

**Promoting Multi-Modal Transit:
The Revitalization of the Shoreline Park & Ride**

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Abstract

With the recent passage of several initiatives, the Puget Sound region has introduced plans to improve the transit system with the introduction of light rail and bus rapid transit. Within the framework established by these initiatives, this thesis focuses on joint development of a site devoted to transit uses. The dual goal of this thesis was first, to develop a design for a specific site, and second, demonstrate the feasibility of similar transit-related development on similar sites elsewhere in the region.

The first step in the development of the thesis was selection of a site. The prerequisites for site selection included: access to two or more modes of transit, include strong ties to the bicycle network, and likely feasibility for redevelopment. After cursory research, four sites were selected for further investigation: the Edmonds Ferry Terminal, the Mukilteo Ferry Terminal, the Aurora Village Transit Center, and the Shoreline Park-and-Ride. This thesis focuses on the Shoreline Park-and-Ride as the design developed on this site is likely adaptable to other suburban sites.

The city of Shoreline is undergoing immense change, and has recently approved several master plans that address the pedestrian realm, promote dense development, improve the bicycle network and create green infrastructure plan. The Shoreline Park-and-Ride is located within the purview of these master plans and offers the potential to implement many of the strategies included in the Shoreline planning.

This thesis examines the adaptation of the Shoreline park-and-ride into a dense, multi-modal hub for the emerging urban center of Shoreline. This area developed primarily after WW-II as an auto-oriented suburb typical throughout the United States. The primary challenges this thesis addresses have been: to create a transit center that caters users and residents; to promote multi-modal use; to address environmental concerns; to extend the time of use outside of peak transit hours; and to respond in a realistic way to the likely future of locations like this

that will rely on bus transit. The major elements include a bus terminal, a parking garage, a bike-and-ride center, and commercial development.

The site is located on the south east corner of North 192nd Street and Aurora Avenue. Although it is located on Aurora Avenue, the site is situated adjacent to a fine-grained residential fabric and is in close proximity to the Interurban Trail accessed from N. 192nd Street. The site is approximately 375 feet by 725 feet, with an area of 5.7 acres. The site is currently a paved 400-car parking lot and is basin shaped in section. There is a large change in topography from the rising 24 feet from the north east corner to the south east corner. 75% of the site is covered by impermeable surfaces. With the merging of the Aurora Village Transit Center, the bus terminal would serve 12 Metro and Community Transit bus routes with a current ridership of 4,000 passengers on weekdays.

The site introduces natural elements into the starkly paved parking lot, and creates views of these elements from Aurora Avenue. The bus terminal is located at the north end of the site where topography is most level. The parking garage is located in the south portion of the site to take advantage of the grade change which provides an extra level of parking without the need for excavation. The parking garage contains approximately 400 spaces, which maintains the existing surface parking capacity. By spacing these major program elements apart, it creates a pedestrian linkage that can spur activity on the site.

The program is divided into smaller buildings with retail, commercial, and office uses that frame the rain garden and provide a linkage from the parking to the bus bays. The buildings create a streetwall along Aurora Avenue with openings to create view access through the site. The linkage between the bus terminal and parking garage has been developed into an arcade to foster activity. The bike-and-ride is located next to the bus terminal to provide ease of mode switching and to connect with the Interurban Trail from North 192nd Street.

The program was developed to extend time of use outside peak transit time, and to provide amenities for the neighborhood. The Plaza Level includes the passenger drop-off area, the bus terminal, water play area, and rain garden. The lower arcade opens to the rain garden and provides an area for a farmer's market. The amphitheater would accommodate community activities. The program elements on this level include a small grocery store, a community center with adjacent garden plots, bicycle repair adjacent to the bicycle and ride, and driver's operations center accessed from the bus terminal. The second level contains the upper arcade between the parking garage and bus terminal. This level is primarily retail, but also contains a daycare with adjacent outdoor play area. The upper levels contain office space and a gym. The buildings have vegetated roofs to mediate storm water and the parking garage roof has a photovoltaic array. The proposed development provides 90,000SF of commercial and office space, increases bicycle parking to 220 spaces, and creates 20,00 SF of green roof and 32,000 SF of photovoltaic array, all while maintaining parking capacity and reducing impermeable surface by 5%.

This thesis is a specific case study demonstrating one possibility of using existing park-and-ride site for denser levels of development.. With the new development master plans, Aurora Avenue will become a more mixed-use street. While this project is designed for this specific site, it can be applicable and could serve as a model in suburban locations where high capacity transit modes, particularly bus transit, are being introduced.

Preface

My interest in communities in transition that desire to create dense mixed-use development that encourage pedestrian activity focused around mass transit use led to my selection of this thesis project. There are many communities in the Puget Sound region that are struggling to provide successful integration of transit linkages with denser urban development to suburban areas. Transit oriented development not only will foster transit use, providing an environmentally responsible alternative to automobile commuting, but it will provide benefits to personal, community, and environmental health. These benefits include an increase in physical activity through walking and cycling, reduction in greenhouse gas emissions, short distance personal vehicle trips, household expenditure, and sprawl. While light rail has received significant attention, I believe that bus transit will continue to serve a much wider array of users in the Puget Sound region for the foreseeable future. Thus, I chose a thesis addressing bus transit because it seems the most important problem in terms of creating environmentally responsible design that addresses the needs in this region.

I would like to acknowledge my thesis committee, professors Rob Peña and Jeffrey Ochsner for their dedication, input, and guidance throughout this process. I would also like to thank: senior lecturer Jim Nicholls for his early guidance; Alicia McIntire of the City of Shoreline for providing information about Shoreline's future development plans; and Katie Chalmers with King County Metro and Martin Munguia with Community Transit for providing information concerning bus routing and ridership figures.

Chapter 1: Introduction

Problem Statement & Rationale

In 1993, the Central Puget Sound Region Transit Authority was created by King, Pierce, and Snohomish counties and tasked with finding ways to manage and solve traffic congestion, especially related to commuter travel in the greater Puget Sound metropolitan area. In November 1996, voters in the three counties approved a regional plan for light rail, commuter rail, express bus service all provided by a new regional transit agency, named Sound Transit in 1999. In November 2008 voters in the three counties approved extensions to the system. These extensions will provide bus rapid transit service, light rail, and increased bus service to the region. For these nodes to be successful, this transit plan must be supplemented with dense mixed-use development that encourage multi-modal use and foster pedestrian activity.

Transit-oriented mixed-use development is relevant today as many cities search for ways to encourage denser nodes of development in suburban areas. Shoreline, Washington, the area chosen for this analysis developed primarily after World War II as an auto-oriented suburb. It is similar to many other post-1945 suburban communities. A transit-oriented design for this kind of area may be considered a prototype that may be replicated in other suburban areas where high capacity transit modes are being introduced.

Multi modal transportation and mixed-use development will become increasingly important as the cost for gas rises, congestion increases, detrimental environmental impacts are felt, and the desire to improve the quality of life and health of the residents increases. Residents will need viable options for mobility that include other modes of transit besides the private automobile. Benefits of non-vehicular modes of transit include: (1) reduced air pollution, congestion, sprawl, monetary expenditure per household; (2) increased physical activity, social equity, community activity; and (3) improved accessibility.

This thesis began with a site selection process exploring sites in the Puget Sound region that will undergo immense change in the near future. The initial exploration sought sites that incorporate at least two modes of transit. From a cursory survey, four sites were selected for additional analysis through site visits, literature review, and diagramming exercises. The four sites were: the Edmonds Ferry Terminal, the Mukilteo Ferry Terminal, the Aurora Village Transit Center, and the Shoreline Park and Ride. Both the Edmonds and Mukilteo Ferry Terminal sites combine ferry, rail, and bus transit options, with the potential for bicycle use. The Aurora Village Transit Center currently has local bus and bus rapid transit service. Information obtained from meetings held by the City of Shoreline and interviews with planning officials indicated that many bus routes could be relocated to the nearby Shoreline Park and Ride in the future. These proposed changes eliminated the Aurora Village Transit Center from consideration. Ultimately, the Shoreline Park and Ride was selected as the final site because it offers the possibility to serve as a prototype that could be replicated in other suburban settings, whereas the Edmonds and Mukilteo Ferry Terminals address water-borne transportation which is applicable only to selected sites within the Puget Sound region.

Thesis Overview

This design thesis examines the adaptation of the existing Shoreline park-and-ride site for a dense, multi-modal hub for the emerging city center in Shoreline. The building program and organization focus around the integration of local bus and bus rapid transit routes, providing services for users of the transit center and for nearby residents, and promoting multi-modal use.

This thesis is presented in a step-by-step organization. Chapter 2 provides an overview of the environmental and health benefits associated with transit, and discusses the regional transit plans of Seattle, King County, and Sound Transit. Chapter 3 examines the history of Shoreline and transformation of Aurora Avenue to provide a context for the thesis project site. Chapter 4 discusses the thesis site in detail. Chapter 5 provides detailed exploration of site strategies. Chapter 6 describes the building organization and design. Chapter 7 offers conclusions to this investigation.

Chapter 2: Theories and Contexts

This section reviews the link between health and the built environment, summarizes future transit plans for the Puget Sound region, presents the thesis site selection, and examines precedents for similar development projects.

Health and the Built Environment

As our cities have become auto-focused since World War II, the impacts of suburban sprawl and dispersed land development and use patterns have had a detrimental effect on the built environment and physical wellbeing. In suburban areas, such as Shoreline, the pedestrian realm does not have priority in land development and use patterns. Instead, the primary mode of transport has been the private automobile.

Numerous studies have analyzed correlations between the built environment and physical health. This section will look at how the built environment can promote healthy, active lifestyles.

Physical Activity Recommendations

Over the last few decades, obesity rates in children and adults have drastically increased. The CDC (Centers for Disease Control and Prevention) uses the Body Mass Index to track changes in obesity over time. The formula is: $BMI = (\text{weight in kilograms})/(\text{height in meters})^2$.

To clarify the differences of being overweight and obese, the CDC classifies overweight as a person having a body mass index (BMI) ≥ 25 ,

while obesity is defined as having a BMI ≥ 30 . According to the CDC, “approximately 17% (or 12.5 million) of children and adolescents aged 2-19 years are obese. Since 1980, obesity prevalence among children and adolescents has almost tripled.” In a 2008 study, the Journal of the American Medical Association (JAMA) found that 34% of American adults are obese, 68% of American adults are overweight or obese.¹

The CDC recommends that children age 6-17 should engage in at least 60 minutes of physical activity everyday. For people aged 18 and older, the CDC recommends at least 150 minutes of physical activity per week.² Inadequate physical activity can contribute to a higher risk of cancer, heart disease, diabetes, and strokes. Less than half of American adults reach the recommendations. With the increase in obesity rates, most Americans could satisfy the CDC’s physical activity recommendations by walking or cycling for short distance errands or to connect to transit modes.

One way to lower the rate of obesity in youth is by promoting walking to school. With several schools near the bus terminal, a child could walk to the bus stop and then walk from the station to school. Seattle’s Department of Transportation directs a Safe Routes to School program that is aimed at late elementary school and middle school aged children. This is to promote walking to school when the children are generally allowed to go alone. But with the close proximity to a transit center, a parent with a younger child could conveniently reach the school on foot, eliminating a car trip.

¹ “Prevalence and Trends in Obesity Among US Adults: 1999-2008”. Journal of the American Medicine Association (JAMA). 13 January 2010.

² “Physical Activity for Everyone”. Centres for Disease Control and Prevention. 30 March 2011

Built Environment

In the metropolitan areas in the United States, the majority of vehicular trips taken are short distance trips. Based on a 2001 National Household Travel survey, approximately 40% of all trips were shorter than two miles and 89% use their car for trips between one and two miles.³ This data shows great promise for promoting non-motorized transit modes. On foot, a person averages fifteen minutes to walk one mile, while a cyclist averages fifteen miles per hour, or one mile in four minutes. Accordingly, 40% of total vehicular trips could take thirty minutes on foot, or eight minutes cycling. In order to encourage people to use non-motorized options for these short trips, designers need to understand the mental and physical barriers that prohibit this option.

Commonly cited physical environment barriers include: lack of facilities, travel distance, poorly maintained, safety from cars and crime, limited pathways, and unpleasant routes. These physical barriers can be addressed through changes in the built environment. It is worth noting that some barriers are difficult or cannot be modified, such as poor weather, short daylight hours, or topography.⁴ Another barrier that is cited for lack of physical activity is limited time to exercise. While designers cannot add more time to the day, neighborhood design can encourage the combining of recreational and utilitarian trips. “Effective strategies for promoting walking and biking likely will involve adding a transportation function to the existing popularity of recreational walking and biking. Combining recreational and travel-based walking and biking will circumvent the issue of limited time, which people often report as a major barrier to physical activity, and therefore may increase the frequency of physically active travel.”⁵ This practice is called trip chaining, where a sequence of trips is made between the initial origin and final destination. Neighborhood design can address the issues that deter people from walking and cycling during these short trips. The combination of improved pedestrian and bicycle infrastructure amenities, mixed land use, and transit options has an influence on travel mode decisions. In

³ “Public Transit in America: Results from the 2001 National Household Travel Survey”. National Center for Transit Research. 2005, p.35

⁴ Chanam Lee and Anne Moudon, “Physical Activity and Environment Research in the Health Field: Implications for Urban and Transportation Planning Practice and Research.” *Journal of Planning Literature*. 19.2 (2004): 147-181, pg. 158.

⁵ “Physical Activity and Environment Research in the Health Field”, pg. 166.

a study conducted by the Victoria Transport Policy Institute, Litman finds that “of people with safe places to walk within 10 minutes of home 43% achieve physical activity targets, compared with just 27% of less walkable area residents.”⁶

These studies show that by providing a safe and pleasant route to nearby amenities, the built environment can promote more non-motorized trips that increase the amount of physical activity for its residents which can have a beneficial impact on their overall health.

Greenhouse Gas Emissions

In 2005, Seattle Mayor Nickels created the Green Ribbon Commission on Climate Protection with aims of finding ways that Seattle could meet the Kyoto Protocol’s emission reduction target. The reduction would be 7% below 1990 greenhouse gas emission levels by 2012.

The Commission found that:

“greenhouse gas (GHG) emissions in the Seattle region come primarily from the burning of fossil fuels such as gasoline, diesel and natural gas for motor vehicles and non-road diesel powered vehicles. Unlike, other regions of the country which rely heavily on fossil fuels such as coal and natural gas to produce electricity, the electricity supply in the Seattle region is already climate neutral due to the regions hydropower resources and Seattle City Light’s existing commitment to zero net GHG emissions.”⁷

⁶ Todd Litman, “Evaluating Public Transportation Health Benefits”. Victoria Transport Policy Institute, 14 June 2010, pg. 2.

⁷ “Washington State GHG Legislation Focuses on Carbon Trading, Transportation, Green Jobs”. Marten Law PLLC. March 2008.

In order to achieve its reduction goal, Seattle residents must drive fewer cars and fewer miles. As a response to the commission's findings, Mayor Nickels released the Seattle Climate Action Plan⁸ that lays out ways to realize this goal. Policies that have been created as part of this reduction plan are: Seattle's Comprehensive Plan, Transportation Strategic Plan, Pedestrian Master Plan, Bicycle Master Plan, Complete Streets ordinance, and Bridging the Gap fund. These plans include upgrade guidelines for pedestrian and bicycle infrastructure, efficient implementation of mass transit growth, and set forth a policy direction for future growth.

This thesis acknowledges the challenges of reducing greenhouse gases, and creates a transit center that will reduce miles driven by promoting mass transit use, improves bicycle infrastructure, and promote pedestrian activity through dense development.

Health and Economic Costs

According to Consumer Expenditures in 2006 (released in February of 2008 by the U.S. Department of Labor's U.S. Bureau of Labor Statistics), the average vehicle costs approximately \$8,000 per year to own and operate.⁹ This annual cost estimate includes a percentage of initial purchase cost, maintenance, gas, insurance, and licensing and registration fees. This figure does not include the cost of parking, since it varies greatly depending on location. Since 73% of households own one or two cars¹⁰, it can be estimated that the annual household cost of car ownership ranges from \$8,000 to \$16,000. As a result, low-income residents spend a higher percentage of their income to cover transportation costs.

⁸ "Seattle Climate Action Plan". Seattle: Office of Sustainability and Environment. September 2006.

⁹ Smith, Lisa. "The True Cost of Owning a Car". Investopedia. 2008.

¹⁰ "Profile of Selected Housing Characteristics 2000: Shoreline, WA". United States Census Bureau: American FactFinder.

The economic costs spread further than the direct costs of car ownership. The auto-dominated urban form discourages pedestrian activity and contributes to sedentary lifestyles.

“Inadequate physical activity contributes to numerous health problems, causing an estimated 200,000 annual deaths in the U.S., and significantly increasing medical costs. Among physically able adults, average annual medical expenditures are 32% lower for those who achieve physical activity targets, \$1,019 per year, than for those who are sedentary, \$1,349 per year”¹¹ (Litman).

In addition, there have been correlations made to the prevalence of private automobiles and the increase of asthma and other respiratory diseases. Children and the elderly are most affected and it adds to annual or lifetime health costs.

The built environment needs to promote equitable use among people of different ages, races, and economics, not just for drivers. The present circumstances seem to affect the health and safety of minorities, children, and elderly disproportionately.

“At least one-third of Americans cannot or chose not to drive, and for most of them, being a pedestrian is an integral part of their daily life. This group includes children, young adolescents, older adults who no longer drive, people with disabilities, low-income individuals, and a growing number who seek to avoid the costs of owning and maintaining a car”¹²

According to a report written by Transportation for America, from 2000 through 2009, more than 47,000 pedestrians were killed and 688,000 pedestrians were injured¹³. These are all preventable deaths and it affects different portions of the population in various ways. In this report, when compared to non-Hispanic whites, Hispanics and African Americans drive less and walk more than other groups, 14% and 20% respectively, and have a substantially higher pedestrian fatality rate - 62% and 73% respectively¹⁴. These injuries and fatalities can be attrib-

¹¹ “Evaluating Public Transportation Health Benefits”. Victoria Transport Policy Institute, Pg. 2.

¹² “Dangerous by Design 2011- Solving the Epidemic of Preventable Pedestrian Deaths”. Transportation for America. 2011, pg. 17.

¹³ “Dangerous by Design”, pg. 6.

¹⁴ “Dangerous by Design”, pg. 19.

uted to lack of safe crossings, facilities, and networks.

Pedestrian safety is a major concern for the elderly. When compared to those under the age of 65, older adults are 96% more likely to be killed while walking.

“The higher fatality rate for older pedestrians can probably be attributed to several factors: 1) older adults are more likely to die than young people in similar crash; 2) existing pedestrian infrastructure, such as the duration of crosswalk signals, ignores the needs of older walkers; and, 3) older pedestrians are more likely to have physical impairments that decrease their ability to avoid oncoming traffic”.¹⁵

It is interesting to compare the U.S.’s walking and bicycling trip rate among elderly people to other developed countries.

“While Americans aged 65 and older make only about nine percent of their trips by walking or bicycling, older adults in other countries make substantially larger shares of similar trips by walking and bicycling: 44-48 percent in Germany, and 50-55 percent in the Netherlands”.¹⁶

While there are cultural difference between the U.S. and Europe, this data exemplifies that designing safe, integrated infrastructure can increase the rate of use in all age groups.

