe of Whistler and requires the use of a vehicle to access the development. Also, the introduction of a ski lift and gondola into PCMR's design allows for ski in/ ski out service to the development. Conversely, Cheakamus Crossing is located directly adjacent to the ski development but no direct access point is provided.

The design for PCMR received lower marks in balance of cut and fill. Where Cheakamus Crossing presented less than 5% difference in earthwork operations, PCMR had considerably more earthwork. Even with the attempt to conform the development to existing topographical changes, there was a difference of 14% more cut than fill on site.

The economic sustainability component was another area of the assessment where the two projects diverged in results. The Resort Municipality of Whistler is receiving approximately 30 million dollars in funding for the development from the Olympic Games Committee. Meanwhile, the rest of the required capital is anticipated to be raised through the sale of converted residential units after the Games. The drawback is that Cheakamus Crossing is anticipating to provide housing for up to 75% of past and current RMOW employees. Therefore, a majority of the housing will be subsidized to ensure affordability.

The design for PCMR, provides subsidized housing for employees at a much smaller scale. The fifty five units reserved for employees will provide housing for approximately 110 employees. The other 325 units will be sold at the full $800 per square foot price. The design for PCMR, therefore, presents a much stronger argument for the financial success of the development.

Conclusion

The benefit of sustainable design and construction has a profound impact on the natural systems, social environment, and economic returns of Park City Mountain Resort. By venturing outside the norm of traditional ski area design, PCMR will be recognized as an icon for the city and a model for sustainable living replicated by future mountain resorts.

Stormwater Best Management Practices and native plantings minimize the additional consumption of valuable water resources. Meanwhile, stormwater and snow melt is slowed and cleansed before moving off site. By controlling and cleansing water flows, the community as well as the golf course adjacent to the site benefits. The design attempts to create continuous habitat corridors between existing sensitive lands through the creation of a stream and subsequent vegetation. The connective habitat network connects the more mountainous wilderness to the west, with the stream corridor within the bounds of the adjacent golf course. Architectural BMPs both preserve and create energy allowing PCMR to operate almost completely off grid.

The bike and pedestrian trail networks provide uninhibited flow through the site, while connecting with important off-site elements. Along the trails and walks, reflective spaces and historical monuments provide educational opportunities for users. Efficient public transportation provides easy access to the rest of the community as well as Deer Valley and The Canyons ski areas. A variety of housing types allow for users of varying incomes to call PCMR “home.” A careful balance of built and open green space provides areas for gathering, events, and recreation. Mixed use design combines affordable living, recreation, shopping, and relaxing within a 12 acre community. The scale of the resort fits in with the architectural volumetrics of the neighboring community allowing a melding of the two.

Substantial income from the sale of homes, condos, and retail space allows the resort to immediately compensate for high capital costs. The ability of the resort to host special events and outdoor concerts provides increased income for the resort. The historically dead off season is no longer present as events occur year round. Well planned phasing allows minimal conflicts with existing portions of the resort, resulting in continual income to the resort.

The designed additions to PCMR addressed the project goals and objectives in a manner in which a mountain resort was designed to fulfill the requirements of being ecologically, socially, and economically sustainable. The design demonstrates how tourism can effectively coexist with and contribute to sustainable mountain development.

Limitations and Guides for Future Research

By following the Sustainability Assessment Framework through all phases of the design process, I feel that the design for the site was successful in accomplishing the project goals and objectives. After re-evaluating the design, though, I have identified specific opportunities for improvements to the master plan. First off, the design would benefit greatly from a more thorough exploration into the physical maintenance of the site. For example, it is important to provide ample room for snow pile during winter months and determine how snow removal operations would be conducted. Secondly, the design would benefit from the addition of at least some short-term above ground parking. The above ground parking would serve the needs of delivery and emergency response vehicles. Thirdly, it would have been idealistic to continue the project further and explore specific plant material on site. I would have liked to develop an in depth planting plan for PCMR.

Besides minor downfalls in the developed design, there were also some limiting factors that were experienced throughout the design process. Limiting factors included distance to the site, and availability of base material. Due to financial limitations, my experience of the site was restricted to a few days in late December. Since the design for Park City Mountain Resort revolved around the creation of a community that would be vibrant and active year round, it would have been conducive to visit Park City in all four seasons.

Lastly, availability of base materials limited my progress through the project on numerous occasions. After some perseverance, I was eventually able to acquire concrete CAD information and GIS data for both Park City and Whistler.

As directions for future research, I would suggest using the developed Sustainability Assessment Framework as a guide with the understanding that it is very adaptable and should be modified to fit the specific project. It is important to mention that there are also considerable gains to be made to the economic portion of the framework.

I would also suggest that future research should examine more of the aesthetic opportunities in mountain design. Examination of other completed mountain resort projects such as Aspen, Keystone, and Breckenridge would be helpful. More research into literature by landscape architects that design in these regions, such as Sherry Dorward, would be beneficial.

References

Bronsky, Peter. 2006. Battling the down valley effect: Mountain resort towns find a variety of ways to provide affordable housing. Praxis (8).

Calthorpe, Peter. 1993. Next american metropolis: Ecology, community, and the american dream. New York: Princeton Architectural Press.

Coalition for Utah's Future. Keeping Utah beautiful prosperous and neighborly for future generations. http://www.envisionutah.org/

Dorward, Sherry. 1990. Design for mountain communities: A landscape and architectural guide. New York: Van Nostrand Reinhold.

Erickson, Bruce. Personal interview. 23 October 2008.

Farr, Douglas. 2008. Sustainable urbanism: Urban design with nature. Hoboken, New Jersey: John Wiley & Sons Inc.

Gripton, S. 2006. Whistler: A case study of the effects of amenity migration on the resort municipality of whistler and surrounding environs. Masters diss., University of British Columbia.

Green residences on snowy slopes [park city, utah]. 2006. Urban Land 65, (4).

Holtzman, David. 2006. Mountain resorts grow up: As mountain resorts morph from ski areas into year round destinations, they face affordable housing shortages and other growth challenges. Urban Land 65, (4).

Kozloff, Howard. 2006. Ten trends affecting mountain resorts. Urban Land 65, (4).

Lawson, Fred. 1995. Hotels and resorts: Planning, design, and refurbishment. Jordan Hill, Oxford: Butterworth Architecture.

Ogilve, Clare. 2008. Whistler reveals proposed games legacies. The Province, August 27.

Price, Martin, Ted Wachs, and Elizabeth Byers. 1999. Mountains of the world: Tourist and sustainable mountain development. Institute of Geography: University of Berne, Switzerland.

Portland Bureau of Environmental Services. 2008 Stormwater management manual. http://www.portlandonline.com/bes/index.cfm?c=35117&

Rademan, Myles. 2003. Change comes to the mountains: Tourist towns face an uncertain future. Planning 69, (1).

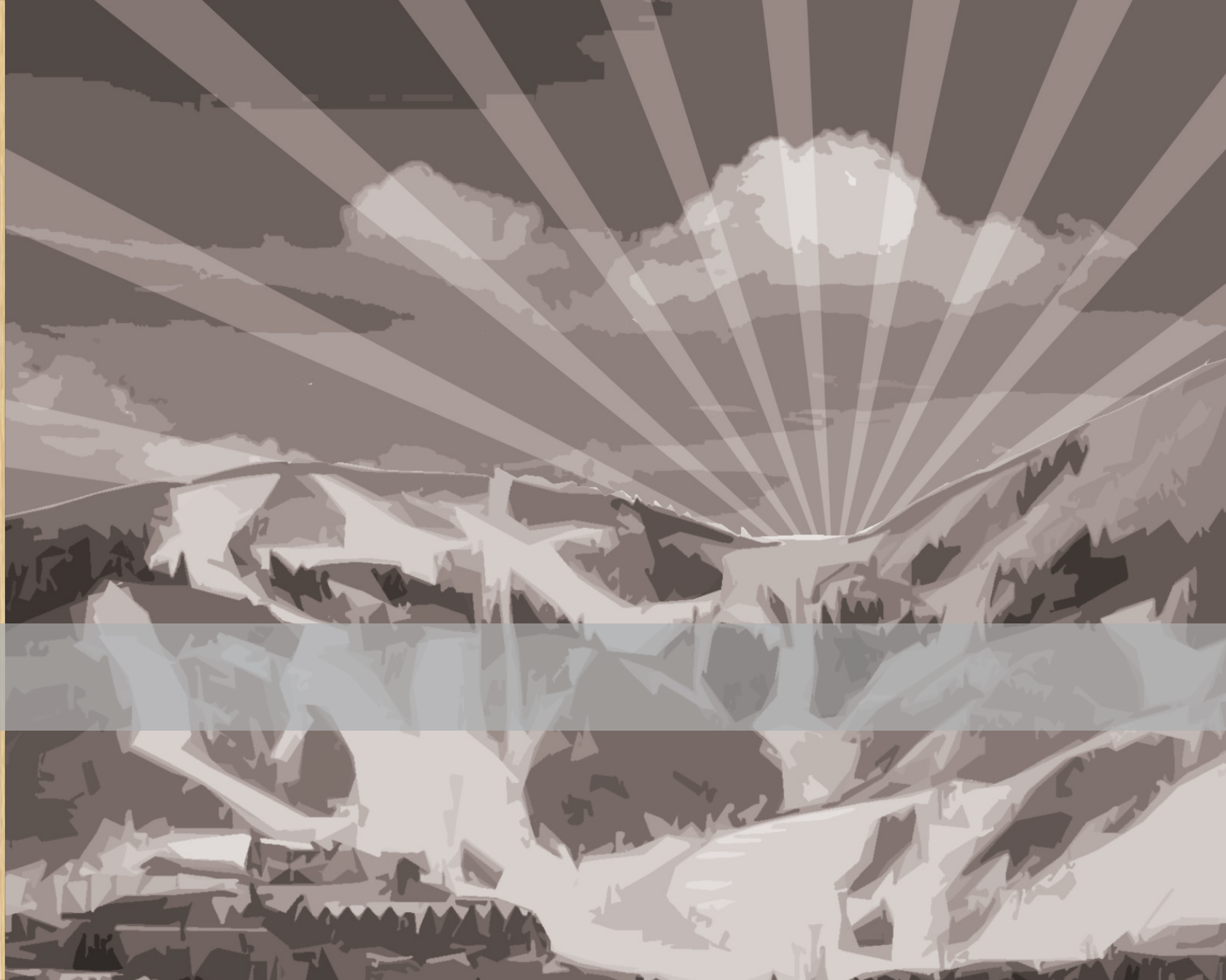
Resort Municipality of Whistler. Athlete village; Whistler's newest neighbourhood. http://www.whistler.ca/content/view/102/133/

Tirman, David. 2006. Sustainable resorts: Developing resort projects sustainably calls for responsible land stewardship and shared community values. Urban Land 65, (8).

