LONG-RANGE DEVELOPMENT PLAN
Shoreline Community College

Student Housing Amendment

4 February 2013

schacht | aslani architects

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At the request of Shoreline Community College (SCC) the Long Range Development Plan (LRDP) is being amended to include on-campus student housing. SCC adopted the LRDP on March 16, 2011, following two prior iterations of master planning and environmental review. The LRDP Housing Amendment describes changes required to accommodate student housing. The Student Housing project is likely to be built during the first phase of the LRDP known as the 15 Year Capital Request Plan that is also part of Master Development Plan ("MDP") phase.

The LRDP Housing Amendment adds a 400-bed student housing project to the LRDP. The chapters noted in this Amendment will be revised and/or supplemented to include information relative to the Student Housing project. The LRDP Housing Amendment includes an Appendix with a new Transportation Technical Report from TSI, transportation consultants. This report replaces the Transportation Technical report in the LRDP document issued in March of 2011. The Appendix also includes Utility Narratives and the Campus Master Drainage Plan Supplement both issued by Reid Middleton, civil engineers. The Proposed Drainage System in the Campus Master Drainage Plan Supplement replaces that section in the previously issued Campus Master Drainage Plan that is in the Appendix of the LRDP. The Utility Narratives have been revised to reflect the Student Housing Project.

A. DEVELOPMENT PLAN

The Student Housing project adds 145,000 gross square feet (GSF) to the campus. The total added GSF during the LRDP is 283,900 GSF. Proposed improvements to the campus site infrastructure require minor changes to accommodate the Student Housing project as noted in the amended Site section below.

D. ACCESS, CIRCULATION & PARKING

The addition of housing does not displace or replace any existing buildings. It will be built on the athletic field on the north side of the internal campus circulation road. The Student Housing project does impact the long term parking supply proposed in the March 2011 LRDP. The Housing Project will reduce the amount of parking that could have been constructed on the athletic fields. This added parking capacity was to mitigate losses that resulted from phased proposed improvements to the campus circulation and parking throughout the LRDP.

C. ACCESS & CIRCULATION

The Student Housing project will be located on the existing athletic fields on the north side of the campus. Although the athletic fields are level there is a steep vegetated slope between the existing internal circulation road and the field for more than half of its length. The east side of the athletic field track is currently a parking lot and is therefore graded appropriately for vehicle access from the existing road. Vehicle access to the housing site, which will accommodate fire trucks as well as automobiles, is proposed to be through this horn shaped parking lot. The steep slopes and their existing vegetation would remain in place. The location of the housing on the north east side of the athletic field away from the steep slopes also preserves access to natural light for the south facing first floor dormitory units.

Parking

MDP Phase: This location for the housing project does impact the existing parking on campus reducing it by about 116 spaces to accommodate the needed vehicular access to the athletic field site. The existing stalls in this horn shaped area on the east side of the track will be replaced in conjunction with the construction of the Student Housing project. The MDP phase of the master plan includes parking for 158 vehicles, 42 for the housing use and 116 to replace the parking lost to creating vehicular access for the Housing project.

LRDP Phase: The athletic fields were to be converted to parking in the last phases of the LRDP. The Student Housing project will reduce this long term parking capacity. Proposed parking supplies for 2040 may not meet forecasted demand resulting in a deficit of up to 425 parking spaces. There are several factors that could mitigate this loss of parking. Online learning programs and increased incentives for trip reduction could result in less demand for on campus parking in 2040. If there is a deficit in 2040, additional off campus parking and/or constructing an on campus parking garage could be solutions to addressing parking demand.

E. INFRASTRUCTURE

The following paragraphs summarize the proposed improvements that would be made to accommodate the Student Housing project as part of the MDP. The revised civil plans showing the Housing project can be found in the Appendix of this LRDP Amendment.

Water Service

Water main improvements are required to serve the proposed master plan build-out for the MDP phase of development. For the Student Housing project to be constructed at the athletic field site, a water main will be extended from the existing 12-inch main south of the athletic field. The extended water main will loop around the new building and connect back to the existing main. Fire hydrants will be installed strategically along the loop to provide fire protection coverage for the new building.

Sanitary Sewer

The athletic fields that will be the site of the Student Housing project are lower than the closest available sewer main. Therefore the Student Housing project will require an on-site lift station. The lift station will pump sanitary sewage from the building to the 8-inch gravity sewer main north of existing Building 2500.

Storm Drainage

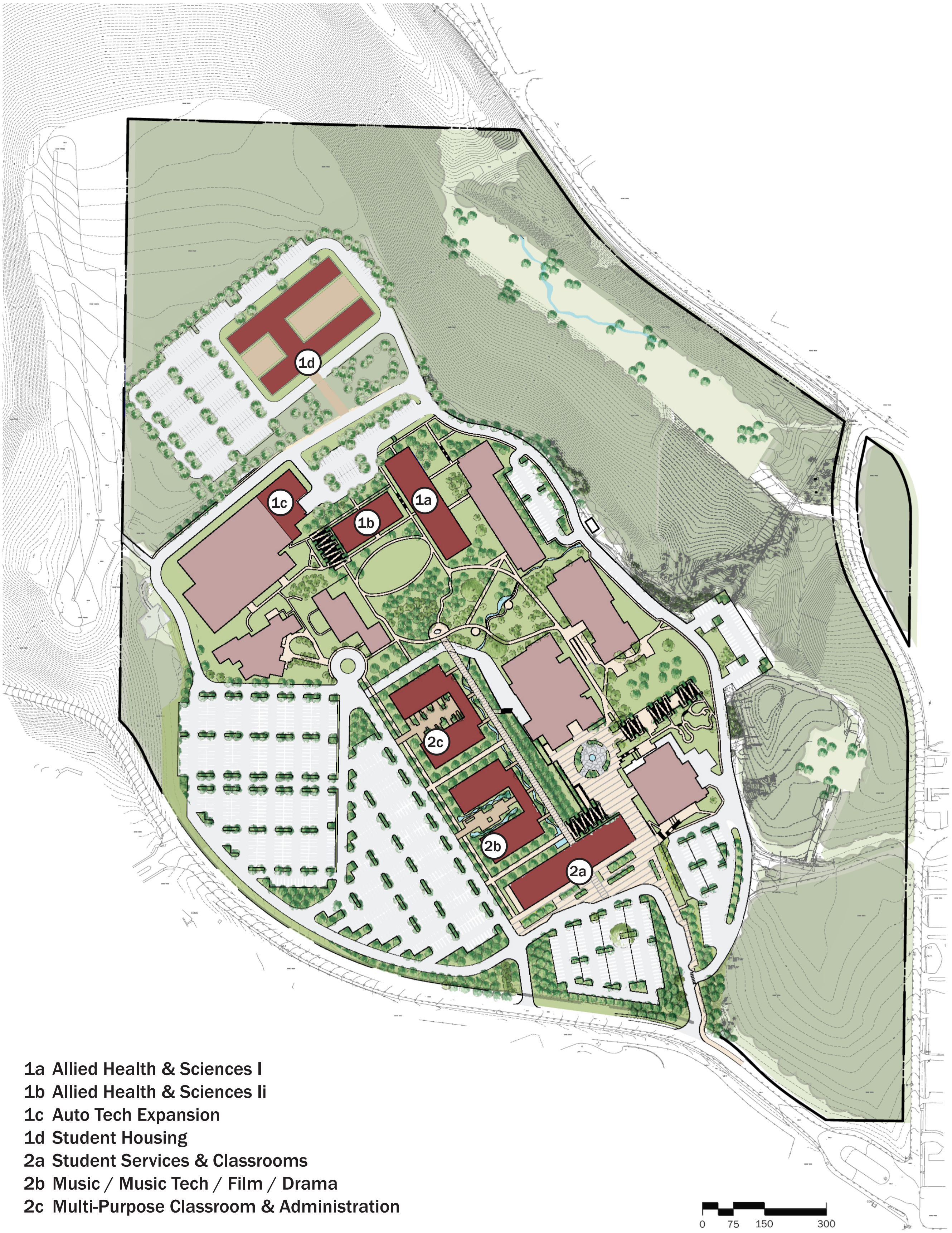
The College storm drainage system has adequate conveyance capacity. It does not, however, meet City of Shoreline requirements for water quality treatment, flow control, or Low Impact Development. The MDP and LRDP propose achieving code compliant solutions on a project by project basis. Proposals include converting the Greenwood parking lot, adjacent to Boeing Creek, into a wet pond for pretreatment and water quality treatment for some projects and providing onsite detention for other projects. The Student Housing project will follow this phased approach to upgrading the campus storm water systems.

The configuration of the drainage basins for the Campus Master Drainage plan will be revised by the addition of the Student Housing project. Basin 1 will increase in size to accommodate the Student Housing project but it will still use the existing storm main to convey the water to Boeing Creek. This storm main has the capacity to accommodate this increased area of Basin 1.

The Student Housing project may be the first project built under the MDP. The Housing project will take advantage of the existing drainage conveyance but will use the onsite approach for water quality treatment and flow control. The timing of the Student Housing project, the type of funding, and the capacity of the proposed future Greenwood wet pond necessitates an onsite solution to stormwater treatment and flow control. The location of the underground detention facility is shown on the revised civil drawings in the Appendix.

Natural Gas

Gas mains and service improvements will be required for the master plan build-out of the MDP development. A new service line will be extended north from the existing line north of Building 2100 to serve the Student Housing project. Revised utilities drawings can be found in the Appendix.



Long-Range Development Plan

A. LONG-RANGE DEVELOPMENT PLAN

The addition of on campus dormitory style housing is planned for the 15-Year Capital Plan which corresponds to the MDP phase of the Long Range Development Plan. The addition of housing does not change the LRDP with the exception of the proposed future parking on the athletic field site. The housing will reduce the amount of parking that could be constructed on the athletic field but the approach to landscaping the parking per the City of Shoreline's Municipal Code requirements will not change. The MDP phase of the master plan includes parking for 158 vehicles. For the LRDP parking can be extended west to cover the entire athletic field to provide an additional 90 parking stalls. This added parking would be designed to have minimal impact if any on the existing steep slopes and vegetation.

The revised Long-Range Development Plan shows the integration of the housing and parking on the athletic field.

B. 15-YEAR CAPITAL REQUEST PLAN & SCOPE OF THE MDP

Student housing (1d) is to be part of the scope of the MDP as shown on the 15-Year Capital Plan. The dormitory style housing will serve primarily international students and will only be open to students of Shoreline Community College. The housing structure will have 400 beds and provide food service for students living there. While existing international students will occupy the housing initially the College estimates that by 2020 an additional 400 FTE's may be on campus occupying the housing.

The Student Housing project is labeled as 1d and as noted below.

1d. Student Housing

145,000 GSF of student housing on the north campus of Shoreline Community College is to be financed privately. The dates of construction and completion are still to be determined.

1. Entry
2. Plaza
3. Upper Green
4. The Forrest
5. The Green
6. Courtyards
7. Landscaped Parking Lot

Long-Range Development Plan - Landscape Plan

D. DEVELOPMENT CAPACITY

15-Year Plan MDP	Build-ing	Existing Use	Year Built	SF Demolished	Future Use	SF of New Building	Net GSF Added	GSF Added per Phase
Project 1a	2400	Greenhouse	1965	1,500	Science & Allied Health I			
	2500	Dental	1972	25,952				
	2600	Biology & Medical Labs	1965	5,820				
	2700	Chemistry	1965	9,400				
	2800	Faculty Offices	1965	4,180				
				46,852		**70,000**	**23,148**	
Project 1b	2100	Automotive	1992	**2,600**	Automotive	**32,400**	**29,800**	
Project 1c	2200	Math	1966	6,270	Science & Allied Health II			
	2300	Nursing	1971	17,589				
				23,859		**40,682**	**16,823**	
Project 1d					Housing	**145,000**	**145,000**	**214,771**

30-Year Plan LRDP	Build-ing	Existing Use	Year Built	SF Demolished	Future Use	SF of New Building	Net GSF Added	GSF Added per Phase
	1000	Administration	1965	13,160	Student Services & Classrooms			
	1100	Lecture	1967	4,367				
	1200	Business	1965	2,690				
	1300	General Labs	1966	13,160				
	1400	Classrooms	1976	6,144				
				39,521		**63,728**	**24,207**	
	1500	Classrooms	1965	10,480	Music & Drama			
	1600	Theater	1965	12,864				
	1700	Classrooms	1965	9,180				
				32,524		**62,202**	**29,678**	
	5000	Classrooms & Offices	1972	**54,756**	Classrooms & Offices	**70,000**	**15,244**	
								69,129
						Total GSF Added in 3 Phases		**283,900**
						Total Current GSF		**497,390**
						Total LRDP GSF		**781,290**

existing tree

proposed tree

proposed planted area

existing forest canopy

1a Allied Health & Sciences I
1b Allied Health & Sciences Ii
1c Auto Tech Expansion
1d Student Housing

15-Year Plan (MDP)

A. CIVIL ENGINEERING

Utility Narratives

Campus Master Drainage Plan Supplement

B. TRANSPORTATION ENGINEERING

Transportation Technical Report

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Project No. 212009.006

Sheet 1 of 7
Design by MAD/DY
Date: Updated 01/24/13
Checked by: DCY

Utility Narratives

The following is the civil utilities section to be included in the final master plan reports.

CONTENTS

FIGURES

SANITARY SEWER SYSTEM

Existing System

The campus sewer system is owned and operated by the Shoreline Community College. The sewer service purveyor is the Ronald Wastewater District. Public sewer service to the campus is provided at the intersection of Carlyle Hall Road NW and Greenwood Avenue NW, where the college system connects to the public system.

The campus sewer main system was constructed with the campus development in the 1960s. Extensions and service connections were added or modified with new buildings and building renovations during the last 40 years. The campus sewer system is a gravity system. It consists of 8-inch, 10-inch, and 12-inch pipes. It generally flows to the northeast. A 10-inch main running in a southwest to northeast direction, from Building 1500 to Building 5000, provides service to buildings in the southern half of the campus. Three separate 8-inch sewer mains provide services to buildings in the northern half of the campus. These sewer mains eventually converge near Building 5000 at the eastern side of the campus. A10-inch sewer main then conveys waste northeast down a steep hill to the Greenwood Parking Lot area. From there, a 12-inch main conveys the sewage to an existing public sewer main in the Carlyle Hall Road NW at the intersection of Carlyle Hall Road NW and Greenwood Avenue NW.

Sewer services to buildings are provided through side sewer lines from college owned and operated sewer mains described above except for the Music Building. The Music Building has a separate sewer service line that discharges directly to the public sewer main in Greenwood Avenue through a side sewer line.

There are two oil/water separators on the college campus providing services to Building 2100 and Building 2900 for building floor drains. One grease interceptor serves Building 800, which has a large kitchen for the student cafeteria. No acid neutralizer exist on the campus.

The college campus is served by a sewer main system that consist of 8-inch and larger pipes. No sewer capacity problem has been reported. No capacity problem is anticipated for future developments. Ronald Wastewater District stated sanitary sewer service will be available for the proposed campus master plan.

The existing sanitary sewer system is shown on Figure 1.0 – Existing Sanitary Sewer System.

Proposed Improvements – 15-Year Plan (MDP)

Sewer improvements will be required for the master plan build-out of the MDP development. The existing 8-inch sewer mains located under the future buildings will be removed. The 8-inch sewer main east of the existing Automotive Center (Building 2100) will be re-routed to make room for the Automotive Center expansion. The grease interceptor outside the existing

Automotive Building Center will be relocated. Side sewer serving Building 1900 will be rerouted to the realigned main east of the Automotive Center.

Gravity side sewer services will be provided to the new buildings from the nearby sewer mains except the Student Housing project. Items such as an oil/water separator, grease interceptor, or acid neutralizer may be required and will be provided as necessary if any of the new building usages include automotive technology, kitchen, or science lab.

For the Student Housing, an on-site lift station will be required. The building will be located at the existing athletic field that is lower than the closest available sewer main. The lift station will pump sanitary sewage from the building to the 8-inch gravity sewer main north of existing Building 2500.

Figure 1.1 – Proposed Sanitary Sewer System for MDP generally depicts proposed sanitary sewer improvements in this phase.

Proposed Improvements – 30-Year Plan (LRDP)

Sewer service improvements will be required for the master plan build-out of the LRDP development. The existing 6-inch side sewer lines and a section of a 10-inch sewer main located under the future buildings will be removed. No sewer main extension is anticipated. One sewer manhole will be added. The new buildings will be served with gravity side sewer lines connecting to nearby existing or new sewer manholes.

Items such as an oil/water separator, grease interceptor, or acid neutralizer may be required if the new building usages include automotive technology, kitchen, or science lab.

Figure 1.2 – Proposed Sanitary Sewer System for LRDP generally depicts proposed sanitary sewer improvements in this phase.

WATER SYSTEM

Existing System

The Seattle Public Utilities provides water for Shoreline Community College. Water is provided to the college campus from a 12-inch public water main along Carlyle Hall Road North. A 12-inch diameter main enters the campus through a master meter at the intersection of Carlyle Hall Road North and Greenwood Avenue North. Shoreline Community College owns and operates the water system downstream of the master meter.

Downstream of the master meter, a 12-inch ductile iron (DI) water main runs southwest through a pump station that provides a pressure boost for the system. The water main then runs uphill to the main campus near Building 3000. The 12-inch DI main branches out and loops the campus along the main circulation route until it reaches Building 1800 in the south and Building 2100 in the north, where the 12-inch DI main branches out to two 8-inch DI mains. The two 8-inch mains create an additional small loop around Buildings 2000 and 2100. Two 8-inch dead-end mains exist at the campus. One is located between Building 1700 and Building 1800. It starts from the main loop southwest of Building 1800 and ends northwest of Building 4000. Another starts from the 8-inch main northwest of the Building 2300, runs west between Buildings 2500 and 2600, and ends north of Building 2900.

Fire hydrants are located along the campus water mains. In addition, dry standpipe systems are extended into the campus interior near Buildings 1400, 1500, and 900. These areas are not accessible for fire trucks. About 50 percent of the campus buildings have fire sprinkler systems. Buildings with fire sprinkler systems are labeled on Figure 3.0. Water services for the fire sprinkler systems are provided from the campus water mains. Domestic water service lines serve each building at the campus. Because the college has a master meter for the entire campus, water service lines to individual buildings are not metered. There are 14 irrigation zones on the college campus. Some of the irrigation systems are metered ("deduct" meters) while some of the irrigation systems are without meters.

The original campus water mains were installed with the campus development in the 1960s. The original water main system consisted primarily of 8-inch asbestos cement pipes. The campus water main improvements project in 2004 to 2005 replaced most of the original water mains with ductile iron pipes in larger sizes. One exception is the dead-end main running between Building 2500 and Building 2600 and from Building 2300 to the dead end remains asbestos cement. A pump station was constructed with the water main improvement in 2004. Pressure reducing valves were added to Buildings 900, 2000, 2100, 2300, 2400, 2500, 2700, 2900, 3000, 4000, and 5000.

Static water pressure at the campus varies considerably due to campus topography. At the master meter, the average static pressure is about 87 psi. The Seattle Public Utilities system is able to deliver a large flow to the master meter. The pump station is able to deliver 3,200 GPM water flow at 65 psi to the highest point on the campus. With the pump station and large flows available at the master meter, the college water system is capable of providing required water flow and pressure for future developments on the campus.

A temporary second connection to the college water system from the public water main was installed near the college main entrance on Innis Arden Way in the campus water main improvements project in 2004. After the pump station and the water main replacements commenced, this second connection was shutoff and locked. It is now inactive.

Details of the existing water system are shown on Figure 3.0 – Existing Water Main System.

Proposed Improvements – 15-Year Plan (MDP)

Water main improvements are required to serve the proposed master plan build-out for the MDP development. The existing asbestos cement dead end water main, that will be located under the proposed buildings, will be removed. A portion of the existing 8-inch looped system east of the Building 2100 will be realigned for the building expansion. Domestic water service lines to the existing buildings will also be removed.

A new water main will be extended south into the campus interior through the area between the two proposed buildings in MDP and connects to the existing 8-inch dead end south of Building 1800 to create a small loop. New fire hydrants will be installed and connected to this new main to accommodate fire protection coverage for the new buildings. The new water main extension will also provide a connection for the water main loop to be completed in the future master plan phases in the campus interior. The new fire hydrants located in the south end of MDP phase will also improve extra fire protection coverage for the existing Building 2900.

For the Student Housing project to be constructed at the athletic field area, a water main will be extended from the existing 12-inch main south of the athletic field. The extended water main will loop around the new building and connect back to the existing main. Fire hydrants will be installed strategically along the loop to fire protection coverage for the new building.

Water services for domestic and building fire sprinkler systems will be provided to each building from the nearby water mains. Fire department connections will be provided for the two proposed buildings and the Building 2100 addition. Post indicator valves will be installed in each fire sprinkler service line. Backflow prevention assemblies will be provided either inside or outside each building for the fire sprinkler systems.

Irrigation improvements are anticipated for this development phase. If the MDP area is in one of the irrigation zones without meter, the proposed irrigation system will be metered to reduce sewer charges that are based on domestic water consumption.

General water system improvements are shown on Figure 3.1 – Proposed Water System for MDP.

Proposed Improvements – 30-Year Plan (LRDP)

Water main improvements are required to serve the proposed master plan build-out for the LRDP development. Water service lines to existing buildings will be removed as they will lie underneath the proposed building locations. The existing 8-inch water main between existing buildings 1700 and 1800 will be removed. A new water main will be installed to provide connections for new fire hydrants in the interior of the college campus. The new main will connect to existing water main west of the existing Building 1700, run east to the south end of the water main extended in MDP, run south from there, and then turn west and connect to the existing water main by the southwest parking lot to complete the interior campus loop. New fire hydrants will be installed along this new main. Water services to the Library (Building 4000) will also be reconnected to this new water main.

Water services for domestic and building fire sprinkler systems will be provided to each proposed building from the nearby water mains. Fire department connections will be provided for all proposed buildings. Post indicator valves will be installed in each fire sprinkler service line. Backflow prevention assemblies will be provided either inside or outside each building for the fire sprinkler systems.

Irrigation improvements are anticipated for this development phase. The improvements include replacing and relocating the existing irrigation meter and any cross connection control devices.

General water system improvements for this phase are shown on Figure 3.2 – Proposed Water System for LRDP.

NATURAL GAS

Existing System

The natural gas system at the college campus is owned and operated by Puget Sound Energy (PSE). The campus gas pipe system originates from a 4-inch gas main at the intersection of Carlyle Hall Road NW and Greenwood Ave NW. The 4-inch gas line runs southwest, continues up the hill to the main college campus, and extends southeast of Building 1500. The gas main branches into two 2-inch lines running in south and north directions. The south line provides services to buildings at the south end of the campus. The north branch runs northwest to provide gas services to buildings on the remainder of the campus. Each building is equipped with an individual gas meter.

The campus gas system was installed with the campus development in the 1960s. Extensions and modifications were made with the campus evolutions in the last 40 years. The gas main system consists of mostly 2-inch and 4-inch lines. The system is assumed adequate for the college's future developments because the master plan build-outs are to replace existing small buildings without expanding the overall building floor square footages except for the addition of the Student Housing project. No statement from PSE is available.

Figure 4.0 – Existing Gas Main System provides general information about the gas main routings in the campus.