As shown, the built environment has an affect on the quality of life. The currently auto-oriented urban form imposes both monetary, health, and environmental costs associated with this type of development, disproportionately affecting the elderly, young, the poor, and minorities. By rethinking the urban form to integrate transit options, mixed-use development, and mobility, the benefits to the community can be far

¹⁵ “Dangerous by Design”, pg. 20.

¹⁶ “Dangerous by Design”, pg. 21.

reaching. Creating a multi-modal transit development will encourage more trips on foot or by bike that will lessen the impacts on the natural environment and will provide healthy and economically viable alternatives to the car.

Puget Sound Future Transit Plans

From 1990 to 2000, the population of the city of Seattle grew by 9 percent, to reach a population of 563,374. From 2000 to 2010, Seattle's population increased by an additional 45,000 residents, at an 8 percent growth rate, to reach a population of 608,660. In response to the high growth rates for the last two decades, Seattle is in the process of upgrading its transportation system to accommodate this influx of residents. Due to its complicated geography of steep terrain and water bodies, the city has chosen to focus on upgrading our current roadway infrastructure and promoting a coherent mass transit system to reduce congestion and pollution while improving mobility.

In 1993, the Central Puget Sound Region Transit Authority was created by King, Pierce, and Snohomish counties and tasked with finding ways to manage and solve traffic congestion, especially related to commuter travel in the greater Puget Sound metropolitan area. In November 1996, voters in the three counties approved a regional plan for light rail, commuter rail, express bus service all provided by a new regional transit agency, named Sound Transit in 1999.

In 2006, King County voters passed an initiative called "Transit Now"¹⁷ approving an 0.1 percent sales tax increase to provide funds to expand bus transit service in King County by up to 20 percent over 10 years. The ten-year plan includes: providing more frequent service along high ridership routes, adding several new bus routes and bus rapid transit, integrating two dozen hybrid-diesel buses to the fleet, enhancing VanPool and ride share programs, providing more bus service for those with disabilities, and retrofitting buses to have a three-bicycle racks.

¹⁷ "Transit Now: Current Status". King County Department of Transportation. 18 May 2011.

¹⁸ Lindblom, Mike. "Residents Prefer Separate Votes on Roads, Transit, Poll Indicates". [Seattle Times](#). 28 November 2007.

In 2007, voters refused a ballot measure titled “Roads & Transit”¹⁸ which would have provided combined funding for highway and transit improvements. This measure only received 44% of the vote in King, Snohomish, and Pierce Counties. Most voters preferred the funding for highways and transit to be separate, and opponents of the measure cited high costs and a low proportion of funding to transit. As a result of the failed attempt in 2007, the voters approved a 2008 transit-only ballot measure, named “Sound Transit 2,”¹⁹ which passed in King, Snohomish, and Pierce County with an average of 58% support. This measure expands regional express bus and commuter rail service, and adds 36 miles of light rail to form a 55-mile regional system to Tacoma, Northgate, and Bellevue. The tri-county projects are planned in phases with completion in 2023. Facilities such as the Mountlake Terrace Freeway Station for express buses have already been constructed,

The passage of these two voter initiatives in 2006 and 2008 demonstrates the public support for improving public mass transit throughout King County and the Puget Sound region. These transit improvements will create opportunities for densification around these bus and light rail stations, and provide better mobility throughout the region.

The areas surrounding the new transit hubs will need to be rezoned to allow for higher density residential and commercial activities, even in suburban locations. The resulting transit-oriented development will prove to be an asset to the community by providing services and improved mobility to existing residents, and by bringing in those outside the area by providing jobs and affordable housing options.

¹⁹ “Regional Transit History 2009”. Sound Transit. 29 May 2011.

Thesis Site Selection

The goal of this thesis has been to respond to the development of mass transit within the region and to show how new development can respond to the transit plans. The site selection process identified sites in the Puget Sound region that will undergo immense change with transportation planning and will incorporate at least two modes of transit. From an initial survey, four sites were identified for further analysis. The four sites were: the Edmonds Ferry Terminal, the Mukilteo Ferry Terminal, the Aurora Village Transit Center, and the Shoreline Park and Ride. These sites were analyzed through site visits, literature and other research, and diagramming exercises

The Edmonds Ferry Terminal was considered because of its connection with Amtrak, the Sounder, Community Transit, and Edmonds/Kingston Ferry. It also has connection to several walking and bike trails. Edmonds has a developed downtown core with plenty of retail and restaurants, and has a popular Sunday Farmer's Market. This site was a strong contender and was the second choice for this thesis.

The Mukilteo Ferry Terminal combines Community Transit, the Sounder, and the Mukilteo/Clinton Ferry. However, this site is isolated from development and is in the process of being evaluated for replacement or relocation. These drastic changes make the scope of research and the scale of site redevelopment too uncertain for this thesis project.

The Aurora Village Transit Center is located in Shoreline near the intersection of Aurora Avenue and North 205th Street. This site was considered because it currently has local bus and bus rapid transit service, and offers a direct connection to the Interurban Trail. However, at meetings held by the City of Shoreline and through interviews with planning officials, it was determined that these bus routes could be relocated to the nearby Shoreline Park and Ride site in the future. These plans eliminated the Aurora Village Transit Center from consideration for this thesis.

The Shoreline Park and Ride is located on Aurora Avenue at the intersection with N. 192nd Street. The site serves four bus routes and provides surface parking for almost 400 vehicles. It currently does not contain any facilities such as retail. With the relocation of the Aurora Village Transit Center and bus rapid transit service to this site, this site will become a viable option for dense transit-oriented development. On this basis, the Shoreline Park and Ride was selected as the thesis site for its more manageable scale and because it can serve as a prototype that may be replicated in other suburban settings. The Edmonds Ferry Terminal would have made an interesting thesis project, but its regional and local specificity, in relation to a shoreline made it less attractive as a site.

Precedents

This section examines building case studies that pertain to transit oriented development and promoting multi-modal transit. The topics include: Bike & Ride Centers and Urban Bicycle Storage Facilities, Transit-Oriented Development, Buildings for Cars, and Covered Arcades.

Transit Oriented Development

Mockingbird Station, Dallas, Texas

Located adjacent to a major highway, this mixed-use development includes light rail, buses, and over 700 commuter parking spaces. This site offers amenities such as retail, restaurants apartments, offices, and a movie theater. This is an interesting development as it shows a space may be activated throughout the day, instead of during normal business hours.

South Kirkland Park and Ride, Kirkland, Washington

This existing park and ride is undergoing redevelopment into a transit-oriented development that has 200 multifamily units with a large proportion of affordable senior units, retail, and 250 additional underground parking spaces (600 spaces currently). Estimated commercial space totals 12,500 SF. There will be improvements made to the transit center, green infrastructure, and streetscape. The site is approximately seven acres and will be incorporated into a forthcoming comprehensive plan for a more pedestrian-oriented neighborhood. The project site is similar in scale to the Shoreline Park-and-Ride site of this thesis.

Tempe Transit Center, Tempe, Arizona

Located near Arizona State University, this transit center incorporates buses and a station for the new Phoenix regional light rail system. Site development includes offices, retail space, bike facilities (shower, storage, repair center), and a community room on the lower two levels. On the third floor, it houses the transit agency's offices and operations. The total square footage is: 40,000 SF. The project is LEED Platinum certified.

Thorton Place, Northgate, Seattle

This project is a 5.9 acre mixed-use, transit-oriented development located adjacent to Northgate Mall. Completed in 2009, it includes 278 apartments, 109 condominiums, a large movie theater, 500,000 SF of retail, and a 2.9-acre senior housing development. A major element of the project involved the day lighting and restoration of Thorton Creek. This development attained a rating of LEED Silver and was a part of LEED's Neighborhood Development Pilot program.

Bike & Ride and Urban Bicycle Storage Facilities

Sunset Transit Center, Portland, Oregon

Operated by TriMet, Portland's transportation agency, this bike and ride station is a prototype for future Portland Park and Ride projects. The Sunset Transit Center is located in conjunction to the MAX light rail station in Beaverton. The enclosed Bike and Ride facility removed eight car parking spots in order to store seventy-four bicycles. The room is accessed by pre-paid keycard. There are plans to open two more similar Bike and Ride Stations along the MAX line.

McDonalds Cycle Center, Chicago, Illinois

Located in Chicago's Millennium Park, this facility has a 300 bike parking capacity, repair center, hourly bicycle rentals, cafe, showers, lockers, and internet café. It is aimed at commuters in downtown, as well as tourists looking to explore Chicago by bicycle through pathways and guided tours.

Bike Port, Pioneer Square, Seattle, Washington

This facility opened in 2003. Now operated by the Seattle Bicycle Alliance, it provides bicycle parking, restrooms, and lockers. There is a full service bike mechanic and retail shop on site, with a vending machine containing emergency bike supplies. It is accessed through keycard, with daily, monthly or annual passes available.

Cyclepoint, Leeds Station, Leeds, UK

Based on a successful Dutch concept, this privately funded pilot project opened in 2010 and creates a secure area for commuters to store their bikes, perform maintenance, and buy accessories. This fully staffed station is located in conjunction with the central Leeds railway sta-

tion. This facility also rents bikes and provides area route information.

Buildings for Cars

Parkhaus Engelenschanze, Münster, Germany

This parking garage incorporates light and open space by featuring an all-glass exterior and an inner courtyard complete with a waterfall and creek and used-glass curtains. An innovative ramp design ensures that up traffic and down traffic circulation patterns never cross paths. It holds 480 spaces on 7 levels.

Car Silo at Autostadt, Wolfsburg, Germany

This is a 20-story cylindrical automated car silo. It is used to deliver cars to new owners at the VW factory with the mileage reading zero. This building form is interesting because it efficiently stores the cars while also exhibiting them. This case study informed the development of the Bike-and-Ride center in this thesis.

Mercedes Benz Museum, Stuttgart, Germany

This building is a museum dedicated to Mercedes Benz, and also holds offices, retail, and an auditorium. The entire structure is comprised of exposed reinforced concrete that forms a double helix, which creates a continuous movement throughout the building and shaping the views to the exterior landscape. The structure and the facade reinforce the concept of two spirals of circulation with the third spiral creating a void atrium space, a geometry based on the clover.

Helios House, Los Angeles, California

This structure is a 10,500-square-foot gas station completed in 2006 that upgraded the original station in an environmentally conscious manner by “upcycling”-recycling old materials, and installing new materials that are sustainable and recyclable. Helios House incorporates green-building features and messages into the project. It engages the urban, car-oriented culture of Los Angeles as a landscape for brand communication and architectural invention. (Arch Record)

Covered Arcades

Located in Paris, the Passage Jouffroy, built in 1847, and Passage des Panoramas built in 1799, were an innovation that protected people from the weather. They were built as mid-block alleyways for commercial activity. These passages were analyzed looking at the proportion of width to height, amount of storefront glazing, quality of paving, and signage. This informed the design of the upper arcade for this thesis.

Chapter 3: Shoreline – Past, Present, and Future

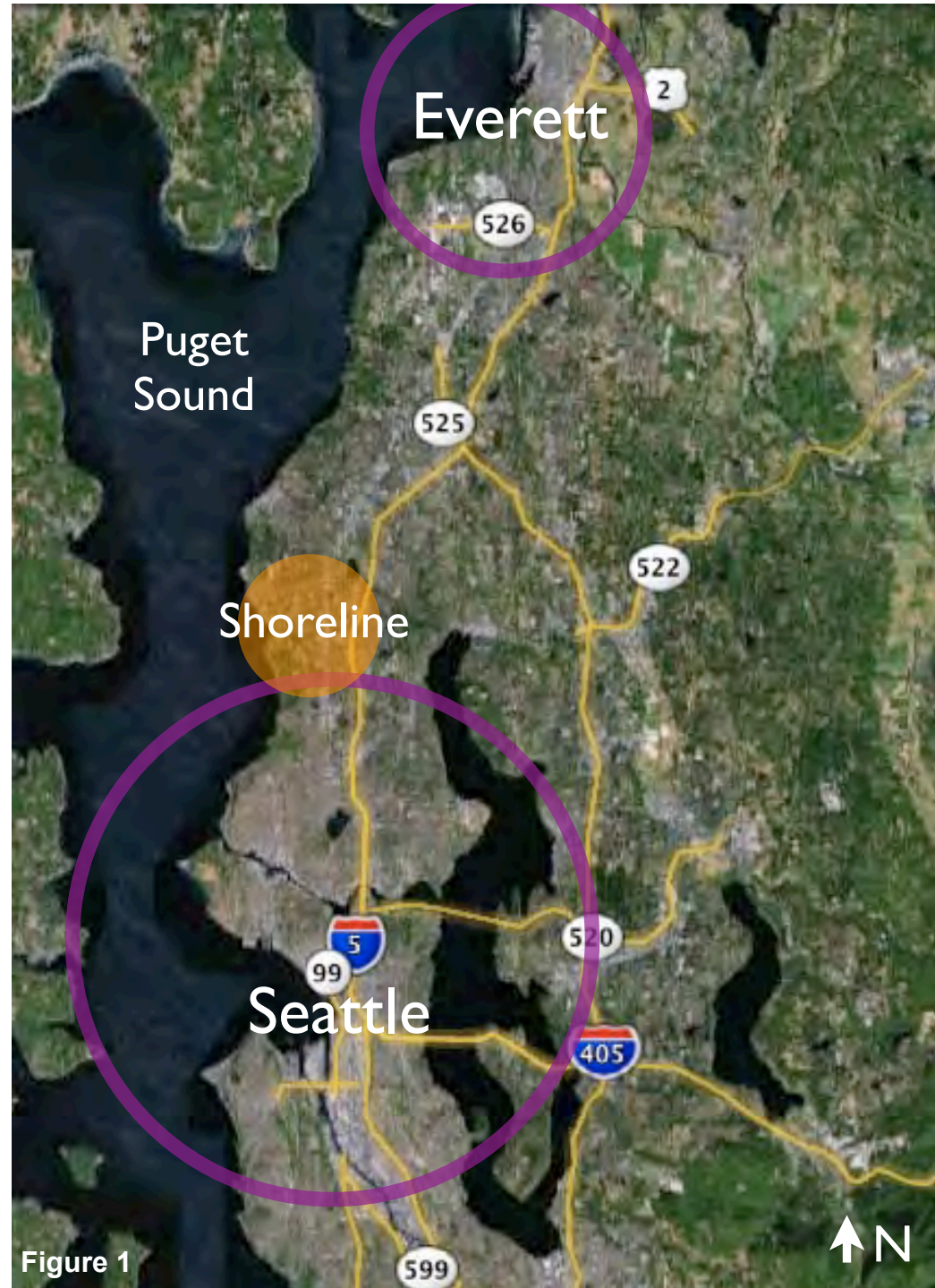
Shoreline's Development

Vicinity

Shoreline is a northern suburb of Seattle. It was part of unincorporated King County until August 31, 1995, when it became a city with a council-manager form of government. On the south its boundary is North 145th Street where it adjoins Seattle. The northern boundary is North 205th Street, which is also the north boundary of King County. The western boundary is Puget Sound. The eastern boundary is an irregular line where Shoreline adjoins Lake Forest Park (See Figure 1),

History

Before the rush of the western expansion of the United States, Native tribes, such as the Duwamish, occupied



the land. During the early period of Euro-American, the land was developed primarily for agricultural purposes, which became the main source of income for residents. In the late nineteenth century, the primary trail through this area was known as the North Trunk Road. In the early 1900s, commercial businesses began to develop as more people settled in the area because of the upgrading of North Trunk Road from a dirt road into a paved thoroughfare. In addition, the Seattle-Everett Interurban, which connected Seattle and Everett, had three stations in Shoreline from 1910 to 1939.

After World War II, Shoreline grew dramatically into an auto-dominated suburb. The idea of a “Town Center” began to take shape in the 1960s with the location of civic buildings such as Shorewood High School and the Fire Department Headquarters at Aurora Avenue and North 175th Street. With the opening of Interstate-5 in the 1970s, regional malls built in Alderwood and Northgate had a detrimental impact on the retail spaces along Aurora Avenue. Since that time, this corridor has had problems of decay, crime, prostitution, and drug trafficking. Community groups have formed to help watch for and report crime.

In 1992, there was public support for the area spanning from North 145th Street to North 205th Street to push for incorporation as a city in King County. On August 31, 1995, this area was officially incorporated and was given the title of Shoreline, named after the school district developed in 1944. Although the population stagnated from 2000 to 2010, city officials predict population growth in the coming decades. The 2010 census listed the population at approximately 53,000 residents.

Interurban Trail

The Seattle-Everett electric interurban railway was in operation from 1910 to 1939 and helped to develop communities along its route.²⁰

²⁰ Bird, Frederick. “The Seattle-Everett Interurban Railway, 1920-1939”. Snohomish County History Series. May 2000.

Located ten miles north of Seattle, the stations of Ronald Station (see Figure 2), Richmond Highlands, and Echo Lake served this area. After the termination of rail service, Seattle City Light purchased the right of way to use as an electrical power transmission corridor. More recently, many improvements have been made to also accommodate as a paved pedestrian and bicycle pathway. This trail runs 15 miles and connects northern Seattle to Everett, with three miles of the trail in Shoreline. Most of the trail is separated from vehicular traffic.

Census Data

While Shoreline's population has stagnated at approximately 53,000 from 2000 to 2010, the city of Shoreline expects population growth during the next twenty years. Overall, Shoreline is more ethnically diverse than Washington State as a whole. In 2009, the racial distribution was: 71% White, 15% Asian, 5% Hispanic, 4% Black, 4% Mixed Race, and the remaining 1% is listed as Other. These demographics are seeing a shift towards more diversity. Interestingly, 17% of the population is foreign born, with the majority (10%) being born in Asia. The age distribution for the population is: 25% under 19, 60.5% between age 19-65, and 15% over 65. The median age is 39.3 years old.



Figure 2: Ronald Station, 1910. Photo Courtesy of the Shoreline Historical Museum, #1411

Economically, the median household income increased from \$52,000 in 2000 to \$66,000 in 2009. 8% of residents live in poverty. In 2000, there were an average of 2.5 people per household. The overwhelming majority of the households are single-family homes, at 72%. Of the remaining, 25% live in multi-family homes, and 3% live in RVs, mobile homes, etc. For completed levels of education, Shoreline is above average in Washington State. 90% graduated from high school, 37% hold bachelor's degrees, and 11% have graduate or professional degrees.

Using the 2000 U.S. census data²¹, car ownership rates are: 6% of households have no car, 73% of households have one or two cars, 20% have 3 or more cars. The average commute time is 27 minutes with approximately 60% of workers commuting in single-occupancy vehicles. The single occupancy vehicle rates will most likely decrease in the 2010 U.S. census data due to the addition of bus routes, improvements to pedestrian infrastructure, the opening of the Swift bus to Everett in 2009, and the increased cost of gasoline. With the schedule opening of the Rapid Ride bus to Seattle in 2013, these numbers could decrease even further.