United States Green Building Council. LEED rating systems. U.S. Green Building Council. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222.

Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games. Sustainability and the games. Vancouver Organizing Committee. http://www.vancouver2010.com /en/news/featurestories//31738/32574/6tw4a8/sustainability-and-tthe-games.html.

Whistler Real Estate Company Limited. Cheakamus crossing; Whistler's newest resident community. http://www.cheakamuscrossing.ca/.



appendix I

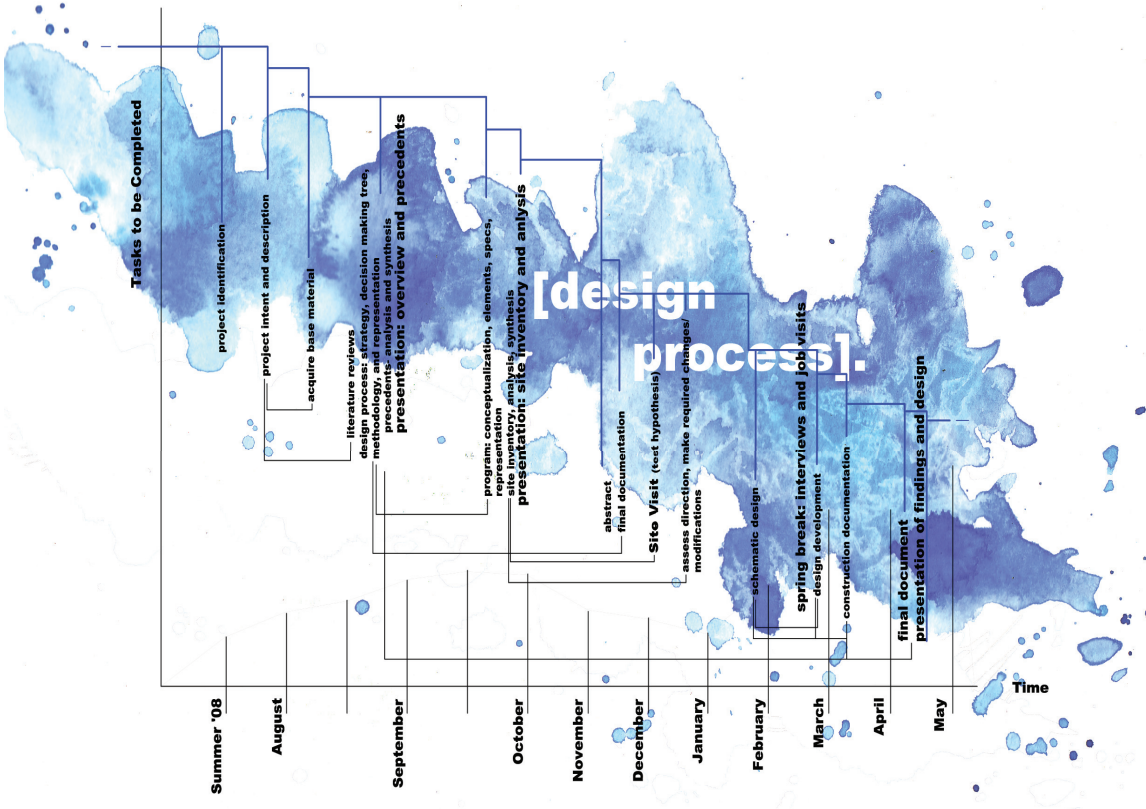
Appendix I

Design Schedule

The design schedule is an anticipated time line of milestones to be achieved throughout the 2008-09 school year. Behind the time line is a fluid graphic with the words “design process” imbedded within it. The graphic represents the design process occurring throughout the year, with the realization that some tasks would not necessarily occur in the intended sequential order (Fig. 5.1 Design Process).

Literature Map

The literature map (Fig. 5.2) is a reflection of the three core components of sustainability as outlined by the Envision Utah Quality Growth Plan. The ecological, social, and economic factors are portrayed as the three main branches of the symbolic sustainability tree. The literature within the graphic is placed according to it’s relevance to the three branches. For example, if a piece of literature is ecologically focused then it is positioned near the environmental “branch”. If a piece of literature overlaps two different aspects of sustainability, it is then reflected that way within the graphic. The Envision Utah Quality Growth Plan is placed throughout the “trunk” because it was used as the lens from which all other literature was examined.



(Figure 5.1 Design Process (Cody Peratt 2008)

Figure 5.2 Literature Map (Cody Peratt 2008)

Glossary of Terms

Big House Apartments- The design of apartments to fit into neighborhoods by making them appear to be a large home while accommodating two, four or even eight units (Coalition for Utah's Future 1997).

Bio-Energy- Energy produced from any renewable organic matter including forest residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residue, aquatic plants, and municipal wastes (Coalition for Utah's Future 1997).

Biodiversity- The variety and essential interdependence of all living things; it includes the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning (Farr 2008, 297).

BMP's (Best Management Practices)- Practice considered most effective to achieve a specific desired result for protection of water, air, and land and control the release of toxins (Farr 2008, 297).

Brownfield- A site that is under utilized or not in active use, or land that is either (Farr 2008, 297).

Charrette- A planning session in which participants brainstorm and visualize solutions to a design issue (Farr 2008, 297).

Contemporary Mountain Architecture- The use of small wood timbers, a large percentage of glass, and stone and metal accents. This style is counter to the traditional use of predominately large timbers in mountain architecture (Bruce Erickson, e-mail message from Stantec Architecture, October 31, 2008).

Built Environment- The urban environment consisting of buildings, roads, fixtures, parks, and all other improvements that form the physical character of a city (Farr 2008, 297).

Capital Improvement Program (CIP)- A communities plan for matching the cost of large-scale improvements- such as fixing roads and water and sewer mains- to anticipated revenues, such as from taxes and bonds (Farr 2008, 297).

Character- The image and perception of a community as defined by its built environment, landscaping, natural features and open space, types and style of housing, and number and size of roads and sidewalks (Farr 2008, 297).

Community- A cluster of residences, civic facilities, and commercial enterprises identified by a place name as a distinct geographical entity (Dorward 1990, 12).

Courtyard Apartments- Apartments situated in residential neighborhoods, with courtyards near the entry. The courtyard traditionally occupies approximately one quarter of the lot area (Coalition for Utah's Future 1997).

Density- The average number of people, families, or housing units on one unit of land. Density is also expressed as dwelling units per acre (Farr 2008, 298).

Density Transfers- A system in which the property owner has the right to the same number units and allowable uses, but the units are transferred on the same parcel from more sensitive lands to less sensitive lands (Coalition for Utah's Future 1997).

Environmentally Sensitive Areas- Areas that have important ecological features that often are disrupted by development (Coalition for Utah's Future 1997).

Flood Plain- The nearly level area adjacent to a body of water, subject to inundation under heavy rain or blockage condition; also called the overflow area (Farr 2008, 298).

Garden Court- A garden surrounded by urban housing (Coalition for Utah's Future 1997).

Geothermal Energy- Heat energy harnessed from the earth with little or no greenhouse gas emissions (Coalition for Utah's Future 1997).

Habitat Fragmentation- The division of large tracts of natural habitat into smaller, disjunct parcels (Farr 2008, 298).

Impervious Cover- Anything that stops rainwater from soaking into the ground, including roads, sidewalks, driveways, parking lots, swimming pools, and buildings (Farr 2008, 298).

Infill Development- A type of development occurring in established areas of a city (Farr 2009, 298).

Intermountain Connections- The notion of connecting numerous mountains into one mega resort. Much like the Alps resorts of Italy, France, and Austria. May help alleviate some of the transportation concerns, as skiers would be able to arrive at one mountain and ski a number of others without ever getting in a car or boarding a shuttle. Involves an extensive network of chairlifts, trams, and gondolas (Kozloff 2006, 50).

LEED- LEED is a third-party certification program and the nationally accepted benchmark for the design, construction and operation of high performance green buildings. LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings' performance. It promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality (United States Green Building Council).

Live-work Units- Housing in which everything from professional services to small manufacturing can be home based. The total non-residential work space in live-work units is usually limited to between a few hundred square feet and roughly 2,000 square feet (Coalition for Utah's Future 1997).

Moderate Income Housing- Housing occupied or reserved for occupancy by households with a gross household income equal to or less than 80% of the median gross income of the metropolitan statistical area for households of the same size (Coalition for Utah's Future 1997).

Natural Hazard Areas- Areas which present a danger to humans when developed (Coalition for Utah's Future 1997).

Open Space and Agricultural Land- Land that possesses cultural, aesthetic, or economic importance that can be lost when developed (Coalition for Utah's Future 1997).

Parkway- A street with a linear park at the center, with one-way roads running on both sides. They are an appropriate device to separate two-way traffic into a one-way couplet, with roads and on-street parking on both sides (Coalition for Utah's Future 1997).

PCMR (Park City Mountain Resort)- PCMR is the client of this project. It is located in Park City, Utah and recognized as one of the top rated mountain resorts in North America.

Redevelopment- The conversion of a building or project from an old use to a new one (Farr 2008, 299).

Resort- A place dominated by temporary lodging and visitors who come for recreation and entertainment. It lacks the network of systems, services, and governance needed in a community (Dorward 1990, 13).

Mountain Resort community- A year-round playground in which skiing is not necessarily the main event; a place where people live and visit in order to enjoy the wonders of the outdoors, skiing, mountain bike or horseback riding. They come to shop, dine, and stroll the streets without leaving the resort (Holtzman, 83). The convergence of the aspects of a "resort" and "community," in which they coexist on a spectrum of maturation (Dorward 1990, 13).

Glossary of Terms

RMOW- The Resort Municipality of Whistler (Gripton, 2006, viii).

Sensitive Lands- Includes any area in which development is either not appropriate or must be approached with care to ensure there is no long-term loss of property or human life. Also refers to areas with exceptional ecological, open space, or agricultural value (Coalition for Utah's Future 1997).

Sustainable- The process of meeting the needs of the present without compromising the ability of future generations to meet their own needs through balancing a community's social, environmental, and economic factors (Coalition for Utah's Future 1997).

TODs Transit Oriented Developments- The creation of compact, walkable communities centered around high quality transportation systems. This makes it possible to live a higher quality life without complete dependence on a car for mobility and survival. (Tirman 2006, 81).

Transfer of Development Rights- Program allowing landowners to sever development rights from properties in government-designated low density areas, and sell them to purchasers who want to increase the density of development in areas that local governments have selected as higher densities (Coalition for Utah's Future 1997).