Proposed Improvements – 15-Year Plan (MDP)

Gas mains and service improvements will be required for the master plan build-out of the MDP development. Existing gas lines, meters, and valves located under future buildings will be removed. The gas main north of the existing Building 2200 will be rerouted to accommodate new building construction and Building 2100 expansion. A new service line will be extended north from the existing line north of Building 2100 to serve the Student Housing project. The service line to Building 2900 will be re-routed to make room for new building construction. Gas meters, service lines, and valves will be installed for each new building. See Figure 4.1 – Proposed Gas System for MDP for the proposed natural gas system in this phase.

Proposed Improvements – 30-Year Plan (LRDP)

Gas main and service line improvements will be required for the master plan build-out of the LRDP development. Existing gas lines, meters, and valves located under future buildings will be removed. Re-routing of the existing gas main from existing Building 1500 to Building 1700 will be required for providing gas services to the new buildings and buildings in the northern part of the campus. Gas service lines with meters and valves will be installed for each new building. See Figure 4.2 – Proposed Gas System for LRDP for the proposed natural gas system.

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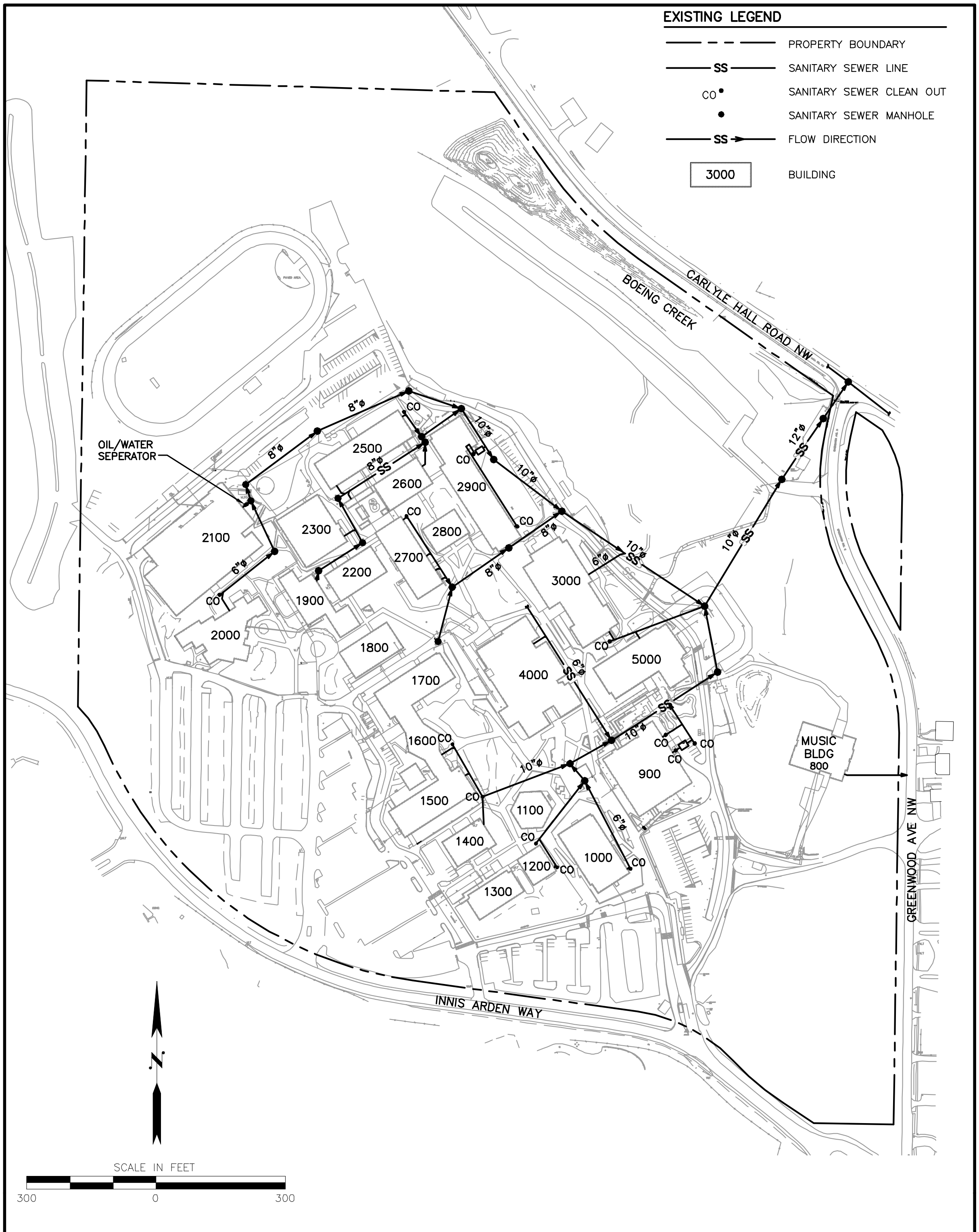

FIGURE 1.0 – EXISTING SANITARY SEWER SYSTEM

SHORELINE COMMUNITY COLLEGE
CAMPUS MASTER PLAN

PRELIMINARY

DEC. 15, 2010

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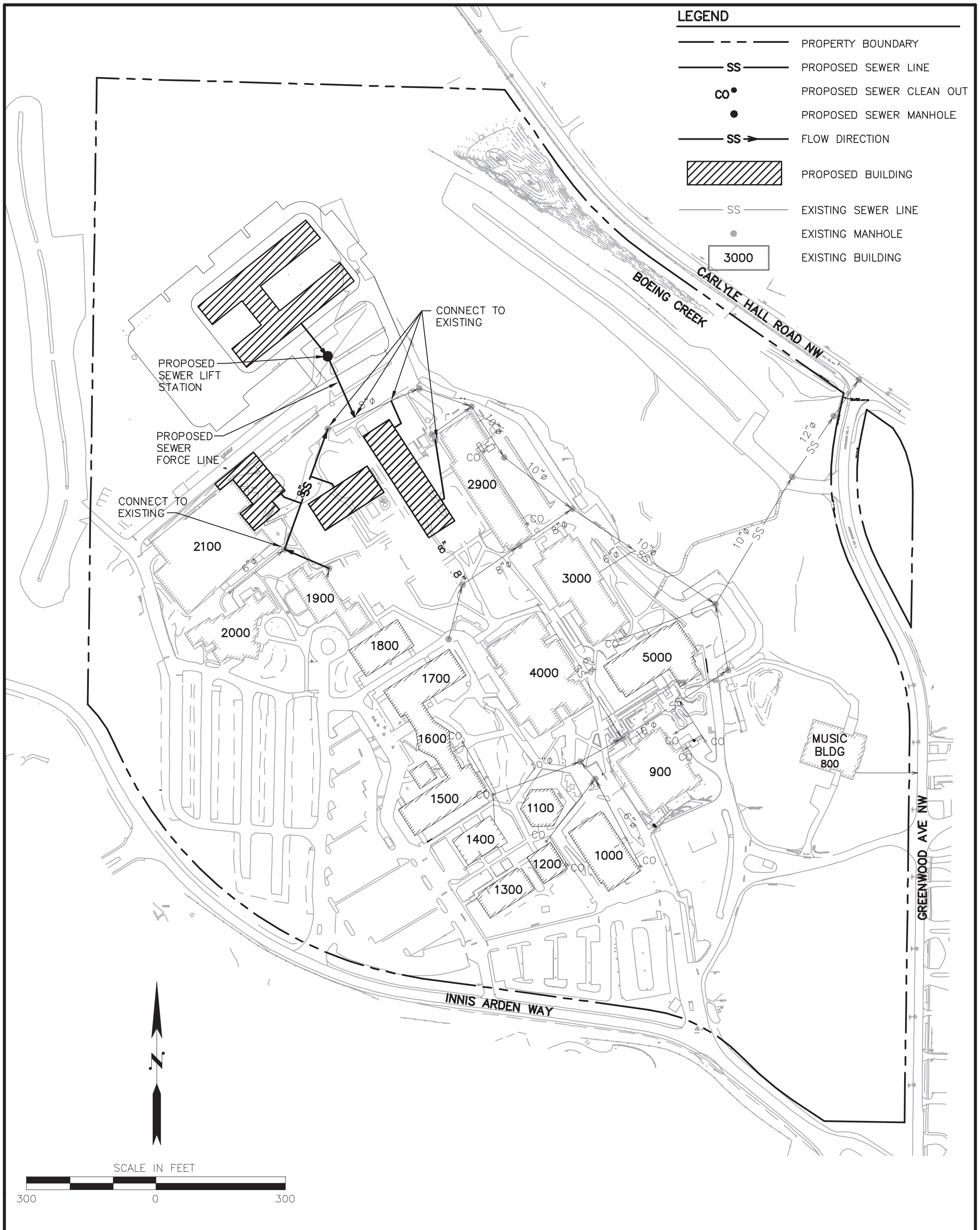