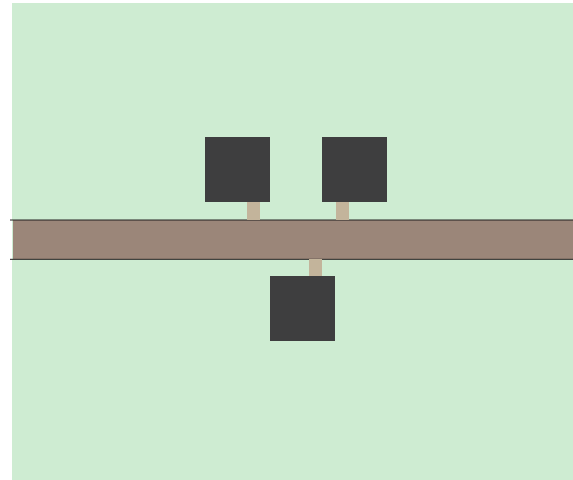
The Evolution of Aurora Avenue and the Impact on Building Typology

The transformation of Aurora Avenue from a wagon trail to major thoroughfare had an impact on commercial building form. In the early 1900s when commercial buildings first started to be constructed, the building frontages addressed the street directly, with little setback from the unpaved North Trunk Road, and little site disturbance. These individual, single-use buildings were small in footprint, only one or two stories tall, and arranged close together for easy walkable access. This building form remained largely unchanged until the proliferation of the personal automobile. (See Figure 3)

²¹ "State and County QuickFacts 2000: Shoreline, WA". United States Census Bureau. 9 May 2011



Property of Shoreline Historical Museum

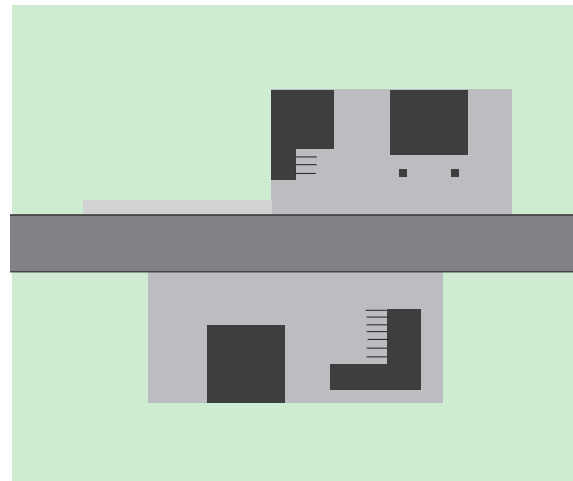


1900-1930s
Development

Figure 3: Market Street, 1920
Photo Courtesy of the Shoreline Historical Museum, #57



Property of Shoreline Historical Museum

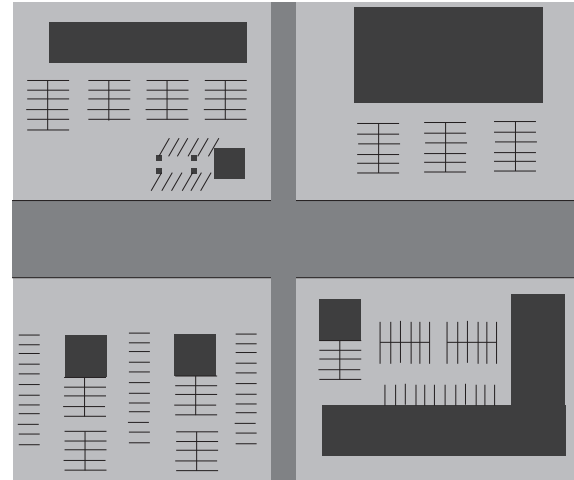


1930-1960s
Development

Figure 4: Art's Service Station, 1945
Photo Courtesy of the Shoreline Historical Museum, #1568



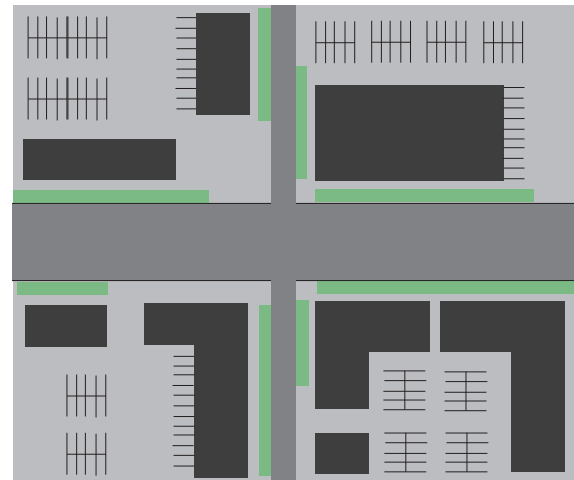
Figure 5: KFC, 1976
Photo Courtesy of MDID



1960-Present
Development



Figure 6: Example of Future Development
Photo Courtesy of Shoreline Town Center Subarea Plan



Proposed
Development Type

In the 1940s, Aurora Avenue was expanded into a larger paved highway that addressed the needs of the car. Some similarities remained from the original building patterns. For instance, the buildings maintained a small footprint, low height, single-use, and were located close together. The changes consisted of increased building setback to allow for vehicle circulation, large signage was added perpendicular to the street to attract the attention of the motorist, and the entire site became a paved surface. Signs became dominant as business owners tried to attract vehicle drivers and passengers who were passing their sites at higher speeds. The signs increased in size, incorporated bright colors and unique fonts, and added outdoor electric neon lighting so they could be read at night (see Figure 4).

Similar to the transformation of the business signage, in the 1960s the commercial building shapes began to compete for the attention of motorists. These “iconic” building forms incorporated bright colors, geometric forms, and/or kitschy shapes. The concept of the drive through and drive-in restaurants had a great impact on building and site form. The buildings became spaced further apart to allow easy driving access for car and plentiful parking. The buildings no longer addressed the street edge or pedestrian activity.

From the 1980s to present, strip mall development became the norm (see Figure 5). These forms combined several commercial and retail outlets into one building with separate entrances. These stores were aligned into a rectangular shape, with the remaining site devoted to parking. Big box stores, such as Target and Costco, have also become popular with combining several types of products under one large roof. This provided convenient one stop shopping for home supplies, food, clothing, electronics, and almost anything imaginable.

Shoreline’s Redevelopment Plans

Future plans for the city of Shoreline are addressing the negative impacts of the pedestrian environment caused by an auto-dominated mindset. The proposed Town Center Subarea Plan, approved by the city July 2011, focuses on the building form in relation to the pedestrian.

There are provisions to address the street edge, move parking to the side or rear of buildings, promote dense mixed-use development, and to create a safe and pleasant environment for pedestrians (see Figure 6). This planning did not come without friction from the community. In opposition to these plans, the business owners along Aurora Avenue want to maintain easy vehicular access for their customers, while residents desire safer, more pleasant streets with access to bus transit.

Today, the City of Shoreline is in the midst of renewal. The city recognizes that improvements need to be made to its infrastructure to accommodate safer and more pleasant pedestrian travel. The major improvements projected are the Aurora Avenue Corridor Project, the Town Center Subarea Plan, and the Transportation Master Plan.

Aurora Corridor Project

As part of a Capital Improvement Program, the Aurora Avenue Corridor Project²² will provide dedicated lanes for business access and transit, widened sidewalks, new crosswalks and lighting, additional traffic signals and left and U-turn pockets, and the undergrounding of overhead power lines. The focus is concentrated around driver safety, pedestrian safety, and congestion relief. The traffic volume of Aurora Avenue is 35,000 cars per day with an average speed of 44 miles per hour.

The area of redevelopment is from North 145th Street to North 205th Street along Aurora Avenue. The project is divided into four phases: N. 145-165th Street, N. 165-185th Street, N. 185th-192nd Street and N. 192nd-205th Street. The construction began in 2005. Phase One was completed in 2007, Phase Two was completed in early 2012, Phase 3 is scheduled to be completed in late 2012, and Phase 4 is currently in the design phase and right-of-way acquisition, with construction beginning as early as summer 2012 depending on funding.

²² "Town Center Subarea Planned Action Draft SEIS_5_2011". The City of Shoreline: Planning and Development Services. May 2011.

Figure 7 shows the before and after conditions of the Aurora Corridor Project. This project aims to improve vehicular and pedestrian safety while providing a more pleasant pedestrian environment along Aurora Avenue. These improvements will help foster pedestrian activity along this busy corridor, creating an opportunity for new business growth.

Transportation Master Plan

In addition to the Aurora Avenue Corridor Project, Shoreline is in the process of redeveloping its transit master plan²³. The emphasis will be placed on creating safe and friendly streets for pedestrians, promoting multi-modal transit, developing a complete pedestrian and bicycle



Figure 7: Photo (left) looking North at N. 175th and Aurora Avenue before construction, Photo looking North at N. 160th and Aurora Ave after construction. Photo from Google Street View (left) and The City of Shoreline (right).

²³ "Transportation Master Plan". City of Shoreline. 11 July 2005

network, and coordinating with the regional network for personal vehicle, mass transit, freight routes.

Mass Transit: Local Bus Routes and Light Rail

The short and mid-term goals, extending to 2020, include providing increased frequency of bus service to Northgate, Shoreline Community College, and to Seattle. The Shoreline Park-and-Ride and the Aurora Village Transit serve an average of 4,000 passengers on 830 departures every weekday. Service is reduced on Saturdays to 660 departures and 270 on Sundays. The Swift bus which departs for Everett every 12 minutes provides the most frequent service. Rapid Ride service is expected to have similar frequency to Seattle when it begins service in 2013.

Pedestrian and Bicycle Network

The pedestrian network is in need of improvement. The main concerns include lack of continuous sidewalks, safe convenient crossings, and lack of protection from cars. Overall, the city is looking at upgrading the sidewalk linkages. As part of the Aurora Corridor Project, the sidewalks are being expanded to seven feet wide with an additional four feet vegetative buffer from cars on Aurora Avenue.

In 2007, Shoreline upgraded the historic Interurban Trail from a dirt and gravel path into a paved, separated pathway. This route serves as a north-south link to Everett and Seattle, but the east-west linkages are severely lacking and create dangerous situations for cyclists. According to the April 2011 Bicycle System Plan²⁴, future improvements consist of completing a network of bicycle paths with designated bicycle lanes, more east-west linkages, and the addition of signed routes (see Figure 8).

²⁴ "Town Center Subarea Planned Action Draft SEIS_5_2011", pg. 92.

Circulation: Bicycle Network

Interurban Trail,
Separated Path



Existing Designated
Bike Lane



Proposed Designated
Bike Lane



Proposed Signed
Bicycle Route

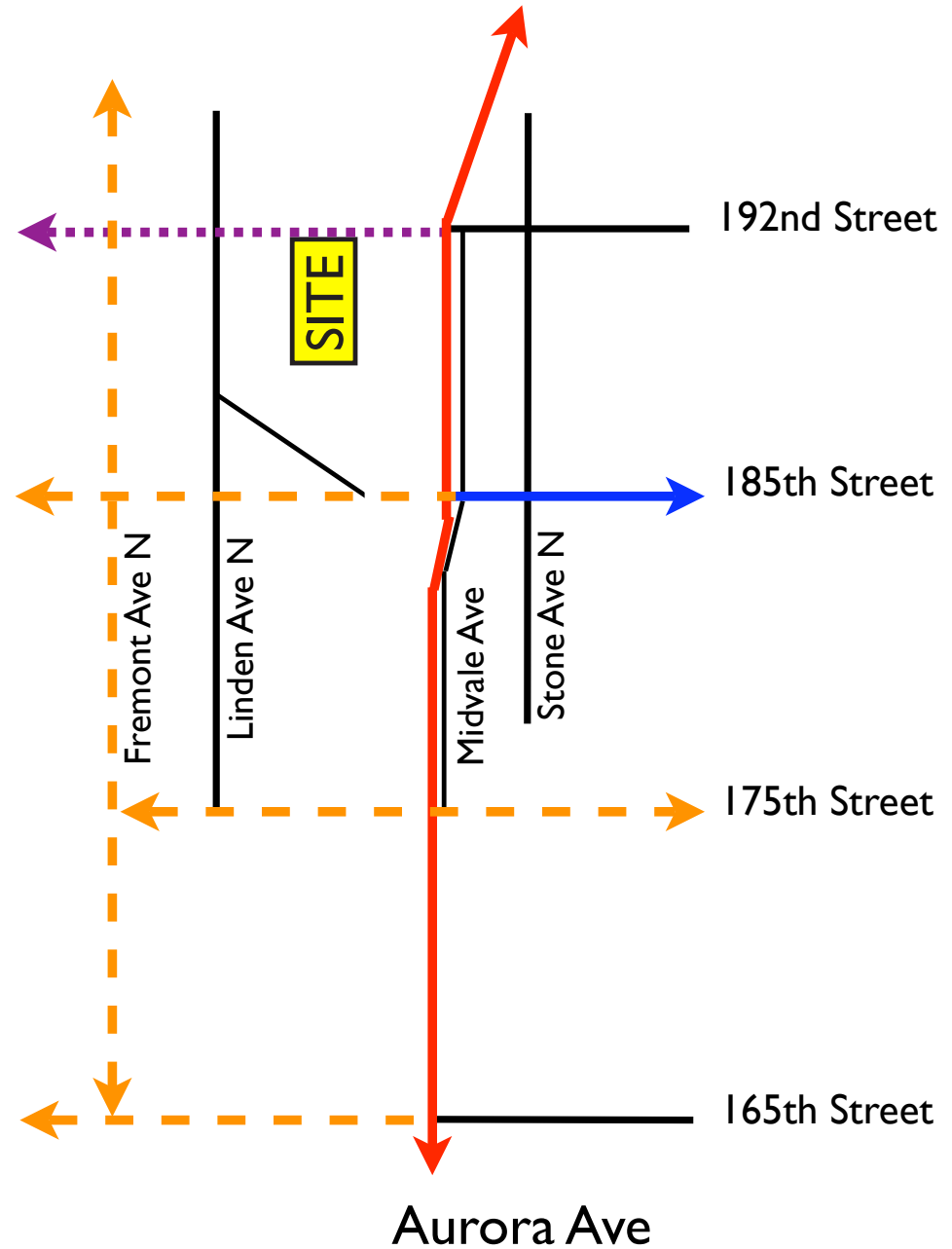


Figure 8: Bike Network

These bicycle infrastructure improvements will make cycling easier, quicker, and safer, which will encourage more people to ride their bikes especially for shorter trips. With this increase in cyclists, there would be a demand for secure bicycle storage at transit stations, as well as showers, lockers, and repair facilities. By providing a bike-and-ride, it would encourage more people to ride their bikes to and from the transit facility instead of driving their cars.

Bus Rapid Transit

In 2009, the City of Shoreline was linked to Everett through the Community Transit's Swift bus rapid transit route. Currently, the Aurora Village Transit Center serves as the southern terminus for this route. This station is located at Aurora Avenue and North 205th Street.

Using funds from the Transit Now initiative, King County Metro plans to open a route connecting Shoreline to downtown Seattle in 2013. Shoreline will be the northern terminus for this route and will provide service regularity of every twelve minutes. It will accomplish this goal with the construction of dedicated business access and transit lanes (BAT lanes) within the Aurora Corridor Project upgrade. The process will be more time efficient because riders will be required to purchase tickets before boarding, the dedicated BAT lanes will decrease traffic delays, and the bus will have access to platforms directly along Aurora Avenue thereby eliminating turns, and the process of entering and exiting a major thoroughfare.

Further in the future and depending on funding availability, there are plans to combine the Rapid Ride and Swift Bus stations since Shoreline is the terminus for each route. The site under consideration is the one chosen for this thesis at North 192nd Street and Aurora Avenue, at the current Shoreline Park and Ride. The reasoning behind relocating the two bus rapid transit routes is to provide direct access to Aurora Avenue for ease of bus movement, efficiency in loading and unloading passengers, and proximity to future Town Center plans.

Town Center Subarea Plan

The Town Center Subarea Plan proposes to redevelop the area between North 170th Street and North 188th Street along Aurora Avenue to serve as the civic center. The vision of the planners is to create “the vibrant cultural and civic heart of the City with a rich mix of housing and shopping options, thriving businesses, and public spaces for gatherings and events” which “stands out as a unique and inviting regional destination while gracefully fitting in within its surrounding landscape and neighborhoods.”²⁵

To accomplish this vision, Shoreline has declared the three E’s of sustainable development: Environmental Quality, Economic Vitality, and Social Equity.²⁶ The environmental practices include: storm water management, buildings with zero carbon impacts, promoting mass transit, and walkability. Economically, this development hopes to attract new office and retail development that spurs further growth and vitality. Socially, the growth of new jobs and alternative housing choices will help spur economic and social diversity. Also, by creating safer public streets and promoting a sense of place, the designers hope that it will create a connection between members of the community.

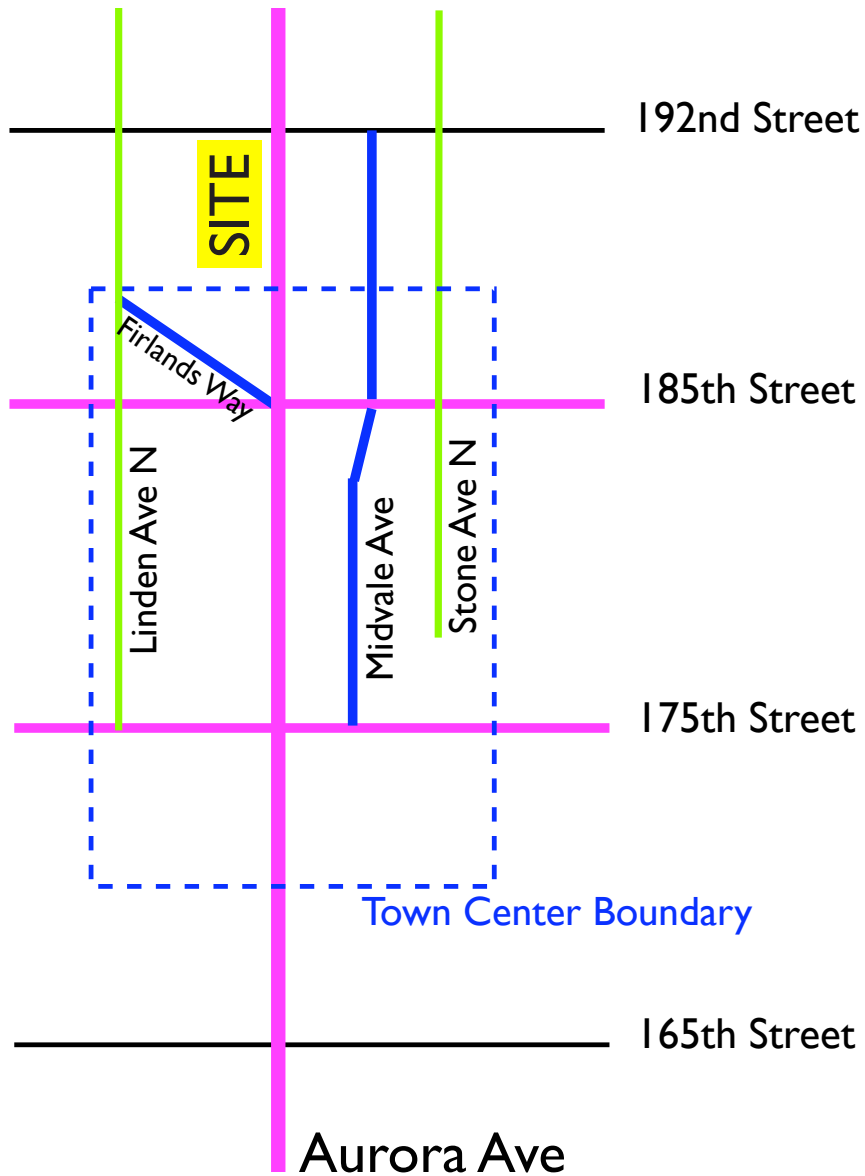
Based on city growth targets over the next twenty years, the proposed Town Center Subarea Plan could result in 1,200 new residential units, 200,000 SF of new office space, and 200,000 SF of new retail space.²⁷ To show support for creating a civic center in the future, in 2009 Shoreline finished construction on its new City Hall with LEED Gold status. Located at N. 175th Street and Aurora Avenue, this will serve as the anchor to the town center plan. To promote the experience of a civic center, the land adjacent to the Town Hall will be developed into a public park.