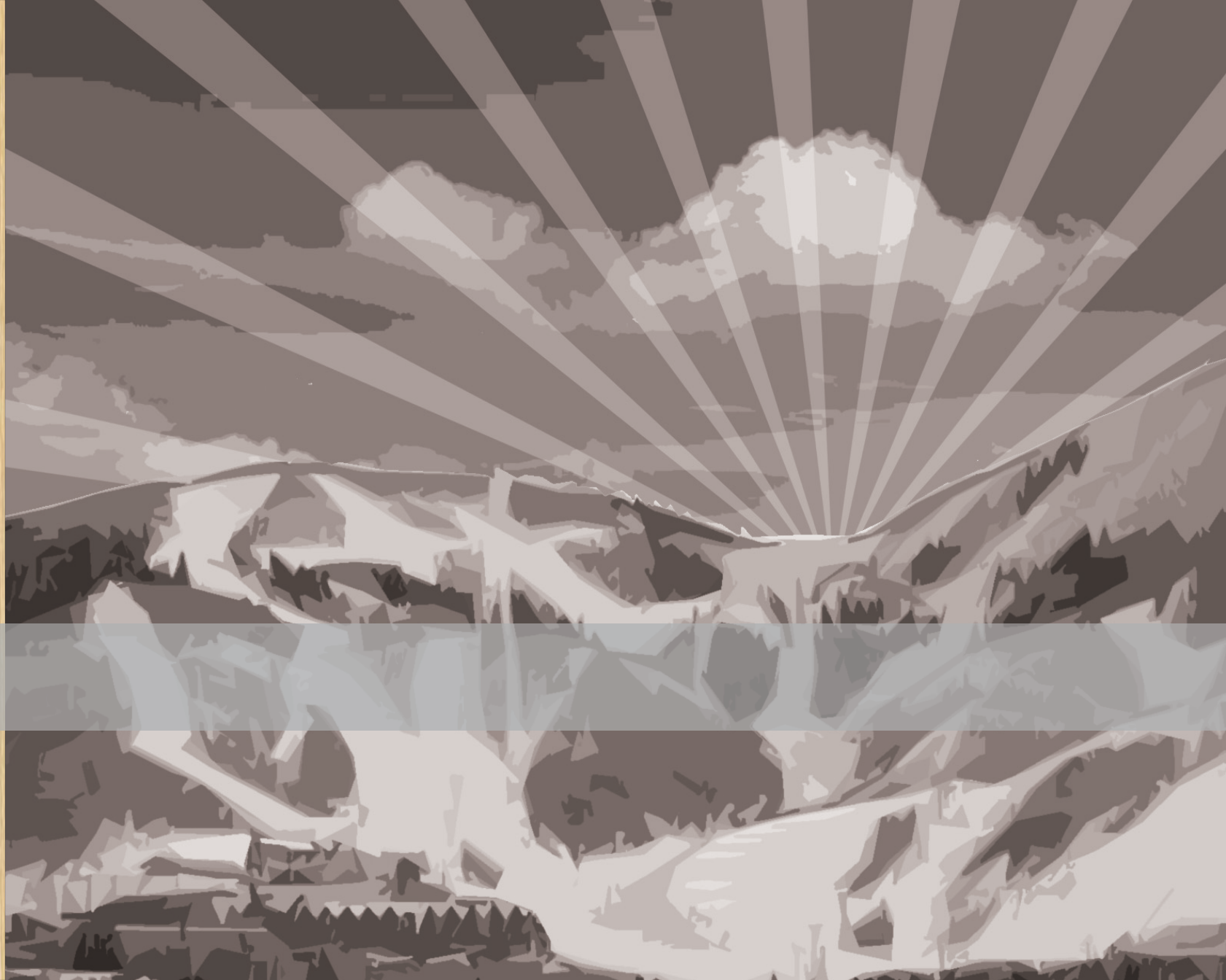
VANOC- Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games (Gripton 2006, viii).

Village- The center of a township; generally denotes more primitive or vernacular settlements (Dorward 1990, 13).

Walkable Communities- A community in which there is considered to be a diversity of uses, a connected street, and often, a transit service that ties into the heart of the community (Coalition for Utah's Future 1997).

Watershed- The geographic area from which water drains into a specific body. A watershed may contain several subwatersheds (Farr 2008, 300).

WHA- the Whistler Housing Authority (Gripton 2006, viii).



appendix II

WATER-WISE PLANTS FOR UTAH

*The following plant list was compiled by the Utah Water-Wise Plants Committee for use with its **Water-Wise Plant Tagging Program**. Please use this list to find plants that are appropriate for Utah's climate and conditions. For specific plant information and design ideas please visit **www.waterwiseplants.utah.gov**.*

ALPHA BY LATIN NAME

CONIFEROUS TREES

Abies concolor	White Fir	*Pinus aristata*	Bristlecone Pine
Calocedrus decurrens	Incense Cedar	*Pinus edulis*	Pinyon Pine
Cedrus atlantica glauca	Blue Atlas Cedar	*Pinus flexilis*	Limber Pine
Cedrus libani	Cedar of Lebanon	*Pinus monophylla*	Single-Needled Pinyon
Cupressus arizonica	Arizona Cypress	*Pinus nigra*	Austrian Pine
Juniperus osteosperma	Utah Juniper	*Pinus ponderosa*	Ponderosa Pine
Juniperus scopulorum	Rocky Mountain Juniper	*Pinus sylvestris*	Scotch Pine

DECIDUOUS TREES

Acer campestre	Hedge Maple	*Gymnocladus dioicus*	Kentucky Coffee Tree
Acer ginnala	Amur Maple	*Koelreuteria paniculata*	Goldenrain Tree
Acer grandidentatum	Bigtooth Maple	*Maclura pomifera*	Osage Orange
Acer tataricum	Tatarian Maple	*Parrotia persica*	Persian Ironwood
Acer truncatum	Shantung Maple	*Ptelea trifoliata*	Hop Tree
Amelanchier sp.	Serviceberry	*Quercus gambelii*	Gambel Oak
Catalpa speciosa	Western Catalpa	*Quercus macrocarpa*	Bur Oak
Celtis occidentalis	Common Hackberry	*Quercus muehlenbergii*	Chinkapin Oak
Chilopsis linearis	Desert Willow	*Robinia neomexicana*	New Mexico Locust
Corylus colurna	Turkish Filbert	*Sophora japonica*	Japanese Pagoda Tree
Cotinus obovatus	American Smoke Tree	*Syringa reticulata*	Japanese Lilac Tree
Crataegus douglasii	Douglas Hawthorne	*Ulmus parvifolia (parviflora)*	Lacebark/Chinese Elm
Fraxinus anomala	Single-Leaf Ash	*Zelkova serrata*	Zelkova
Ginkgo biloba	Ginkgo		

Table 6.1 Additional Native Plants (wwww.waterwiseplants.utah.gov)

SHRUBS

Agave utahensis	Utah Agave
Amorpha canescens	Leadplant
Artemisia cana	Silver Sage
Artemisia filifolia	Sand Sage
Artemisia frigida	Fringed Sage
Artemisia nova	Black Sage
Artemisia tridentata	Big Sage
Atriplex canescens	Fourwing Saltbrush
Atriplex confertifolia	Shadscale
Buddleia davidii	Butterfly Bush
Caragana arborescens	Siberian Peashrub
Caryopteris x clandonensis	Blue Mist Spirea
Ceanothus martinii	Utah Mountain Lilac
Cercocarpus intricatus	Little-Leaf Mtn Mahogany
Cercocarpus ledifolius	Curl-Leaf Mtn Mahogany
Cercocarpus montanus	Alder-Leaf Mtn Mahogany
Chamaebatiaria millefolium	Fernbush
Cotinus coggygria	Smoke Bush
Cotoneaster apiculatus	Cranberry Cotoneaster
Cotoneaster dammeri	Bearberry Cotoneaster
Cotoneaster divaricatus	Spreading Cotoneaster
Cotoneaster horizontalis	Rock Cotoneaster
Cytisus scoparius	Scotch Broom
Ephedra viridis	Green Mormon Tea
Ericameria nauseosus	Rubber Rabbitbrush
Fallugia paradoxa	Apache Plume
Forestiera neomexicana	New Mexican Privet
Genista hispanica	Spanish Broom
Genista pilosa	Silky-Leaf Broom
Genista tinctoria	Common Woadwaxen
Holodiscus dumosus	Mountain Spray
Iliamna rivularis	Maple Mallow
Juniperus sp.	Juniper
Kolkwitzia amabilis	Beauty Bush
Krascheninnikovia lanata	Winterfat
Mahonia aquifolium	Oregon Grape
Mahonia fremontii	Fremont Holly
Peraphyllum ramosissimum	Sqaw Apple
Philadelphus microphyllus	Littleleaf Mockorange
Physocarpus malvaceus	Mallow-leaved Ninebark
Physocarpus opulifolius	Ninebark
Pinus mugo	Mugo Pine
Potentilla fruticosa	Shrubby Cinquefoil
Prunus pumila v. besseyi	Sand Cherry
Purshia mexicana	Cliffrose
Quercus turbinella	Shrub Live Oak
Rhus aromatica	Fragrant Sumac
Rhus glabra	Smooth Sumac
Rhus trilobata	Squawbush
Rhus typhina	Staghorn Sumac
Ribes aureum	Golden Currant
Rosa glauca (rubrifolia)	Shrub Rose
Rosa rugosa	Rugosa Rose
Rosa woodsii	Woods Rose
Rubus deliciosus	Rocky Mtn Thimbleberry
Salvia dorrii	Dorr Sage
Shepherdia argentea	Silver Buffaloberry
Sorbaria sorbifolia	False Spirea
Symphoricarpos orbiculatus	Coralberry
Symphoricarpos oreophilus	Mountain Snowberry
Symphoricarpos x chenaultii	Snowberry
Syringa vulgaris	Lilac
Viburnum lantana	Wayfaring Tree
Viburnum rhytidophylloides	Blackhaw
Viburnum rhytidophyllum	Leather-Leaf Viburnum
Yucca sp.	Yucca
Zizophora clinopodioides	Blue Mint Bush