FIGURE 1.1 – PROPOSED SANITARY SEWER SYSTEM FOR MDP

SHORELINE COMMUNITY COLLEGE
PRELIMINARY CAMPUS MASTER DEVELOPMENT PLAN JAN 23, 2013

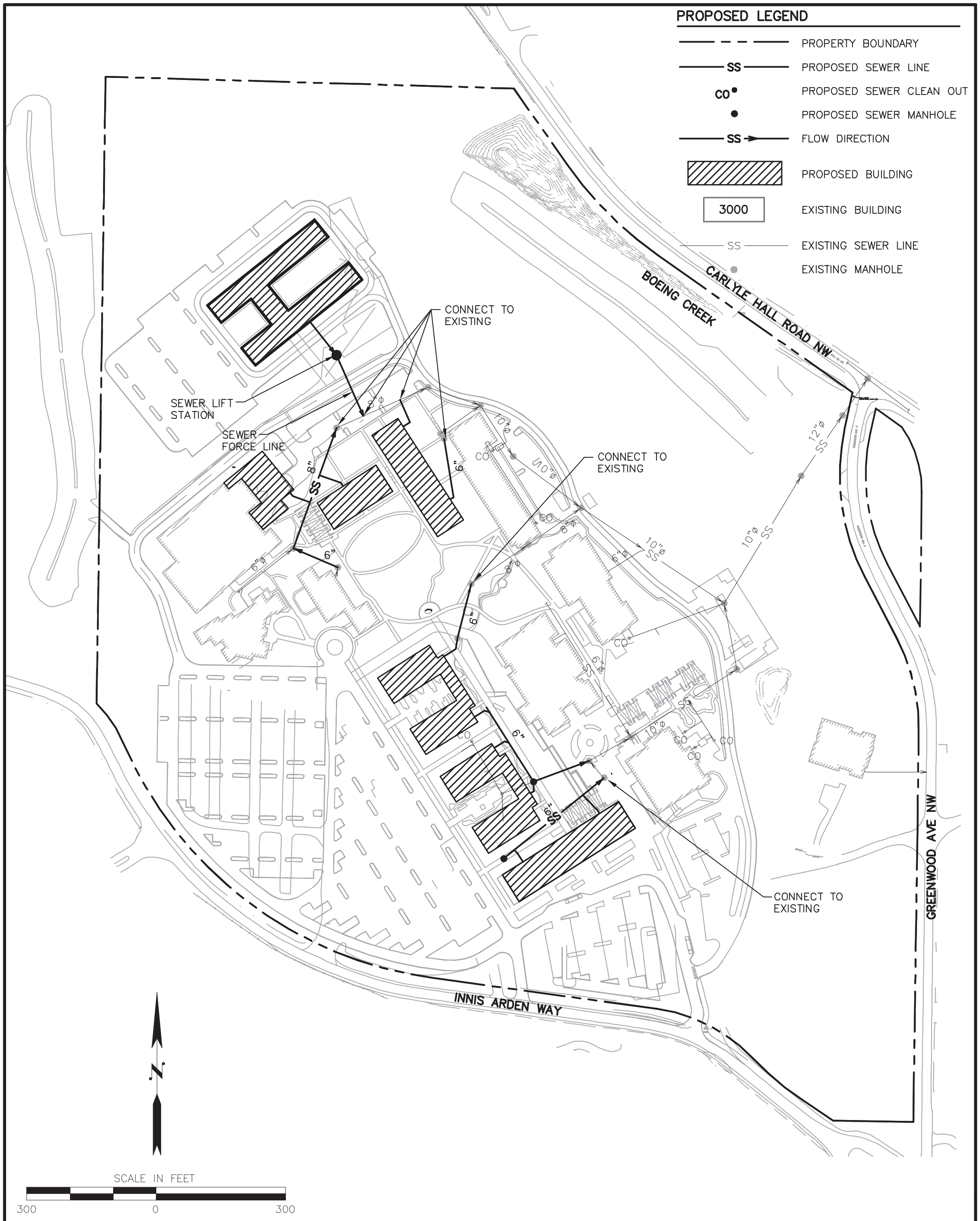

FIGURE 1.2 – PROPOSED SANITARY SEWER SYSTEM FOR LRDP

PRELIMINARY

SHORELINE COMMUNITY COLLEGE
CAMPUS MASTER DEVELOPMENT PLAN

JAN 23, 2013

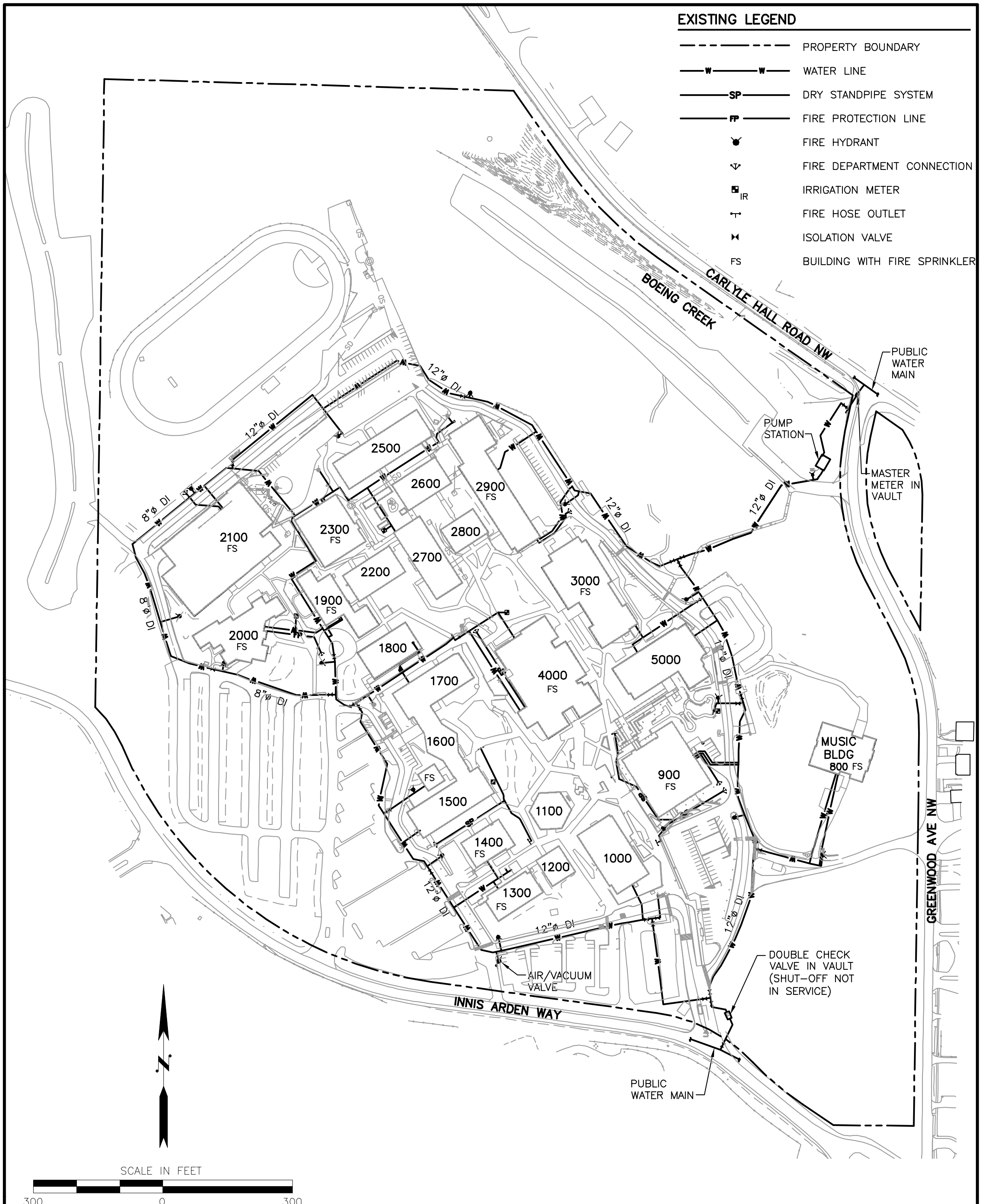

FIGURE 3.0 – EXISTING WATER SYSTEM

PRELIMINARY

SHORELINE COMMUNITY COLLEGE
CAMPUS MASTER PLAN

DEC. 15, 2010

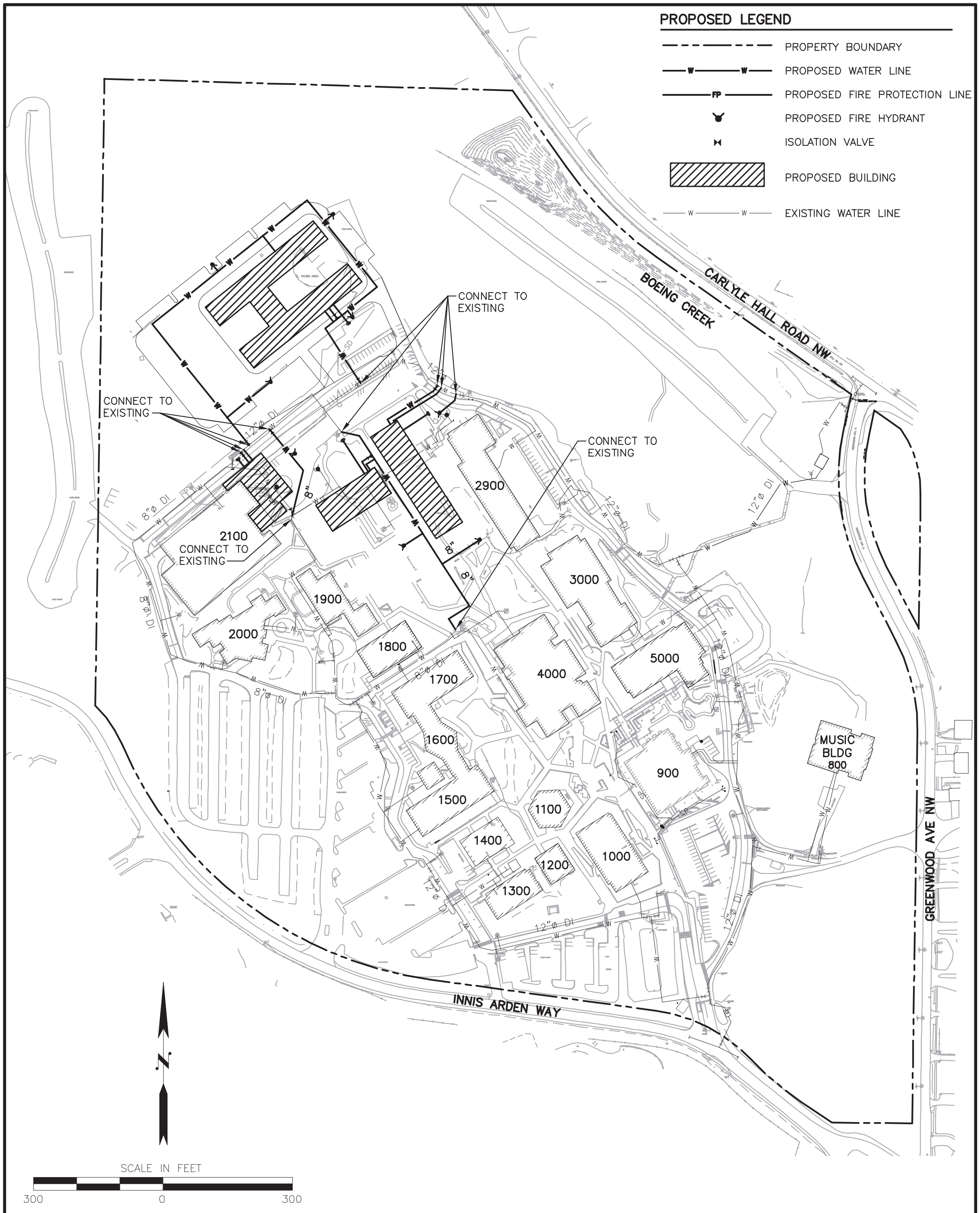

FIGURE 3.1 – PROPOSED WATER SYSTEM FOR MDP

SHORELINE COMMUNITY COLLEGE
CAMPUS MASTER DEVELOPMENT PLAN

PRELIMINARY

JAN 23, 2013

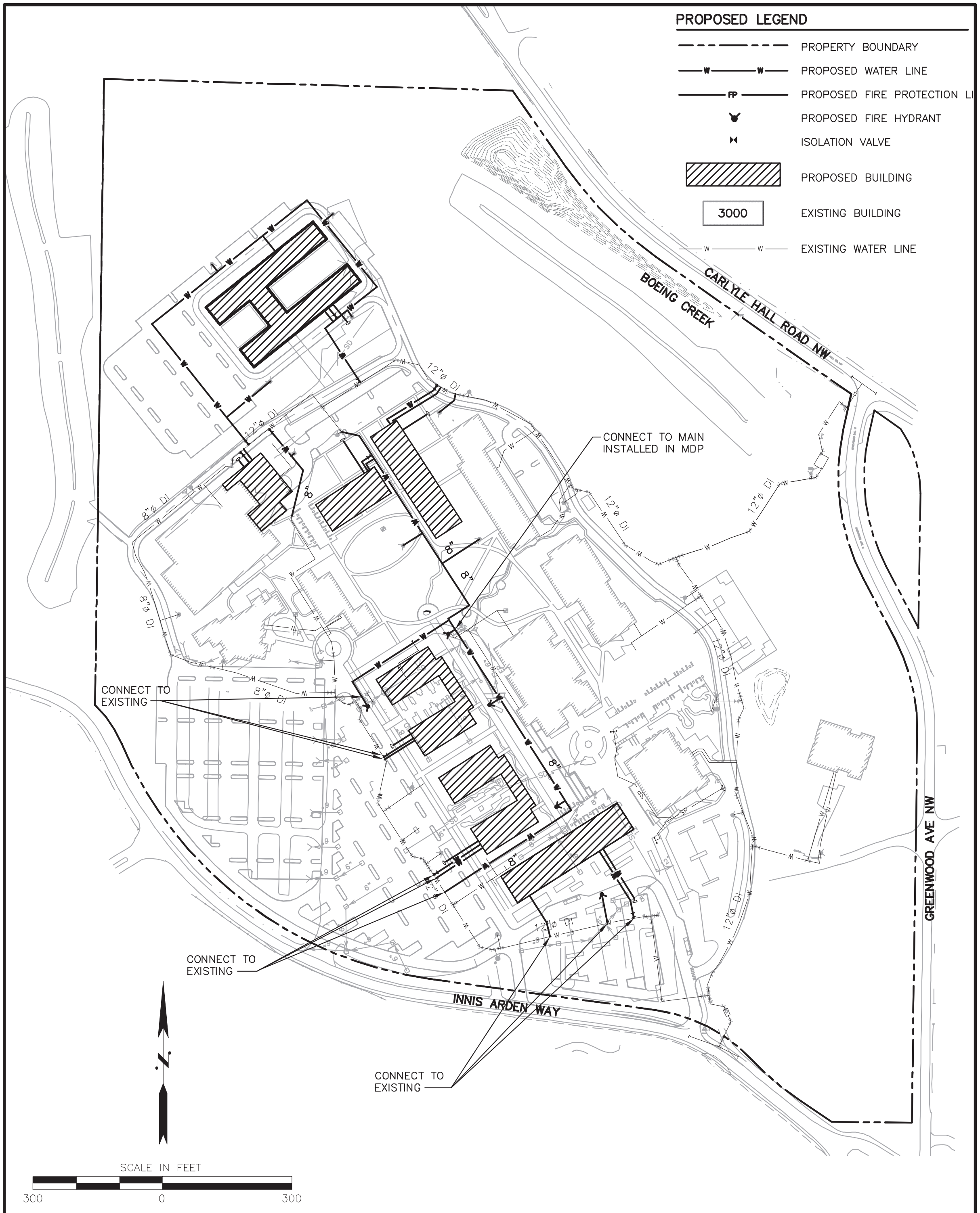

FIGURE 3.2 – PROPOSED WATER SYSTEM FOR LRDP

PRELIMINARY	SHORELINE COMMUNITY COLLEGE CAMPUS MASTER DEVELOPMENT PLAN	JAN 23, 2013

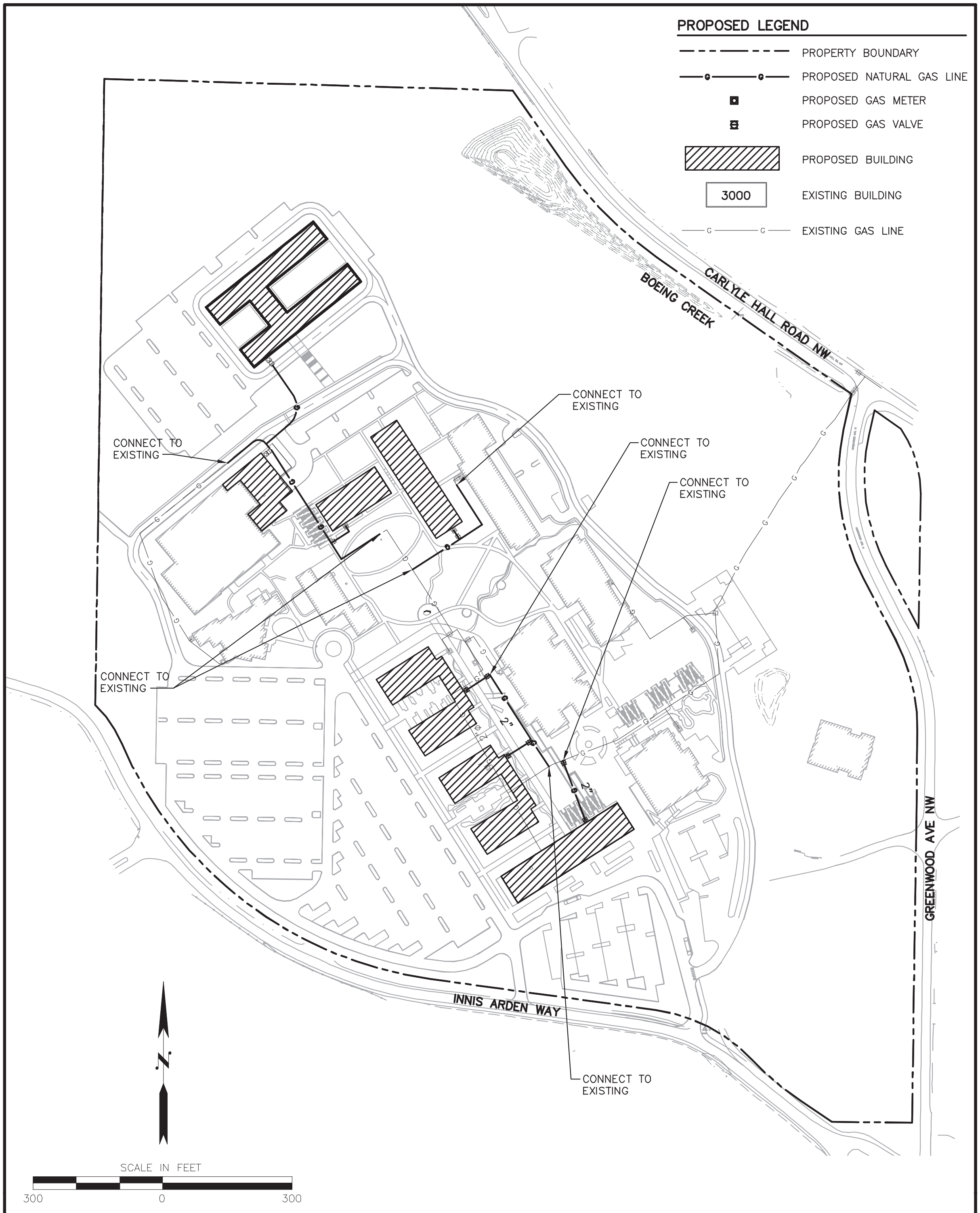

FIGURE 4.2 – PROPOSED GAS SYSTEM FOR LRDP

PRELIMINARY

SHORELINE COMMUNITY COLLEGE
CAMPUS MASTER DEVELOPMENT PLAN

JAN 23, 2013

Campus Master Drainage Plan Supplement for

Shoreline Community College

State Project No. 2008-833

Prepared for Schacht Aslani Architects

February 2013

ReidMiddleton 1953 – 2013

Campus Master Drainage Plan Supplement

Shoreline Community College
State Project No. 2008-833

February 2013

The engineering material and data contained in this report were prepared under the supervision and direction of the undersigned, whose seal as a registered professional engineer is affixed below.

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INTRODUCTION

This document revises and replaces the Proposed Drainage System section of the Campus Master Drainage Plan for Shoreline Community College (College), State Project No. 2008-833, dated March 2011. The campus Master Drainage Plan was developed and submitted to the City of Shoreline (City) in January 2011 for initial review and comment. The City's review comments were incorporated into the March 2011 edition of the Master Drainage Plan.

The Campus Master Drainage Plan is revised to respond to the additional development of the Student Housing project. The Shoreline Community College (College) decided to develop a Student Housing project at the existing athletic field after the Master Drainage Plan was completed. This decision changed the planned use of the existing athletic field and development sequence of the original College master plan. The existing athletic field was allocated originally as a parking lot in the College's Long Range Development Plan (LRDP) that covers the College's planned development up to 30 years.

The Student Housing project will change the planned use of the athletic field and move the redevelopment at that area from the LRDP timeframe to the Master Development Plan (MDP) lifetime. The MDP covers the College's planned developments for the next 15 years. These changes in proposed land use and development sequence necessitate the revisions of the Campus Master Drainage Plan.

No major building, site, drainage, or utility improvements have occurred at the college campus in the last two years (since the Campus Master Drainage Plan was completed in March 2011); therefore, this supplement revises only the Proposed Drainage System section of the Campus Master Drainage Plan to respond to the additional planned development of the Student Housing project. The revised Proposed Drainage System section shall supersede the original one. The rest of the Campus Master Drainage Plan remains valid and unchanged.

The City's Surface Water Management Code (Shoreline Municipal Code Chapter 13.0) and Stormwater Manual (*2005 Stormwater Management Manual for Western Washington* by Washington State Department of Ecology) have not been revised since March 2011. However, Washington State Department of Ecology issued the *2012 Stormwater Management Manual for Western Washington* (2012 Ecology Manual) in August 2012, and the City will likely adopt the new 2012 Ecology Manual some time during the Master Drainage Plan's lifetime. For this reason, the 2012 Manual requirements were considered during preparation of this supplement. The newest available Western Washington Hydrology Model (WWHM Version 3) was used for preliminary sizing, stormwater detention, infiltration, and water quality treatment facilities.

PROPOSED DRAINAGE SYSTEM

The proposed drainage system for the Shoreline Community College campus is developed to respond to the college MDP and LRDP. The proposed system will service the planned new developments and gradually improve the existing system campus wide to meet the City's code requirements for stormwater management.

The proposed drainage system improvements take advantage of the existing conveyance systems, the college campus topography, and soil conditions at the college campus. Development phases, sequence, and low impact development (LID) requirements are considered and coordinated. The proposed drainage system improvements are based on the LRDP and the City's current code requirements.

The proposed drainage system improvements maintain the same number of drainage subbasins as the existing conditions. The general discharge locations of each subbasin are not changed; however, the boundary of each subbasin is adjusted to meet the development size, phasing, and sequencing requirements.

The area to be redeveloped in the 15-year MDP is within Basin 1. LRDP will redevelop a small portion of Basin 1 and areas in Basins 2 and 4. Impervious area information for each redevelopment and drainage threshold is shown in Tables 1 and 2.

Table 1. Impervious Area Information - Threshold Discharge Area East.

		Total Area (acres)	** Existing Impervious (acres)	* Proposed Impervious (acres)
Threshold Discharge Area East (Basins 1,2,3, & 5)	MDP (Basin 1)	12.7	8.5	9.7
	LRDP (Basins 1&2)	31.8	21.8	24.3
	Threshold	65.1	28.7	31.2

* Assumed 80 percent impervious coverage of building development areas in Basins 1 and 2 and 95 percent impervious coverage in parking lots. No proposed impervious coverage in Basins 3 and 5.

** Based on proposed basin boundary as shown on Figure 4.

Table 2. Impervious Area Information - Threshold Discharge Area West.

		Total Area (acres)	** Existing Impervious (acres)	* Proposed Impervious (acres)
Threshold Discharge Area West (Basin 4)	MDP (Basin 1)	N/A	N/A	N/A
	LRDP (Basin 4)	10.3	6.2	9.3
	Threshold	11.7	6.2	9.3

* Assumed 90 percent impervious coverage of redevelopment area.

** Assumed compacted gravel area as 100 percent impervious.

See Figure 4 for subbasin information in proposed conditions. See Figure 5 for boundary information of the 15-year MDP and LDRP.

Conveyance Systems

The proposed improvements will take advantage of the existing drainage system at the College campus. Many of the existing storm drainage mains will remain to service the proposed long range development plans, including the two storm mains coming down the hill from central campus to Boeing Creek.

The College campus will maintain the same five drainage subbasins in the master planned developments as in the existing conditions. Basin 2 will be expanded at its southeast corner into existing Basin 5 to include the parking areas near the college main entrance on Innis Arden Way. Its northern boundary will, however, retreat for development phasing reasons. Basin 1 will be expanded into existing Basins 2 and 3 to include the entire MDP area and a small area of LRDP west of the existing athletic field. Stormwater runoff from proposed development at the existing athletic field will be diverted eastward to drain downhill to the Greenwood parking lot and then to Boeing Creek.

Just as it does currently, stormwater runoff from Basins 1 and 2 will be collected into underground pipe systems through yard drains, catch basins, and roof drain collections. New branch collection systems will be provided for the new development in the subbasins. The collected water is conveyed east by the underground pipe systems. Instead of discharging directly into Boeing Creek as in the existing conditions, the collected water will be intercepted and conveyed to retention and water quality treatment facilities for flow control and water quality treatment. Overflow and controlled flows will discharge to the regional detention pond behind M1 Dam in Boeing Creek. See "Options for Detention and Water Quality Treatment and Mitigation Measures" paragraph for more information about retention and water quality treatment.

In Basin 4, stormwater runoff from the parking lots will be collected into an underground conveyance system through yard drains and catch basins. The collected water will be conveyed to an underground detention system for flow control. Released water from the detention facility will be treated by an underground facility for water quality treatment before being discharged to a ravine, which drains to the roadside ditch along Innis Arden Way.

Basin 5 is primarily a forested area. Stormwater runoff from this subbasin drains to Boeing Creek either in sheetflows or through ditches. No development is proposed in the LRDP for this subbasin except for transferring the Greenwood parking lot into an infiltration pond. No improvement of the conveyance system is required.

Basin 3 will be primarily a forested area after converting the existing athletic field to Basin 1 for redevelopment. Stormwater runoff from this subbasin drains to Boeing Creek in sheetflows. No development is proposed in the LRDP for this subbasin. No improvement of the conveyance system is required.

Capacity of the two major storm mains conveying runoff downhill from the central campus area to Boeing Creek were checked and verified. Stormwater runoff from 25-year, 24-hour storm events were used for capacity calculations according to the City's code requirement. Preliminary calculations for the pipe capacity checks are included in Appendix F.

Figure 6 shows the conveyance systems for the overall development plan of the College.

01/25/2013 9:41am I:\21\2009\006 Shoreline CC Master Plan\Campus Master Plan and LRDP\Master Drainage Plan\FIG 4-1906.dwg

SHORELINE COMMUNITY COLLEGE SHORELINE COMMUNITY COLLEGE MASTER DRAINAGE PLAN	DATE JAN. 23, 2013 DES. DCY	ReidMiddleton	728 134th Street SW - Suite 200 Everett, Washington 98204 Ph: 425 741-3800
FIGURE 4 — PROPOSED DRAINAGE BASINS	DR. CSM CH. DCY FILE NO. 21-2009-006		


01/31/2013 2:03pm I:\21\2009\006 Shoreline CC Master Plan\Campus Master Plan and LRDP\Master Drainage Plan\FIG 5-1906.dwg
PRELIMINARY
LEGEND:
PROPERTY BOUNDARY
DRAINAGE BASIN BOUNDARY
470
EXISTING CONTOUR LINE
MDP DEVELOPMENT AREA
LRDP DEVELOPMENT AREA
3000
EXISTING BUILDING TO REMAIN
INNIS ARDEN WAY
GREENWOOD AVE. NW
CARLYLE HALL ROAD NW
BOEING CREEK
BASIN 5
BASIN 4
BASIN 2
BASIN 1
BASIN 3
BASIN 3
BASIN 5
MUSIC BLDG 800
900
4000
3000
2000
1900
2100
2900
SCALE IN FEET
100 0 100 200
"L"
NOTE:
IF "L" DOES NOT MEASURE 1"
ADJUST SCALES ACCORDINGLY.
SHORELINE COMMUNITY COLLEGE
SHORELINE COMMUNITY COLLEGE MASTER DRAINAGE PLAN
PROPOSED MDP AND LRDP BOUNDARY
FIGURE 5
DATE: JAN. 23, 2013
DES: DCY
DR: CSM
CH: DCY
FILE NO: 21-2009-006
ReidMiddleton
728 134th Street SW - Suite 200
Everett, Washington 98204
Ph: 425 741-3800


01/25/2013 9:43am I:\21\2009\006 Shoreline CC Master Plan\Campus Master Plan and LRDP\Master Drainage Plan\FIG 6-1906.dwg
NOTES:
1 CONNECT TO EXISTING STORM LINE/CATCH BASIN.
2 INTERCEPT EXISTING STORM LINE WITH CATCH BASIN.
3 UNDISTURBED AND UNIMPROVED DRAINAGE.
LEGEND:
PROPERTY BOUNDARY
PROPOSED STORM DRAINAGE LINE (12" DIA UNLESS NOTED OTHERWISE
EXISTING STORM PIPE TO REMAIN
CREEK/DITCH
FLOW DIRECTION
PROPOSED BUILDING
EXISTING BUILDING TO REMAIN
EXISTING CONTOUR LINE
EXISTING CULVERT
PROPOSED CATCH BASIN/MANHOLE
PROPOSED CATCH BASIN
EXISTING CATCH BASIN/MANHOLE
EXISTING CATCH BASIN
PRELIMINARY
INNIS ARDEN WAY
USE PERMEABLE PAVEMENT WEST OF ACCESS ROAD IF FEASIBLE
REGULAR PAVEMENT
ACCESS ROAD
UNDERGROUND DETENTION SYSTEM
OUTFALL
UNDERGROUND WATER QUALITY FACILITY
UNDERGROUND DETENTION VAULT
GREENWOOD AVE NW
MUSIC BLDG 800
900
4000
3000
2900
2000
1900
2100
PRE-SETTLEMENT AND WATER QUALITY POND
INFILTRATION POND
ABANDON EXISTING OUTFALL
CARLYLE HALL ROAD NW
BOEING CREEK
FLOW CONTROL STRUCTURE
ABANDON IN PLACE
REPLACE EXISTING OUTFALL, 24"φ
MI DAM
SCALE IN FEET
100 0 100 200
NOTE: IF "1" DOES NOT MEASURE 1" ADJUST SCALES ACCORDINGLY.
SHORELINE COMMUNITY COLLEGE
SHORELINE COMMUNITY COLLEGE MASTER DRAINAGE PLAN
PROPOSED STORM DRAINAGE SYSTEM – LRDP
FIGURE 6
DATE: JAN. 23, 2013
DES. DCY
DR. CSM
CH. DCY
FILE NO. 21-2009-006
ReidMiddleton
728 134th Street SW - Suite 200
Everett, Washington 98204
Ph: 425 741-3800

Options for Detention and Water Quality Treatment and Mitigation Measures

Open pond, underground vault, and pre-cast underground module systems are feasible options for flow control depending on locations, soil conditions, and land availability. Pre-cast underground module systems are the best fit for the parking lot that drains to the roadside ditch along Innis Arden Way. The existing soil in the parking lot is glacial till that has minimal infiltration capacity. To maximize the available parking area, open pond is not feasible for this area.

Infiltration ponds in the Greenwood parking lot provide a regional solution for flow control for most of the areas in the campus that drain east to Boeing Creek. The sandy soil in the parking lot has high infiltration capacity. The parking lot is at a lower elevation than both storm mains conveying runoff from the central campus to Boeing Creek. The infiltration pond will have capacity for redevelopment of the campus areas that drain east to Boeing Creek, except for the existing athletic field. Development at the existing athletic field will require an on-site stormwater detention system.

An underground vault would be a good choice for the Student Housing development project at the existing athletic field. Although this area will drain east to Boeing Creek and can theoretically use the infiltration pond to be constructed in the Greenwood parking lot, the capacity of the infiltration pond, the project funding, timing, and needed parking areas require development at this area to have an on-site detention system. The existing soil in the athletic field is glacial till with minimal infiltration capacity. To maximize parking and development areas and minimize the detention facility footprint, an underground vault is the best fit for this area.

For stormwater quality treatment, both wet pond and media filters can be a good fit for the college campus. Due to limited available space in the southwest parking area, underground media filters are best for this area. For the portion of the campus that drains eastward to Boeing Creek, ponds in the Greenwood parking lot will provide pretreatment for infiltration and water quality treatment.

Rain gardens/bioretention can be used in open spaces for small areas for both water quality treatment and retention. However, due to limited open areas available in the college campus, rain gardens/bioretention can only be used as an LID design feature and a supplement for water quality treatment and runoff control. Rain gardens/bioretention alone cannot satisfy the City's code requirements for water quality treatment and flow control mitigation.

Figures 6 and 7 show locations and approximate sizes of the proposed detention and water quality treatment facilities for the overall campus development. Appendix F shows the preliminary sizing calculations of these facilities. Calculations are based on the *2012 Stormwater Management Manual for Western Washington* by Washington State Department of Ecology (2012 Ecology) requirements and calculation method. It is assumed for preliminary calculations that 80 percent of the central areas and 90 to 95 percent of the parking lots are impervious. Permeable pavements are assumed to be used in the western half of the southwest parking lot and the parking lot in the existing athletic field if feasible; however, these areas are assumed impervious in the calculations.

Applicable Low Impact Development (LID) Design

Developments outlined in the LRDP will replace existing small buildings at the College campus with fewer larger buildings. The master-planned development will have smaller building footprints, more open spaces, and smaller impervious areas than the existing conditions in the college campus. It will increase vegetated areas through landscaping improvements. In addition, the master-planned development will focus on redeveloping the developed areas. Existing forests outside the current developed areas will remain. The LRDP is taking an LID approach.

Besides reducing impervious areas, maximizing vegetated open space, and protecting existing forests, other LID techniques applicable to the college redevelopment include permeable pavements, rain gardens, and water infiltration.

Permeable Pavements

Permeable pavements (including permeable pavers, asphalt, concrete, and plastic grid systems) can be used on the campus. These pavements can be used on plazas, pathways, driveways, and parking lots. The lower portion of the southwest parking lot by Innis Arden Way and the parking lot on the existing athletic field are possible locations for permeable pavements, if feasible. Central campus open space pathways are other potential permeable pavement locations.

Use of permeable pavements will encourage water infiltration and reduce stormwater runoff. However, due to the limited infiltration capacity of most of the on-site soils, only minor rainfall events will infiltrate permeable pavements. The infiltration rate will decrease further as the site soils become saturated during the rainy season. Stormwater runoff collection systems (such as catch basins, ditches, and underground pipes) are consequently required for runoff generated from most storms.

Permeable pavements should not be placed at locations where the water that is allowed to drain through the permeable surface and into the subgrade may damage adjacent improvements. Examples include areas adjacent to buildings where the subgrade slopes toward the building and adjacent to buildings with basements.

Rain Gardens

Rain gardens with proper planting soils can be used over all of the college campus. Rain gardens can be used for stormwater detention and water quality treatments. Small and scattered rain gardens over the campus will encourage rainwater infiltration in localities. Rain gardens in the LRDP are proposed in open spaces in the central campus and some available landscaping areas in the parking lots; however, rain gardens can only be used for small areas or as supplemental features for stormwater management because of the limited available open spaces and limited infiltration capacity of the on-site soils. Rain gardens alone may be able to provide water quality treatment for small projects but cannot provide adequate stormwater detention and water quality treatments for the entire college campus. Rain gardens are not included in the preliminary sizing of stormwater detention and water quality treatment features because of their limited effectiveness.

<u>Infiltration</u>

Surficial soils at Shoreline Community College are either glacial till or advance outwash, depending on the location. Advance outwash is a sandy soil that has high infiltration capacity. The advance outwash soils occur in scattered pockets in the northeast part of the college campus. The Greenwood parking lot is the largest area that has sand deposits capable of infiltration. Pockets of sand deposits also exist in the athletic field and area north of the Library building. The Campus MDP proposes a large infiltration pond at the Greenwood parking lot for stormwater runoff from most of the developed parts of the campus. Permeable pavements are proposed for the parking lot at the athletic field and some paths in the central campus area.

The water infiltration facility should be placed away from the top of steep slopes. Infiltration near the steep slopes will increase the potential of slope instability. The minimum setback, according to the City's requirements, is 50 feet. The setback may be reduced if geotechnical studies demonstrate that setback reduction will not threaten the stability of the steep slopes.

The proposed infiltration pond in the Greenwood parking lot should be set back from the toe-of-slope to the west and from Boeing Creek regional retention pond to the east. The pond should also be built outside the creek buffer. Further geotechnical investigation of subsurface soils is required for the pond design and setback requirements.

Implementation Phasing

The proposed stormwater drainage system improvements are planned to support the LRDP. The proposed improvements cannot be implemented in a single project due to state project funding regulations. They must be implemented in phases, as needed, to support individual development projects.

The LRDP identifies two development phases:

1. MDP includes building projects anticipated within 15 years.

2. LRDP includes buildings anticipated beyond 15 years and extending to 30 years, as required for the state master plan.

Figure 7 shows the storm drainage improvements in the MDP area. Figure 6 shows the overall drainage system improvements proposed for the LRDP.