²⁵ “Town Center Subarea Plan”, pg. 16.

²⁶ “Town Center Subarea Plan”, pg. 26.

²⁷ “Town Center Subarea Plan”, pg. 9.

Future Shoreline Plans - Street Hierarchy



Boulevard Street



Up to 6
Stories

Storefront Street



4 to 5
Stories

Greenlink Street



1 to 3
Stories

Photos from Shoreline Town Center Subarea Plan

Figure 8: Street Hierarchy

The Subarea Plan provides building form guidelines which addresses building height, density, fenestration, roof pitch, and a variety of other features. To organize these guidelines, the city has proposed a hierarchy of three street-type designations²⁸: Boulevard, Storefront, and Green Link streets (see Figure 9). Aurora Avenue is classified as a boulevard street with the maximum building height at six stories. Along the storefront streets of Midvale Avenue and Firlands Way, the building heights will have a maximum of four to five stories. The Green Link streets will step down in height as the buildings transition into neighboring single-family home areas. The building form guidelines include reduced parking requirements for retail, commercial, and residential use. The plan restricts surface parking lots to the rear or sides of buildings and encourages parking structures.

Increasing building height, zoning for mixed-use development, and creating a continuous street edge will reinforce the city's vision to create a vibrant, walkable community by addressing the needs of the pedestrian instead of on purely auto-focused use. These improvements will draw more residents, businesses, and workers to Shoreline, which will increase the demand for a transit facility to accommodate different users.

²⁸ "Town Center Subarea Plan", pg. 75.

Chapter 4: Site Description and Analysis

Shoreline is undergoing immense change with the implementation of large-scale projects that will improve mobility and safety for vehicles and pedestrians and create a new sense of place. The first project, the Aurora Avenue Corridor Project which will upgrade Aurora Avenue between North 145th Street and North 205th Street, will improve pedestrian and vehicle safety. The next project involves few physical changes, but major new bus routing. Shoreline is already the southern terminus for the existing Swift Bus connecting to Everett. In the future, Shoreline will be the northern terminus of the planned Rapid Ride buses connecting to downtown Seattle. Third, Shoreline is redeveloping the area between North 175th Street and North 185th Street to create a civic space with the Town Center Subarea Plan. Finally, with the proximity of this area to the Interurban Trail, as well as proposed improvements to the pedestrian and bicycle network, there is great potential for multi-modal use including bicycles. With large-scale infrastructure improvements, proximity to the new Town Center and Interurban Trail, and access to the bus rapid transit corridor, the existing Shoreline Park and Ride site is an ideal candidate for redevelopment from a low density surface park and ride facility to a high density transit oriented development.

Site Conditions

The site is situated on the southwest corner of North 192nd Street and Aurora Avenue. The parcel is generally rectangular in shape with a north-south dimension of 725' and an east-west dimension of 375' at the widest point. The total area of the site is approximately 6 acres. Currently the site is occupied by a paved surface parking lot with the spaces for 393 cars. The park-and-ride lot also includes 4 bike lockers. Five bus routes, four of which operate only on weekdays during peak time, currently serve the site. These peak-only routes connect to Renton, the University District, and First Hill. The fifth bus route connects to downtown Seattle, arriving every fifteen minutes on weekdays

and every twenty minutes on weekends.

Currently the traffic volume on Aurora Avenue is 35,000 cars per day.²⁹ The posted speed limit is 40 miles per hour, but the average speed measured near the site is 44 miles per hour. On Aurora Avenue there were 1,581 traffic accidents between April 2005 and March 2008, nearly 46 accidents per month. Between 2002 and 2006, 35 pedestrians were struck while jaywalking on Aurora Avenue North, according to Seattle Transportation Department records.³⁰ The Aurora Corridor Project improvements will address safety issues by providing additional lanes for business access and transit, new sidewalks, crosswalks and lighting, additional signals and left and U-turn pockets, and the undergrounding of overhead power lines. The primary focus of the project is driver safety, pedestrian safety, and congestion relief.

Zoning

The City of Shoreline Subarea Plan aims to create a vibrant mixed-use Town Center. To accomplish this goal, the zoning along Aurora will be changed to foster a higher density of development and mix of uses. The future zoning 31 planned along Aurora Avenue between North 170th Street and North 188th Street calls for mixed use, with some parcels specifically for multi-family housing at R-48 (forty eight residential units per acre). Even though the Shoreline Park and Ride is located at the north end of the Shoreline Subarea Plan, the Park and Ride can serve as catalyst for activity through its movement of people into Shoreline. Improved bus transit to this site will add pedestrians to the newly densifying mixed-use Town Center.

The park and Ride site is currently zoned Industrial. The restrictions for parcels zoned as industrial are 45' maximum height, 25' street set-

²⁹ "Town Center Subarea Plan", pg. 61.

³⁰ McNERthney, Casey. "Hundreds ticketed as cops crack down on Aurora". Seattle PI. 15 April 2011.

³¹ "Town Center Subarea Plan", pg. 29.

back, and maximum floor to lot ratio is 2.5:1. There is a provision for additional height, which allows for one additional foot of height per one foot stepped back from the required setback. The change in zoning to mixed-use will foster much denser development than currently allowed under the Industrial zoning.

The nearby residential neighborhoods are zoned R-18 and R-6 residential. On the east side of Aurora Avenue, the parcels are zoned for as MUCZ for mixed-use development and industrial. On the east side of Aurora Avenue are two multi-family developments with retail and office space on the ground floor. These developments were completed in 2009. One caters specifically to residents aged 55 and older, and the other is a typical rental property. The Blakely Senior Apartments have 200 units with rents offered at below market rate and the Echo Lake Apartments contain 289 units with all rent at market-rate.

Amenities

Studies have shown that pedestrians will generally walk a limited distance before switching to driving. For transit oriented development, the typical amenity range is specified at quarter mile and half-mile distance from the station. These two radii are considered the catchment area for pedestrians and associated with probable use patterns. In addition to these standard measurements, this analysis includes a one-mile radius which typical for a bicycle catchment area. For reference, an average pedestrian can walk a quarter mile in less than five minutes, a half mile in seven minutes, and a mile in fifteen minutes. For comparison, an average cyclist travels one mile in four minutes.

Amenities within one quarter mile of the site include King School, Echo Lake Elementary, YMCA, multi-family housing, and the Interurban Trail. Amenities within one half mile include the future Shoreline Town Center, Aurora Village Shopping Center, Gateway Shopping Center, Echo Lake Park, and King's Park. Amenities within one mile include Costco, QFC, Richmond Village Shopping Center, St. Luke Middle

School, Shorewood Senior High School, Albert Einstein Middle School, Shoreline City Hall, the future Park at Town Center, and the Shoreline Historical Museum (see Figures 9-12).

This brief amenities assessment shows that even within this auto-oriented landscape, there are many amenities that can be accessed within a short distance from the project site. Even more opportunities will develop as the Town Center Subarea begins to take form.

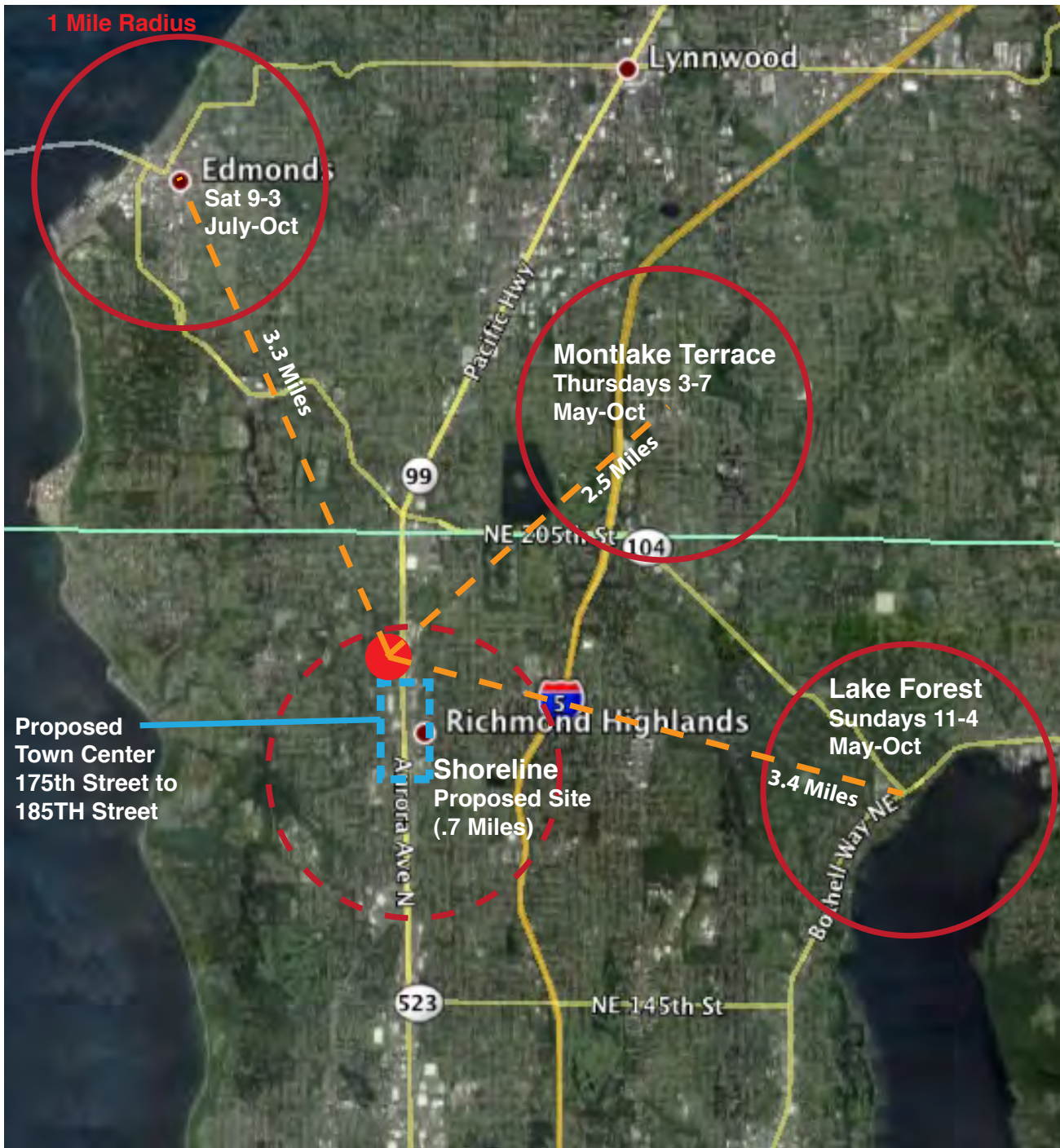


Figure 9: Proximity to Farmer's Markets



Figure 10: Proximity to Grocery Stores

- - - 1/4 Mile Radius
- - - 1/2 Mile Radius
- - - 1 Mile Radius
- Grocery Store
- Convenience Store

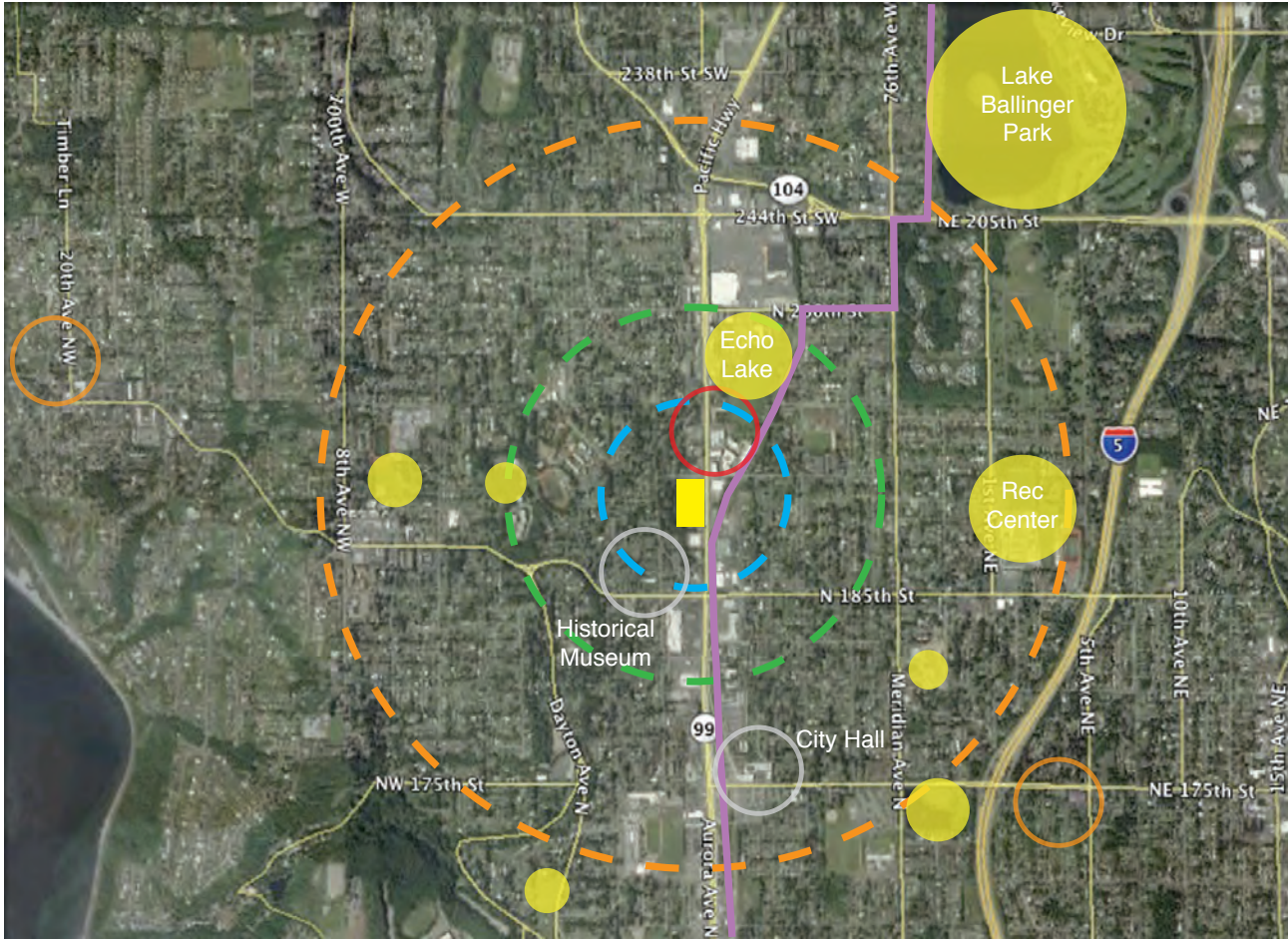


Figure 11: Proximity to Neighborhood Amenities

- - - 1/4 Mile Radius
- - - 1/2 Mile Radius
- - - 1 Mile Radius
- Interurban Trail
- YMCA
- Civic Buildings
- Libraries
- Parks and Recreation Centers

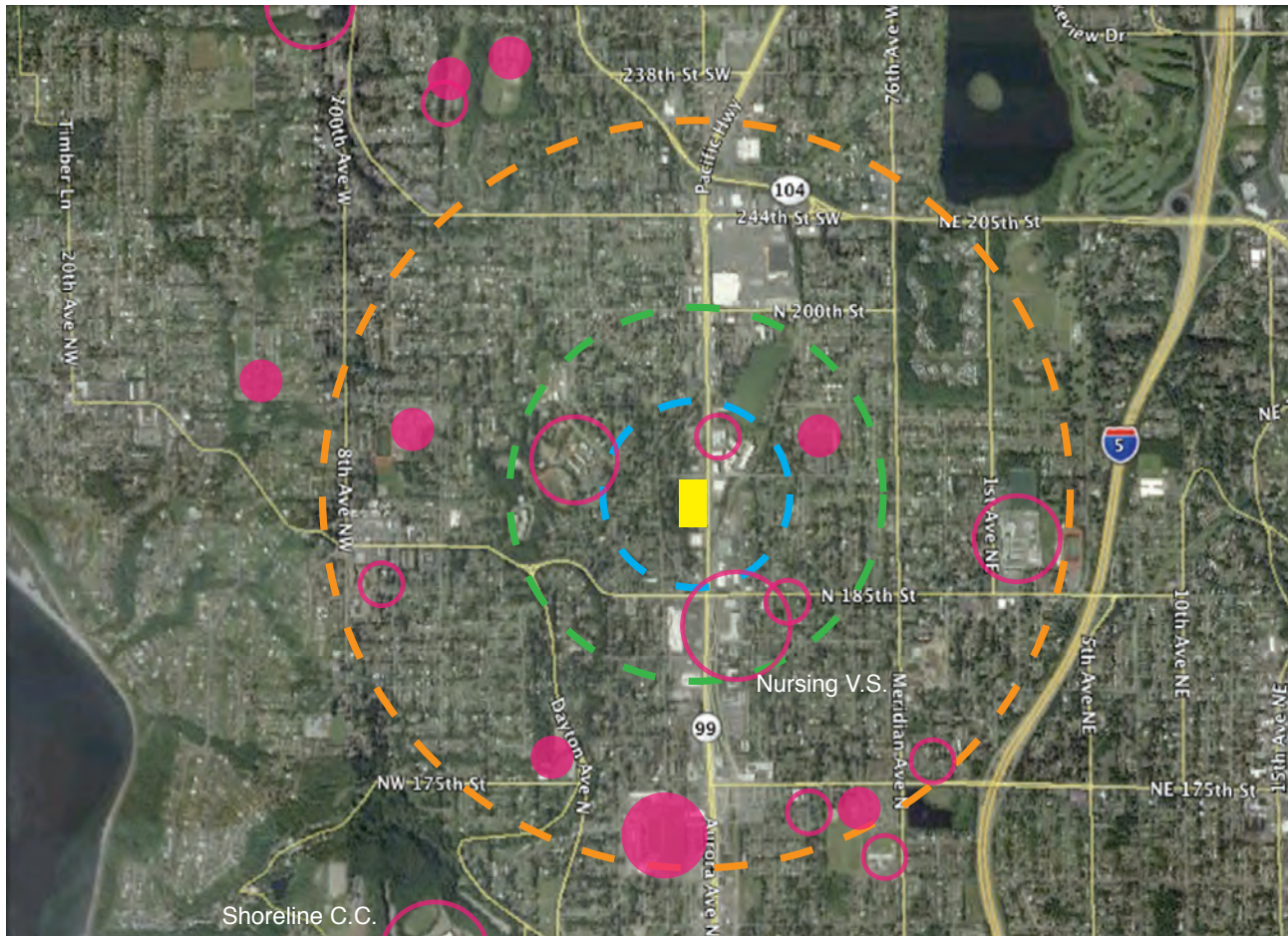
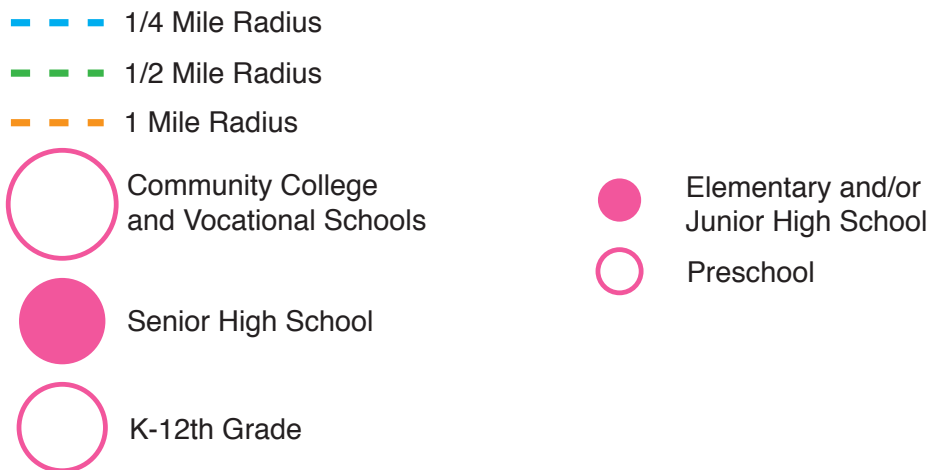


Figure 12: Proximity to Schools



Contexts

Regionally, the site is located in a hydro-basin with no major streams nearby, but is proximate to two lakes. The closest is Echo Lake located approximately a quarter mile northeast from the site along the Interurban Trail. Echo Lake is a small lake that covers 16 acres, with the longest dimension being approximately one quarter mile. Lake Ballinger is a much larger lake, at 200 acres, located approximately 1.5 miles northeast from the site; its longest dimension is one half a mile.