Appendix II

PERENNIALS

Achillea filipendula 'Gold Plate'	'Gold Plate' Yarrow	*Hesperaloe parvifolia*	Red Yucca
Achillea millefolium	Common Yarrow	*Heuchera sp.*	Coral Bells
Achillea tomentosa	Wooly Yarrow	*Hymenoxis acaulis*	Sundancer Daisy
Achillea x 'Coronation Gold'	'Coronation Gold' Yarrow	*Iberis sempervirens*	Candytuft
Achillea x 'Moonshine'	'Moonshine' Yarrow	*Iris sp.*	Iris
Aethionema schistosum	Stonecress	*Kniphofia uvaria*	Red-Hot Poker/Torch Lily
Agastache rupestris	Sunset Hyssop	*Lavandula angustifolia*	English Lavender
Alchemilla sp.	Lady's Mantle	*Leucojum aestivum*	Summer Snowflake
Allium sp.	Allium/Ornamental Onion	*Liatris punctata*	Dotted Blazing-Star
Amsonia tabernaemontana	Willow Blue Star	*Liatris scariosa*	Tall Gayfeather
Anacyclus depressus	Mount Atlas Daisy	*Liatris spicata*	Spike Gayfeather
Anaphalis margaritacea	Pearly Everlasting	*Limonium latifolium*	Sea Lavender
Aquilegia sp.	Columbine	*Linum lewisii*	Lewis Flax
Arabis caucasica	Rock Cress	*Linum perenne*	Blue Flax
Arenaria macradenia	Showy Sandwort	*Melampodium leucanthum*	Blackfoot Daisy
Armeria maritima	Sea Pinks/Thrift	*Mirabilis multiflora*	Desert Four O'Clock
Asclepias tuberosa	Butterfly Weed	*Monardella odoratissima*	Little Bee Balm
Aster x frikartii 'Monch'	'Monch' Aster	*Narcissus sp.*	Daffodils/Narcissus
Aster x frikartii 'Wonder of Staffa'	'Wonder of Staffa' Aster	*Nepeta x faassenii*	Catmint
Astragalus sp.	Utah Ladyfinger	*Oenothera caespitosa*	White Evening Primrose
Aubrieta hybrids	Purple Rock Cress	*Oenothera howardii*	Bronze Evening Primrose
Aurinia saxatilis	Basket-of-Gold	*Oenothera macrocarpa*	Missouri Evening Primrose
Baileya multiradiata	Desert Marigold	*Oenothera pallida*	Pale Evening Primrose
Ballota pseudodictamnus	Horehound	*Origanum sp.*	Oregano
Bergenia cordifolia	Bergenia	*Papaver orientale*	Oriental Poppy
Berlandiera lyrata	Chocolate Flower	*Penstemon barbatus*	Common Beardtongue
Brodiaea sp.	Brodiaea	*Penstemon caespitosus*	Mat Penstemon
Callirhoe involucrata	Poppy Mallow/Wine Cups	*Penstemon cobaea*	Foxglove Penstemon
Calylophus sp.	Sundrops	*Penstemon cyananthus*	Wasatch Penstemon
Castilleja sp.	Indian Paint Brush	*Penstemon eatonii*	Firecracker Penstemon
Catananche caerulea	Cupid's Dart	*Penstemon mexicali hybrids*	Mexicali Penstemon
Centranthus ruber	Jupiter's Beard	*Penstemon palmeri*	Palmer Penstemon
Colchicum autumnale	Autumn Crocus	*Penstemon pinifolius*	Pine-Leaf Penstemon
Coreopsis grandiflora	Large-flowered Coreopsis	*Penstemon pseudospectabilis*	Canyon Penstemon
Coreopsis verticillata	Thread-Leaf Coreopsis	*Penstemon rostriflorus*	Bridges Penstemon
Corydalis lutea	Yellow Corydalis	*Penstemon sepalulus*	Littlecup Penstemon
Crocus sp.	Crocus	*Penstemon strictus*	Rocky Mtn Penstemon
Delosperma sp.	Ice Plant	*Penstemon utahensis*	Utah Penstemon

Dianthus deltoides	Maiden Pinks
Dianthus gratianopolitanus	Cheddar Pinks
Dianthus plumarius	Cottage Pinks
Dianthus x allwoodii	Border Pinks
Diascia integerrima 'Coral Canyon'	'Coral Canyon' Twinspur
Dictamnus albus	Gas Plant
Echinops ritro	Globe Thistle
Epimedium sp.	Barrenwort
Erigeron compositus	Fernleaf Fleabane
Erigeron speciosus	Showy Fleabane
Eriogonum heracleoides	Hercules Buckwheat
Eriogonum jamesii	James Buckwheat
Eriogonum ovalifolium	Silver Buckwheat
Eriogonum umbellatum	Sulfur Buckwheat
Erygium amethystinum	Amethyst Sea Holly
Gaillardia aristata	Blanket Flower
Gaillardia pinnatifolia	Hopi Blanket Flower
Gaillardia x grandiflora	Blanket Flower
Gaura lindheimeri	Gaura
Geranium endressii	Endress Cranesbill
Geranium macrorrhizum	Bigroot Cranesbill
Geranium sanguineum	Bloody Cranesbill
Geranium viscosissimum	Sticky Geranium
Gypsophila paniculata	Baby's Breath
Hedysarum boreale	Utah Sweetvetch
Helenium hoopesii	Orange Sneezeweed
Helianthemum nummularium	Sun Rose
Hemerocallis hybrid	Daylily
Penstemon whippleanus	Whipple's Penstemon
Perovskia atriplicifolia	Russian Sage
Phlomis sp.	Jerusalem Sage
Potentilla sp.	Cinquefoil/Potentilla
Psilostrophe tagetina	Paper Flower
Pulsatilla vulgaris	Pasqueflower
Ratibida columnifera	Mexican Hat
Salvia aurea	Blue Sage
Salvia nemorosa	Violet Sage
Salvia officinalis	Garden Sage
Santolina sp.	Cotton Lavender
Scabiosa caucasia	Pincushion Flower
Sedum acre	Gold Moss Sedum
Sedum kamtschaticum	Kamschatka Stonecrop
Sedum spurium	Two-Row Stonecrop
Sedum x 'Autumn Joy'	'Autumn Joy' Sedum
Sempervivum tectorum	Hens and Chicks
Smilacina racemosa	False Solomon Seal
Sphaeralcea sp.	Desert Globemallow
Tetraneuris (Hymenoxys) acaulis	Sundancer Daisy
Teucrium chamaedrys	Germander
Tithonia rotundifolia	Mexican Sunflower
Tulipa sp.	Tulip
Veronica spicata	Spike Speedwell
Viguiera multiflora	Showy Goldeneye
Zauschneria sp.	Hummingbird Flower
Zinnia grandiflora	Desert Zinnia

Appendix II

GROUNDCOVERS

Antennaria sp.	Pussytoes	*Erigeron flagellaris*	Trailing Fleabane
Arctostaphylos uva-ursi	Bearberry	*Hypericum calycinum*	St. Johns Wort
Cerastium tomentosum	Snow-in-Summer	*Juniperus horizontalis*	Horizontal Juniper
Mahonia repens	Creeping Mahonia	*Thymus sp.*	Thyme
Phlox subulata	Creeping Phlox	*Veronica liwanensis*	Turkish Veronica
Stachys byzantina	Lamb's Ear	*Veronica prostata*	Creeping Veronica

GRASSES

Achnatherum hymenoides	Indian Rice Grass	*Hesperostipa comata*	Needle-and-Thread Grass
Andropogon gerardii	Big Bluestem	*Leymus cinereus*	Great Basin Wildrye
Aristida purpurea	Purple Three-Awn	*Miscanthus sinensis*	Maiden Grass
Arundo donax	Giant Reed Grass	*Molina sp.*	Purple Moor Grass
Bouteloua curtipendula	Sideoats Grama Grass	*Nassella (Stipa) tenuissima*	Mexican Feather Grass
Bouteloua gracilis	Blue Grama Grass	*Panicum virgatum*	Switch Grass
Buchloe dactyloides	Buffalograss	*Saccharum (Erianthus) ravennae*	Ravenna Grass
Calamagrostis acutiflora	Feather Reed Grass	*Schizachyrium scoparium*	Little Bluestem
Deschampsia caespitosa	Tufted Hair Grass	*Sorghastrum nutans*	Indian Grass
Festuca ovina glauca (cinerea)	Blue Fescue	*Sporobolus airoides*	Alkali Sacaton Grass
Helictotrichon sempervirens	Blue Oat Grass		

VINES

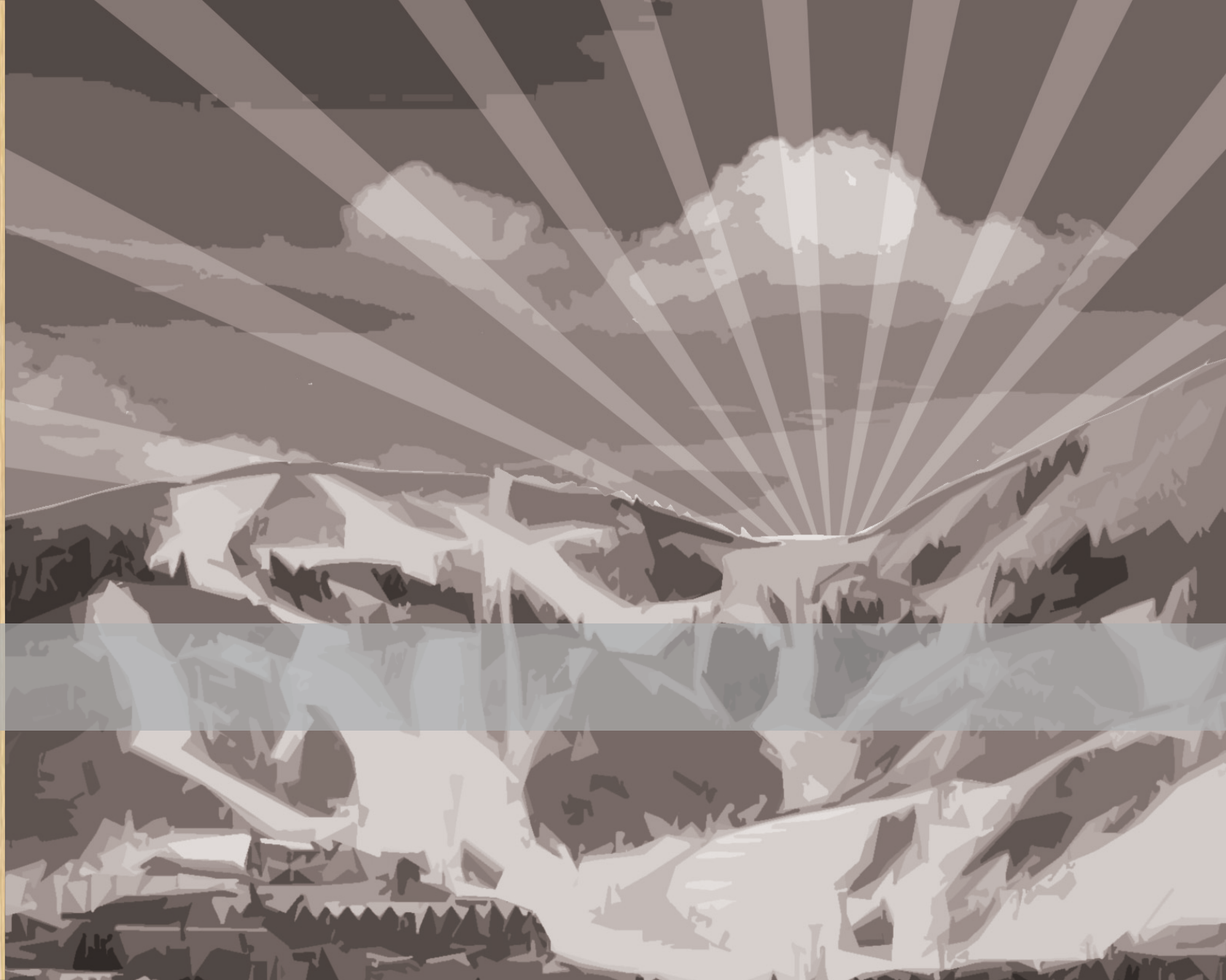
Campsis radicans	Trumpet Vine	*Polygonum aubertii*	Silverlace Vine
Clematis ligusticifolia	White Virgins-Bower	*Wisteria floribunda*	Japanese Wisteria
Clematis tangutica	Golden Clematis		