MDP development generally includes new buildings anticipated northwest of the Library (Building 4000) and northeast of the ridge that defines the west edge of drainage to Boeing Creek. The storm drainage improvements required to support MDP include:

- A new conveyance system around the proposed buildings and to the top of the steep slope to the northeast. (The existing pipe system will convey stormwater from the top of the steep slope to the Greenwood Avenue parking lot.)
- A pretreatment and water quality pond.
- An infiltration pond.
- A reconstructed outfall to Boeing Creek using the existing stormwater outfall and piping to the extent possible.
- An on-site stormwater management (detention and water quality treatment) system for the Student Housing project at the athletic field.

The pretreatment and water quality pond and the infiltration pond required for MDP will be a portion of the entire pond system required for the fully developed master plan. The MDP ponds will be located to allow expansion to accommodate the entire pond system as shown on the MDP.

The Student Housing project at the athletic field will likely be the first project of the MDP phase. This project will be funded and constructed by a private developer. Because of the way the project is funded, its timing in the MDP development sequence, the capacity of infiltration pond, and the need for the Greenwood Avenue parking lot during the development, a separate, on-site stormwater management system (including detention and water quality treatment facility) will be required for this project. An underground vault for stormwater detention and a proprietary manufactured water quality treatment system (such as StormFilter®, ecoStorm™, and Filtera) is a good fit for this system. If space allows, rain gardens/bioretentions can be used for water quality treatment as well.

Stormwater released from the detention facility of the Student Housing project will mix with stormwater runoff from the rest of Basin 1 and drain downhill through the Greenwood Avenue parking lot area to Boeing Creek. In the future when the infiltration pond at the Greenwood Avenue parking lot is built, water released from the underground detention facility of the Student Housing project area will become a part of the inflow to the infiltration pond. Water quality treatment facilities will remain in service until the pretreatment and water quality pond and the infiltration pond are constructed for the fully developed MDP. At that point, the on-site water quality treatment facilities could be retired, but the underground detention should remain in service.

The Automotive Center Expansion (Building 2100) may be the next project (following Student Housing) to be funded and constructed in the MDP phase. This project will have public and private funding and will be subject to stringent financial control. There are two options for stormwater improvements for this project:

1. Provide a separate system (detention and water quality treatment) at the building site and discharge to the existing conveyance system. This system will probably be an underground system for stormwater detention and a proprietary manufactured water

quality system (i.e., StormFilter®, ecoStorm™, Filtera). This approach is similar to that for the Student Housing project.

2. Provide a system at the Greenwood Avenue parking lot by constructing a portion of the master planned pretreatment and infiltration pond, using the existing pipe conveyance system from the building site to the parking lot. The system size will be limited to accommodate this project's redevelopment area. A structure to divert the project's proportionate share of stormwater to this pretreatment and infiltration facility will be required. The remainder of the stormwater flow in the existing pipe system will bypass this facility and discharge into Boeing creek, as it does currently. An on-site water quality treatment system will be required until the pretreatment and water quality pond and the infiltration pond in the Greenwood parking lot are constructed for the fully developed MDP. Obtaining the City's approval for this option prior to detailed design is recommended.

As other individual building projects are developed in MDP, the master planned conveyance system can be constructed in increments, as needed, to collect and convey flows to the Greenwood Avenue pond. The pond system can also be constructed incrementally to provide pretreatment and infiltration for each project area. Water quality treatment facilities will likely need to be installed with each individual project until the pretreatment and water quality pond and the infiltration pond in the Greenwood parking lot are constructed for the fully developed MDP. Pond design for each project must accommodate the master drainage plan and provide for future expansion of the ponds.

When building projects occur in Storm Basin 2 (that is conveyed to Boeing Creek in a separate existing 18-inch pipe), the pond system can be constructed incrementally to provide pretreatment, water quality treatment, and infiltration for each project area; and the master planned conveyance system can be constructed incrementally as required.

Storm drainage improvements for Storm Basin 4 (the southwest parking lot) will be constructed when the southwest parking lots are redeveloped.

An important caveat and unfortunate quandary for a master drainage plan is that if the City's code is revised during the time period of the planned development, the drainage plan must be revised to comply with the newer code. There is a vesting period for the MDP. Beyond that, the College will be subject to new codes.

This storm drainage master plan is a campus-wide schematic to provide a system that will support the MDP and comply with current code. The system provides a phased implementation that will, over time, bring the entire campus storm drainage system into compliance with current code for new development and redevelopment and will allow the College to work successfully under the state's capital projects funding process.

vlf\h:\doc\21cp\09\006 scc master plan\reports\supplement 2013\master drainage plan supplement.docx\dcy

01/25/2013 9:44am I:\21\2009\006 Shoreline CC Master Plan\Campus Master Plan and LRDP\Master Drainage Plan\FIG 7-1906.dwg

	SHORELINE COMMUNITY COLLEGE SHORELINE COMMUNITY COLLEGE MASTER DRAINAGE PLAN	DATE: JAN. 23, 2013 DES: DCY DR: CSM	ReidMiddleton 728 134th Street SW - Suite 200 Everett, Washington 98204 Ph: 425 741-3800
FIGURE 7	PROPOSED STORM DRAINAGE SYSTEM – MDP	CH: DCY FILE NO. 21-2009-006	

Appendix F
Preliminary Sizing of Proposed Drainage Systems

PROJ: SHORELINE CC MASTER DRAINAGE PLAN

Checking Existing Outfall Conveyance Capacity-Prop. Development

WO: 21-09-006 (Runoff by Rational Method)

DATE: ####### Updated: 1/24/2013 (Pipe Capacity by Manning's Eqn.)

FILE: H:\DOC\21Cp\09\006 SCC Master Plan\Hydraulics\[Pipe Sizing - Prop. Conveyance.xls]Pipe Sizing Table

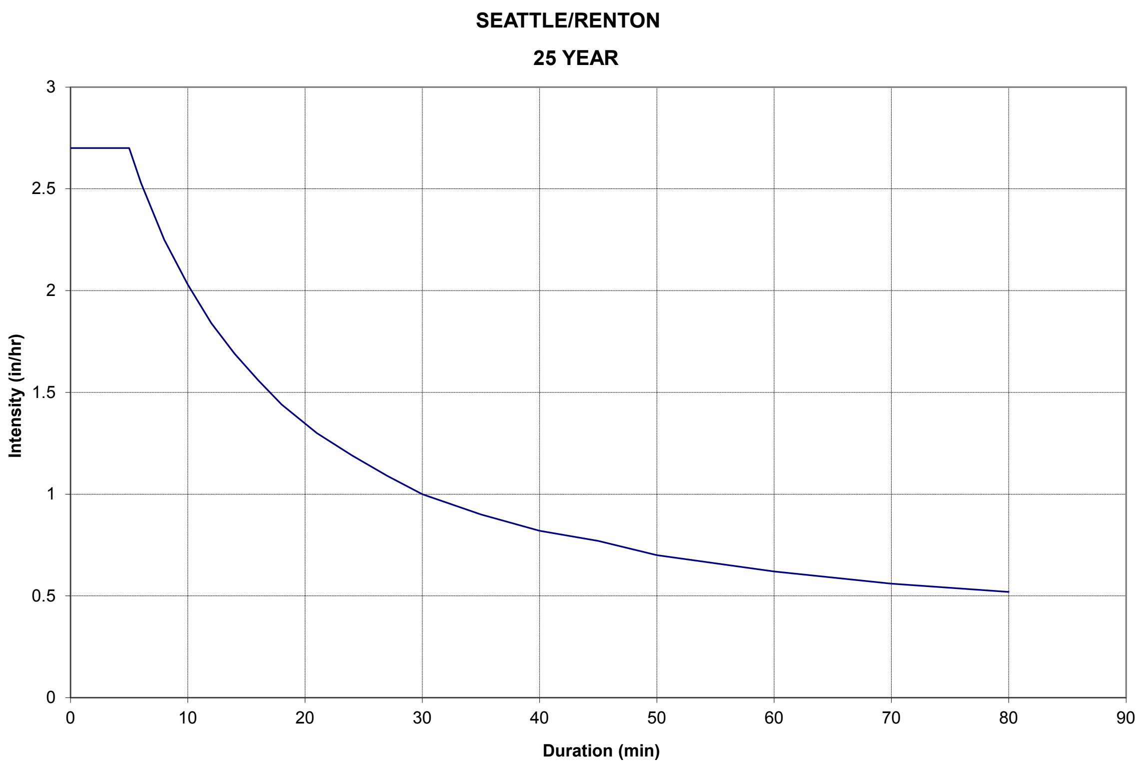
Storm Table #: 24 Storm: SEATTLE/RENTON 25 YEAR

From	To	Inc. Area (ac)	Runoff Coef.	A*C	Sum A*C	Time of Conc (min)	Rain Intens (in/hr)	Runoff (cfs)	n Value	Diam (inch)	Slope (%)	Length (feet)	Pipe Capac (cfs)	% Capac Used	Veloc Full (ft/sec)	Flow Time (min)	Remarks
Existing 18" Storm Main Conveying Runoff From Basin 2 to Proposed Infiltration Pond																	
		18.30	0.77	14.09	14.09	12.00	1.84	25.93	0.013	18	12.60	567.0	37.29	70	21.10	0.45	
Existing 18" Storm Main Conveying Runoff From Basin 1 to Proposed Infiltration Pond																	
		12.70	0.80	10.16	10.16	13.00	1.77	17.93	0.013	18	26.30	400.0	53.87	33	30.49	0.22	
Proposed Outfall From Infiltration Pond																	
		0.00	0.90	0.00	24.25	10.00	2.03	49.23	0.013	24	8.00	60.0	63.99	77	20.37	0.05	Proposed Pipe Slope

Assumed infiltration pond is plugged and runoff from Basins 1 & 2 is conveyed to Outfall.

Page 1 of2

PIPE SIZING TABLE
IDF CURVE



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Fax: 425 741-3900

Client: Schacht/Aslani Architects
Project: SHORELINE COMMUNITY COLLEGE
MASTER DRAINAGE PLAN
Preliminary Detention and WQ Facility Sizing
Project No. 21-09-006

Sheet: o
Design: MAD
Date: 01/30/13
Checked: DCY
Date: 01/31/13

File location: H:\DOC\21Cp\09\006 SCC Master Plan\Hydraulics\[SCC MDP Pond sizing.xls]Sheet1

A. DRAINAGE BASIN 1 (STUDENT HOUSING PROJECT) - DETENTION VAULT & WATER QUALITY

Area: 4.9 Acres
Impervious Area 3.5 Acres (90% Impervious of Building Development Area of 3.9 acres, Roof and Pavement, Flat Terrain, Till Soils)
Pervious Area 1.4 Acres (Lawn, Flat, Till Soils) = 0.4 acres + 1.0 acre Tributary Open Space

DETENTION ONLY

Calculated Volumes From WWHM 3 Program

Calculated Detention Volume: 2.34 AC-FT = 101,930 CF
Calculated WQ Rate: 0.41 CFS

Facility	Req. Vol.(cf)	Active D	*Dimensions
DETENTION	101,930	7	78' x 205'
WQ	(19) Low Drop Filter Cartridges in an 8'x11' Vault is Required		

*10% additional volume included

B. DRAINAGE BASIN 1 - INFILTRATION POND FOR MDP BUILDOUT

Total Area: 12.7 Acres
Student Housing 4.9 Acres — See Item A above. On-site Detention provided for this area
Remaining Basin 1 Area 7.8 Acres — 6.2 Acres (80% Impervious, Flat, Till Soils), 1.6 Acres (20% Pervious, Flat, Till Soils)
Pavement west of Student Housing not included in Basin 1 Area

LONGTERM INFILTRATION RATE : 2 in/hr Per Geotechenical Report

Calculated Volumes From WWHM 3 Program

Calculated Detention Volume: 1.2 AC-FT = 52,272 CF
Calculated WQ Volume: 1.05 AC-FT = 45,738 CF

Facility	Req. Vol.(cf)	Active D	Top- L	Top- W	Bot -L	Bot-W	Actual vol
RETENTION	52,272	6	158	77	134	53	57,804
WQ	45,738	7	146	75	104	33	50,337

SET BACKS OF 10 FT FROM TOE OF SLOPE AND 15 FT FROM TOP OF CREEK BANK

NOTE: Infiltration Pond Side Slopes: 2H : 1V
WQ Pond Side Slopes: 3H : 1V

C. DRAINAGE BASINS 1 AND 2 - INFILTRATION POND FOR LRDP BUILDOUT

Total Area	31.8 Acres	
Student Housing	4.9 Acres	3.5 Acres (Impervious Roof & Pavement, Flat, Till), 1.4 Acres (Pervious, Flat, Till Soils)
Remaining Basin 1 Area	7.8 Acres	6.2 Acres (80% Impervious, Flat, Till Soils), 1.6 Acres (20% Pervious, Flat, Till Soils)
Parking west of Student Housing	0.8 Acres	0.76 Acres (95% Impervious, Pavement), 0.04 acres Pervious
Basin 2	18.3 Acres	14.6 Acres (80% Impervious , Flat, Till soils), 3.7 acres (20% Pervious, Flat, Till soils)

LONGTERM INFILTRATION RATE : 2 in/hr Per Geotechnical Report

Calculated Volumes From WWHM 3 Program

Calculated Detention Volume:	3.7	AC-FT =	161,172	CF
Basin 2 - Calculated WQ Volume:	1.55	AC-FT =	67,518	CF
Basin 1 - Calculated WQ Volume:	1.1	AC-FT =	47,916	CF

Facility	Req. Vol.(cf)	Active D	Top- L	Top- W	Bot -L	Bot-W	Actual vol
RETENTION	161,172	6	465	77	441	53	177,534
WQ-BASIN 2	67,518	7	210	75	168	33	74,529
WQ-BASIN 1	47,916	7	152	75	110	33	52,605

SET BACKS OF 10 FT FROM TOE OF SLOPE AND 15 FT FROM TOP OF CREEK BANK

NOTE: Infiltration Pond Side Slopes: 2H : 1V
WQ Pond Side Slopes: 3H : 1V

D. DRAINAGE BASIN 4 - UNDERGROUND DETENTION & WQ FACILITIES

Area:	10.3 ACRES
Impervious Area	9.3 Acres (90% Impervious, Roof and Pavement, Flat Terrain, Till Soils)
Pervious Area	1.0 Acre (Lawn, Flat, Till Soils)

DETENTION ONLY

ASSUMED UNDERGROUND STORMTRAP MODULAR UNITS

Calculated Volumes From WWHM 3 Program

Calculated Detention Volume:	6.3	AC-FT =	274,428	CF
Calculated WQ Rate:	1.2	CFS		

Facility	Req. Vol.(cf)	Active D	*Dimensions
DETENTION	274,428	4	356' x 210'
WQ	(45) Low Drop Filter Cartridges in an 8'x20' Vault is Required		

*10% additional volume included

Western Washington Hydrology Model
PROJECT REPORT

Project Name: SCC Master Drainage Plan
Site Address: Shoreline Comm. College
City : Shoreline
Report Date : 1/22/2013
Gage : Seatac
Data Start : 1948/10/01
Data End : 1998/09/30
Precip Scale: 0.83
WWHM3 Version:

MDP Plan – STUDENT HOUSING

PREDEVELOPED LAND USE

Name : Student Housing - Predeveloped
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	4.9

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Student Housing - Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	1.4

Impervious Land Use	Acres
ROADS FLAT	3.5

Element Flows To:

Surface	Interflow	Groundwater

1

SH Vault, SH Vault,

Name   : SH Vault
Width :   69.1722246796794 ft.
Length :   207.516674039038 ft.
Depth: 8ft.
Volume at riser head : 2.343ft
Discharge Structure
Riser Height: 7 ft.
Riser Diameter: 18 in.
NotchType   : Rectangular
Notch Width : 0.019 ft.
Notch Height: 2.083 ft.
Orifice 1 Diameter: 0.804 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1   Outlet 2
Basin 1 Infil Pond,

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	0.330	0.000	0.000	0.000
0.089	0.330	0.029	0.005	0.000
0.178	0.330	0.059	0.007	0.000
0.267	0.330	0.088	0.009	0.000
0.356	0.330	0.117	0.010	0.000
0.444	0.330	0.146	0.011	0.000
0.533	0.330	0.176	0.012	0.000
0.622	0.330	0.205	0.013	0.000
0.711	0.330	0.234	0.014	0.000
0.800	0.330	0.264	0.015	0.000
0.889	0.330	0.293	0.016	0.000
0.978	0.330	0.322	0.017	0.000
1.067	0.330	0.352	0.018	0.000
1.156	0.330	0.381	0.018	0.000
1.244	0.330	0.410	0.019	0.000
1.333	0.330	0.439	0.020	0.000
1.422	0.330	0.469	0.020	0.000
1.511	0.330	0.498	0.021	0.000
1.600	0.330	0.527	0.021	0.000
1.689	0.330	0.557	0.022	0.000
1.778	0.330	0.586	0.023	0.000
1.867	0.330	0.615	0.023	0.000
1.956	0.330	0.644	0.024	0.000
2.044	0.330	0.674	0.024	0.000
2.133	0.330	0.703	0.025	0.000
2.222	0.330	0.732	0.025	0.000
2.311	0.330	0.762	0.026	0.000
2.400	0.330	0.791	0.026	0.000
2.489	0.330	0.820	0.027	0.000
2.578	0.330	0.849	0.027	0.000
2.667	0.330	0.879	0.028	0.000
2.756	0.330	0.908	0.028	0.000

2.844	0.330	0.937	0.029	0.000
2.933	0.330	0.967	0.029	0.000
3.022	0.330	0.996	0.030	0.000
3.111	0.330	1.025	0.030	0.000
3.200	0.330	1.055	0.030	0.000
3.289	0.330	1.084	0.031	0.000
3.378	0.330	1.113	0.031	0.000
3.467	0.330	1.142	0.032	0.000
3.556	0.330	1.172	0.032	0.000
3.644	0.330	1.201	0.032	0.000
3.733	0.330	1.230	0.033	0.000
3.822	0.330	1.260	0.033	0.000
3.911	0.330	1.289	0.034	0.000
4.000	0.330	1.318	0.034	0.000
4.089	0.330	1.347	0.034	0.000
4.178	0.330	1.377	0.035	0.000
4.267	0.330	1.406	0.035	0.000
4.356	0.330	1.435	0.035	0.000
4.444	0.330	1.465	0.036	0.000
4.533	0.330	1.494	0.036	0.000
4.622	0.330	1.523	0.037	0.000
4.711	0.330	1.552	0.037	0.000
4.800	0.330	1.582	0.037	0.000
4.889	0.330	1.611	0.038	0.000
4.978	0.330	1.640	0.039	0.000
5.067	0.330	1.670	0.042	0.000
5.156	0.330	1.699	0.046	0.000
5.244	0.330	1.728	0.050	0.000
5.333	0.330	1.758	0.055	0.000
5.422	0.330	1.787	0.060	0.000
5.511	0.330	1.816	0.066	0.000
5.600	0.330	1.845	0.072	0.000
5.689	0.330	1.875	0.078	0.000
5.778	0.330	1.904	0.084	0.000
5.867	0.330	1.933	0.090	0.000
5.956	0.330	1.963	0.096	0.000
6.044	0.330	1.992	0.104	0.000
6.133	0.330	2.021	0.112	0.000
6.222	0.330	2.050	0.120	0.000
6.311	0.330	2.080	0.128	0.000
6.400	0.330	2.109	0.163	0.000
6.489	0.330	2.138	0.174	0.000
6.578	0.330	2.168	0.185	0.000
6.667	0.330	2.197	0.197	0.000
6.756	0.330	2.226	0.209	0.000
6.844	0.330	2.255	0.222	0.000
6.933	0.330	2.285	0.235	0.000
7.022	0.330	2.314	0.293	0.000
7.111	0.330	2.343	0.786	0.000
7.200	0.330	2.373	1.552	0.000
7.289	0.330	2.402	2.513	0.000
7.378	0.330	2.431	3.637	0.000
7.467	0.330	2.461	4.903	0.000
7.556	0.330	2.490	6.295	0.000
7.644	0.330	2.519	7.804	0.000
7.733	0.330	2.548	9.421	0.000
7.822	0.330	2.578	11.14	0.000

7.911	0.330	2.607	12.95	0.000
8.000	0.330	2.636	14.86	0.000
8.089	0.330	2.666	16.85	0.000
8.178	0.000	0.000	18.92	0.000

MITIGATED LAND USE

Flow Frequency Return Periods for Predeveloped. POC #1(Student Housing)

Return Period	**Flow(cfs)**
2 year	0.075478
5 year	0.138948
10 year	0.177515
25 year	0.219305
50 year	0.245261
100 year	0.267191

Flow Frequency Return Periods for Mitigated. POC #1 (Student Housing)

Return Period	**Flow(cfs)**
2 year	0.039862
5 year	0.066297
10 year	0.089932
25 year	0.128371
50 year	0.164366
100 year	0.207727

POC #1 (Student Housing)
The Facility PASSED

The Facility PASSED.