This the site serves as a local water basin, so it is necessary to consider the volume of water that enters the site during a typical rainfall, and during extreme 50 and 100-year rainfall storms. Hypothetically, if every drop of water that falls within the site boundaries is captured during a twenty-four hour, 50-year storm 480,000 gallons could be collected. 560,000 gallons could be collected in a twenty-four hour period during a 100-year storm. During a twenty-four hour period of a more typical two-year storm, the site could collect 270,000 gallons of water.

Jurisdictions in the Puget Sound region are increasingly requiring use of “green infrastructure” to mediate runoff and lessen the need for additional storm sewer capacity. The City of Shoreline adopted a Surface Water Master Plan in December 2011. Green infrastructure also contributes to groundwater recharge and can serve to filter the water lessening the impact of pollutants in runoff on area streams and other bodies of water. Thus, site topography and water movement must be addressed in the design of the project site. Because the site serves as a water basin, the site design is required address the influx of water and provide for a system of green infrastructure to mediate the storm water runoff (see Figures 13 and 14).

Figure 13: Site Topography

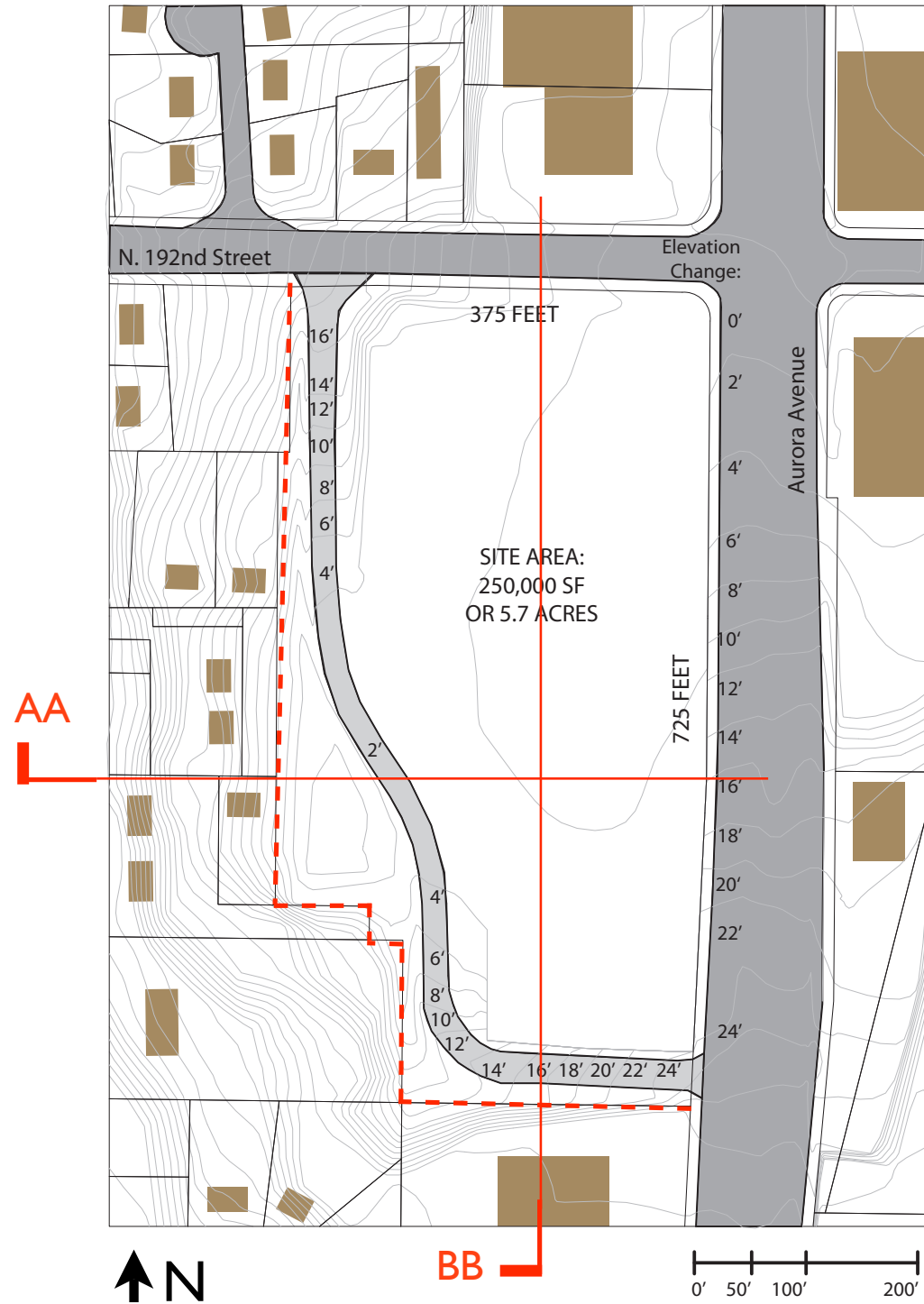
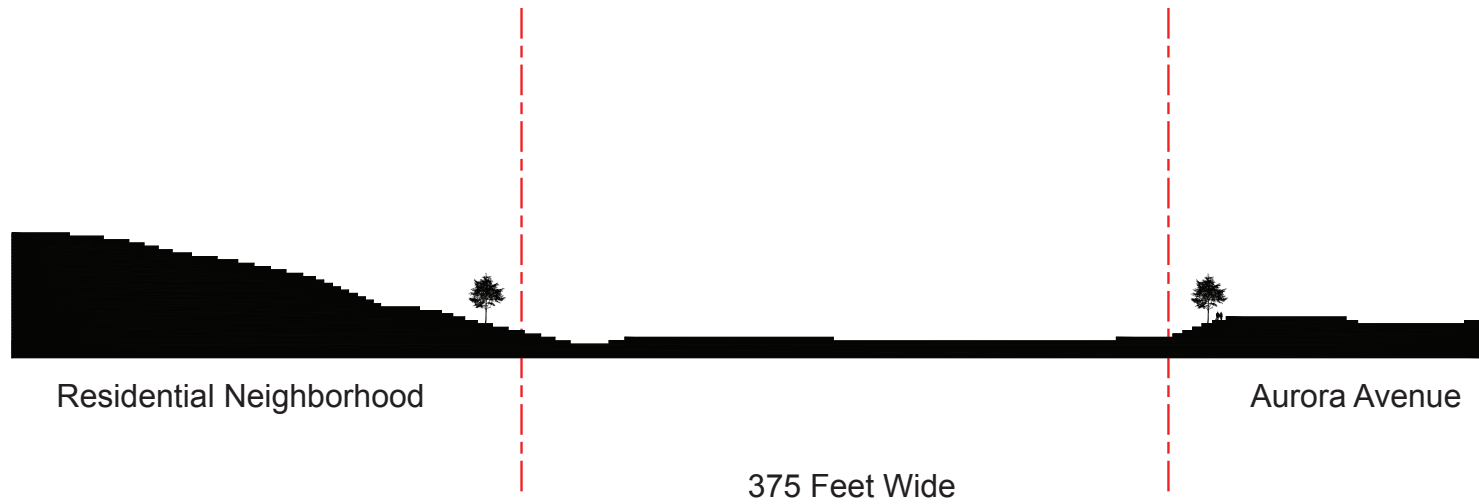
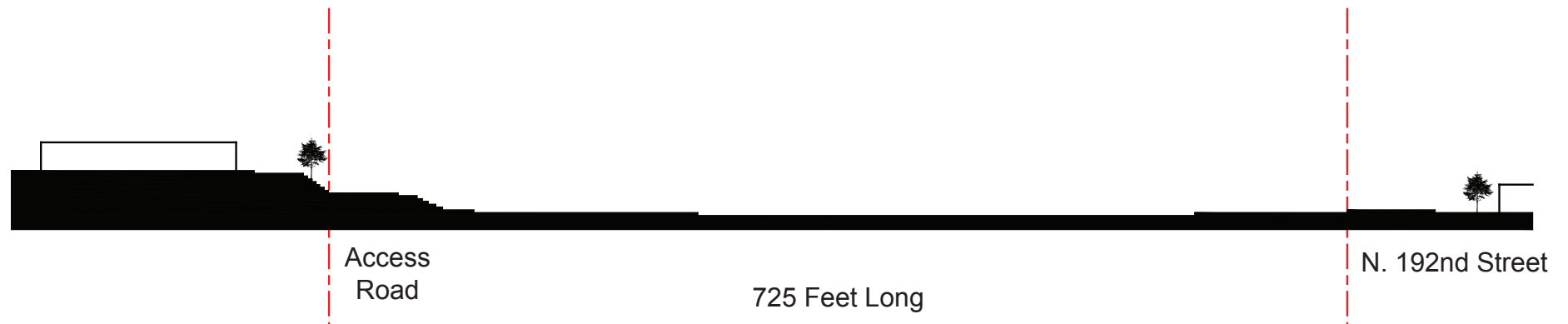


Figure 14: Site Section Cuts

Transverse Section AA, Facing North



Longitudinal Section BB, Facing West



On its east side, the project site fronts on the busy arterial, Aurora Avenue. However along its west site the site adjoins a fine-grained residential neighborhood as shown in Figure 15. The new development on the project site will respond to the density of the anticipated urban scale along Aurora while simultaneously stepping down to the scale of the residential neighborhood to the west.

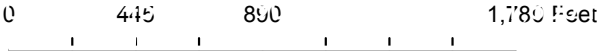
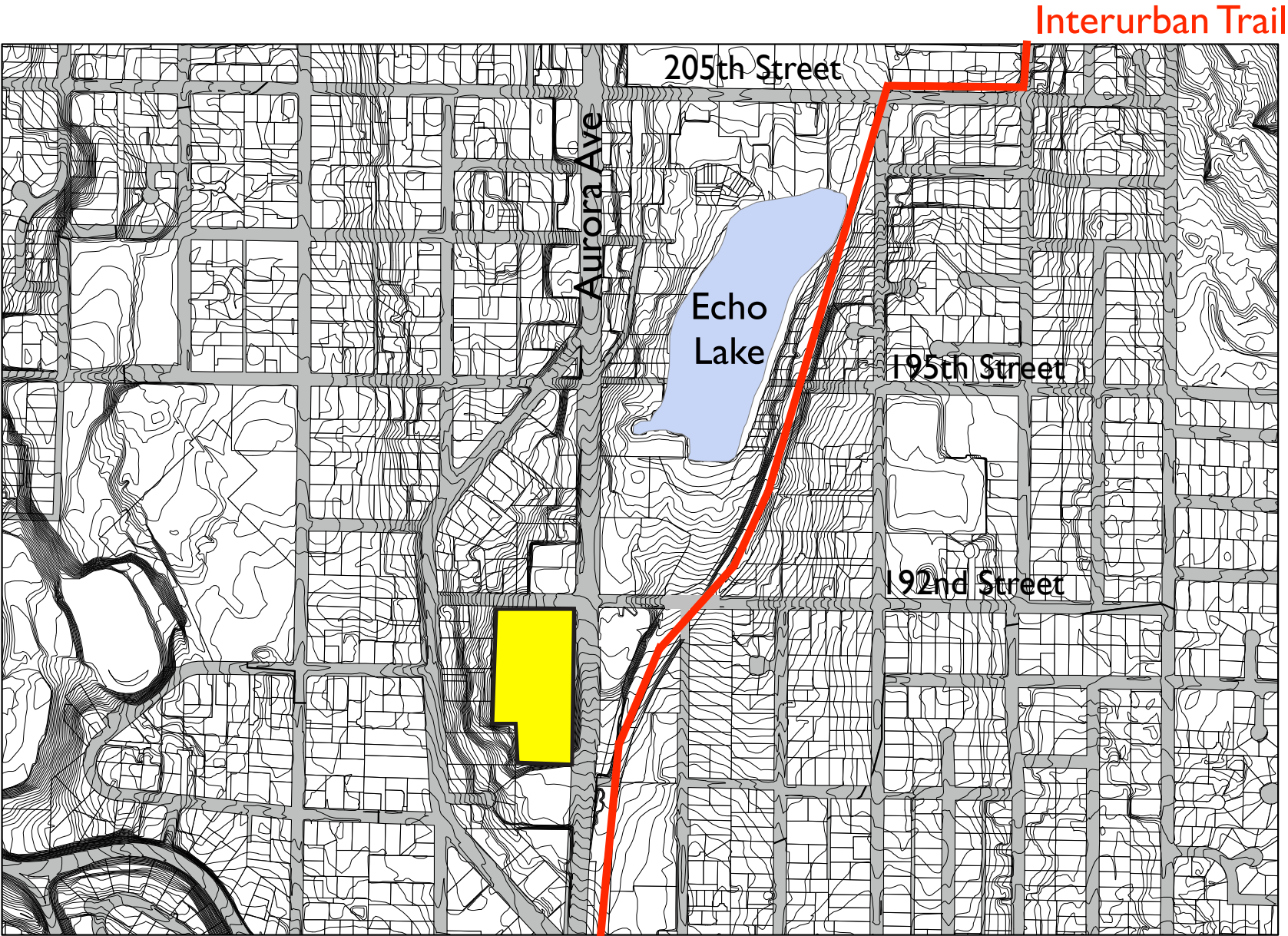
Physical Characteristics of Site

The six acre project site, measuring 375 feet by 725 feet, is relatively flat where the existing parking lot was constructed, but the perimeter of the site has a significant grade change. In section the site has a basin shape (see Figure 14). The northeast corner of the site is at the lowest elevation and the southeast corner is at the highest elevation with a twenty-four foot grade change.

The current use is a 393 car paved parking lot with bus shelters located along North 192nd Street. The adjacent residential area is heavily wooded and slopes steeply away from the site. The topography and woods present as an opportunity to bring natural elements into this starkly paved parking lot.

The parcels surrounding the site along Aurora Avenue mostly have low rise buildings set back from the street edge with large parking lots in the front. An exception is the site at the northeast corner of North 192nd Street and Aurora Avenue, which is occupied by a newly constructed mixed-use building with commercial on the ground floor and apartments above. The building addresses the street edge and hides parking. This building exemplifies the type of development that is likely to come to this area with the implementation of the various Shoreline plans.

Figure 15: Vicinity Map



Anticipated Future Changes

Future changes in the vicinity of the project site will include denser development along Aurora that incorporates a mix of uses and fosters enhanced pedestrian activity. These changes are required in new construction through zoning changes and building guidelines set forth in the Town Center Subarea Plan. Transportation connections will continue to improve with the Rapid Ride connection to Seattle in 2013, as well as more frequent service to Northgate. The Pedestrian and Bicycle network is also being expanded, promoting more linkages and safer, more pleasant environments.

Chapter 5: Site Strategies and Site Organization

The design of the new mixed use development on the Shoreline Park and Ride site takes into account the various plans for the City of Shoreline, the planned changes in bus transit and the likely new development in the immediate vicinity. The design derives from a two-step process. The first step, presented in this chapter places the various elements of the program on the site. The second step, development of the actual building design, is presented in the next chapter (Chapter 6).

Natural Elements

A key idea in the development of the site plan is to bring natural elements into the area that is currently a paved parking lot. Once natural elements are brought into the site, they can be made available to passers-by through creating view access from Aurora Avenue (see Figure 16). The site plan directly responds to the natural elements of the adjacent residential neighborhood and addresses the water runoff. Creating visual access from Aurora highlights the environmentally responsive and responsible design.