CACTI

Dasylirion wheeleri	Sotol/Desert Spoon	*Opuntia erinacea*	Hedgehog Prickly Pear
Echinocereus englmannii	Engelmann Hedgehog	*Opuntia phaeacantha*	Prickly Pear Cactus
Echinocereus triglochidiatus	Claretcup Cactus	*Opuntia polyacantha*	Plains Prickly Pear Cactus
Opuntia basilaris	Beavertail Cactus		

Brought to you by:

· Utah Division of Water Resources
· Utah State University Center for Water-Efficient Landscaping
· Central Utah Water Conservancy District
· Utah Water Conservation Forum
· Washington County Water Conservancy District
· Jordan Valley Water Conservancy District
· US Bureau of Reclamation
· Utah State University Extension
· Utah Nursery and Landscape Association
· Utah Botanical Center
· Red Butte Garden
· Salt Lake City Corporation
· Utah Native Plant Society
· Wasatch Community Gardens



appendix III

Appendix III

Whistler British Columbia

-Olympic-Mountain- Resort- Community- Sustainable- Livable-

Project Name: Olympic Athlete Village (Cheakamus Crossing)
Location: Whistler, BC
Landscape Architect: Tom Barratt Ltd.
Design Initiation: 2003
Planned Completion Date: Fall 2009
Size: 56 acre mixed-use development
Client: Resort Municipality of Whistler

What is it?

Cheakamus Crossing is a permanent mixed use neighborhood development that is currently being constructed to house athletes for the 2010 Winter Olympic Games. The site is being planned, designed, and constructed with green principles as guiding forces. The development was chosen as a precedent study in an effort to maximize the understanding of changes in sustainable practices that have occurred between the 2002 Olympic Games in Park City, Utah and those scheduled for 2010 in Whistler. Cheakamus Crossing is one of only 20 Canadian developments designated as a pilot project for the LEED-ND, (Leadership in Energy and Environmental Design-Neighborhood Development) which currently sets the highest standards for neighborhood design development. The development will accommodate about 2,400 athletes and officials in approximately 350 dwelling units (Ogilve 2008). The units will be sold prior to the 2010 Olympic Games and will then be occupied by the new homeowners after the Olympic ceremonies conclude. The community will also include commercial space for basic services, an athlete hostel, an international hostel, a high performance center, and community recreation fields (Whistler Real Estate Company).

Location

Cheakamus Crossing is located approximately six kilometers south of Whistler directly across Highway 99 from Function Junction, an existing retail development. The 56 acre site is nestled along the Cheakamus River, adjacent to the city's old landfill. It is bordered by the Whistler Interpretive Forest, and minutes from Cheakamus and Logger's Lakes (Whistler Real Estate Company Limited). The site for the Athlete Village was chosen through an extensive public consultation program in 2003-2004 as part of an overall Whistler Visioning Process. Residents and stakeholders were adamant about keeping any new development in Whistler to a minimum and in an already developed corridor (Resort Municipality of Whistler). See Fig. 7.1 and 7.2 Whistler Aerial.

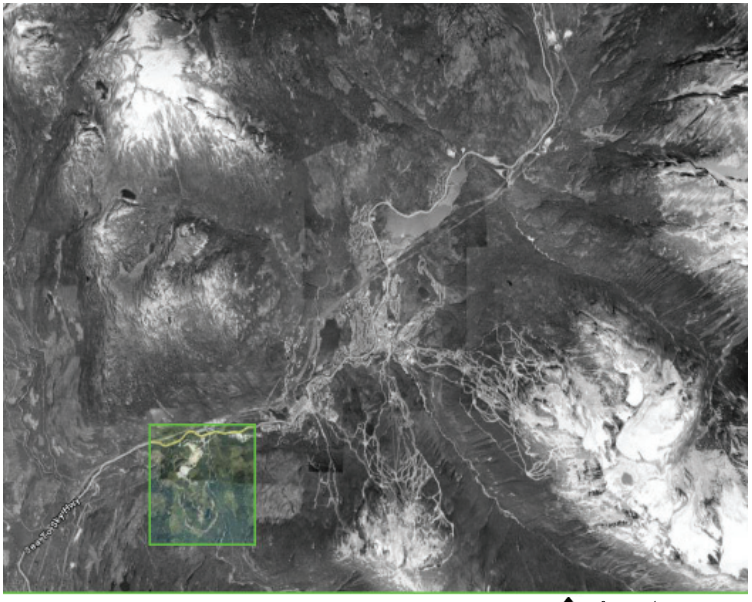


Figure 7.1 Whistler Aerial (Cody Peratt 2008, Adapted from Google Earth)

Figure 7.2 Whistler Aerial 2 (Cody Peratt 2008, Adapted From Google Earth)

Appendix III

Self Proclaimed Sustainability

The role of sustainability within Olympic planning is still relatively new and not wholly defined. At the Centennial Olympic Congress in 1994 the traditional pillars (Sport and Culture) of the Olympic Games were modified to include the pillar of Environment. From the 1994 proceedings, and in collaboration with the United Nations Environment Program, the Sport for Sustainable Development was created. The Sport for Sustainable Development is an adaptation of the United Nations Agenda 21 for sustainable development that was adopted by the Olympic Committee in 1999. The Olympic Games version of Agenda 21 has three objectives that include: Improving the socio-economic conditions in host communities, improving the Games-based practices on environmental conservation, and strengthening the inclusion of women, youth, and Indigenous peoples in the games (Vancouver Organizing Committee). The principles of Agenda 21 were key to integrating sustainable design for the 2010 Olympics.

Sensitive lands

Cheakamus Crossing has been situated in order to protect identified sensitive lands of the area. It has been designed to protect and enhance natural wetlands through its stormwater retention areas. Stormwater rain gardens have been designed to detain rainwater run-off and avoid deterioration of the natural surroundings of Cheakamus Crossing. The water has been piped where deemed necessary to prevent precipitation from entering the recently capped landfill adjacent to the site. (The Resort Municipality of Whistler). Figure 7.3 illustrates the criteria used in determining the siting of the facility in order to minimize habitat and ecological disruption. The overlay shows how the development's configuration protects vital wetlands around the Cheakamus River and encompassing floodplain. Other sensitive lands such as old growth forests, habitat connectivity corridors, and avalanche potential are shown. Figures 7.4-7.11 illustrate the types of stormwater BMPs that have been considered during the development process.

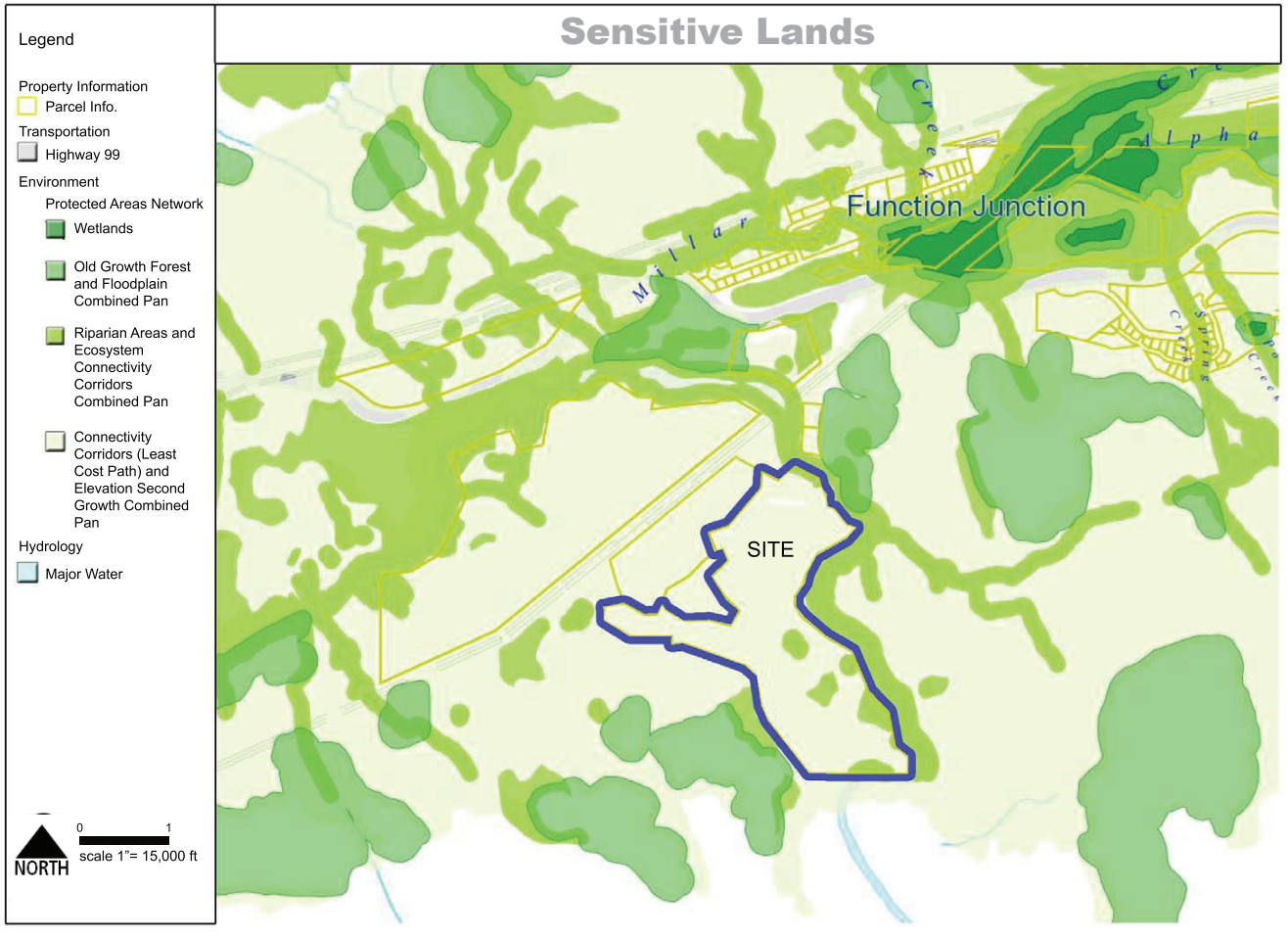


Figure 7.3 Whistler Sensitive Lands (Cody Peratt 2008, Adapted From Resort Municipality of Whistler GIS Database)