Flow(CFS)	**Predev**	**Dev**	**Percentage**	**Pass/Fail**
0.0377	4151	3227	77	Pass
0.0398	3750	1722	45	Pass
0.0419	3384	1608	47	Pass
0.0440	2936	1402	47	Pass
0.0461	2705	1288	47	Pass
0.0482	2477	1180	47	Pass
0.0503	2309	1098	47	Pass
0.0524	2127	1011	47	Pass
0.0545	1963	943	48	Pass
0.0566	1837	894	48	Pass
0.0587	1717	848	49	Pass
0.0608	1605	796	49	Pass
0.0629	1499	751	50	Pass
0.0650	1421	701	49	Pass
0.0671	1293	646	49	Pass
0.0692	1202	615	51	Pass
0.0713	1126	590	52	Pass
0.0734	1046	563	53	Pass
0.0755	987	529	53	Pass
0.0776	932	501	53	Pass
0.0797	882	479	54	Pass

0.0818	832	454	54	Pass
0.0839	786	436	55	Pass
0.0860	745	413	55	Pass
0.0880	689	386	56	Pass
0.0901	655	365	55	Pass
0.0922	628	342	54	Pass
0.0943	606	314	51	Pass
0.0964	572	293	51	Pass
0.0985	540	270	50	Pass
0.1006	515	255	49	Pass
0.1027	498	239	47	Pass
0.1048	466	228	48	Pass
0.1069	434	214	49	Pass
0.1090	407	204	50	Pass
0.1111	381	195	51	Pass
0.1132	361	187	51	Pass
0.1153	339	180	53	Pass
0.1174	319	172	53	Pass
0.1195	304	165	54	Pass
0.1216	284	156	54	Pass
0.1237	267	149	55	Pass
0.1258	253	145	57	Pass
0.1279	242	138	57	Pass
0.1300	230	132	57	Pass
0.1321	213	124	58	Pass
0.1342	199	120	60	Pass
0.1363	193	114	59	Pass
0.1384	187	105	56	Pass
0.1405	179	92	51	Pass
0.1425	174	87	50	Pass
0.1446	163	85	52	Pass
0.1467	156	81	51	Pass
0.1488	149	76	51	Pass
0.1509	143	75	52	Pass
0.1530	132	67	50	Pass
0.1551	128	63	49	Pass
0.1572	121	59	48	Pass
0.1593	112	57	50	Pass
0.1614	107	52	48	Pass
0.1635	97	49	50	Pass
0.1656	92	45	48	Pass
0.1677	84	40	47	Pass
0.1698	78	38	48	Pass
0.1719	71	36	50	Pass
0.1740	63	33	52	Pass
0.1761	55	29	52	Pass
0.1782	51	28	54	Pass
0.1803	49	26	53	Pass
0.1824	44	25	56	Pass
0.1845	42	23	54	Pass
0.1866	38	23	60	Pass
0.1887	34	20	58	Pass
0.1908	31	20	64	Pass
0.1929	27	19	70	Pass
0.1950	25	17	68	Pass
0.1970	21	15	71	Pass
0.1991	19	13	68	Pass

0.2012	18	13	72	Pass
0.2033	15	10	66	Pass
0.2054	14	8	57	Pass
0.2075	14	7	50	Pass
0.2096	11	7	63	Pass
0.2117	10	6	60	Pass
0.2138	9	5	55	Pass
0.2159	8	4	50	Pass
0.2180	8	4	50	Pass
0.2201	5	3	60	Pass
0.2222	3	3	100	Pass
0.2243	3	3	100	Pass
0.2264	2	1	50	Pass
0.2285	2	1	50	Pass
0.2306	1	1	100	Pass
0.2327	0	0	100	Pass
0.2348	0	0	0	Pass
0.2369	0	0	0	Pass
0.2390	0	0	0	Pass
0.2411	0	0	0	Pass
0.2432	0	0	0	Pass
0.2453	0	0	0	Pass

Water Quality BMP Flow and Volume for POC 1 (Student Housing).
On-line facility volume: 0.3878 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 0.4512 **cfs.**
Off-line facility target flow: 0.2342 **cfs.**
Adjusted for 15 min: 0.2559 **cfs.**

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Determining Number of Cartridges for Systems Downstream of Detention

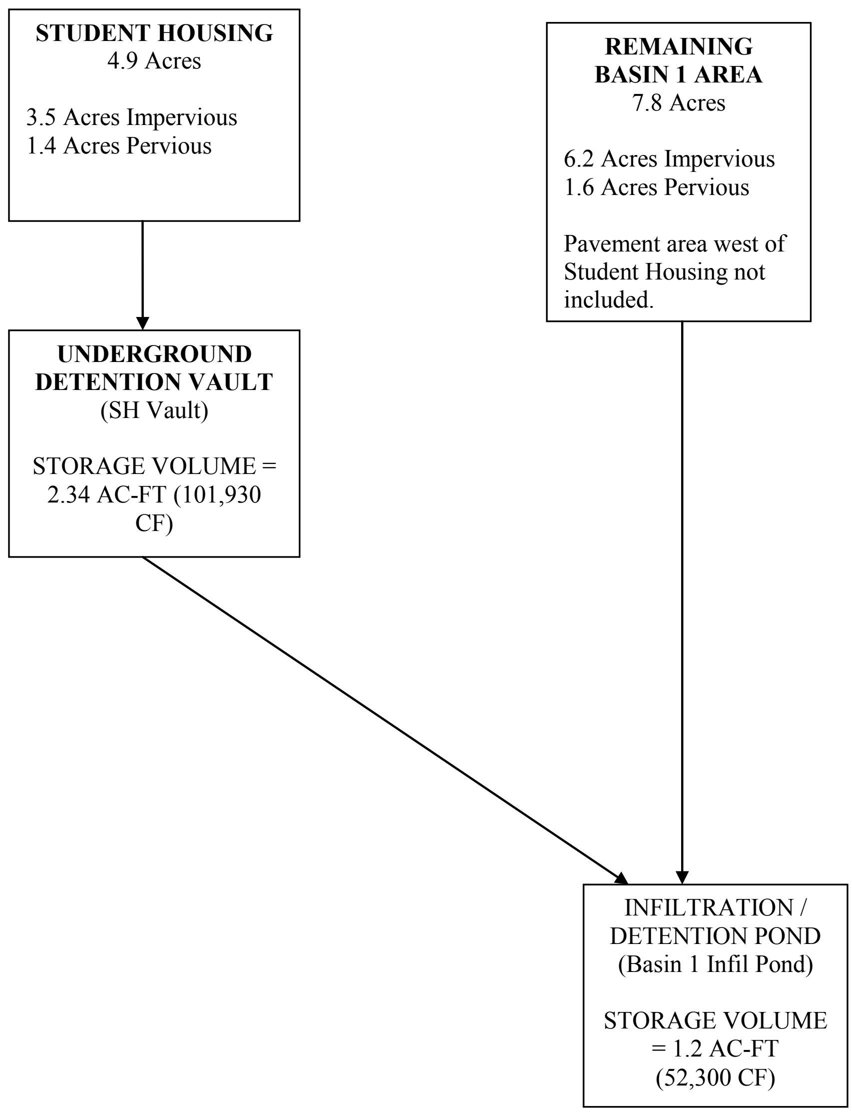
CONTECH Stormwater Solutions Inc. Engineer:	JHR	
Date	1/18/2013	
Site Information		
Project Name	Shoreline Community College	
Project State	Washington	
Project Location	Seattle	
Drainage Area, Ad	3.50	ac
Impervious Area, Ai	3.50	ac
Pervious Area, Ap	0.00	
% Impervious	100%	
Runoff Coefficient, Rc	0.95	
Upstream Detention System		
Peak release rate from detention, $Q_{release\ peak}$	0.21	cfs
Treatment release rate from detention, $Q_{release\ treat}$	0.04	cfs
Detention pretreatment credit (from removal efficiency calcs)	50%	
Mass loading calculations		
Mean Annual Rainfall, P	36	in
Agency required % removal	80%	
Percent Runoff Capture	90%	
Mean Annual Runoff, V_t	391,060	ft^3
Event Mean Concentration of Pollutant, EMC	60	mg/l
Annual Mass Load, M_{total}	1463.90	lbs
Filter System		
Filtration brand	StormFilter	
Cartridge height	12	in
Specific Flow Rate	1.0	gpm/ft^2
Number of cartridges - mass loading		
Mass removed by pretreatment system, M_{pre}	731.95	lbs
Mass load to filters after pretreatment, M_{pass1}	731.95	lbs
Estimate the required filter efficiency, E_{filter}	0.60	
Mass to be captured by filters, M_{filter}	439.17	lbs
Allowable Cartridge Flow rate, Q_{cart}	5.00	
Mass load per cartridge, M_{cart} (lbs)	24.00	lbs
Number of Cartridges required, N_{mass}	19	
Treatment Capacity	0.21	cfs
Determine Critical Sizing Value		
Number of Cartridges using $Q_{release\ treat}$, N_{flow}	4	
Method to Use:	MASS-LOADING	

SUMMARY

Treatment Flow Rate, cfs	0.21
Cartridge Flow Rate, gpm	5.0
Number of Cartridges	19

1 of 1

MDP BUILDOUT – SCHEMATIC LAYOUT



Western Washington Hydrology Model
PROJECT REPORT

Project Name: SCC Master Drainage Plan
Site Address: Shoreline Comm. College
City : Shoreline
Report Date : 1/22/2013
Gage : Seatac
Data Start : 1948/10/01
Data End : 1998/09/30
Precip Scale: 0.83
WWHM3 Version:

MDP Plan – MDP BUILDOUT

Name : Student Housing - Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	1.4

Impervious Land Use	Acres
ROADS FLAT	3.5

Element Flows To:

Surface	Interflow	Groundwater
SH Vault,	SH Vault,	

Name : SH Vault
Width : 69.1722246796794 ft.
Length : 207.516674039038 ft.
Depth: 8ft.
Discharge Structure
Riser Height: 7 ft.
Riser Diameter: 18 in.
NotchType : Rectangular
Notch Width : 0.019 ft.
Notch Height: 2.083 ft.
Orifice 1 Diameter: 0.804 in. **Elevation:** 0 ft.

Element Flows To:

Outlet 1	Outlet 2
Basin 1 Infil Pond,	

2

PREDEVELOPED LAND USE

Name : Basin 1 (Remaining Area)- Predeveloped
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	7.8

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 1 (Remaining Area)- Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	1.6

Impervious Land Use	Acres
PARKING FLAT	6.2

Element Flows To:

Surface	Interflow	Groundwater
Basin 1 Infil Pond,	Basin 1 Infil Pond,	

Name : Basin 1 Infil Pond
Bottom Length: 120ft.
Bottom Width: 53ft.
Depth : 7ft.
Volume at riser head : 1.2054ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Side slope 1: 2 To 1
Side slope 2: 2 To 1
Side slope 3: 2 To 1
Side slope 4: 2 To 1
Discharge Structure
Riser Height: 6 ft.
Riser Diameter: 18 in.
NotchType : Rectangular

Notch Width : 0.017 ft.
Notch Height: 2.782 ft.
Orifice 1 Diameter: 1.199 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	0.146	0.000	0.000	0.000
0.078	0.147	0.011	0.011	0.294
0.156	0.148	0.023	0.015	0.294
0.233	0.150	0.035	0.018	0.294
0.311	0.151	0.046	0.021	0.294
0.389	0.152	0.058	0.024	0.294
0.467	0.153	0.070	0.026	0.294
0.544	0.155	0.082	0.028	0.294
0.622	0.156	0.094	0.030	0.294
0.700	0.157	0.106	0.032	0.294
0.778	0.159	0.118	0.033	0.294
0.856	0.160	0.131	0.035	0.294
0.933	0.161	0.143	0.036	0.294
1.011	0.162	0.156	0.038	0.294
1.089	0.164	0.169	0.039	0.294
1.167	0.165	0.181	0.041	0.294
1.244	0.166	0.194	0.042	0.294
1.322	0.168	0.207	0.043	0.294
1.400	0.169	0.220	0.045	0.294
1.478	0.170	0.234	0.046	0.294
1.556	0.172	0.247	0.047	0.294
1.633	0.173	0.260	0.048	0.294
1.711	0.174	0.274	0.049	0.294
1.789	0.176	0.287	0.050	0.294
1.867	0.177	0.301	0.052	0.294
1.944	0.178	0.315	0.053	0.294
2.022	0.180	0.329	0.054	0.294
2.100	0.181	0.343	0.055	0.294
2.178	0.182	0.357	0.056	0.294
2.256	0.184	0.371	0.057	0.294
2.333	0.185	0.385	0.058	0.294
2.411	0.186	0.400	0.059	0.294
2.489	0.188	0.414	0.060	0.294
2.567	0.189	0.429	0.060	0.294
2.644	0.191	0.444	0.061	0.294
2.722	0.192	0.459	0.062	0.294
2.800	0.193	0.474	0.063	0.294
2.878	0.195	0.489	0.064	0.294
2.956	0.196	0.504	0.065	0.294
3.033	0.198	0.519	0.066	0.294
3.111	0.199	0.535	0.067	0.294
3.189	0.200	0.550	0.067	0.294
3.267	0.202	0.566	0.069	0.294
3.344	0.203	0.582	0.072	0.294
3.422	0.205	0.598	0.075	0.294

3.500	0.206	0.614	0.079	0.294
3.578	0.208	0.630	0.083	0.294
3.656	0.209	0.646	0.087	0.294
3.733	0.210	0.662	0.092	0.294
3.811	0.212	0.679	0.096	0.294
3.889	0.213	0.695	0.101	0.294
3.967	0.215	0.712	0.106	0.294
4.044	0.216	0.729	0.111	0.294
4.122	0.218	0.745	0.117	0.294
4.200	0.219	0.762	0.122	0.294
4.278	0.221	0.780	0.127	0.294
4.356	0.222	0.797	0.134	0.294
4.433	0.224	0.814	0.140	0.294
4.511	0.225	0.832	0.147	0.294
4.589	0.227	0.849	0.154	0.294
4.667	0.228	0.867	0.182	0.294
4.744	0.230	0.885	0.191	0.294
4.822	0.231	0.903	0.200	0.294
4.900	0.233	0.921	0.210	0.294
4.978	0.234	0.939	0.219	0.294
5.056	0.236	0.957	0.229	0.294
5.133	0.237	0.975	0.239	0.294
5.211	0.239	0.994	0.249	0.294
5.289	0.240	1.013	0.259	0.294
5.367	0.242	1.031	0.270	0.294
5.444	0.243	1.050	0.280	0.294
5.522	0.245	1.069	0.291	0.294
5.600	0.246	1.088	0.302	0.294
5.678	0.248	1.107	0.313	0.294
5.756	0.250	1.127	0.324	0.294
5.833	0.251	1.146	0.336	0.294
5.911	0.253	1.166	0.347	0.294
5.989	0.254	1.186	0.359	0.294
6.067	0.256	1.205	0.613	0.294
6.144	0.257	1.225	1.164	0.294
6.222	0.259	1.246	1.893	0.294
6.300	0.261	1.266	2.764	0.294
6.378	0.262	1.286	3.756	0.294
6.456	0.264	1.307	4.856	0.294
6.533	0.265	1.327	6.055	0.294
6.611	0.267	1.348	7.344	0.294
6.689	0.269	1.369	8.719	0.294
6.767	0.270	1.390	10.17	0.294
6.844	0.272	1.411	11.70	0.294
6.922	0.274	1.432	13.31	0.294
7.000	0.275	1.453	14.98	0.294
7.078	0.277	1.475	16.71	0.294

MITIGATED LAND USE

Flow Frequency Return Periods for Predeveloped. POC #2 (Basin 1)

Return Period	Flow(cfs)
2 year	0.120149
5 year	0.221183
10 year	0.282574
25 year	0.349098
50 year	0.390415
100 year	0.425323

Flow Frequency Return Periods for Mitigated. POC #2 (Basin 1)

Return Period	Flow(cfs)
2 year	0.064309
5 year	0.111249
10 year	0.154513
25 year	0.226712
50 year	0.295885
100 year	0.380778

POC #2 (Basin 1)
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0601	4004	728	18	Pass
0.0634	3648	596	16	Pass
0.0667	3299	508	15	Pass
0.0701	2937	430	14	Pass
0.0734	2733	391	14	Pass
0.0768	2505	378	15	Pass
0.0801	2282	357	15	Pass
0.0834	2113	344	16	Pass
0.0868	1961	325	16	Pass
0.0901	1800	310	17	Pass
0.0934	1686	293	17	Pass
0.0968	1584	278	17	Pass
0.1001	1471	259	17	Pass
0.1035	1394	245	17	Pass
0.1068	1313	231	17	Pass
0.1101	1198	218	18	Pass
0.1135	1126	212	18	Pass
0.1168	1052	198	18	Pass
0.1201	979	186	18	Pass
0.1235	925	177	19	Pass
0.1268	879	172	19	Pass
0.1301	819	160	19	Pass
0.1335	780	155	19	Pass
0.1368	737	148	20	Pass

0.1402	691	136	19	Pass
0.1435	659	129	19	Pass
0.1468	634	128	20	Pass
0.1502	599	121	20	Pass
0.1535	570	118	20	Pass
0.1568	540	113	20	Pass
0.1602	509	107	21	Pass
0.1635	493	106	21	Pass
0.1669	462	104	22	Pass
0.1702	428	98	22	Pass
0.1735	410	97	23	Pass
0.1769	386	93	24	Pass
0.1802	361	91	25	Pass
0.1835	339	85	25	Pass
0.1869	319	83	26	Pass
0.1902	301	75	24	Pass
0.1935	283	72	25	Pass
0.1969	266	70	26	Pass
0.2002	250	66	26	Pass
0.2036	239	61	25	Pass
0.2069	230	57	24	Pass
0.2102	214	52	24	Pass
0.2136	200	48	24	Pass
0.2169	193	46	23	Pass
0.2202	186	45	24	Pass
0.2236	179	40	22	Pass
0.2269	174	37	21	Pass
0.2302	161	33	20	Pass
0.2336	155	28	18	Pass
0.2369	149	26	17	Pass
0.2403	143	23	16	Pass
0.2436	134	22	16	Pass
0.2469	128	20	15	Pass
0.2503	121	18	14	Pass
0.2536	112	17	15	Pass
0.2569	107	16	14	Pass
0.2603	97	16	16	Pass
0.2636	92	14	15	Pass
0.2670	84	13	15	Pass
0.2703	77	11	14	Pass
0.2736	68	8	11	Pass
0.2770	62	7	11	Pass
0.2803	55	7	12	Pass
0.2836	51	6	11	Pass
0.2870	50	5	10	Pass
0.2903	43	4	9	Pass
0.2936	42	2	4	Pass
0.2970	38	0	0	Pass
0.3003	34	0	0	Pass
0.3037	31	0	0	Pass
0.3070	27	0	0	Pass
0.3103	25	0	0	Pass
0.3137	21	0	0	Pass
0.3170	19	0	0	Pass
0.3203	18	0	0	Pass
0.3237	15	0	0	Pass
0.3270	14	0	0	Pass

0.3304	13	0	0	Pass
0.3337	11	0	0	Pass
0.3370	9	0	0	Pass
0.3404	8	0	0	Pass
0.3437	8	0	0	Pass
0.3470	8	0	0	Pass
0.3504	5	0	0	Pass
0.3537	3	0	0	Pass
0.3570	3	0	0	Pass
0.3604	2	0	0	Pass
0.3637	2	0	0	Pass
0.3671	0	0	0	Pass
0.3704	0	0	0	Pass
0.3737	0	0	0	Pass
0.3771	0	0	0	Pass
0.3804	0	0	0	Pass
0.3837	0	0	0	Pass
0.3871	0	0	0	Pass
0.3904	0	0	0	Pass

Water Quality BMP Flow and Volume for POC 6 (Basin 1)
On-line facility volume: 1.0515 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 1.2545 **cfs.**
Off-line facility target flow: 0.6488 **cfs.**
Adjusted for 15 min: 0.7132 **cfs.**

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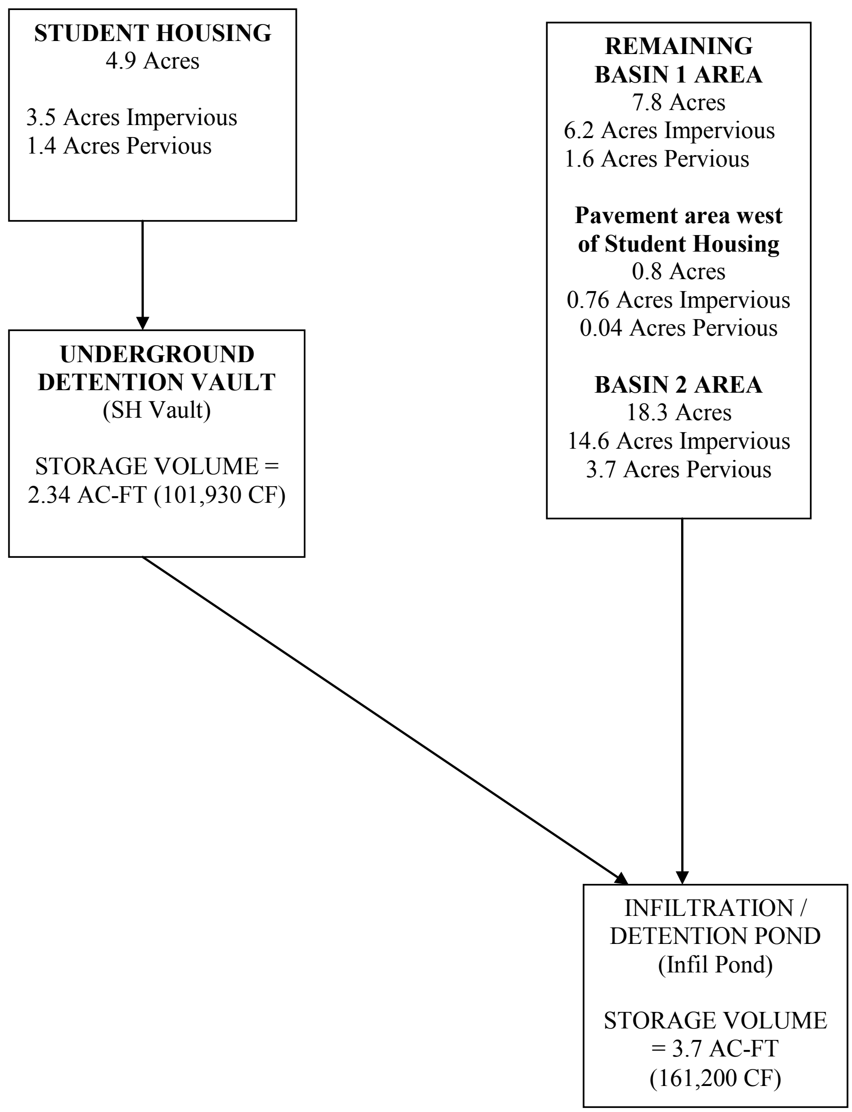
LRDP BUILDOUT – SCHEMATIC LAYOUT



Western Washington Hydrology Model
PROJECT REPORT

Project Name: SCC Master Drainage Plan
Site Address: Shoreline Comm. College
City : Shoreline
Report Date : 1/22/2013
Gage : Seatac
Data Start : 1948/10/01
Data End : 1998/09/30
Precip Scale: 0.83
WWHM3 Version:

LRDP PLAN – BASINS 1 & 2

Name : Student Housing - Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	1.4

Impervious Land Use	Acres
ROADS FLAT	3.5

Element Flows To:

Surface	Interflow	Groundwater
SH Vault,	SH Vault,	

Name : **SH** Vault
Width : 69.1722246796794 ft.
Length : 207.516674039038 ft.
Depth: 8ft.
Discharge Structure
Riser Height: 7 ft.
Riser Diameter: 18 in.
NotchType : Rectangular
Notch Width : 0.019 ft.
Notch Height: 2.083 ft.
Orifice 1 Diameter: 0.804 in. **Elevation:** 0 ft.