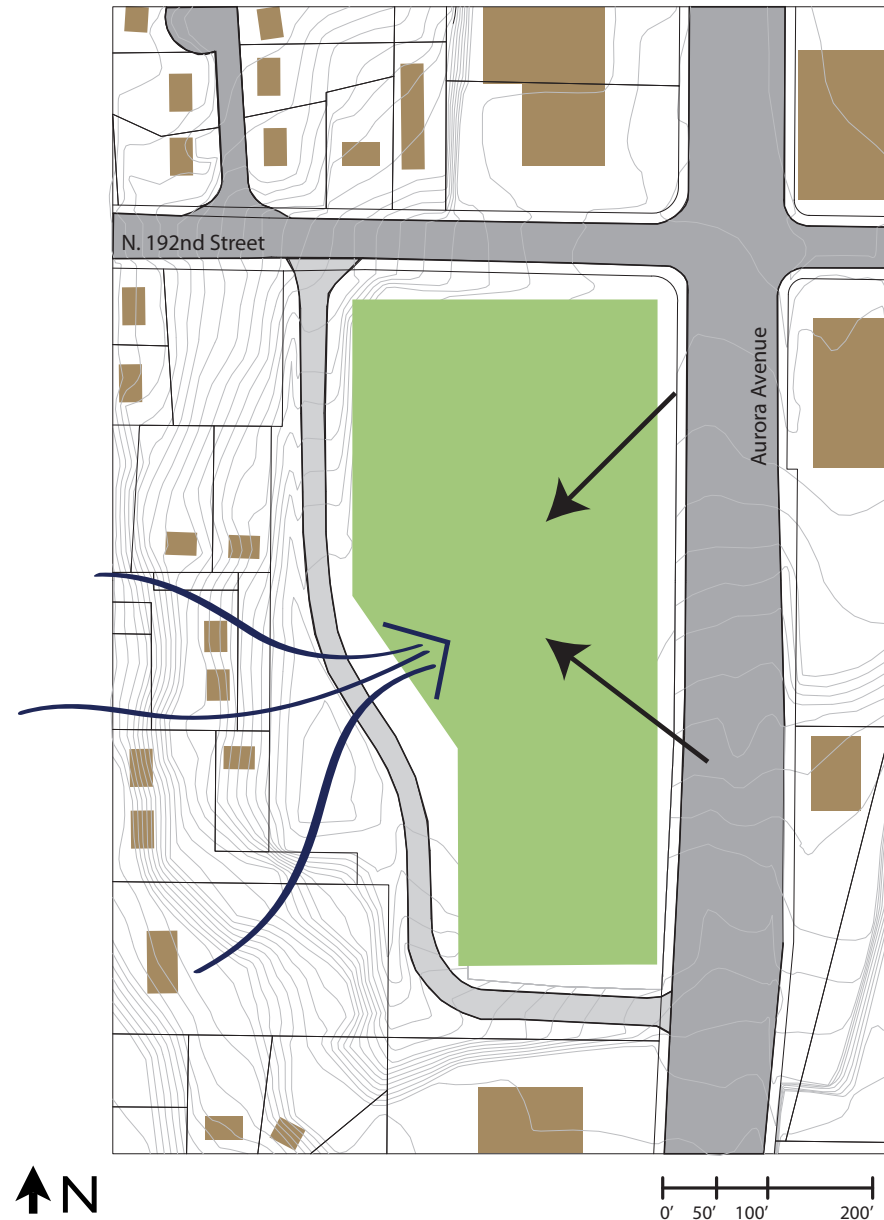


Figure 16: Natural Elements and View Access

Site Organization

The successful multi-modal development of this site depends on accommodating the functional and spatial demands of buses, cars, pedestrians and cyclists. The bus terminal is located in the northern portion of the site where the topography is most level. The parking garage is located in the southern part of the site to take advantage of the grade change. An additional level of parking can be provided without the need for excavation. Spacing these two primary program elements at opposite ends of the site will foster north-south pedestrian movement across the site, which, in turn can support retail development (see Figure 17).

Bus Circulation

The bus terminal serves as the terminus for both northbound and southbound buses. The ideal configuration will allow buses to enter and exit the site without creating conflicts. Keeping the northbound buses in the north portion of the bus terminal and the southbound buses in the south portion of the bus terminal will also be most understandable to passengers who will board the buses in this area. The existing access road along the south and west side of the site provides a route that allows buses to circulate on the

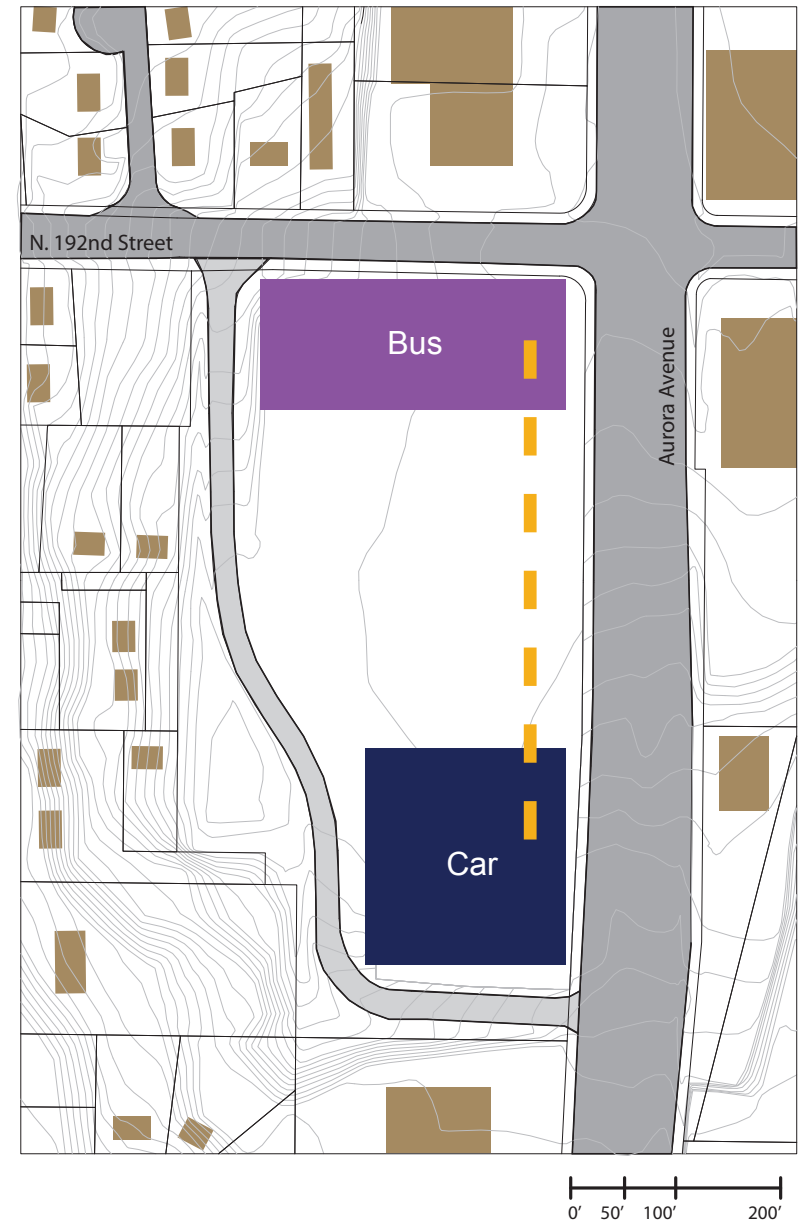


Figure 17: Site Organization

site but not cross paths. As shown in the diagram (Figure 18), southbound buses enter the site by turning right off Aurora and exit the site to North 192nd before returning north. Northbound buses turn left off Aurora at the access road, then turn right into the bus bays; exiting the site, these buses turn right to head south on Aurora. For ease of movement, a traffic signal has been added to the intersection of Aurora Avenue and the access road. Initially, the terminal will serve 12 Metro and Community Transit bus routes, with a current ridership of 4,000 passengers on weekdays. 9 routes on Saturday, and 4 routes on Sunday. The bus rapid transit routes have the most frequent service departing every 12 minutes.

Car Circulation

Personal vehicles enter the parking garage from the access road via North 192nd Street or from Aurora Avenue (see Figure 19). The access road is a two-way street, but passenger drop-off (“kiss-and-ride”) is provided only in the northbound direction eliminating possible conflicts between vehicles and passengers. The parking garage contains approximately 400 spaces, maintaining the existing capacity. The parking garage will have floor-to-floor heights of 13 feet and will be designed with removable ramps for potential redevelopment for other uses in the future.

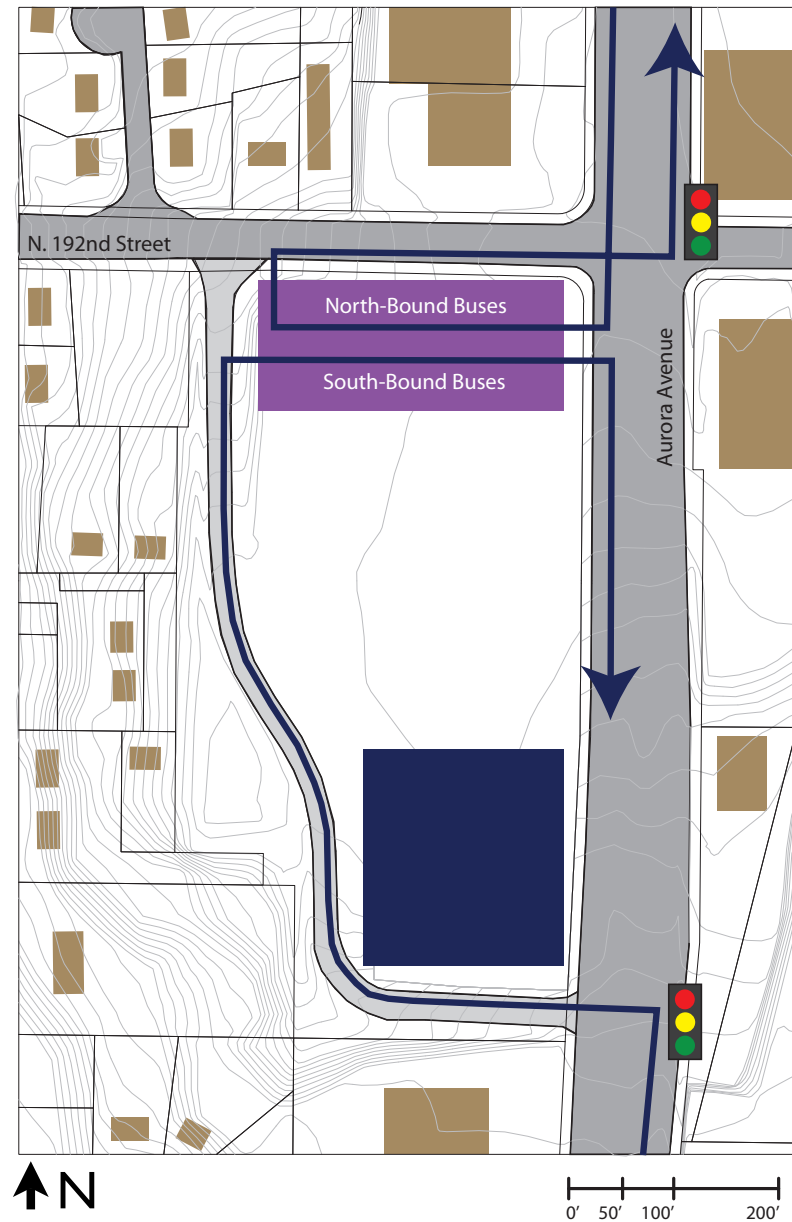


Figure 18: Bus Circulation

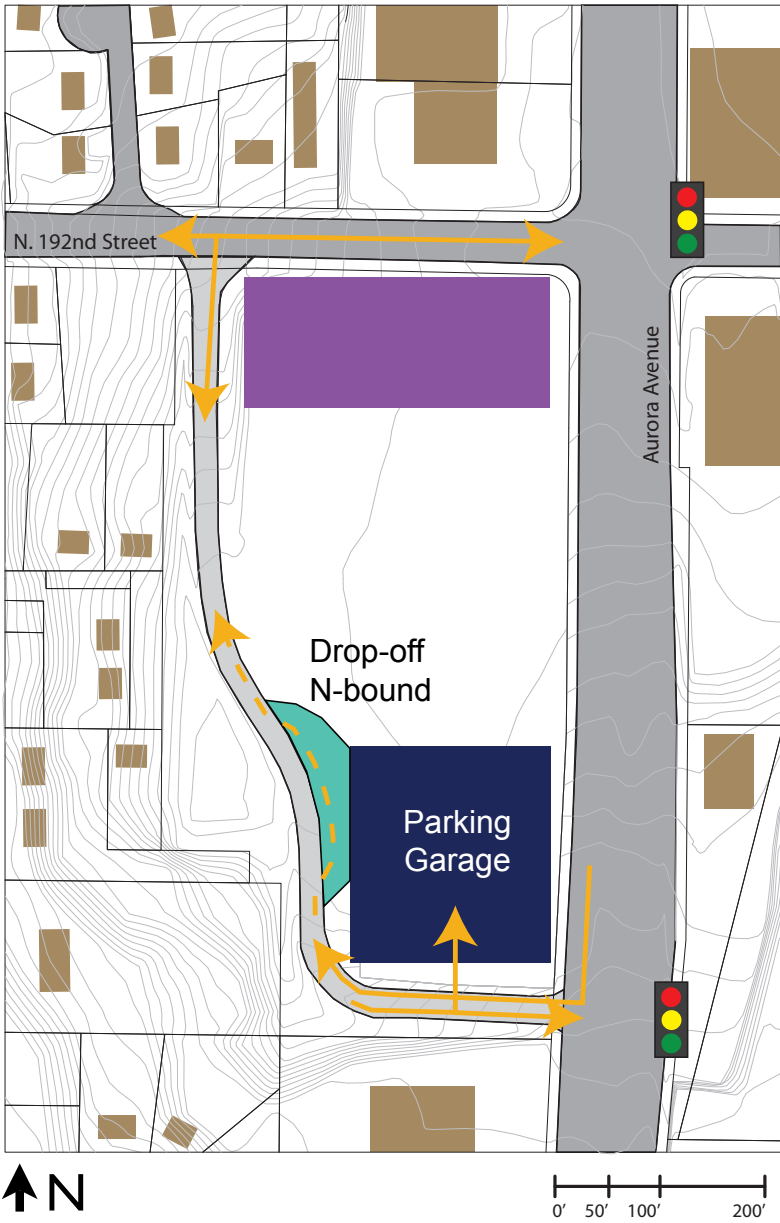


Figure 19: Vehicle Circulation

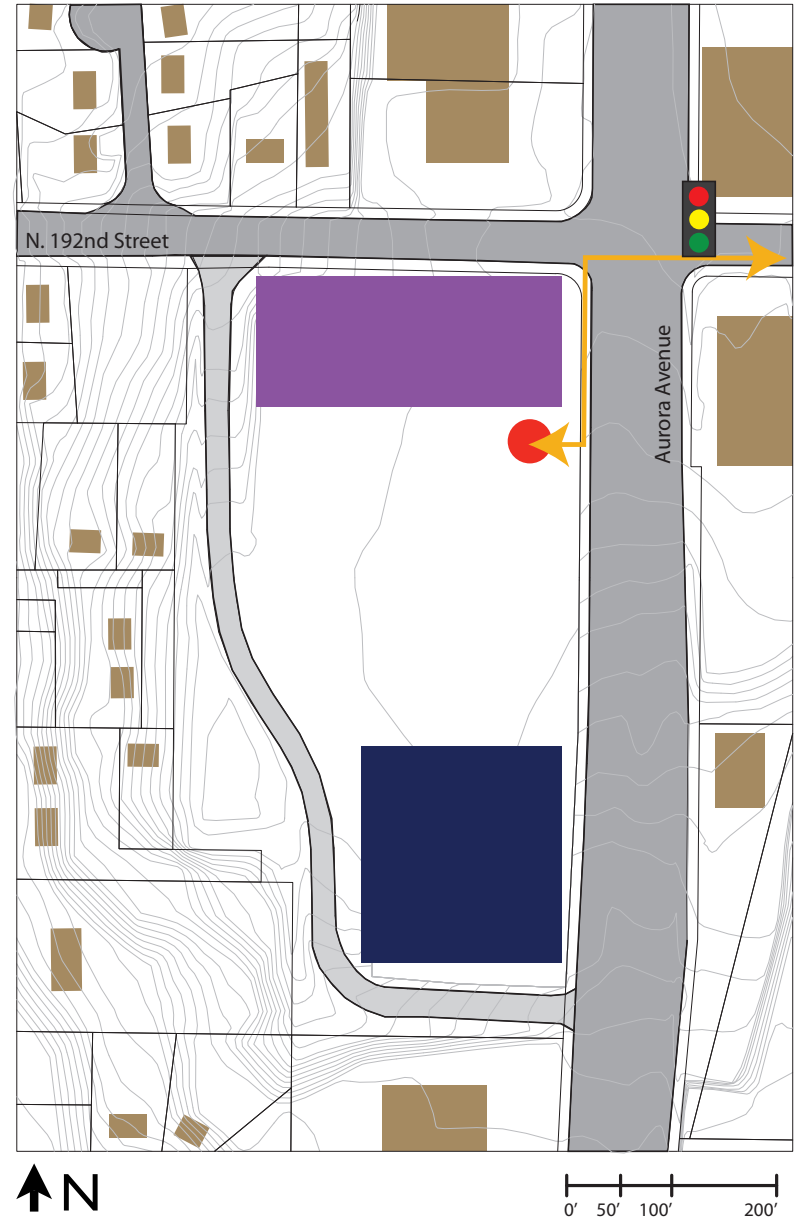


Figure 20: Bike Circulation

Bike Circulation

The bike-and-ride is located adjacent to the bus terminal to promote ease of mode switching and to connect with the Interurban Trail from North 192nd Street (see Figure 20). It is prominently placed near the street to serve as an icon for the site. The bike-and-ride will contain parking for 220 bicycles, 120 lockers, 5 showers, and a 4' x 10' service elevator.

Commercial Program Massing Strategy

The commercial program includes a variety of retail, office and related uses. The commercial program is divided into several smaller buildings that frame the central zone of the site--the natural elements (Figure 21). The buildings are arranged to maintain a relatively continuous street edge along Aurora Avenue with openings for view access through the site. The pedestrian linkage between the bus terminal and the parking garage is designed as a retail arcade to foster activity. The other buildings blend the building height from Aurora Avenue to the adjacent residential area. Space will also be provided for a daycare facility, a bus driver operations center, and community center.



Figure 21: Program Massing

Chapter 6: Site and Building Development

Program Development

The primary program requirements are to provide parking for the transit center, an area for bus operations to occur, bicycle storage, ground level retail space, and office space. The development of the site with a mix of uses will encourage at least 18 hour, seven day activity. This level of activity will be by created through development with overlapping use patterns and appeal to varying users throughout the day.

Rain Garden

The center of the site, which is devoted to natural elements functions as a rain garden. This provides a basin for rainwater runoff, and fosters the re-vegetation of an area that is currently paved. The rain garden has an area of approximately 26,000 SF. The rain garden would be designed with three planting zones, one in the center for plants that can tolerate wet conditions, the middle zone for plants that grow in occasional standing water, and the edge for plants that prefer drier conditions. The plant species would be native, to be better suited for Shoreline's climate.

Amphitheater

Extending north from the retail adjacent to the parking garage are a series of steps that create an amphitheater south of the rain garden. These steps and tree planters can be used as seating, and the western edge includes three large stepping terraces. The amphitheater would accommodate community activities, such as movie nights, or school performances.

Building Organization

The Plaza Level (see Figure 22) includes the passenger drop-off area, the bus terminal, a water play area, and rain garden. The lower arcade opens to the rain garden and provides an area for a farmer's market. Program elements on this level include a small grocery store, a community center with adjacent garden plots ("pea patches"), bicycle repair adjacent to the bicycle and ride, and driver's operations center accessed from the bus terminal. The second level (see Figure 23) contains the upper arcade linking the parking garage and bus terminal. This connection is covered, and contains planters with integrated seating. This level is primarily retail oriented to activate the arcade, but also contains a daycare with adjacent outdoor play area. The upper levels (see Figure 24) contain office space and a gym. The office space brings people to the site during working hours, while a gym provides an amenity for transit users, workers, and residents.

The parking garage contains approximately 400 spaces, which maintains the existing capacity. The parking garage has floor-to-floor heights of 13 feet for adaptability in the future. The central vehicle circulation ramps are designed to be removed to create a light filled atrium. Stair cores are located in each corner, providing for future redevelopment of this parking building. A "clip-on" curtainwall façade would be one way to seal the building in the future. All or part of the garage could be redeveloped over time as parking demand changes.