Appendix III

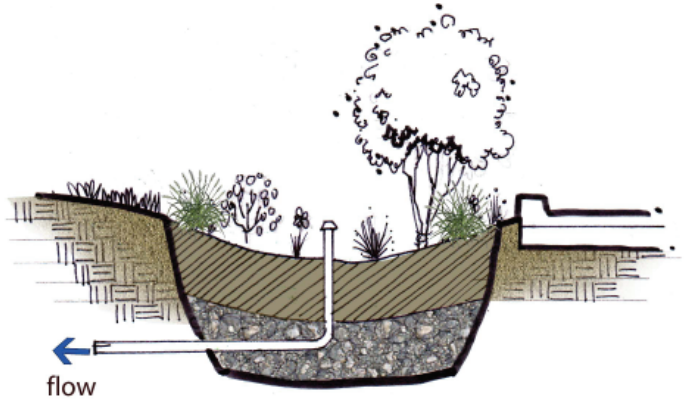


Figure 7.4 Bioswale (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

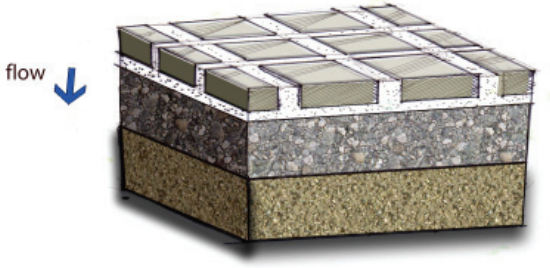


Figure 7.5 Pervious Pavement (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

Figure 7.6 Filter Strip (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

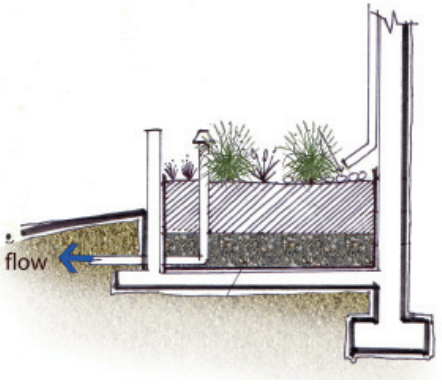


Figure 7.7 Raised Planter (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

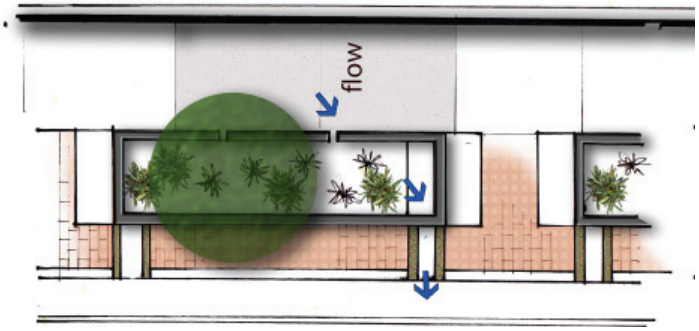


Figure 7.8 Sidewalk Planters (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

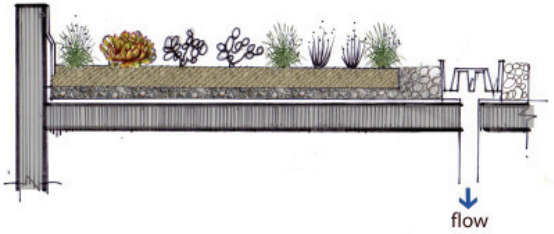


Figure 7.9 Green Roof (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

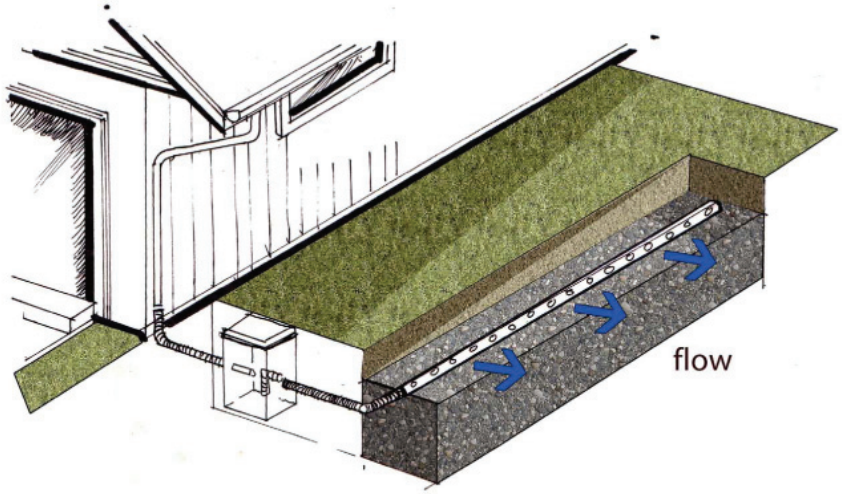


Figure 7.10 Soakage Trench (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

Figure 7.11 Rainwater Harvesting (Cody Peratt 2008, Adapted From Portland Bureau of Environmental Services 2008 Stormwater Management Manual)

Appendix III

Energy

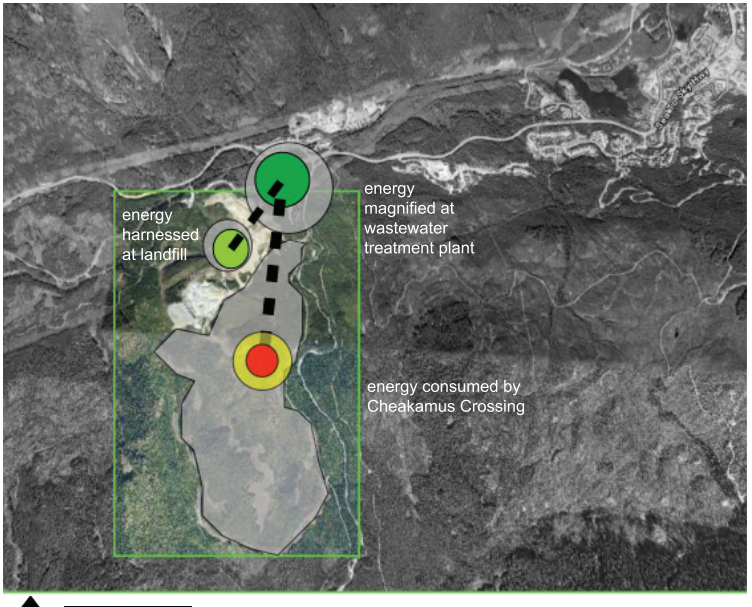
A combination of efficiency and innovation will provide for non-conventional forms of energy supplying Cheakamus Crossing. A heat exchanger has been incorporated into the wastewater treatment plant adjacent to the parcel and will utilize heat from the effluent to distribute temperate water throughout the site. It is anticipated that the heat exchanger will provide approximately 90% of the neighborhood's energy needs. Even more extraordinary is that the treatment plant boilers are fueled from methane acquired by tapping the adjacent closed landfill (Resort Municipality of Whistler) (See Figure 7.12 Energy Sources).

In order to conserve energy the community will utilize energy efficient appliances. Cheakamus Crossing will take advantage of energy efficient lighting, radiant floor heating, double pane vinyl windows, Energy Star appliances, dual-flush toilets with light flush and normal flush settings, low-flow faucets and shower heads, native landscaping, and efficient irrigation systems.

The architectural makeup of the structures also contributes to the conservation of energy by utilizing local source materials. 90% of the particle materials for the development have been obtained from the site. The particle material includes all topsoil and gravel that was separated and crushed to be later used on the development. The practice of utilizing site materials, along with a careful balance of cut and fill has limited the need to truck materials on and off-site during construction. The carpet and other flooring materials of the development will be comprised of recycled fibers, while the concrete will be made of recycled content concrete (fly-ash). The structures will also incorporate local native stone and framing lumber (Whistler Real Estate Company Limited).

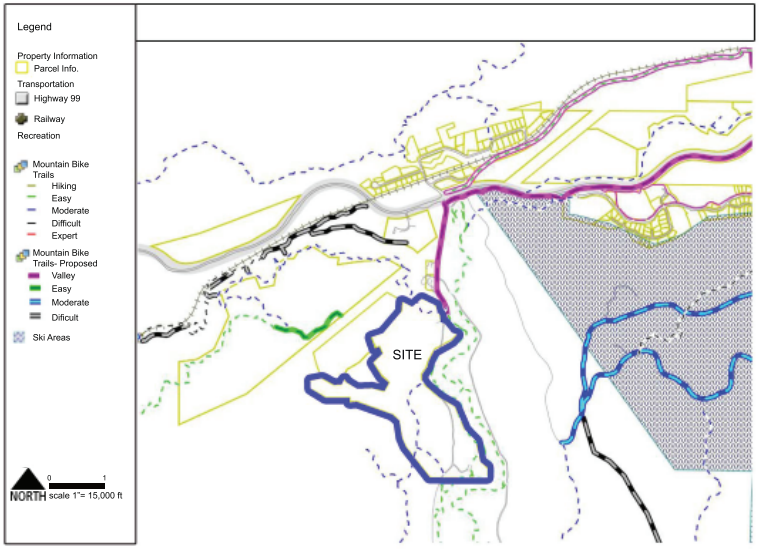
Recreation

Recreation is an important component to the lifestyle of the people of Whistler. The town was founded on recreation (as a ski resort) and continues to revolve around recreation. The area is located adjacent to an extensive network of walking, hiking, and mountain bike trails and is bordered by the Cheakamus River. Besides the recreational components provided by the natural setting surrounding the development, there are also community athletic fields and park areas. The variety of recreational activities provide for year round activity (Whistler Real Estate Company Limited) (See Figure 7.13 Recreation).