Element Flows To:

Outlet 1	Outlet 2
Infil Pond,	

2

PREDEVELOPED LAND USE

Name : Basins 1 & 2 - Predeveloped
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	26.9

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

DEVELOPED LAND USE

Name : Basin 1&2 Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	5.34

Impervious Land Use	Acres
PARKING FLAT	21.56

Element Flows To:

Surface	Interflow	Groundwater
Infil Pond,	Infil Pond Pond,	

Name : Infil Pond
Bottom Length: 396ft.
Bottom Width: 53ft.
Depth : 7ft.
Volume at riser head : 3.7091ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Side slope 1: 2 To 1
Side slope 2: 2 To 1

Side slope 3: 2 To 1
Side slope 4: 2 To 1
Discharge Structure
Riser Height: 6 ft.
Riser Diameter: 18 in.
NotchType : Rectangular
Notch Width : 0.069 ft.
Notch Height: 2.484 ft.
Orifice 1 Diameter: 2.432540661 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Pond Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	0.482	0.000	0.000	0.000
0.078	0.485	0.038	0.043	0.972
0.156	0.488	0.075	0.061	0.972
0.233	0.491	0.114	0.075	0.972
0.311	0.495	0.152	0.087	0.972
0.389	0.498	0.190	0.097	0.972
0.467	0.501	0.229	0.106	0.972
0.544	0.504	0.268	0.115	0.972
0.622	0.508	0.308	0.123	0.972
0.700	0.511	0.347	0.130	0.972
0.778	0.514	0.387	0.137	0.972
0.856	0.517	0.427	0.144	0.972
0.933	0.521	0.468	0.150	0.972
1.011	0.524	0.508	0.156	0.972
1.089	0.527	0.549	0.162	0.972
1.167	0.530	0.590	0.168	0.972
1.244	0.534	0.632	0.173	0.972
1.322	0.537	0.673	0.179	0.972
1.400	0.540	0.715	0.184	0.972
1.478	0.544	0.757	0.189	0.972
1.556	0.547	0.800	0.194	0.972
1.633	0.550	0.843	0.199	0.972
1.711	0.553	0.885	0.203	0.972
1.789	0.557	0.929	0.208	0.972
1.867	0.560	0.972	0.212	0.972
1.944	0.563	1.016	0.217	0.972
2.022	0.567	1.060	0.221	0.972
2.100	0.570	1.104	0.225	0.972
2.178	0.573	1.148	0.229	0.972
2.256	0.577	1.193	0.233	0.972
2.333	0.580	1.238	0.237	0.972
2.411	0.583	1.283	0.241	0.972
2.489	0.587	1.329	0.245	0.972
2.567	0.590	1.375	0.249	0.972
2.644	0.593	1.421	0.253	0.972
2.722	0.597	1.467	0.256	0.972
2.800	0.600	1.513	0.260	0.972
2.878	0.604	1.560	0.264	0.972
2.956	0.607	1.607	0.267	0.972

3.033	0.610	1.655	0.271	0.972
3.111	0.614	1.702	0.274	0.972
3.189	0.617	1.750	0.278	0.972
3.267	0.620	1.798	0.281	0.972
3.344	0.624	1.847	0.284	0.972
3.422	0.627	1.895	0.287	0.972
3.500	0.631	1.944	0.291	0.972
3.578	0.634	1.993	0.297	0.972
3.656	0.637	2.043	0.309	0.972
3.733	0.641	2.092	0.323	0.972
3.811	0.644	2.142	0.338	0.972
3.889	0.648	2.193	0.355	0.972
3.967	0.651	2.243	0.373	0.972
4.044	0.655	2.294	0.392	0.972
4.122	0.658	2.345	0.411	0.972
4.200	0.661	2.396	0.431	0.972
4.278	0.665	2.448	0.451	0.972
4.356	0.668	2.500	0.472	0.972
4.433	0.672	2.552	0.493	0.972
4.511	0.675	2.604	0.513	0.972
4.589	0.679	2.657	0.538	0.972
4.667	0.682	2.710	0.563	0.972
4.744	0.686	2.763	0.590	0.972
4.822	0.689	2.817	0.617	0.972
4.900	0.693	2.870	0.644	0.972
4.978	0.696	2.924	0.763	0.972
5.056	0.700	2.979	0.799	0.972
5.133	0.703	3.033	0.837	0.972
5.211	0.707	3.088	0.875	0.972
5.289	0.710	3.143	0.914	0.972
5.367	0.714	3.198	0.953	0.972
5.444	0.717	3.254	0.994	0.972
5.522	0.721	3.310	1.035	0.972
5.600	0.724	3.366	1.077	0.972
5.678	0.728	3.423	1.119	0.972
5.756	0.731	3.479	1.163	0.972
5.833	0.735	3.536	1.207	0.972
5.911	0.738	3.594	1.251	0.972
5.989	0.742	3.651	1.297	0.972
6.067	0.745	3.709	1.557	0.972
6.144	0.749	3.767	2.110	0.972
6.222	0.753	3.826	2.840	0.972
6.300	0.756	3.884	3.713	0.972
6.378	0.760	3.943	4.707	0.972
6.456	0.763	4.002	5.809	0.972
6.533	0.767	4.062	7.010	0.972
6.611	0.770	4.122	8.301	0.972
6.689	0.774	4.182	9.677	0.972
6.767	0.778	4.242	11.13	0.972
6.844	0.781	4.303	12.67	0.972
6.922	0.785	4.364	14.27	0.972
7.000	0.788	4.425	15.94	0.972
7.078	0.792	4.486	17.68	0.972

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #2 (Basins 1&2)

Return Period	Flow(cfs)
2 year	0.41436
5 year	0.762798
10 year	0.974519
25 year	1.203941
50 year	1.34643
100 year	1.466821

Flow Frequency Return Periods for Mitigated. POC #2 (Basins 1&2)

Return Period	Flow(cfs)
2 year	0.264653
5 year	0.444399
10 year	0.606306
25 year	0.871283
50 year	1.120796
100 year	1.42274

POC #2 (Basins 1&2)
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.2231	3996	1557	38	Pass
0.2355	3602	1323	36	Pass
0.2479	3250	1097	33	Pass
0.2603	2937	908	30	Pass
0.2727	2705	779	28	Pass
0.2851	2460	643	26	Pass
0.2975	2285	535	23	Pass
0.3099	2103	468	22	Pass
0.3223	1937	384	19	Pass
0.3347	1802	321	17	Pass
0.3471	1669	288	17	Pass
0.3594	1566	266	16	Pass
0.3718	1472	254	17	Pass
0.3842	1382	243	17	Pass
0.3966	1293	227	17	Pass
0.4090	1191	217	18	Pass
0.4214	1117	203	18	Pass
0.4338	1037	195	18	Pass
0.4462	978	182	18	Pass
0.4586	920	175	19	Pass
0.4710	869	170	19	Pass
0.4834	819	161	19	Pass
0.4958	776	155	19	Pass
0.5082	730	149	20	Pass
0.5206	690	143	20	Pass
0.5330	655	139	21	Pass

0.5453	626	132	21	Pass
0.5577	600	128	21	Pass
0.5701	565	122	21	Pass
0.5825	535	117	21	Pass
0.5949	509	114	22	Pass
0.6073	488	112	22	Pass
0.6197	451	104	23	Pass
0.6321	428	99	23	Pass
0.6445	407	92	22	Pass
0.6569	382	87	22	Pass
0.6693	360	81	22	Pass
0.6817	338	76	22	Pass
0.6941	315	72	22	Pass
0.7065	301	72	23	Pass
0.7188	280	72	25	Pass
0.7312	261	69	26	Pass
0.7436	250	68	27	Pass
0.7560	237	67	28	Pass
0.7684	227	64	28	Pass
0.7808	214	61	28	Pass
0.7932	198	58	29	Pass
0.8056	193	56	29	Pass
0.8180	186	54	29	Pass
0.8304	178	50	28	Pass
0.8428	172	50	29	Pass
0.8552	161	48	29	Pass
0.8676	154	46	29	Pass
0.8800	148	41	27	Pass
0.8924	142	40	28	Pass
0.9047	133	35	26	Pass
0.9171	128	30	23	Pass
0.9295	121	27	22	Pass
0.9419	112	25	22	Pass
0.9543	101	24	23	Pass
0.9667	97	20	20	Pass
0.9791	91	20	21	Pass
0.9915	82	17	20	Pass
1.0039	77	14	18	Pass
1.0163	65	13	20	Pass
1.0287	61	11	18	Pass
1.0411	55	9	16	Pass
1.0535	51	6	11	Pass
1.0659	48	6	12	Pass
1.0782	43	6	13	Pass
1.0906	42	6	14	Pass
1.1030	36	6	16	Pass
1.1154	34	5	14	Pass
1.1278	29	5	17	Pass
1.1402	27	5	18	Pass
1.1526	25	4	16	Pass
1.1650	21	4	19	Pass
1.1774	19	4	21	Pass
1.1898	18	4	22	Pass
1.2022	15	4	26	Pass
1.2146	14	4	28	Pass
1.2270	13	3	23	Pass
1.2394	11	2	18	Pass

1.2518	9	2	22	Pass
1.2641	8	2	25	Pass
1.2765	8	2	25	Pass
1.2889	8	2	25	Pass
1.3013	5	1	20	Pass
1.3137	3	0	0	Pass
1.3261	3	0	0	Pass
1.3385	2	0	0	Pass
1.3509	2	0	0	Pass
1.3633	0	0	0	Pass
1.3757	0	0	0	Pass
1.3881	0	0	0	Pass
1.4005	0	0	0	Pass
1.4129	0	0	0	Pass
1.4253	0	0	0	Pass
1.4376	0	0	0	Pass
1.4500	0	0	0	Pass

ADDITIONAL BASIN INFORMATION

Name : Basin 2 - Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	3.7

Impervious Land Use	Acres
PARKING FLAT	14.6

Water Quality BMP Flow and Volume for POC 5 (Basin 2).
On-line facility volume: 1.5576 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 1.8935 cfs.
Off-line facility target flow: 0.9768 **cfs.**
Adjusted for 15 min: 1.0781 cfs.

Name : Basin 1 (Full Buildout)- Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	3.04

Impervious Land Use	Acres
PARKING FLAT	10.46

Water Quality BMP Flow and Volume for POC 4 (Basin 1 Full Buildout).
On-line facility volume: 1.1293 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 1.3526 **cfs.**
Off-line facility target flow: 0.6996 **cfs.**
Adjusted for 15 min: 0.77 **cfs.**

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Western Washington Hydrology Model
PROJECT REPORT

Project Name: SCC Master Drainage Plan
Site Address: Shoreline Comm. College
City : Shoreline
Report Date : 1/22/2013
Gage : Seatac
Data Start : 1948/10/01
Data End : 1998/09/30
Precip Scale: 0.83
WWHM3 Version:

LRDP PLAN – BASIN 4

PREDEVELOPED LAND USE

Name : Basin 4 (SW Parking Area)
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	10.3

Impervious Land Use	Acres

DEVELOPED LAND USE

Name : Basin 4 (SW Parking Area) - Developed
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	1.0

Impervious Land Use	Acres
PARKING FLAT	9.3

Element Flows To:

Surface	Interflow	Groundwater
Basin 4 Vault,	Basin 4 Vault,	

1

Name : Basin 4 Vault
Width : 149.256979031125 ft.
Length : 447.770937093363 ft.
Depth: 5ft.
Volume at riser head : 6.308ft.
Discharge Structure
Riser Height: 4 ft.
Riser Diameter: 18 in.
NotchType : Rectangular
Notch Width : 0.106 ft.
Notch Height: 1.214 ft.
Orifice 1 Diameter: 1.345 in. **Elevation:** 0 ft.

Element Flows To:
Outlet 1 **Outlet 2**

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
0.000	1.534	0.000	0.000	0.000
0.056	1.534	0.085	0.011	0.000
0.111	1.534	0.170	0.016	0.000
0.167	1.534	0.256	0.019	0.000
0.222	1.534	0.341	0.022	0.000
0.278	1.534	0.426	0.025	0.000
0.333	1.534	0.511	0.027	0.000
0.389	1.534	0.597	0.030	0.000
0.444	1.534	0.682	0.032	0.000
0.500	1.534	0.767	0.034	0.000
0.556	1.534	0.852	0.035	0.000
0.611	1.534	0.938	0.037	0.000
0.667	1.534	1.023	0.039	0.000
0.722	1.534	1.108	0.040	0.000
0.778	1.534	1.193	0.042	0.000
0.833	1.534	1.279	0.043	0.000
0.889	1.534	1.364	0.045	0.000
0.944	1.534	1.449	0.046	0.000
1.000	1.534	1.534	0.048	0.000
1.056	1.534	1.620	0.049	0.000
1.111	1.534	1.705	0.050	0.000
1.167	1.534	1.790	0.051	0.000
1.222	1.534	1.875	0.053	0.000
1.278	1.534	1.960	0.054	0.000
1.333	1.534	2.046	0.055	0.000
1.389	1.534	2.131	0.056	0.000
1.444	1.534	2.216	0.057	0.000
1.500	1.534	2.301	0.058	0.000
1.556	1.534	2.387	0.059	0.000
1.611	1.534	2.472	0.060	0.000
1.667	1.534	2.557	0.061	0.000
1.722	1.534	2.642	0.062	0.000
1.778	1.534	2.728	0.063	0.000
1.833	1.534	2.813	0.064	0.000
1.889	1.534	2.898	0.065	0.000

1.944	1.534	2.983	0.066	0.000
2.000	1.534	3.069	0.067	0.000
2.056	1.534	3.154	0.068	0.000
2.111	1.534	3.239	0.069	0.000
2.167	1.534	3.324	0.070	0.000
2.222	1.534	3.409	0.071	0.000
2.278	1.534	3.495	0.072	0.000
2.333	1.534	3.580	0.073	0.000
2.389	1.534	3.665	0.073	0.000
2.444	1.534	3.750	0.074	0.000
2.500	1.534	3.836	0.075	0.000
2.556	1.534	3.921	0.076	0.000
2.611	1.534	4.006	0.077	0.000
2.667	1.534	4.091	0.078	0.000
2.722	1.534	4.177	0.078	0.000
2.778	1.534	4.262	0.079	0.000
2.833	1.534	4.347	0.084	0.000
2.889	1.534	4.432	0.092	0.000
2.944	1.534	4.518	0.103	0.000
3.000	1.534	4.603	0.116	0.000
3.056	1.534	4.688	0.130	0.000
3.111	1.534	4.773	0.145	0.000
3.167	1.534	4.859	0.161	0.000
3.222	1.534	4.944	0.178	0.000
3.278	1.534	5.029	0.196	0.000
3.333	1.534	5.114	0.215	0.000
3.389	1.534	5.199	0.233	0.000
3.444	1.534	5.285	0.253	0.000
3.500	1.534	5.370	0.272	0.000
3.556	1.534	5.455	0.292	0.000
3.611	1.534	5.540	0.312	0.000
3.667	1.534	5.626	0.332	0.000
3.722	1.534	5.711	0.352	0.000
3.778	1.534	5.796	0.373	0.000
3.833	1.534	5.881	0.397	0.000
3.889	1.534	5.967	0.422	0.000
3.944	1.534	6.052	0.448	0.000
4.000	1.534	6.137	0.474	0.000
4.056	1.534	6.222	0.666	0.000
4.111	1.534	6.308	1.016	0.000
4.167	1.534	6.393	1.470	0.000
4.222	1.534	6.478	2.007	0.000
4.278	1.534	6.563	2.616	0.000
4.333	1.534	6.649	3.289	0.000
4.389	1.534	6.734	4.021	0.000
4.444	1.534	6.819	4.808	0.000
4.500	1.534	6.904	5.645	0.000
4.556	1.534	6.989	6.530	0.000
4.611	1.534	7.075	7.460	0.000
4.667	1.534	7.160	8.433	0.000
4.722	1.534	7.245	9.448	0.000
4.778	1.534	7.330	10.50	0.000
4.833	1.534	7.416	11.60	0.000
4.889	1.534	7.501	12.73	0.000
4.944	1.534	7.586	13.89	0.000
5.000	1.534	7.671	15.09	0.000
5.056	1.534	7.757	16.33	0.000

5.111	0.000	0.000	17.60	0.000

MITIGATED LAND USE

Flow Frequency Return Periods for Predeveloped. POC #7 (Basin 4)

Return Period	**Flow(cfs)**
2 year	0.158658
5 year	0.292075
10 year	0.373143
25 year	0.460988
50 year	0.515547
100 year	0.561645

Flow Frequency Return Periods for Mitigated. POC #7 (Basin 4)

Return Period	**Flow(cfs)**
2 year	0.085247
5 year	0.141765
10 year	0.192294
25 year	0.274467
50 year	0.35141
100 year	0.444096

POC #7 (Basin 4)
The Facility PASSED

The Facility PASSED.

Flow(CFS)	**Predev**	**Dev**	**Percentage**	**Pass/Fail**
0.0793	4025	3803	94	Pass
0.0837	3663	2785	76	Pass
0.0881	3239	2354	72	Pass
0.0925	2975	2150	72	Pass
0.0970	2753	1949	70	Pass
0.1014	2471	1745	70	Pass
0.1058	2314	1591	68	Pass
0.1102	2099	1424	67	Pass
0.1146	1951	1315	67	Pass
0.1190	1831	1217	66	Pass
0.1234	1679	1102	65	Pass
0.1278	1581	1031	65	Pass
0.1322	1471	941	63	Pass
0.1366	1394	845	60	Pass
0.1410	1292	747	57	Pass
0.1454	1202	692	57	Pass
0.1498	1129	651	57	Pass
0.1542	1037	603	58	Pass
0.1586	985	560	56	Pass
0.1630	914	509	55	Pass
0.1675	870	479	55	Pass
0.1719	827	448	54	Pass
0.1763	776	412	53	Pass
0.1807	734	388	52	Pass

0.1851	689	363	52	Pass
0.1895	658	349	53	Pass
0.1939	631	330	52	Pass
0.1983	600	308	51	Pass
0.2027	570	285	50	Pass
0.2071	535	266	49	Pass
0.2115	512	254	49	Pass
0.2159	495	247	49	Pass
0.2203	452	232	51	Pass
0.2247	429	223	51	Pass
0.2291	407	214	52	Pass
0.2335	383	205	53	Pass
0.2380	363	197	54	Pass
0.2424	338	185	54	Pass
0.2468	318	177	55	Pass
0.2512	301	165	54	Pass
0.2556	282	151	53	Pass
0.2600	266	145	54	Pass
0.2644	251	137	54	Pass
0.2688	239	130	54	Pass
0.2732	227	123	54	Pass
0.2776	214	115	53	Pass
0.2820	198	105	53	Pass
0.2864	193	99	51	Pass
0.2908	187	96	51	Pass
0.2952	178	91	51	Pass
0.2996	172	88	51	Pass
0.3040	161	83	51	Pass
0.3085	155	79	50	Pass
0.3129	149	74	49	Pass
0.3173	142	70	49	Pass
0.3217	134	67	50	Pass
0.3261	128	64	50	Pass
0.3305	121	62	51	Pass
0.3349	112	60	53	Pass
0.3393	101	57	56	Pass
0.3437	97	57	58	Pass
0.3481	91	54	59	Pass
0.3525	83	49	59	Pass
0.3569	77	46	59	Pass
0.3613	65	42	64	Pass
0.3657	61	39	63	Pass
0.3701	55	36	65	Pass
0.3745	51	32	62	Pass
0.3790	50	29	58	Pass
0.3834	43	27	62	Pass
0.3878	42	26	61	Pass
0.3922	36	24	66	Pass
0.3966	34	24	70	Pass
0.4010	31	21	67	Pass
0.4054	27	21	77	Pass
0.4098	25	18	72	Pass
0.4142	21	16	76	Pass
0.4186	19	15	78	Pass
0.4230	18	13	72	Pass
0.4274	15	10	66	Pass
0.4318	14	10	71	Pass

0.4362	11	9	81	Pass
0.4406	11	8	72	Pass
0.4450	9	7	77	Pass
0.4495	8	7	87	Pass
0.4539	8	6	75	Pass
0.4583	8	4	50	Pass
0.4627	5	4	80	Pass
0.4671	3	3	100	Pass
0.4715	3	3	100	Pass
0.4759	2	2	100	Pass
0.4803	2	1	50	Pass
0.4847	1	1	100	Pass
0.4891	0	0	100	Pass
0.4935	0	0	0	Pass
0.4979	0	0	0	Pass
0.5023	0	0	0	Pass
0.5067	0	0	0	Pass
0.5111	0	0	0	Pass
0.5155	0	0	0	Pass

Water Quality BMP Flow and Volume for POC 7 (Basin 4).
On-line facility volume: 0.9558 acre-feet
On-line facility target flow: 0.01 **cfs.**
Adjusted for 15 min: 1.2158 cfs.
Off-line facility target flow: 0.6227 **cfs.**
Adjusted for 15 min: 0.6958 **cfs.**

h:\doc\21cp\09\006 scc master plan\hydraulics\wwhm - lrdp basin 4 plan.doc

Determining Number of Cartridges for Systems Downstream of Detention

CONTECH Stormwater Solutions Inc. Engineer:	JHR	
Date	1/18/2013	
Site Information		
Project Name	Shoreline Community College	
Project State	Washington	
Project Location	Seattle	
Drainage Area, Ad	8.55	ac
Impervious Area, Ai	8.55	ac
Pervious Area, Ap	0.00	
% Impervious	100%	
Runoff Coefficient, Rc	0.95	
Upstream Detention System		
Peak release rate from detention, $Q_{release\ peak}$	0.21	cfs
Treatment release rate from detention, $Q_{release\ treat}$	0.04	cfs
Detention pretreatment credit (from removal efficiency calcs)	50%	
Mass loading calculations		
Mean Annual Rainfall, P	36	in
Agency required % removal	80%	
Percent Runoff Capture	90%	
Mean Annual Runoff, V_t	955,303	ft^3
Event Mean Concentration of Pollutant, EMC	60	mg/l
Annual Mass Load, M_{total}	3576.09	lbs
Filter System		
Filtration brand	StormFilter	
Cartridge height	12	in
Specific Flow Rate	1.0	gpm/ft^2
Number of cartridges - mass loading		
Mass removed by pretreatment system, M_{pre}	1788.05	lbs
Mass load to filters after pretreatment, M_{pass1}	1788.05	lbs
Estimate the required filter efficiency, E_{filter}	0.60	
Mass to be captured by filters, M_{filter}	1072.83	lbs
Allowable Cartridge Flow rate, Q_{cart}	5.00	
Mass load per cartridge, M_{cart} (lbs)	24.00	lbs
Number of Cartridges required, N_{mass}	45	
Treatment Capacity	0.50	cfs
Determine Critical Sizing Value		
Number of Cartridges using $Q_{release\ treat}$, N_{flow}	4	
Method to Use:	MASS-LOADING	

SUMMARY

Treatment Flow Rate, cfs	0.50
Cartridge Flow Rate, gpm	5.0
Number of Cartridges	45

1 of 1

Shoreline Community College

Master Plan

Transportation Technical Report

January 18, 2011
(Updated January 28, 2013)

Prepared by:

Transportation Solutions, Inc.
8250 165th Avenue NE
Redmond, WA 98052

425-883-4134

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Introduction

In June 2006, Shoreline Community College issued a Final Environmental Impact Statement ("FEIS") that evaluated a Concept Master Plan for the college ("2006 Draft Plan"). The 2006 Draft Plan was intended to guide future development on the SCC campus and serve as the basis for subsequent approval by the City of Shoreline of an overlay-zoning district. The 2006 Draft Plan was not adopted by the College or approved by the City. A comprehensive traffic impact analysis was prepared as part of that FEIS.

The College is now preparing two new planning documents. One is the Shoreline Community College Long Range Development Plan 2010 – 2040 ("LRDP"). The LRDP presents a 30 year long range look at the future development opportunities at the College and is anticipated to be adopted by the College. The first phase of the LRDP (15 years) is proposed to be submitted for approval to the City of Shoreline as a separate plan in order to meet the City's new code provisions requiring a Master Development Plan (MDP) for the College.

An Addendum to the FEIS was prepared because these new proposals are not likely to have new significant adverse environmental impacts not already evaluated in the FEIS.

Changes in economic conditions, long range planning, and potential opportunities for program growth have resulted in the development of a LRDP that focuses on replacement of older structures, improved pedestrian and vehicular circulation, and a more modest growth in the student population then contemplated in the 2006 Draft Plan. The intent of this document is to present transportation related analysis of anticipated campus growth that is described in the Campus Master Plan for the MDP 15-year (2025) and LRDP 30-year (2040) time frames.

The analysis in this report is based on updated AM and midday peak hour traffic counts that were made in May of 2009 and updated parking supply and utilization counts that were made in May of 2009 as well as updated parking supply counts that were made in 2010.

The report is divided into sections that first examine existing conditions. The existing conditions section establishes the baseline against which future conditions will be evaluated. Subsequent sections evaluate traffic conditions without and with campus development for the 2025 and 2040 development periods.

This update also incorporates revisions to the previously adopted master plan to provide student housing on-campus. In addition, some sections have been expanded to provide additional discussion that addresses City staff comments on the previous (1/18/11) version of this report.

Existing Conditions

This section describes existing on and off-campus transportation conditions. It includes a discussion of the existing road network and traffic volumes, analysis of intersection operations, parking supply and demand, transit service, as well as bicycle and pedestrian facilities.

Existing Road Network

The existing road network is characterized by a north/south and east/west grid network with the principle arterials running in a north/south direction. Minor deviations from the grid pattern accommodate changes in grade and topography to the west and south of the campus. The SCC campus is surrounded by suburban residential land uses that are linked via the local road network to Aurora Avenue to the east. Aurora Avenue provides access to adjacent commercial land uses and is the major transportation corridor in the area.