A section cut through the site looking south (Figure 25) shows the development of the site. From east to west, the section shows the reconfiguration of Aurora Avenue with street trees and wider sidewalks, retail fronting Aurora Avenue, the arcade on the second floor, the lower arcade opening to the central rain garden, the westernmost building with the daycare and community center, the access road, and the residential area. The section also shows the current development patterns of neighboring buildings east of Aurora as well as what future zoning will allow (dashed line).

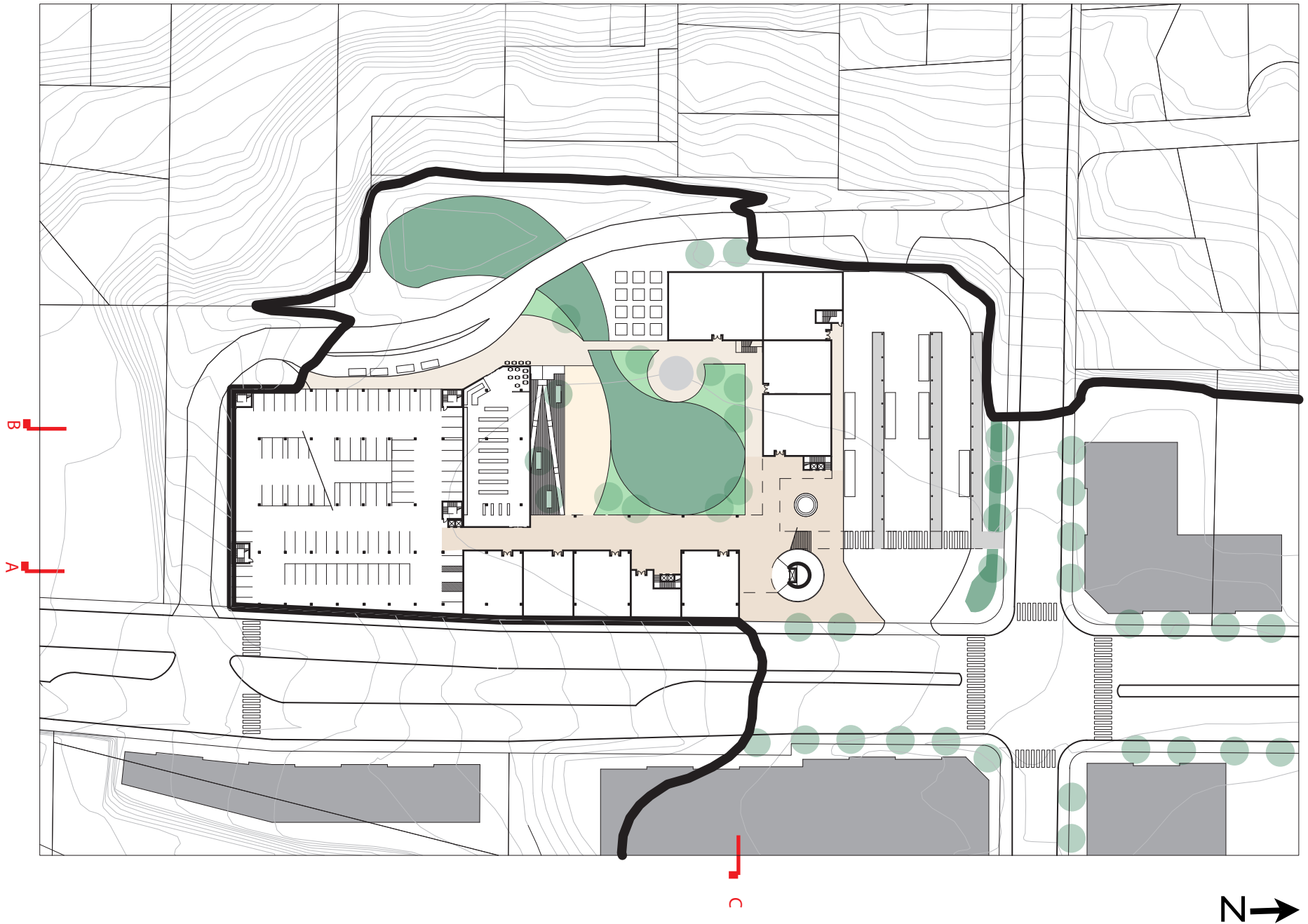


Figure 22: Plaza Level

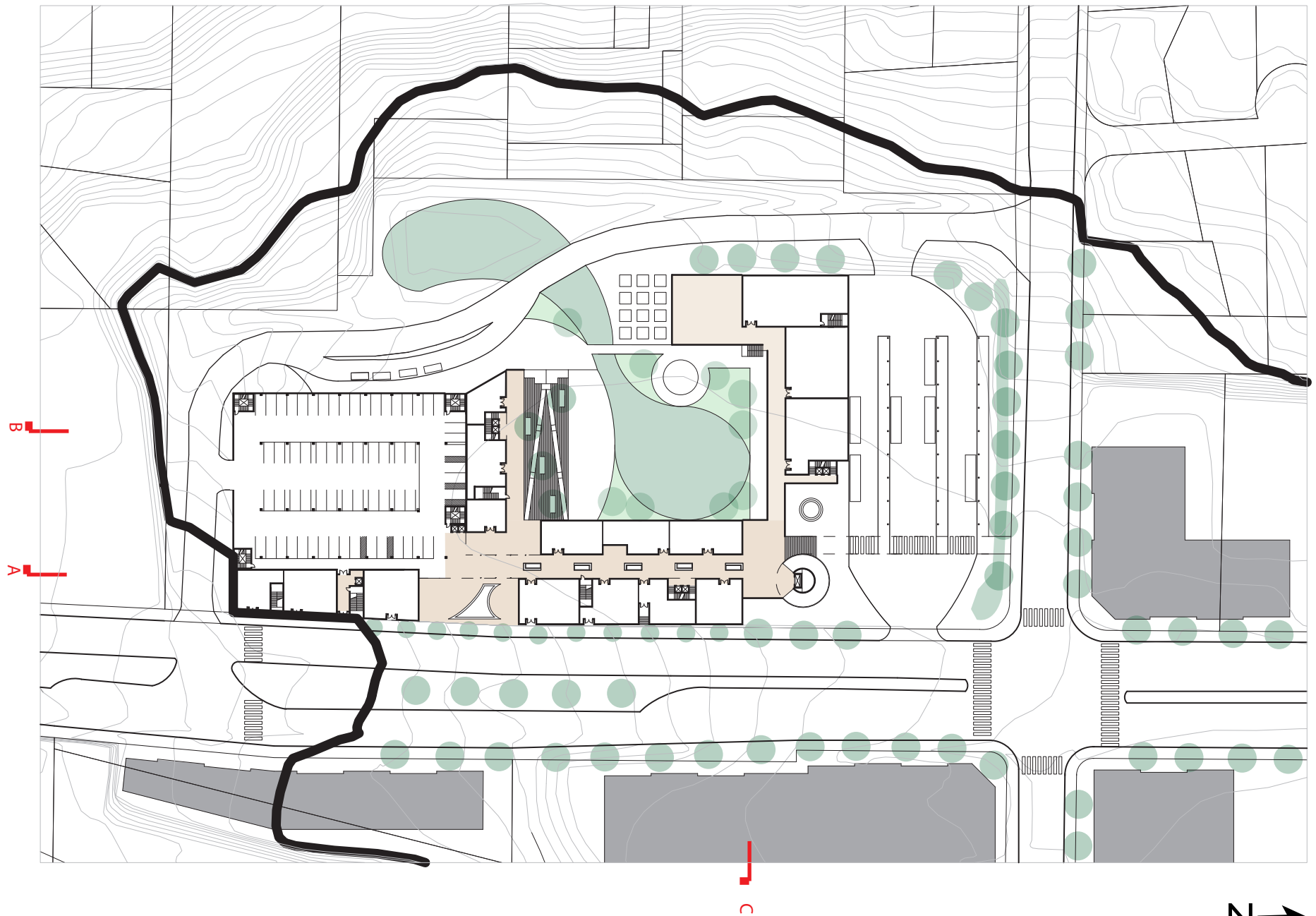


Figure 23: Arcade Level

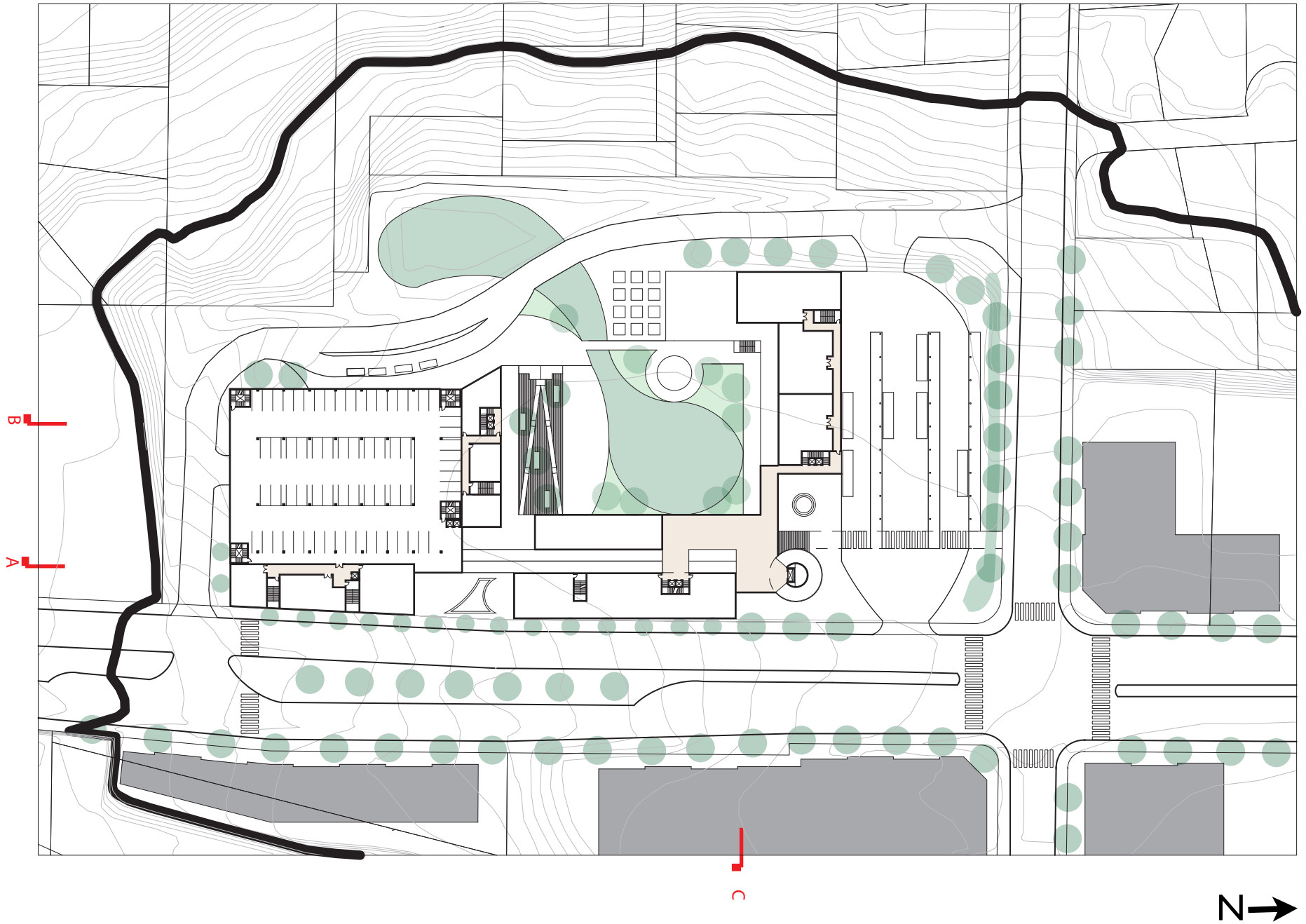


Figure 24: Third Level



Figure 25: Transverse Section Cut, Facing South

Bike and Ride

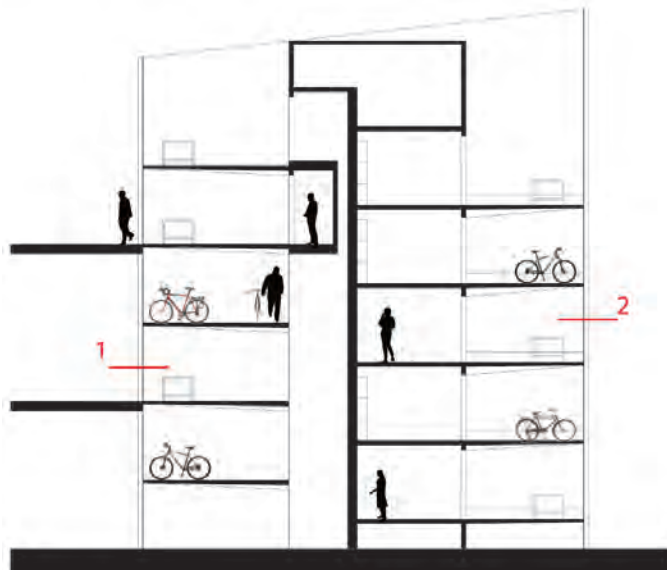
The Bike and Ride is designed as a memorable iconic element on the site. It appears cylindrical but actually incorporates a spiral ramp. The Bike and Ride contains parking for 220 bicycles, 120 lockers, 5 showers, and a 10'x4' service elevator. The bike-and-ride connects directly to the first three floors of the commercial development providing multiple exit points.

The core cylinder of the Bike and Ride has solid concrete walls and the spiral ramp is cantilevered from this core. The outer façade is a perforated metal screen for daylight and ventilation (see Figure 26). At night, the illuminated Bike and Ride would serve as a “lantern” or “beacon” for this site.

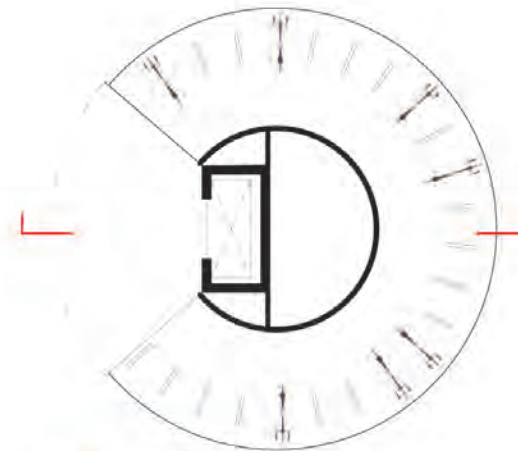
Sustainability

The project design incorporates multiple sustainability strategies. The first, of course, is the development of a mixed-use center on a bus transit terminal site, providing incentives for more use of mass transit and less dependence on single-occupancy vehicles. The next most ap-

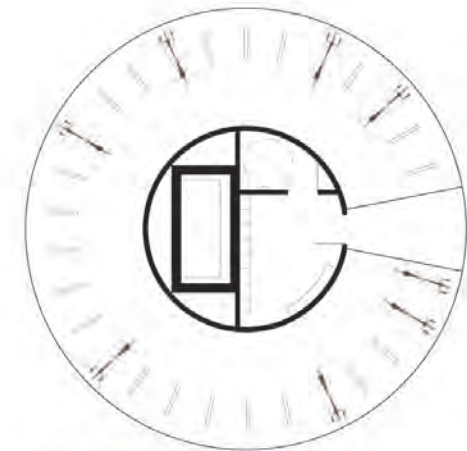
Bike Storage, Section and Plan



Capacity: 220 Bicycle Parking Stalls, 5 Showers, 120 Lockers



1: Elevator Entrance



2: Locker Entrance

Figure 26: Bike and Ride

parent sustainability strategy addresses storm water management. The central portion of the site has been turned into a rain garden, which will reduce the total amount of impermeable surface on site. Even with the greater density of development it is possible to reduce impervious surface from 75% to 70%. The buildings have green roofs that will slow the infiltration into stormwater systems, and reduce the heat island effect. The building facades respond to their solar orientation by having shading devices to reduce solar heat gain. The parking garage contains a rooftop photovoltaic array, which will produce energy to be used on site. The parking garage also incorporates strategies for adaptive reuse in the future, eliminating the loss of embodied energy.

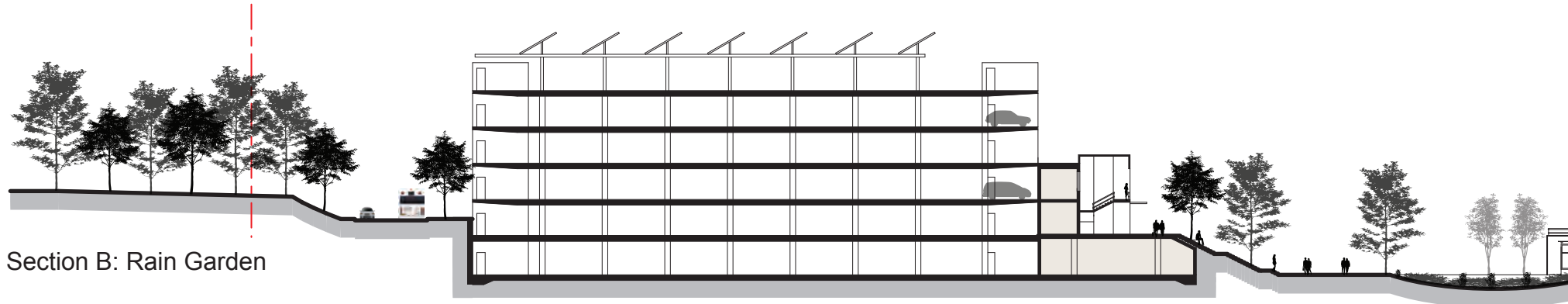
Summary of Site Strategies and Development

The site development revolves around designing a transit center and mixed-use development to provide services to users and residents, while incorporating natural elements and other sustainability strategies. The primary program elements include parking for the transit center, an area for bus operations to occur, bicycle storage, retail space, and office space. The program encourages 18-hour, seven day use by creating a development with overlapping use patterns and appealing to various users throughout the day.

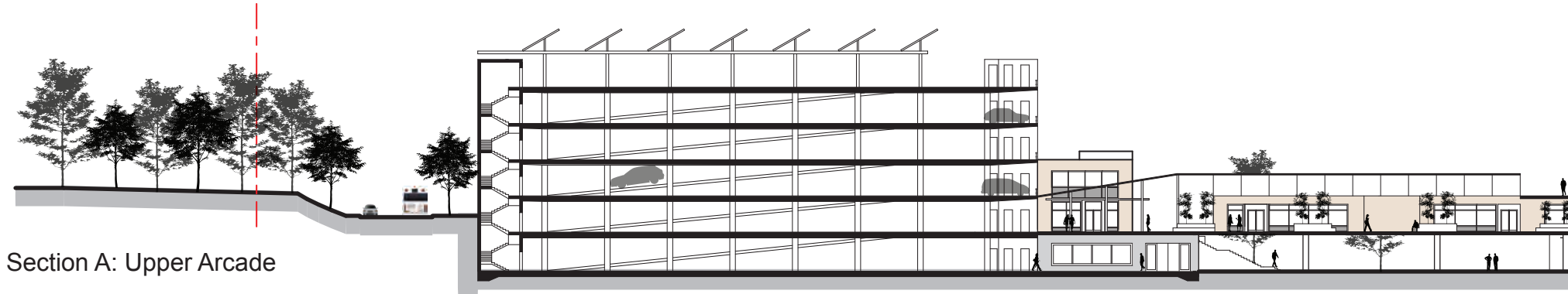
The chart below shows “before and after” conditions of site development:

	Existing	Proposed
Percent of Impermeable Surface	75%	70%
Parking Stalls	393	399
Bike Storage	4	220
Commercial Space (SF)	0	70,600
Office Space (SF)	0	16,000
Green Roof (SF)	0	19,700
Solar Panel (SF)	0	32,700

By designing a parking garage with an adequate floor-to-floor height and shallow floor plates, the design can be converted to other uses depending on demand in the future. The parking garage accommodates the existing parking capacity, yet at the same time clears the site for a mix of uses to foster a lively level of activity.