Energy

Figure 7.12 Whistler Energy Transfer (Cody Peratt 2008, Adapted from Google Earth)



Recreation

Figure 7.13 Recreation Activities (Cody Peratt 2008, Adapted from the Resort Municipality of Whistler's GIS Database

Appendix III

Housing Diversity

The developers of the project have the ambitious goal of providing housing for 75% of the resort's employees. The employee housing will be occupancy, resale, and rent restricted. The housing for employees is offered at discounted rates and is available for current employees as well as retirees who were employed in Whistler for five of the six years prior to retirement. There is also a resale cap on employee housing units. This has been established in an effort to keep housing prices affordable for Whistler resident employees and retirees. The Whistler Housing Authority calculates the maximum resale value for each restricted housing unit (Whistler Real Estate Company Limited).

An important aspect of socially sustainable designs is the inclusion of multiple types of housing at varying costs. Once the Olympic Athlete Village is transformed to a permanent residential neighborhood, it will provide a range of housing options from studio apartments to four bedroom homes.

Neighborhood Facts

152 townhomes/duplexes
67 condominiums
55 hostel units
55 Whistler Housing Authority rental units
20 market townhomes

(Whistler Real Estate Company Limited).

(See Figures 7.14-7.18)

Social Diversity

Maintaining and creating cultural diversity within the development is integral in becoming socially sustainable. One of the goals of the Olympic committee was to strengthen the inclusion of women, youth, and Indigenous peoples in the games (Vancouver Organizing Committee). Achieving cultural diversity for the Athlete Village during the Olympic Games is easy when there are over 2,400 athletes, coaches, and trainers from all over the world staying there, but what happens when they leave? This matter will be facilitated with the housing development projecting to supply most of the housing needs of the employees. The cultural makeup of the community should remain unique since mountains resorts traditionally employ a culturally diverse workforce (Bronsky 2006, 19). A large percent of the ski instructors and lift operators come from Europe, New Zealand, and Australia to work the mountains during the winter months.

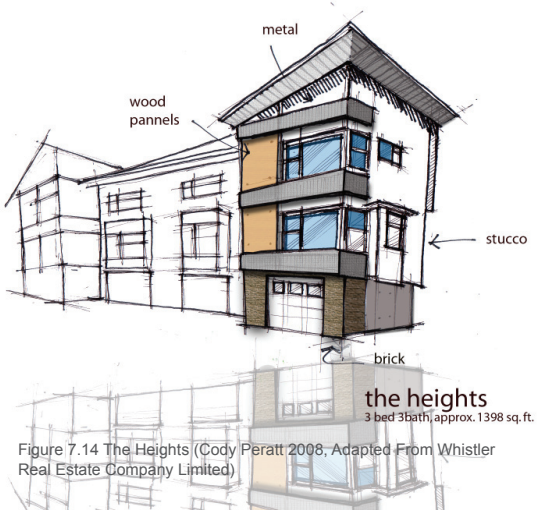


Figure 7.14 The Heights (Cody Peratt 2008, Adapted From Whistler Real Estate Company Limited)

Figure 7.15 The Springs (Cody Peratt 2008, Adapted From Whistler Real Estate Company Limited)

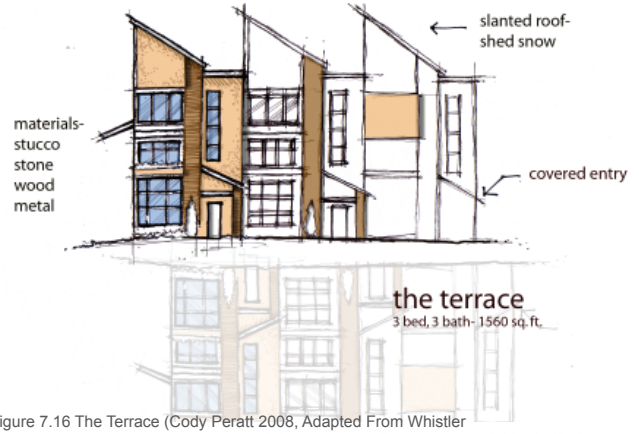


Figure 7.16 The Terrace (Cody Peratt 2008, Adapted From Whistler Real Estate Company Limited)

Figure 7.17 The Falls (Cody Peratt 2008, Adapted From Whistler Real Estate Company Limited)

Figure 7.18 White Water (Cody Peratt 2008, Adapted From Whistler Real Estate Company Limited)

Appendix III

Identity

Located in the Coast Mountains and a two hour drive north of Vancouver; Whistler was conceived as a mountain resort in the 1960s, built as a mountain resort in the 1970s, and thrives today as a world-famous four-season destination mountain resort (Gripton 2006). Post Olympic Games of 2010, Whistler will have an additional identity; past Olympic venue. One method the developers will use to maintain Olympic identity will be to provide the residents of each housing unit a signed certificate of the athlete(s) that stayed there during the Games (Whistler Real Estate Company Limited). As for maintaining Whistler's identity as a sustainably conscious mountain resort town, the homes and facilities will be representative of contemporary mountain architecture and demonstrate green construction principals (Whistler Real Estate Company Limited).

Views

View sheds, view corridors, and focal points are important in the design of any landscape, but especially important in the mountain setting (Dorward 1990, 48). Assessments of designed or existing views are determined by the number of people that see the element, where it is being viewed from, and the distance from which the viewer is observing it. In order to reduce the visual contrast of the newly constructed development and the ancient mountain landscape, the site is positioned on already disturbed land, at lower elevations, and within the already existing development corridor. The site is situated with views of Black Tusk, Whistler Peak, and Mount Fee in mind (Resort Municipality of Whistler) (See Figure 7.19 "View Corridors").

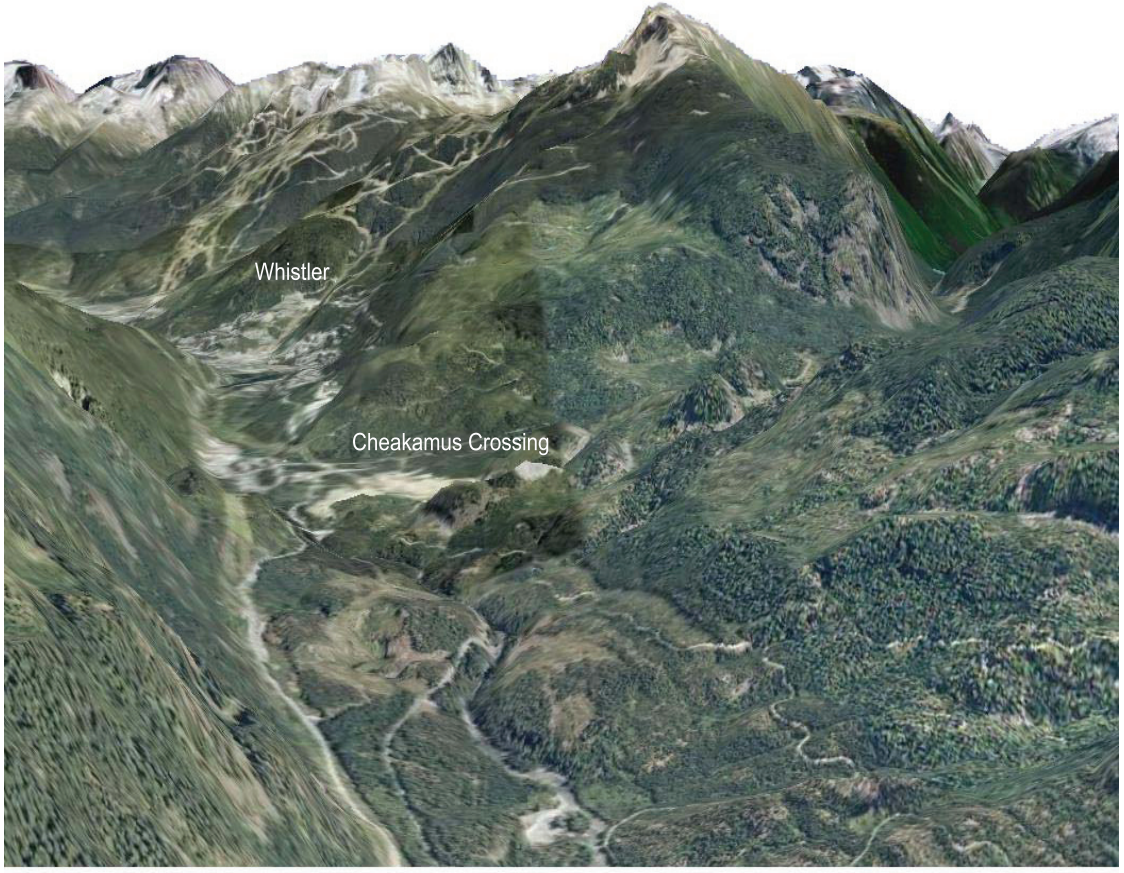


Figure 7.19 Views From Cheakamus Crossing (Cody Peratt 2008, adapted from Google Earth)

Appendix III

Resort as community

Recognizing the similarities between the resort, resort community, and neighborhood are important in defining the type of development that is being examined. Throughout this study, I have continued to call Cheakamus Crossing a neighborhood, as this is the description the developer has given the site. Because of its social and economic complexities, Cheakamus Crossing is more than a neighborhood in the sense of suburbia USA. Cheakamus Crossing is a place where people live, work, shop, and play all within a relatively small physical area. It can be labeled a resort because it is tied to ski facilities. It is considered a neighborhood because it is a place where people live. Lastly, it is a community because it ties the components of a resort and neighborhood together.

As part of a sustainable design, the concept of walkability becomes an important issue. As in many mountain resort villages there is often an important center of attraction where people can congregate and participate in outdoor activities. In Park City, Utah's The Canyons, the village is the center of attraction. It is the area where lodging, condos, restaurants, and retail, along with ice skating, heated outdoor pools, and other amenities are clustered around the base of the mountain. Cheakamus Crossing's retail center is the anticipated junction of activity. The retail center is located near the housing and recreational facilities and provides ample room for gathering space. Characteristics of a walkable community include a diversity of uses, a connected street, and transit services that tie to the center of the community (Coalition for Utah's Future). Cheakamus Crossing will have transit stops and stations in the community core. It will provide on street parking to act as a buffer between traffic on the road and pedestrians on the sidewalk. Retail will be street facing, and the community will have a maximum walking distance of less than one half mile. (See Walkability Map Figure 7.20).