The primary facilities that make up the local street network include:

Aurora Avenue (SR 99) is a north-south, four-lane state route and principal urban arterial with a center, two way left-turning lane. Aurora Avenue links Shoreline to the cities of Seattle to the south and Lynwood, Edmonds, and Everett to the north. Travel lanes are generally 12 feet wide with 10-foot paved shoulders on both sides of the street. Curbs, gutters and sidewalks are located along the more recently developed property frontages of Aurora Avenue. The speed limit is posted at 40 mph. Traffic volumes range from 36,300 daily vehicles north of N 155th Street to 40,700 daily vehicles south of N 175th Street.

Innis Arden Way is an east-west, two-lane collector arterial providing primary access to the campus and residential areas west of the study area. Travel lanes are roughly 11 feet wide with 5 to 7-foot paved shoulders. The speed limit is posted at 35 mph. On days of peak campus activity (Monday through Thursday), approximately 8,930 vehicles per day travel the segment of Innis Arden Way between Greenwood Avenue N and the main campus access. Daily traffic volumes drop to approximately 2,170 vehicles west of the western most campus access on Innis Arden Way. Parking is prohibited along this road.

Greenwood Avenue is a north-south, two-lane roadway providing access to the Shoreline CC campus along its eastern edge. Travel lanes are approximately 11 feet in width. South of N 160th Street, the roadway has 3 to 4-foot paved shoulders and open ditches on both sides of the street with a 4-foot paved pathway on the east side of the street. North of N 160th Street, the shoulders diminish and there are open ditches on both sides of the street. North of Greenwood Drive, the roadway consists of 4 to 6-foot paved shoulders on both sides of the street with open ditches on the west side of the street. The posted speed limit is 35 mph south of N 160th Street and 30 mph north of N 160th Street. On days of peak campus activity (Monday through Thursday), this roadway averages approximately 4,480 vehicles per day north of Innis Arden Way, and approximately 4,950 daily vehicles south of Carlyle Hall Road. South of N 160th Street, traffic volumes on Greenwood Avenue increase to approximately 6,450 vehicles per day. South of NE 160th Street, Greenwood Ave N is identified as a collector arterial. North of N 160th Street, it is identified as a residential street.

Dayton Avenue is a north-south, two-lane minor arterial. The total pavement width is approximately 54 feet in the vicinity of N 160th Street. Travel lanes are approximately 11 feet wide. Parking is allowed on both sides of the street north of N 160th Street. The speed limit is posted at 35 mph. Daily traffic volumes average 8,970 vehicles north of Carlyle Hall Road N.

Carlyle Hall Road is an east-west, two-lane collector arterial that runs along the northern property line of the campus. Travel lanes are generally 11 feet wide. East of Greenwood Avenue, shoulders consist of pavement about 1 to 2 feet wide on both sides of the street, along with 4-foot gravel shoulders on the north side of the street and 12-foot gravel shoulders on the south side of the street. West of Greenwood Avenue, the roadway consists of 4-foot gravel shoulders on the north side of the street and 8-foot gravel shoulders on the south side of the street. The speed limit is posted at 25 mph. West of Dayton Avenue approximately 3,400 vehicles per day travel this roadway.

N 175th Street is an east-west, four-lane principal arterial that links Aurora Avenue N with I-5 to the east. Travel lanes are 11 to 12 feet wide. Curbs, gutters and sidewalks are located on both sides of the street. The posted speed limit is 35 mph. This roadway averages approximately 25,760 daily vehicles east of Aurora Avenue (SR 99).

N 160th Street is an east-west roadway that serves as a primary link between the campus and Aurora Avenue N to the east. It consists of 4 travel lanes east of Dayton Avenue and 2 travel lanes with parking on both sides of the roadway west of Dayton Avenue. The pavement width is approximately 44 feet east of Dayton Avenue and approximately 40 feet west of Dayton Avenue. Curbs, gutters and sidewalks are located on both sides of the street. West of Greenwood Avenue, the roadway is not channelized, consisting of 2 travel lanes and parking on both sides of the roadway. The total pavement width along this segment is approximately 35 feet with curbs, gutters and sidewalks on the north side of the street and 7 to 10-foot gravel shoulders on the south side of the street. The posted speed limit is 35 mph. Between Dayton Avenue and Greenwood Avenue, daily traffic volumes reach approximately 8,190 vehicles. West of Greenwood Avenue, where N 160th Street provides access to Highland Terrace Elementary School and nearby residences, traffic volumes drop to approximately 1,355 vehicles per day. It is identified as a minor arterial between Dayton Ave N and Aurora Ave N and is a collector arterial between Dayton Ave N and Greenwood Ave N.

Existing Traffic Volumes

As stated in the introduction, AM and midday peak hour traffic counts were made in May of 2009 at selected intersections to establish existing traffic conditions in the area surrounding the campus.

Peak hour turning movement volumes at intersections along the primary routes serving the campus are analyzed to assess traffic operations and levels of congestion within the study area. In an urban environment, intersections by definition are the point where traffic streams converge and the potential for congestion and delay is at its greatest. Typically, it is the PM peak hour where the combination of commuter traffic traveling from work to home and general traffic volumes reach the greatest volume and the potential for congestion peaks. However, given the nature of SCC class schedules and campus activity it is more important to examine the AM peak hour when students are arriving and the midday peak hour when the volume of campus generated traffic exiting the campus peaks. The intersections selected for analysis with city staff input are listed in Table 1 below. All unsignalized intersections are two-way stop controlled except for the intersections of Greenwood Ave N/ N 160th St and Dayton Ave N/ Carlyle Hall Rd N, which are all-way stop controlled.

Table 1: Analyzed Intersections

Signalized
N 160th St/ Aurora Ave
N 160th St/ Dayton Ave
N 165th St/ Aurora Ave
Unsignalized
West Campus Access/ Innis Arden Way
Innis Arden Way/ Central Campus Access
Innis Arden Way/ Main Campus Access
Innis Arden Way/ Greenwood Ave N**
N 160th St/ Greenwood Ave N**
Greenwood Ave N/ E Campus Access
SCC N Parking Lot/ Greenwood Ave N
Carlyle Hall Rd NW/ Greenwood Ave N
Carlyle Hall Rd NW/ Dayton Ave
N Greenwood Dr/ Dayton Ave
N 165th St/ Fremont Ave N

Source: TSI

AM Peak Hour

The AM peak hour is defined as the one hour period between 7 and 9 AM when traffic volumes at a specific intersection are at their peak. Figure 1 illustrates the existing (2009) AM peak hour turning movement volumes for the intersections listed in Table 1. During the AM peak hour the SCC campus generates approximately 984 trips per hour. Approximately 85% of these trips are inbound to the campus and 15% are outbound from the campus. Observations at campus load zones indicate that the relatively high outbound volume is likely attributable to carpool activity where staff and students are dropped off at the campus while the driver continues on to his or her final destination. Most of the AM peak hour campus generated traffic (34%) uses the west campus access on Innis Arden Way followed by the main campus access on Innis Arden Way (31%) and east campus access on Greenwood Ave N (27%). The north parking lot access on Greenwood Ave N accommodates 4% of the AM peak hour volume while the central campus access (exit only) on Innis Arden Way also carries 4% of the peak hour volume.

Local circulation patterns on streets within the study area reflect the typical north to south morning commute as workers travel from home to work. The effects of inbound SCC students are also noticeable at N 160th St/ Greenwood Ave N. Turning movement volumes (Figure 1) at Aurora Ave N/ N 160th Street show significant volumes turning onto westbound N 160th St and then turning north onto Greenwood Ave N and west onto Innis Arden Way to enter the campus.

Midday Peak Hour

Figure 2 illustrates existing (2009) midday peak hour turning movement volumes for the intersections listed in Table 1. The midday peak hour is defined as the one hour period between 11AM and 1 PM when traffic volumes generated by the college at the analyzed intersections are at their peak. The SCC campus generates approximately 986 vehicles trips during the midday peak period. This is approximately the same as the volume documented for the AM peak hour. The inbound and outbound split is 41% inbound and 59% outbound. This, more balanced, distribution of arriving and departing students is in contrast with the greater inbound volumes observed during the AM peak hour. Most of the midday peak hour campus generated traffic (30%) uses the east campus access on Greenwood Avenue followed by the main campus access on Innis Arden Way (29%) and west campus access on Innis Arden Way (27%). The north parking lot access on Greenwood Ave N accommodates 8% of the midday peak hour volume while the central campus access (exit only) on Innis Arden Way carries 6% of the peak hour volume.

Midday traffic volumes at intersections surrounding the campus tend to be somewhat less than AM peak hour volumes as are traffic volumes at intersections more distant from the campus. The exception to this is on Aurora Ave N, where midday peak hour volumes are slightly higher than AM peak hour volumes.

PM Peak Hour

Evaluation of PM peak hour conditions is typically included in a traffic analysis since it is the time frame when weekday traffic volumes typically peak and the potential for congestion is greatest. However, during the scoping process for this traffic report that updates the 2006 Draft Plan EIS, City staff stated their concern was to focus on AM and midday peak hour conditions since those are the time periods when the college is generating the greatest number of trips and the potential for college generated congestion at nearby intersections is greatest. For an examination of PM peak hour conditions, the reader is referred to the transportation section of the 2006 Draft Plan EIS. In that document, PM peak hour trips generated by the college are shown to be approximately half of those generated during the AM and midday peak hours. There is nothing proposed in the LRDP that would increase PM peak hour trips relative to trips generated in the AM or midday peak hours.

Campus Trip Generation Summary

Table 2 summarizes the daily and peak hourly trip generation characteristics for the SCC campus. The relationship between campus generated trips and campus population can be established by dividing the number of student FTE's (full time equivalents) enrolled during the time the counts were made into the number of trips generated during different time periods. This ratio will serve as a baseline for forecasting future campus trip generation with master plan development. During spring quarter of 2009 when the intersection counts were made there were 4,959 student FTE's enrolled. Campus trip generation during both the AM and midday peak hours is 0.199 vehicle trips per student FTE.

Table 2: SCC Trip Generation Summary (2009)

Time Period	Trips Generated	Student FTE's	Trips per Student FTE
AM Peak Hour	984	4,959	0.199
Midday Peak Hour	986		0.199

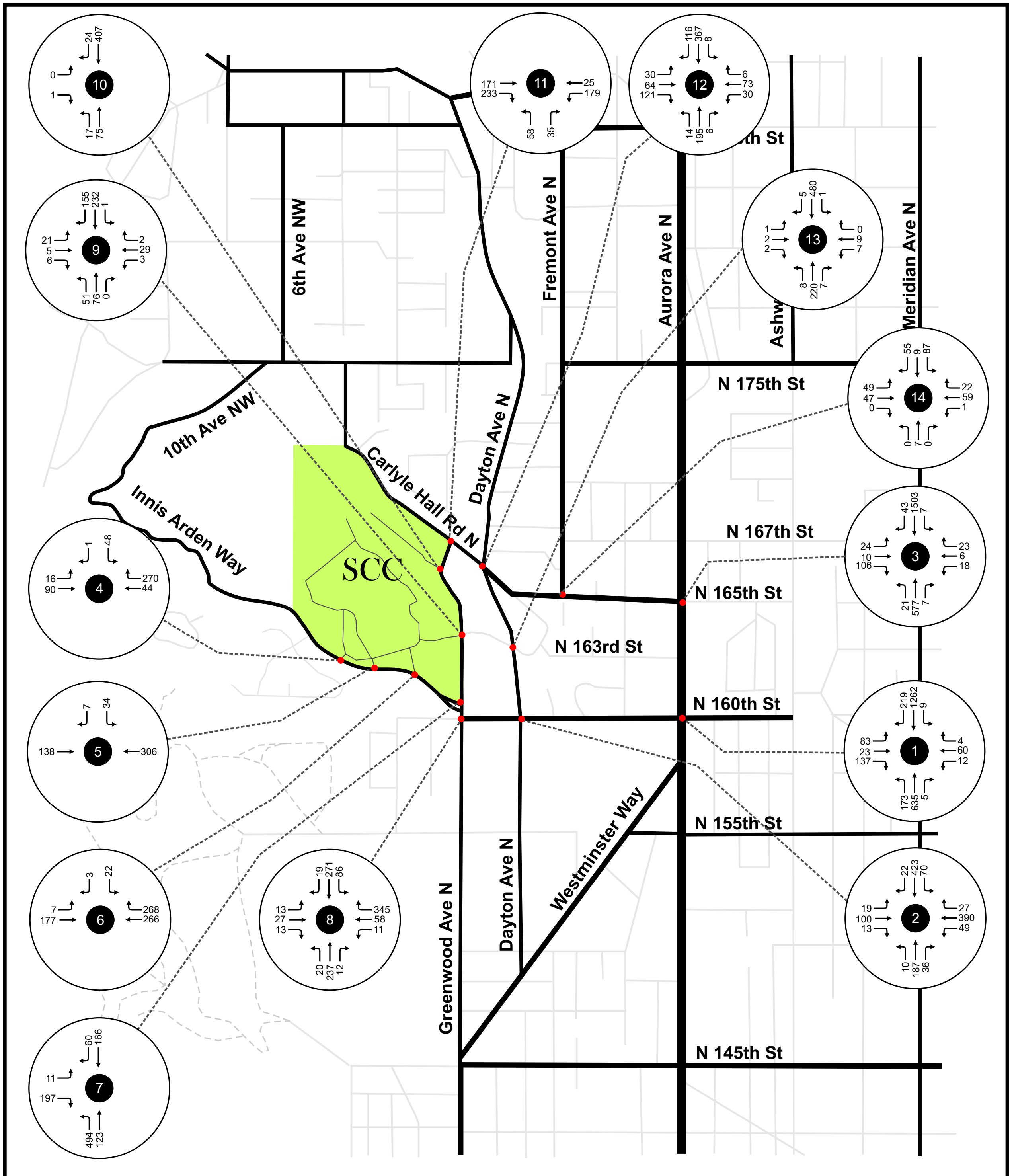
Source: TSI

The number of trips generated by the campus is based on driveway counts at each campus access. Student FTE's were used as the factor to calculate a trip generation rate since it is measurable and consistent. The resulting peak hour rate of 0.199 trips per student FTE incorporates trips generated by faculty, staff, full-time and part-time students as well as visitors and vendors. A trip generation ratio based on actual driveway counts and a consistent statistical factor (student FTE's) that is used for campus planning is a reasonable and accurate approach to establish a baseline for forecasting future campus generated trips.

This rate purposely does not incorporate trips generated by the satellite lot or trips generated by those parking on neighborhood streets. The access to the satellite lot is not included because the access serves not only the portion of the Sears site that is used by the college but also provides an access to the rest of the Aurora Square Shopping Center. It is assumed that SCC use of this lot would not increase and that for purposes of analysis SCC trips using this access are considered part of the background traffic volumes. The same assumption was applied to campus generated trips that park in the surrounding neighborhood. It is not possible to separate them from other vehicles parking in the area and given the presence of the RPZ it is assumed that the number would not increase and that they will remain part of the background traffic volumes.

It could be argued that the trip rate should be adjusted to reflect trips generated by those that do not park on campus. It could also be argued more effectively that increasing fuel prices will shift more students to transit and decrease the trip generation rate as would planned increases in on-line learning opportunities. For these reasons it is understood that the documented trip generation rate is valid and that maintaining that rate when forecasting future campus generated trips is a conservative approach.

This approach to forecasting trip generation is much more accurate than using building area since it is based on two easily measurable variables; peak hour traffic counts at campus accesses and student FTE statistics. The relationship of building area to student can fluctuate widely from program to program and building construction is not necessarily and indicator of campus growth. For example, the automotive center program requires significantly more building space per student than a typical classroom and support buildings such as the student union building or library generate few if any exclusive trips to the campus. Furthermore, student FTE’s are the variable used in state and campus based planning and provide a consistent reference for making projections to campus growth. For these reasons, student FTE’s will be used as the basis for forecasting trip generation and recommended parking supplies for the master plan program.



Shoreline COMMUNITY COLLEGE

Figure 1
AM Peak Hour (2009)
Existing Turning Movement Volumes

Master Plan
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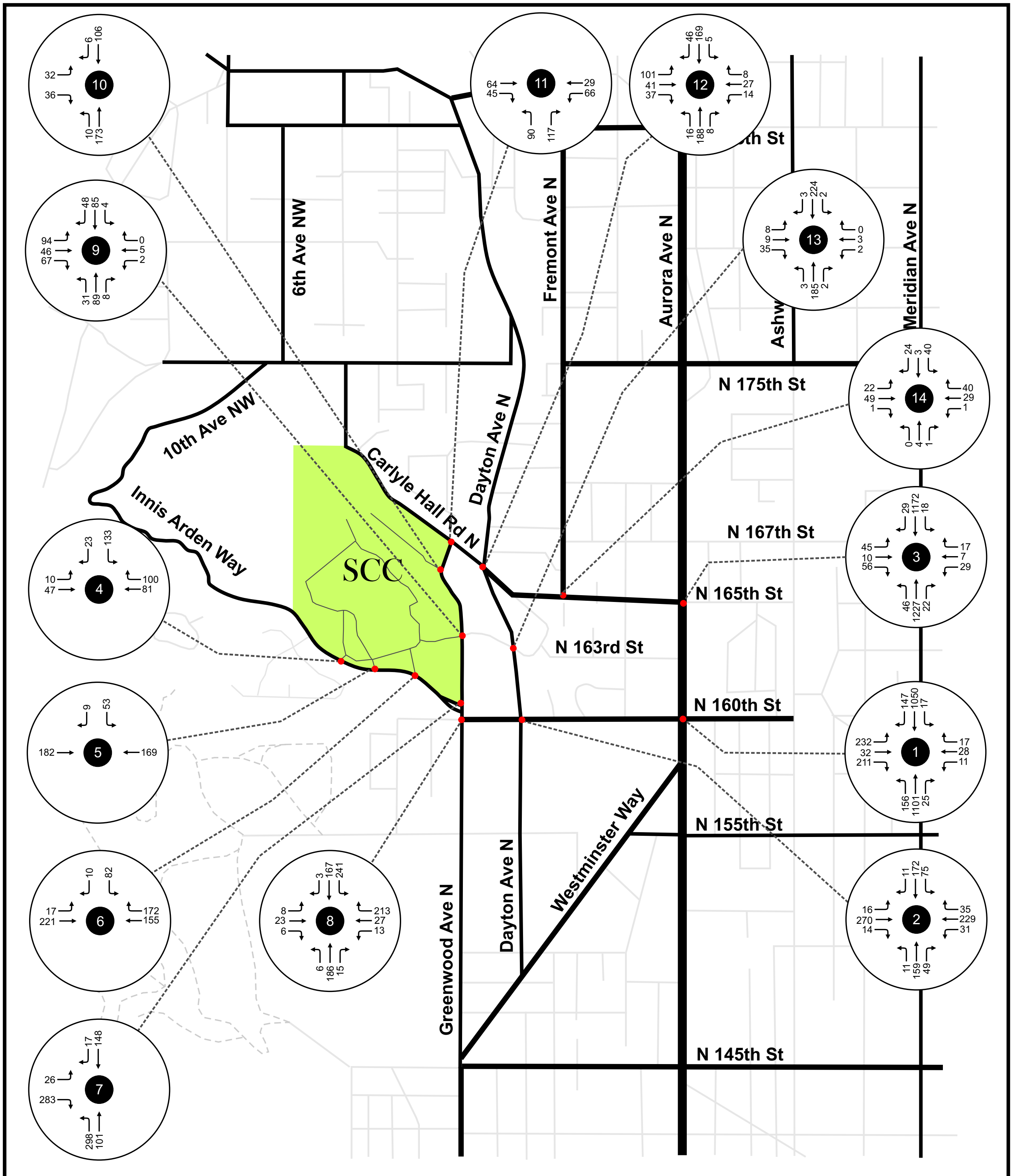


Shoreline
COMMUNITY COLLEGE

Figure 2
Midday Peak Hour (2009)
Existing Turning Movement Volumes

Master Plan
Transportation Technical Report

Existing Traffic Operations

The level of service at the selected intersections was analyzed for the AM and midday peak hours. Level of service (LOS) is a measure of the ability of a given intersection to serve traffic traveling through it. The Transportation Research Board developed the LOS methodology, which used is summarized in the *Highway Capacity Manual (HCM), 2000*. The methodology takes into account the geometry and channelization of the intersection, pedestrian activity, traffic controls, signal timing and phasing for signalized intersections, as well as turning movement volumes for each leg of the intersection. These factors are entered into a computer model to determine the LOS of an intersection.

Intersection LOS is defined in terms of seconds of average vehicle control delay. Control delay includes all the time a driver is delayed at an intersection. At signalized intersections, the majority of control delay is associated with waiting during a red light. At unsignalized intersections, the majority of control delay is associated with moving through the queue at a stop sign controlled approach. Control delay at both types of intersection also includes the time to decelerate while approaching an intersection and accelerate when leaving an intersection. Intersection level of service calculations were made using the *Synchro* computer program, Version 7, which was developed by Trafficware to be consistent with the 2000 HCM methodology.

Seconds of control delay are divided into several categories ranging from LOS-A, which is very good, to LOS-F, which reflects a breakdown in traffic flow. Although these letter designations provide a simple basis for comparison, seconds of average vehicle delay should be used as the exact measure of comparison. Table 3 summarizes the breakdown of LOS categories by seconds of delay for both signalized and unsignalized intersections.

Table 3: Intersection Level of Service Criteria

LOS Category	**Intersection Type and Delay Range (sec.)**	
	Unsignalized LOS	Signalized
A	≤ 10	≤ 10
B	> 10 and ≤ 15	> 10 and ≤ 20
C	> 15 and ≤ 25	> 20 and ≤ 35
D	> 25 and ≤ 35	> 35 and ≤ 55
E	> 35 and ≤ 50	> 55 and ≤ 80
F	> 50	> 80

Source: Highway Capacity Manual, Special Report 209, 2000

The City of Shoreline has adopted LOS-E as a city wide standard for signalized arterial intersections. The LOS standard is based on the *Transportation Research Board's* delay method described above. Excluded from this standard are state operated facilities identified by WSDOT as *Highways of Statewide Significance*. Aurora Avenue N, Ballinger Way NE, and I-5 are *Highways of Statewide Significance* within the City of Shoreline. WSDOT is responsible for establishing and maintaining the LOS standard for such facilities.

AM Peak Hour

Table 4 summarizes existing LOS and average vehicle delay for the AM peak hour. One signalized intersection operates poorly (LOS-E or LOS-F) during the AM peak hour. Aurora Ave N/ N 175th St operates at LOS-E with the westbound approach operating at LOS-F. This poor operation is largely due to the high volume of southbound traffic combined with a relatively high volume of vehicles making westbound left turn movements and eastbound through movements.