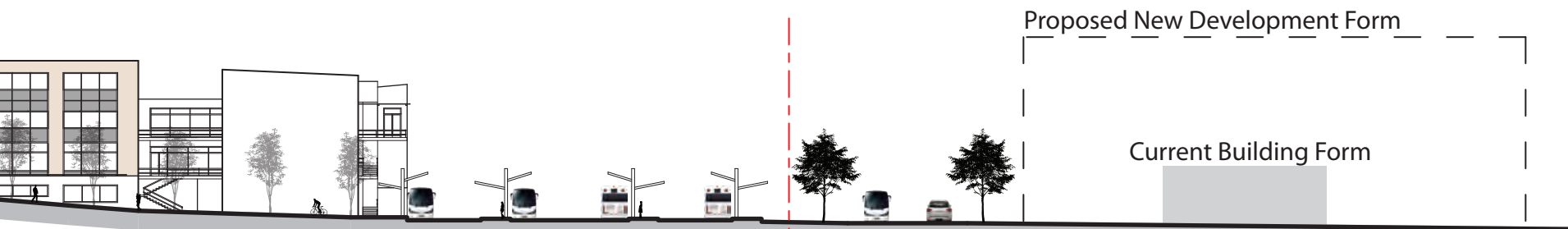
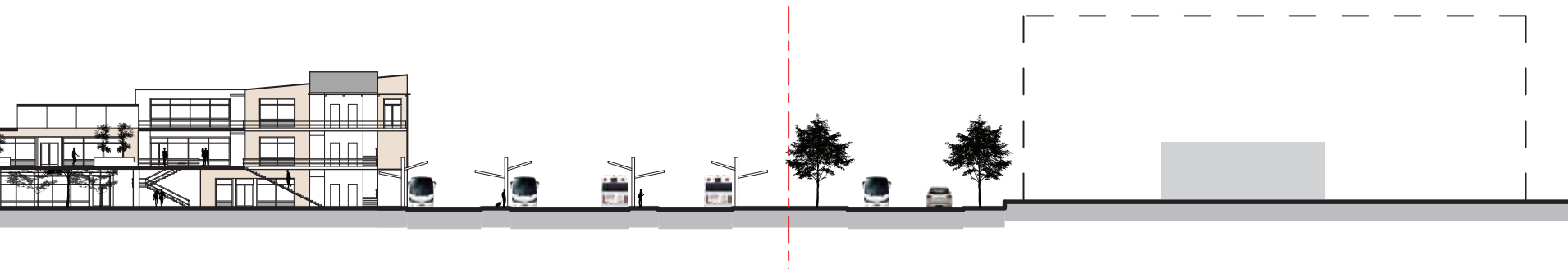
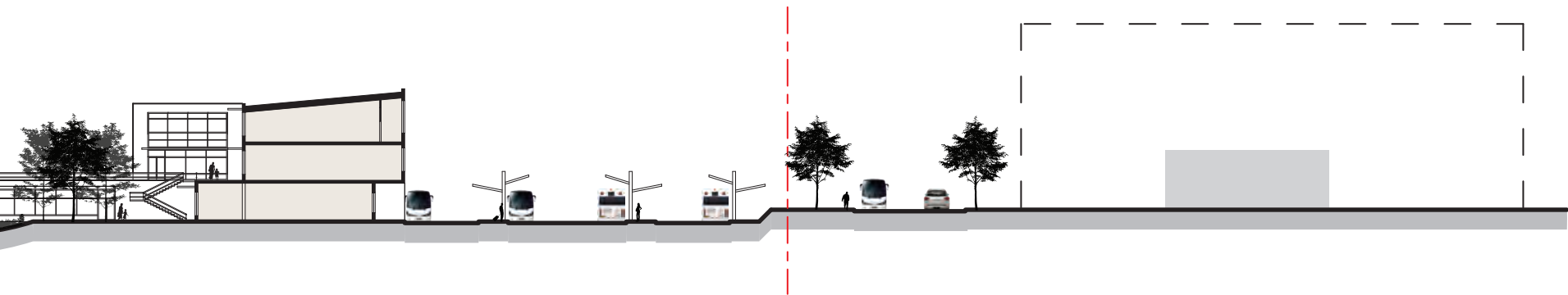
Section B: Rain Garden



Section A: Upper Arcade



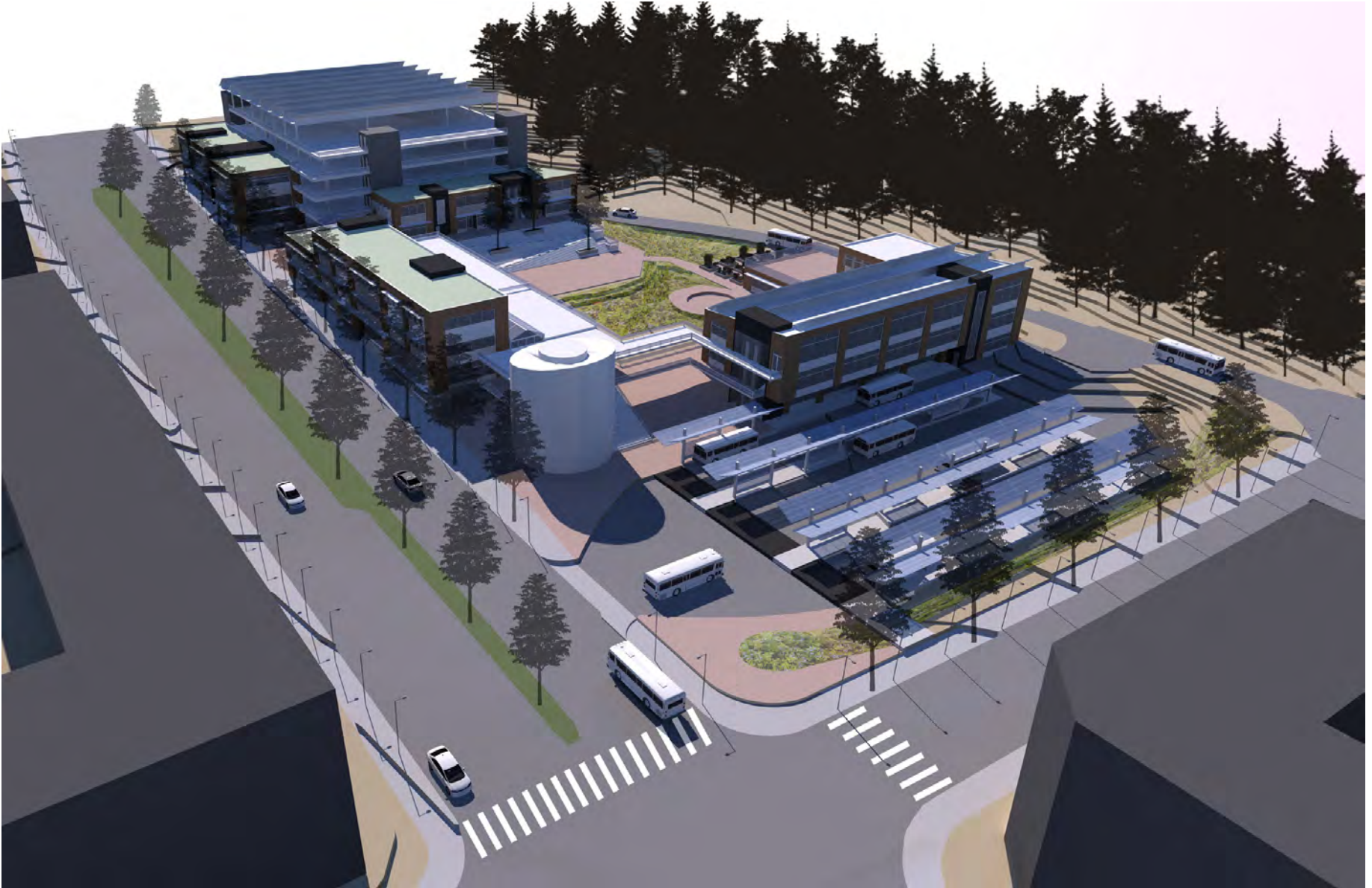
Aurora Avenue Elevation



N. 192ND AVE



Site Facing South West, Current Conditions
(photo from Google Earth, March 2012)



Site Facing South West, Thesis Proposal

Chapter 7: Conclusions and Recommendations

Summary of Thesis Research

With the recent passage of several transit initiatives, the Puget Sound region has introduced plans to improve the transit system steadily with the introduction of light rail and bus rapid transit systems. To be successful, this transit plan must be supplemented with nodes of dense mixed-use development, encourage multi-modal use, and foster pedestrian activity.

Multi-modal transportation and mixed-use development will become increasingly important as the cost for gas rises, congestion increases, the detrimental environmental impacts of sprawl are felt, and the desire to improve the quality of life and health of the residents increases. Residents will need viable options for mobility that include other modes of transit besides the private automobile. This thesis examined studies relating physical well-being, environmental health, and the built environment. Benefits of non-vehicular modes of transit include reduced air pollution, congestion, sprawl, monetary expenditure per household, increased physical activity, social equity, community activity, and improved accessibility.

Transit oriented development is relevant today as many cities are searching for ways to encourage denser nodes of development in suburban areas. After exploring several site options in the Puget Sound area, the Shoreline Park-and-Ride site was selected for the thesis project. This thesis has demonstrated one way to convert the existing Shoreline park-and-ride into a dense, multi-modal hub. One reason this site was chosen is because it can serve as a model for other car-centric, suburban sites where high capacity transit modes, particularly bus transit are being introduced. The challenges for this type of development are to promote activity for transit as well as non-transit users, and also extend the hours of operation beyond peak commute times.

Site Information and Program

The programmatic needs were determined by assessing the typical pattern of use for transit users and residents, and looking to extend the hours of operation outside peak commute times of 6 to 9am and 4 to 6pm. The program was developed to encourage trip chaining for transit users with the inclusion of a daycare, grocery store, gym, and other retail spaces. These services also appeal to residents. Other strategies include: developing office space for continuous 9 to 5 use, amenities such as the grocery store, gym, and restaurants, for extended hours seven day use and providing a flexible space for community activities on nights and weekends with the lower arcade farmer's market, community center, and amphitheater.

Additional Areas for Investigation

Parking Garage Lifecycle

Since the parking garage is a major component of the thesis, it would be valuable to explore how it can be adapted in the future for other purposes. It is designed as a concrete frame structure with precast central ramps that could be removed as needed without damaging the structural integrity of the whole. Removal of the ramps would create a central atrium that would provide daylight access to the now narrow floor plate. The floor-to-floor height is higher than normal parking garages at 13' which allows for flexibility in use. Fire stair cores are found in each of the corners, so egress access would be adequate for future use changes. The adaptive reuse possibilities could be shown through diagrams of partial conversion, or full conversion as parking demand changes. Because of the structural flexibility, the future uses could be office, housing, or commercial.

Relationship to Neighborhood

One of the initial diagrams for developing the site revolved around bringing natural elements and view access into the site. The incorporation of natural elements might be investigated further by bringing natural elements through the site to Aurora Avenue. Currently, the rain garden terminates before the bike-and-ride and it could extend further east towards the sidewalk. The view corridors could be more prominent or frequent to provide more visual access into and out of the site from Aurora Avenue.

There was some concern about the frequency of buses using the access road to enter the bus terminal, which might create excess noise and pollution to the site and residential area. However, even with the addition of the Rapid Ride bus in 2013, there would only be four bus routes that would use the access road. The Rapid Ride will be a low emission, hybrid bus and have departures every twelve minutes. The Swift Bus is already in operation by Community Transit and its fleet is made up of hybrid diesel-electric buses. Also, it is very likely that as the regional bus fleet ages, Metro Transit and Community Transit would replace the vehicles with lower emission hybrid buses.

Project as a Prototype

Throughout the United States, there are many suburban areas that have park-and-ride lots that provide a service for drivers for commuting Monday-Friday. These sites do not contribute to the activity of the neighborhood, nor provide an amenity to nearby residents. While this thesis is designed for this specific site, it can be applicable and could serve as a model in suburban locations where high capacity transit modes, particularly bus transit, are being introduced.

This thesis design provides the same parking capacity that currently exists and creates almost 90,000 SF of leasable retail and office space,

while reducing the amount of impervious surface on site. It promotes multimodal use and builds upon Shoreline's vision of the Town Center by creating a walkable dense mixed-use development in an auto-dominated environment. This design can serve as a model for approaches that would be applicable to many other similar sites.

Conclusion

This thesis examines the adaptation of an existing Park-and-Ride covering an area of 6 acres into a dense, multi-modal hub for the city of Shoreline. Since there are no plans to bring light rail into the heart Shoreline, bus rapid transit is a reality to serve transportation needs. The question is, how can bus rapid transit spur dense development in suburban areas? This thesis is a specific case study demonstrating one possibility of using existing park and ride sites for denser levels of development. The parking garage accommodates the existing parking capacity, yet at the same time clears the site for a mix of uses to foster a lively level of activity. With the new development master plans, Aurora Avenue will become a more mixed-use street. While this project is designed for this specific site, it can be applicable and could serve as a model in suburban locations where high capacity transit modes, particularly bus transit, are being introduced.

Given the scale of the project, the emphasis was on developing the initial concept, focused on how best to use the site, how to arrange the elements, how to make the circulation work, how to provide all of the required uses, how to use the parking and the bus terminal to activate other uses on the site, and how to design buildings for this context carried to a schematic level.

The primary challenges this thesis has addressed have been: to create a transit center that caters to the users and residents; promote multi-modal use; address environmental concerns; extend the time of use outside peak transit hours; and respond in a realistic way to the likely future of locations like this that will rely on bus transit not lightrail.

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This article gives the amount of traffic accidents and pedestrian fatalities and injuries on Aurora Avenue. It also shows that speeding is a problem in this corridor.

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"Pedestrian Master Plan". Seattle: Department of Transportation. September 2009. 20 April 2011 <http://www.seattle.gov/transportation/pedestrian_masterplan/default.htm>.

"Town Center Subarea Planned Action Draft SEIS_5_2011". The City of Shoreline: Planning and Development Services. May 2011. The City of Shoreline's proposal for the Town Center Subarea Plan.

"Transportation Master Plan". City of Shoreline. 11 July 2005.

The City of Shoreline proposal for the Transportation Master Plan.

Appendix

Renderings



Site Perspective, Facing NE from Residential Area



Water Play Area and Rain Garden



Pea Patch



Movie Night, Amphitheater



Lower Arcade, Facing North



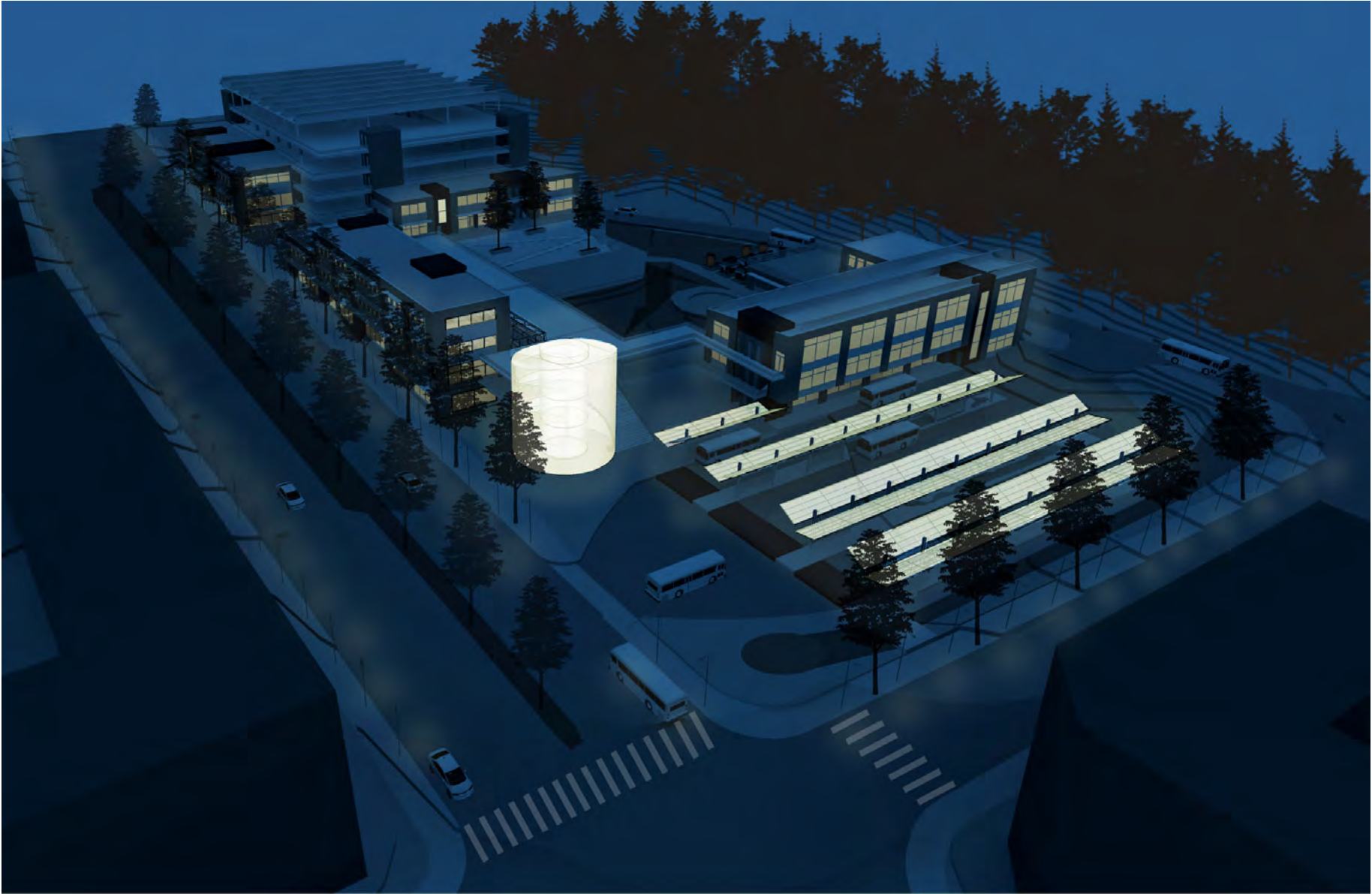
Upper Arcade, Facing South



Bus Waiting Area



Passenger Drop Off Area



Site at Night, Facing South West