Walkability

Figure 7.20 Walkability Map- NTS (Cody Peratt 2008)

Appendix III

Transportation

Because residents have desired destinations other than the resort community, having options as to how they get there, how fast it will take, and much it will cost them becomes important. Cheakamus Crossing is located close in proximity to Highway 99, providing a rapid transportation route. Both existing and proposed walking and biking trails run through the site, as well as Whistlers public transit system the WAVE (Whistler and Valley Express). Funding for the WAVE is cost shared between the Resort Municipality of Whistler and BC Transit. The WAVE runs from 5:30 a.m. to 3:00 a.m. 365 days a year (Resort Municipality of Whistler). Figure 7.21 “Connectivity Corridors” illustrates the most efficient transportation corridors within the sites’ near proximity.

Economic

The economic costs of design and construction of Olympic accommodations can sometimes outweigh the economic returns to the community. The Whistler Athlete Village is budgeted to cost about $131 million dollars, with the Olympic Committee contributing $37.5 million and the Resort Municipality of Whistler raising the rest of the funds. It is anticipated that the municipality will make the money back by selling the homes to local residents after the games (Ogilve 2008).

Conclusion

The Resort Municipality of Whistler, the Vancouver Organizing Committee, and the residents of Whistler have come together to create what they envision as the future of a sustainable Whistler. Cheakamus Crossing is a development that utilizes the three components of sustainability to maximize diversity, provide for economic returns, while preserving the fragile mountain ecosystems of the area. The development will act as a showcase of sustainability during the 2010 Olympics and provide a base for future sustainable mountain resorts.

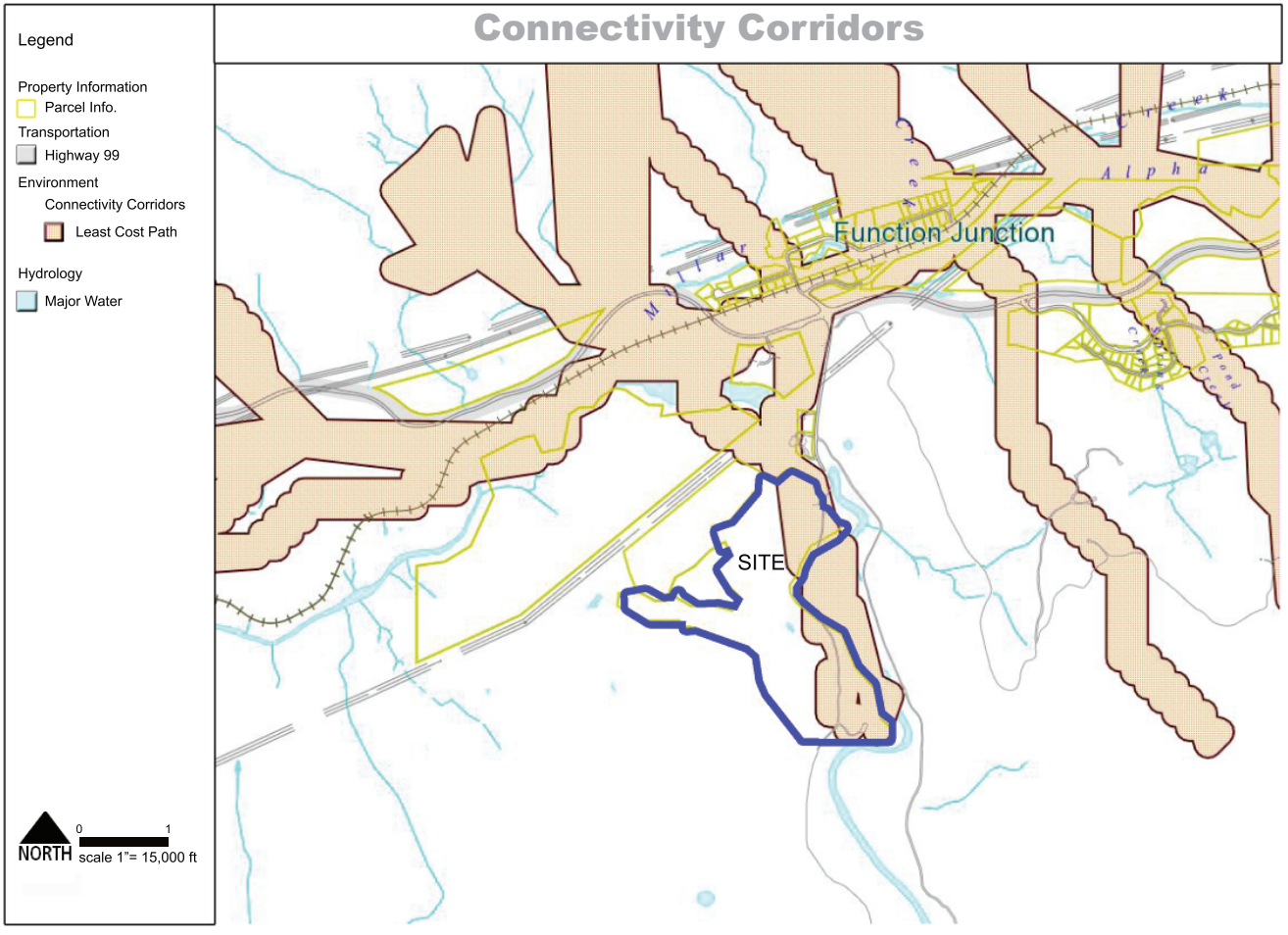


Figure 7.21 Connectivity Corridors (Cody Peratt 2008, Adapted from the Resort Municipality of Whistler's GIS Database)

Appendix III

Whistler, BC- Athlete Housing Development- Cheakamus Crossing

Ecology	Physiography and Natural Systems	Wildlife	Animal Migratory Routes	None	5	Wildlife Value
				Minimal	3	
				Extensive	1	+
		Solar Aspect	Surface Aspect Analysis	SW, S, SE	5	Solar Aspect Value
				E, W, Flat	3	
				NW,N,NE	1	+
		Slope	Surface Slope Analysis	2-10%	5	Slope Value
				< 2%	3	
				>10%	1	+
		Pre Development Vegetation	Old Growth Forests	0%	5	Pre Dev. Value
				<30%	3	
				>30%	1	+
		Post Development Vegetation	Use of Natives	All Native Planting	5	Post Dev. Value
				Like Irrigation Requirements	3	
				No Consideration	1	+
		Hydrology	Hydric Soils	Not Hydric	5	Hydrology Value
				Somewhat Hydric	3	
				Very Hydric	1	+
		Existing Land Use	Type of Development	Brownfield	5	Land Use Value
				Greyfield	4	
				Greenfield	1	+
		Cut vs. Fill	Balance of Cut vs. Fill	<5% Difference	5	Earthwork Value
				5-15% Difference	3	
				> 15% Difference	1	+
	LEED Certification		Level of LEED	Platinum	5	LEED Value
				Gold	4	
				Silver	3	
				Certified	2	=
				None	1	

34	Total Ecological Sustainability Value
3.77	Ecological Sustainability Average

Table 7.1 Whistler Sustainability Assessment (Cody Peratt 2008)

Society

Walkability	Recreation	Distance to Recreation	1/4 mile	5	Recreation Value
			1/2 mile	4	
			1 mile	3	+
			>1 mile	1	
	Civic	Gathering/ Open Space	1/4 mile	5	Transportation Value
			1/2 mile	4	
			1 mile	3	
			>1 mile	1	+
	Retail/Commercial	Shopping	1/4 mile	5	Transportation Value
			1/2 mile	4	
			1 mile	3	
			>1 mile	1	+
	Transportation	Distance to Public Transportation	1/4 mile	5	Civic Value
			1/2 mile	4	
			1 mile	3	
			>1 mile	1	+
	Transportation	Types of Routes within 1/2 mile	Highway	5	Retail Value
			Major Street	4	
			Neighborhood Street	3	
			Trail	1	+
Diversity	Housing Types/ Costs	Diverse Options	High Mix of Housing Types	5	Diversity Value
			Two Housing Types	3	
			Single Housing Type	1	+
Aesthetics	Intrinsic Qualities	Desired Views of Natural Features	Mountain Peaks and Water	5	Intrinsic Quality Value
			Mountains or Water	3	
			Neither	1	+
Aesthetics	Open Space	Usable Open Space	10-20%	5	Open Space Value
			21-40%	3	
			<10% or >40%	1	+
Historical	Relationships	Expression of Historical Connections	High Level of Expression	5	Historic Value
			Hint of Expression	3	
			No Expression	1	=

41	Total Social Sustainability Value
4.55	Social Sustainability Average

Appendix III

Economy

Proximity	Proximity to Population Centers	Attract Outside Income	1 mile	5		Proximity Value
			1-10 miles	4		
			10-30 miles	3		+
			>30 miles	1		
Mixed-Use	Variety of Uses	Commercial, Residential, Recreation	High Level of Mixture	5		Use Value
			Some Mixed-Use	3		
			No Mixed-Use	1		+
Transportation	Interconnections	Types	Ski In/Out	5		Interconnections Value
			Free Shuttle	3		
			Shuttle for Fee	2		
			Must Drive	1		
Development Cost	Economic Feasibility	Ability to Pay Off Development	Through Increased Revenue	5	*****	
			With Help from Tax Dollars	3		
			Not Feasible to Pay Off	1		
Development Cost Over Time	Economic Feasibility	Temporal	<20 Years	5	*****	
			20-30 Years	3		
			>30 Years	1		=

12	Total Economic Sustainability Value
4.00	Economic Sustainability Average

NOTE ****** See Explanation in Supplementary Text

Total Ecological, Social, and Economic Average	4.10

Whistler Sustainability Assessment Applied

As a conclusion to the precedence study of the 2010 Olympic Athlete Village of Whistler, the process model developed earlier was applied and tested (Table 7.1). By testing it on a site that was already considered highly sustainable, I was able to insure that the process was viable and easily applied. The information that was used to fill in the matrix for the model was taken from the GIS data provided by the Resort Municipality of Whistler, as well as from literature about the site. After applying the sustainability assessment, the Whistler's Olympic Athlete Village received an overall sustainability score of 4.10 out of 5.0.

There was, however, one piece of information that was missing for the matrix. The missing information revolved around the economic subcategories of sustainability. From the research conducted, it was found that the RMOW plans on paying for the development through revenues from the sale of the residential units after the Olympics. A conflict arose in the fact that the majority of the housing would be rent restricted and provided to employees of the resort municipality. No reliable information was found regarding how the RMOW was planning to pay the subsequent 93.5 million dollars for the development with rent restrictions. There was also no information obtained about the anticipated time period it would take to pay off. Therefore, the "Economic Costs," and "Economic Costs Over Time" portion of the matrix were not figured into the assessment framework. Instead of analyzing the economic portion of sustainability by five portions it was only averaged by three subdivisions.