Table 4: AM Peak Hour Intersection Level of Service (Existing 2009)

Intersection	**LOS (sec.)[1]** Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	21.2			
N 160th St/ Dayton Ave	B	14.5			
N 165th St/ Aurora Ave	A	6.3			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	12.1
Innis Arden Way/ Central Campus Access			SB	B	13.1
Innis Arden Way/ Main Campus Access			SB	C	15.9
Innis Arden Way/ Greenwood Ave N[3]	C	20.7	SB	F	62.9
N 160th St/ Greenwood Ave N[3]	A	9.2	WB	B	12.9
Greenwood Ave N/ E Campus Access			WB	C	17.5
SCC N Parking Lot/ Greenwood Ave N			EB	B	11.0
Carlyle Hall Rd NW/ Greenwood Ave N			NB	D	27.6
Carlyle Hall Rd NW/ Dayton Ave	D	32.7	SB	F	52.2
N Greenwood Dr/ Dayton Ave			WB	C	18.3
N 165th St/ Fremont Ave N			SB	B	13.2

Source: TSI
[1](sec.) = vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

The unique channelization and operating characteristics of the intersection of Greenwood Ave N with Innis Arden Way and N 160th St are discussed separately below.

All signalized and unsignalized intersections operate at LOS-C or better based on the average of all approaches with the exception of Carlyle Hall Rd NW/ Dayton Ave, which is controlled by an all-way stop and operates at LOS-D. The southbound approach of this intersection operates at LOS-F due to the relatively high volume of southbound commuter traffic.

The adjacent intersections of Greenwood Ave N/ Innis Arden Way and Greenwood Ave N/ N 160th St are separated by approximately 50 feet. Given this proximity, their operation is interconnected and must be evaluated in this context. The *Syncho* software used in this analysis does not effectively model intersections in close proximity or those with a non-traditional placement of stop signs. However, *SimTraffic* (a module of *Synchro*) creates traffic simulations using data imported from *Synchro*. *SimTraffic* incorporates collision avoidance logic, which allows the simulation to depict real life driving conditions. *SimTraffic* also provides reports indicating the LOS for an intersection and individual approaches to the intersection. *SimTraffic* was used to analyze the intersections of Greenwood Ave N/ Innis Arden Way and Greenwood Ave N/ N 160th Street for all time periods and conditions included in this study.

During the AM peak hour, the intersection of Greenwood Ave N/ N 160th Street operates at LOS-A with the westbound approach operating at LOS-B. The highest turning movement volume during the AM peak hour at this intersection is the westbound right turn followed by the southbound and northbound movements.

The intersection of Greenwood Ave N/ Innis Arden Way operates at LOS-C with the southbound movement operating at LOS-F. The highest turning movement volume at this intersection is the northbound left turn followed by almost identical volumes for southbound through and eastbound right turning traffic.

AM peak hour operations for the two intersections are governed by the relatively high volume of inbound traffic to SCC that is either making a northbound through or westbound right turn movement at the intersection of Greenwood Ave N/ N 160th Street. This traffic then makes a northbound left turn at Greenwood Ave N/ Innis Arden Way to access the campus from Innis Arden Way. The relatively high volume of traffic making this series of movements results in excessive delay for the southbound through movement at Greenwood Ave N/ Innis Arden Way. Eastbound right turning traffic entering Greenwood Avenue N from Innis Arden Way benefits from the relatively large volume of northbound traffic making a left turn. The northbound traffic impedes the southbound through volume resulting in increased opportunities for the eastbound volumes to make a right turn onto southbound Greenwood Avenue N.

Midday Peak Hour

Table 5 summarizes the midday peak hour LOS for the analyzed intersections. All signalized intersections operate at LOS-C or better. The unsignalized intersections all operate at LOS-C or better with the worst approaches on these intersections operating at LOS-C or better with one exceptions. The southbound approach to the intersection of Innis Arden Way/ Greenwood Avenue N operates at LOS-D.

Table 5: Midday Peak Hour Intersection Level of Service (Existing 2009)

Intersection	LOS (sec.)[1] Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	26.4			
N 160th St/ Dayton Ave	B	11.5			
N 165th St/ Aurora Ave	A	6.3			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	13.2
Innis Arden Way/ Central Campus Access			SB	B	12.5
Innis Arden Way/ Main Campus Access			SB	C	18.2
Innis Arden Way/ Greenwood Ave N**	C	16.6	EB	D	30.2
N 160th St/ Greenwood Ave N**	A	6.1	NB	A	8.5
Greenwood Ave N/ E Campus Access			EB	C	16.5
SCC N Parking Lot/ Greenwood Ave N			EB	B	10.9
Carlyle Hall Rd NW/ Greenwood Ave N			NB	B	12.8
Carlyle Hall Rd NW/ Dayton Ave	B	11.6	EB	B	12.4
N Greenwood Dr/ Dayton Ave			EB	B	11.4
N 165th St/ Fremont Ave N			NB	B	10.6

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

Traffic operations for the intersections of Greenwood Avenue N/ Innis Arden Way and Greenwood Avenue N/ N 160th Street are generally good during the midday with both intersections operating at LOS-C or better. The circulation pattern between the two intersections is fairly well balanced with the inbound campus traffic on N 160th Street turning right onto northbound Greenwood Avenue N and then left onto Innis Arden Way. Conversely, traffic leaving the campus is turning right (southbound) onto Greenwood Avenue N and then left onto eastbound N 160th Street. The complementary arrival and departure traffic flows observed during the midday peak hour result in a good LOS.

Parking Supply and Demand

Campus Parking

Campus parking supply and demand characteristics were surveyed in May 2009 to document the existing campus parking supplies and the parking demand generated by SCC faculty, staff, and students. The purpose of this survey was to establish the adequacy of existing parking supplies and establish a baseline for forecasting future parking demand characteristics and recommended parking supplies. There are two parking resources utilized by SCC; on-campus parking and the satellite lot parking located at the upper level of the Sears building on N 160th St.

The available campus parking supply consists of approximately 2,061 stalls. The supply decreased from previous counts due to the closure of the City owned parcel located on the west side of the campus. The existing parking supply is summarized in Table 6. A figure illustrating the on-campus parking supply may be found in the appendices.

Table 6: Existing Parking Supply (2010)

	Parking Zone	Supply
1	Visitor Lot (south)	150
2	Southwest Lots	375
3	North and Northwest Lots	850
4	East Lots	76
5	North Greenwood Lot	400
6	Satellite Lot (Sears)	210
	Total	**2,061**

Source: TSI

The hourly demand for campus parking was counted on a weekday during spring quarter 2009 and is illustrated in Table 7. Parking demand peaked at approximately 1,600 vehicles around 10:00 AM. Demand for parking in the lots close to the campus core was near or at capacity with the outlying north lot being at 55% of its capacity. Campus wide, 80% of the parking stalls were occupied around 10:00 AM and at 11 AM. The usable parking supply is typically 95% of the total supply for parking lots that serve a group that frequents them on a regular basis and are familiar with their operation. It is necessary to provide this reserve capacity to reduce circulation and congestion within the parking lots, allow for parking maneuvers, and reduce the delays in finding a parking stall. The existing on-campus parking demand is met by the existing supply. There is some capacity remaining to accommodate future increases in demand.

Table 7: Campus Parking Demand (2009)

	Zone	Time		
		9 AM	10 AM	11 AM
1	Visitor Lot (south)	85	124	134
2	Southwest Lots	323	357	361
3	North and Northwest Lots	578	735	720
4	East Lots	71	72	70
5	North Greenwood Lot	124	188	181
6	Satellite Lot (Sears)	120	126	130
	Total	**1,301**	**1,602**	**1,596**

Source: TSI

On-Street Parking Supply and Demand

On-street parking conditions were assessed to establish the available parking supply, the demand for that supply, and the presence of parking restrictions intended to manage parking demand. On-street conditions were assessed within a study area bounded by the area north of N 155th St, south of Carlyle Hall Road N, west of Dayton Ave N, and east of 3rd Avenue NW on the north side of the campus and east of NW 165th St on the south side of the campus. Within the study area, parking is prohibited on the following street segments:

1. Innis Arden Way between Greenwood Ave N and NW 165th St
2. Carlyle Hall Road N between 3rd Ave NW and Dayton Ave N

3. Dayton Ave N between Carlyle Hall Road and N Greenwood Drive
4. On N 160th St west of its intersection with Greenwood Ave N and Dayton Ave N
5. On both sides of N 160th St adjacent to Highland Terrace Elementary School

Parking is also prohibited between 7:30 AM and 4:30 PM on the following street segments:

1. East side of Greenwood Ave N between N 160th St and N 155th St
2. South side of N 160th St between Greenwood Ave N and Palatine Ave N
3. Both sides of N Greenwood Dr between Greenwood Ave N and Dayton Ave N
4. Both sides of Dayton Ave N between N Greenwood Dr and N 160th St

There are approximately 250 on-street parking spaces within the study area. Approximately 70 of these spaces are controlled with signs prohibiting parking between the hours of 7:30 AM and 4:30 PM except holidays. Therefore, the effective on-street supply available to the general public during the school day is approximately 180 stalls.

The demand for on-street parking was established by making hourly vehicle counts between 9 AM and 11 AM on a weekday during spring quarter 2009 when SCC was in session. The hourly on street parking demand is summarized in Table 8.

Table 8: On-Street Parking Demand (2009)

Area	Time	
	9 AM	10 AM
On Street	52	48

Source: TSI

The data shows that on-street parking remained relatively constant in the morning. During the peak, only 30% of available on street parking is utilized.

Cumulative Parking Demand

The combination of campus, satellite lot, and on-street campus generate parking demand is summarized in Table 9. The campus generates a peak parking demand of approximately 1,645 vehicles at 10:00 AM.

Table 9: Parking Demand Summary

Parking Location	Peak Demand (10 AM)
Campus	1,602
On-Street	52
Total	1,654

Source: TSI

The relationship between SCC generated parking demand and the campus population may be made by dividing the number of student FTE's (full time equivalents) into the parking demand to establish the parking demand per student FTE. With an enrollment of 4,959 student FTE's for Spring Quarter of 2009, the peak parking demand generated by SCC is 0.33 parked vehicles per student FTE. The peak parking demand ratio documented in the Master Plan FEIS for 2006 was 0.38 vehicles per student FTE. This small drop in parking demand per student FTE is likely due to increasing fuel prices causing a shift towards transit usage and the college's new program that provides student access to subsidized transit passes.

Parking Management

Campus parking is managed through a fee based permit system that allocates the parking to different user groups. Daytime parking permits are $15 per quarter and are available at the Cashier's Office in the 5200 (FOSS) Building. SCC encourages carpooling and offers free priority parking to students who carpool with two or more per vehicle. In addition to the parking fee, students are charged a transportation fee of $34 per quarter which entitles students to have up to $105 in eligible transportation fares loaded onto their ORCA card. Faculty and staff are not charged for parking.

The Satellite Parking Lot is located on the Sears property to the east and accessed from N 160th Street. Parking in the lot is free and SCC provides continuous shuttle service between the campus and the lot between 8 AM and 4 PM Monday through Thursday and 8 AM to 2 PM on Friday. Service is not provided during summer quarter. Ridership during fall quarter 2010 averaged 475 people per day.

Transit Service

A number of King County Metro Transit routes serve the SCC campus directly with a stop on-campus while other routes serve the campus from adjacent streets.

Transit Routes that Stop On-Campus:

- Route 330 travels east west providing a connection between the primary campus loading area, North Seattle, and Lake City area.
- Route 331 also stops on-campus and provides service between the SCC campus and Kenmore area.
- Route 345 stops on the SCC campus and provides service between SCC, Northwest Hospital, North Seattle Community College, and the Northgate Transit Center.
- Route 355 and Route 5 provide service between the SCC campus and downtown Seattle during the morning and afternoon peak commuting periods with limited stops.

Transit Routes with stops near Campus:

- Route 304 provides morning express service between Richmond Beach and downtown Seattle and afternoon express service between downtown Seattle and Richmond Beach. The nearest stop to the SCC campus is on Dayton Ave N.

All routes provide service at 30 minute headways or less during peak commuting hours.

Pedestrian and Bicycle Facilities

The sidewalk system in Shoreline is limited. In the vicinity of SCC there are sidewalks present on N 160th St from Aurora Ave N to just west of Greenwood Ave N and on both sides of Greenwood Ave N from N 160th St to N Greenwood Dr. There is also a sidewalk on the west side of Greenwood Ave N between N 160th St and N 155th St. There is a wide shoulder but no sidewalk on Innis Arden Way between Greenwood Ave N and the campus access. Angle parking is allowed along this segment and parked vehicles provide adequate separation between pedestrians and the adjacent travel lane. Students walking between the campus and the Sears satellite parking lot use this route, which is approximately 1,600 feet. The path transitions to an internal sidewalk on the east side of the main entrance drive. The sidewalk between the satellite parking lot on N 160th Street and the intersection of Greenwood Avenue N/ Innis Arden Way is in good condition and a minimum of four feet wide. This route is used by students parking in the satellite lot who choose to walk the 1,600 feet to and from the campus rather than use the shuttle service.

Bicycle racks are located on the SCC campus outside of the 1000 Building, the Pagoda Union Building (900), the FOSS Building (5000) and the Gymnasium (3000). There are no marked bike routes or trails linking the campus with local or regional destinations.

Commute Trip Reduction

SCC is identified as an affected employer under the state's Commute Trip Reduction (CTR) ordinance. The CTR ordinance requires employers within King County that have 100 or more employees arriving to work before 9 AM on three or more days per week to offer a set of incentives and disincentives that are focused on reducing the number of single occupant vehicles traveling to the campus. SCC meets this requirement by offering an ORCA card to faculty and staff working at least 50% of a full-time equivalent. The ORCA card can be used on Community Transit, Everett Transit, Kitsap Transit, Metro Transit, Pierce Transit, and Sound Transit. The subsidized cost to faculty or staff for an annual pass is $76.83. Students pay a 'Sustainable Commuter Options Fee' (SCOF) of $34 per quarter as part of their tuition payments. Students can then purchase an ORCA card and be reimbursed up to $105 per quarter for the costs of transit services loaded onto the ORCA card.

The 2011 CTR 'Employer Annual Report & Program Description' identifies 911 employees of which 362 are defined as CTR-affected employees. The 2009 'CTR Employer survey Report' identifies the following commute characteristics for all employees:

Drive alone	78.6%
Carpool	9.7%
Bus	4.7%
Other	7.0%

The average number of vehicle miles traveled per one-way trip is 8.1 miles. The 2011-2012 CTR goals established for area employers are a drive alone rate of 56.1% and 6.0 vehicle miles traveled per one-way trip.

Forecasted Conditions

This section of the Transportation Technical Report evaluates the effects and potential impacts of the MDP and LRDP on the local transportation network. Two future conditions are analyzed. A detailed description of the projects contemplated under the master plan may be found in the proposed Master Plan. For the purposes of evaluating the effects of the master plan on campus growth it is assumed that there will be 5,700 student FTE's enrolled in 2025 and 6,000 student FTE's enrolled by 2040 when the LRDP is complete. Part of this growth will be 400 student FTE's living in on-campus housing. These assumptions for campus growth represent more modest growth than the 1,170 additional student FTE's contemplated for the Expanded Development Alternative and other alternatives evaluated in the 2006 Draft Plan FEIS. In 2003, SCC had a student FTE count of 5,600. That fell to 5,262 in 2005, with significantly lower levels in 2006 through 2008. There were 4,959 student FTE's enrolled for fall quarter 2009. The proposed Master Plan contemplates that the college will recover student FTE's to achieve the 2005 level by 2025 and add 400 student FTE's that will be living on-campus. By 2040, the college hopes to add approximately 300 additional student FTE's.

Future Conditions without the Master Plan

Capital Improvement Plan

The '2012–2017 Adopted Capital Improvement Plan' does not identify any funded transportation improvements in the vicinity of SCC. The plan identifies general funding areas such as sidewalk improvements that may result in improvements in the vicinity of SCC. It also identifies an unfunded project to improve the intersection of N 160th Street and Greenwood Avenue North/ Innis Arden Way. This project would "improve the operations and safety of this five-way intersection at N 160th St. Greenwood Ave N and Innis Arden Way. Design will be coordinated with Shoreline Community College (SCC) Master Planning and with Metro Transit. Illumination and landscaping will be provided through the realignment area. Bus zone and layover improvements will be included. This project also includes the construction of a new sidewalk on the north side of N 160th Street from Dayton Ave N to Greenwood Ave N. Prior to construction, a study will be performed to identify a preferred solution to the current traffic operating problems at this intersection." The cost for the project is estimated to be between $1,750,000 and $2,000,000.

Traffic Volumes

In order to establish a baseline against which campus growth and potential impacts can be evaluated it is necessary to first forecast future traffic conditions for 20252025 and 2040 without any increase in campus generated trips. To project increases in existing traffic volumes, the transportation element of the City of Shoreline's Comprehensive Plan (2005) was reviewed to determine the growth rates the City used for citywide and local planning purposes. The Comprehensive Plan used 2002 PM peak hour intersection counts as a baseline and project future volumes for 2022. This information was used to calculate annual growth rates by comparing the 2002 intersection PM peak hour traffic volume counts with the 2022 forecasts for intersections within the study area. The resulting annual growth rates (Table 20) show a growth rate of less than 1% per year at intersections some distance from the campus and approximately 2% per year near the campus. It is assumed that the 2% annual growth rate reflects campus generated trips since the surrounding area is residential and built out. Historic growth rates for the study intersections were calculated using AM peak hour data from 2004 and 2009. A comparison of 2004 and 2009 data shows a significant negative annual growth rate that is likely due to lower traffic volumes due to the recession and for intersections near the campus, the drop in student enrollment.

To balance the difference between the positive growth rates used in the Comprehensive Plan forecast and the historic negative rates TSI used an annual growth rate that equaled 70% of the rate for intersections included in the Comprehensive Plan. All other intersections are assumed to have a positive growth rate of 0.35% per year. The Comprehensive Plan annual growth rates of approximately 2% applied to intersections near the campus were reduced to 0.35% so campus generated trips were not counted twice. The rates discussed above are summarized in Table 10.

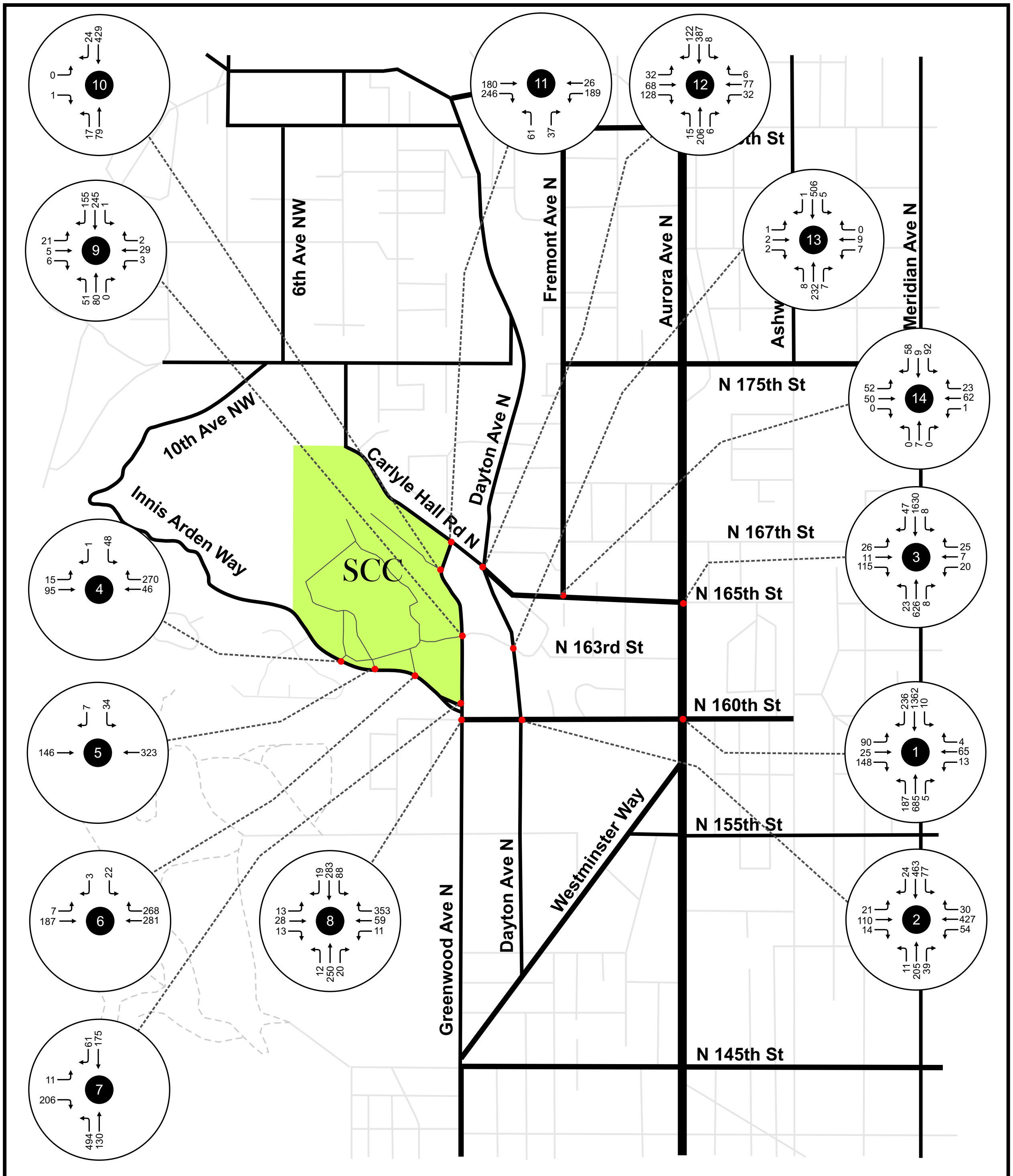
Table 10: Peak Hour Annual Growth Rates for Analyzed Intersections

Intersection	Comprehensive Plan Rate (PM)	2004-2009 Historic Rate (AM)	Rate Used for Analysis (AM & Midday)
Aurora Ave N/ N 165th St	0.72%	-3.9%	0.50%
Aurora Ave N/ N 160th St	0.87%	-5.5%	0.61%
Dayton Ave N/ N 160th St	0.77%	-2.1%	0.54%
Innis Arden Way/ West Campus Access		-3.0%	0.35%[1]
Innis Arden Way/ Central Campus Access		-3.9%	0.35%[1]
Innis Arden Way/ Main Campus Entrance		-3.0%	0.35%[1]
Greenwood Ave N/ Innis Arden Way	2.22%	-2.0%	0.35%[2]
Greenwood Ave N/ N 160th St	2.05%	-1.5%	0.35%[2]
Greenwood Ave N/ East Campus Access		-1.5%	0.35%[1]
Greenwood Ave N/ SCC North Parking Lot		-3.0%	0.35%[1]
Greenwood Ave N/ Carlyle Hall Rd N[3]		-2.3%	0.35%[3]
Dayton Ave N/ N 165th St		-0.3%	0.35%[3]
Dayton Ave N/ N Greenwood Dr		-2.5%	0.35%[3]
Fremont Ave N/ N 165th St		-4.8%	0.35%[3]

Source: TSI
[1]Growth rate applied to through movements only at campus accesses.
[2]The annual growth rate for both intersections was 2% in the Comprehensive Plan. It is assumed that this rate reflected growth in campus generated trips since there is no other major trip generator affecting these two intersections. The rate was changed to .50% per year to avoid double counting.
[3]Estimated since these intersections were not included in the Comprehensive Plan analysis.

The annual growth rates were applied to the existing AM peak hour (Figure 1) and midday peak hour (Figure 2) turning movement volumes to establish 2025 and 2040 traffic volumes without the master plan projects and associated growth in the campus population. These rates are considered to be higher than what would actually occur since they are based on PM peak hour volumes which tend to grow at a more rapid rate than AM or midday peak hour volumes. Peak hour traffic volumes for the future background conditions are illustrated in the following figures:

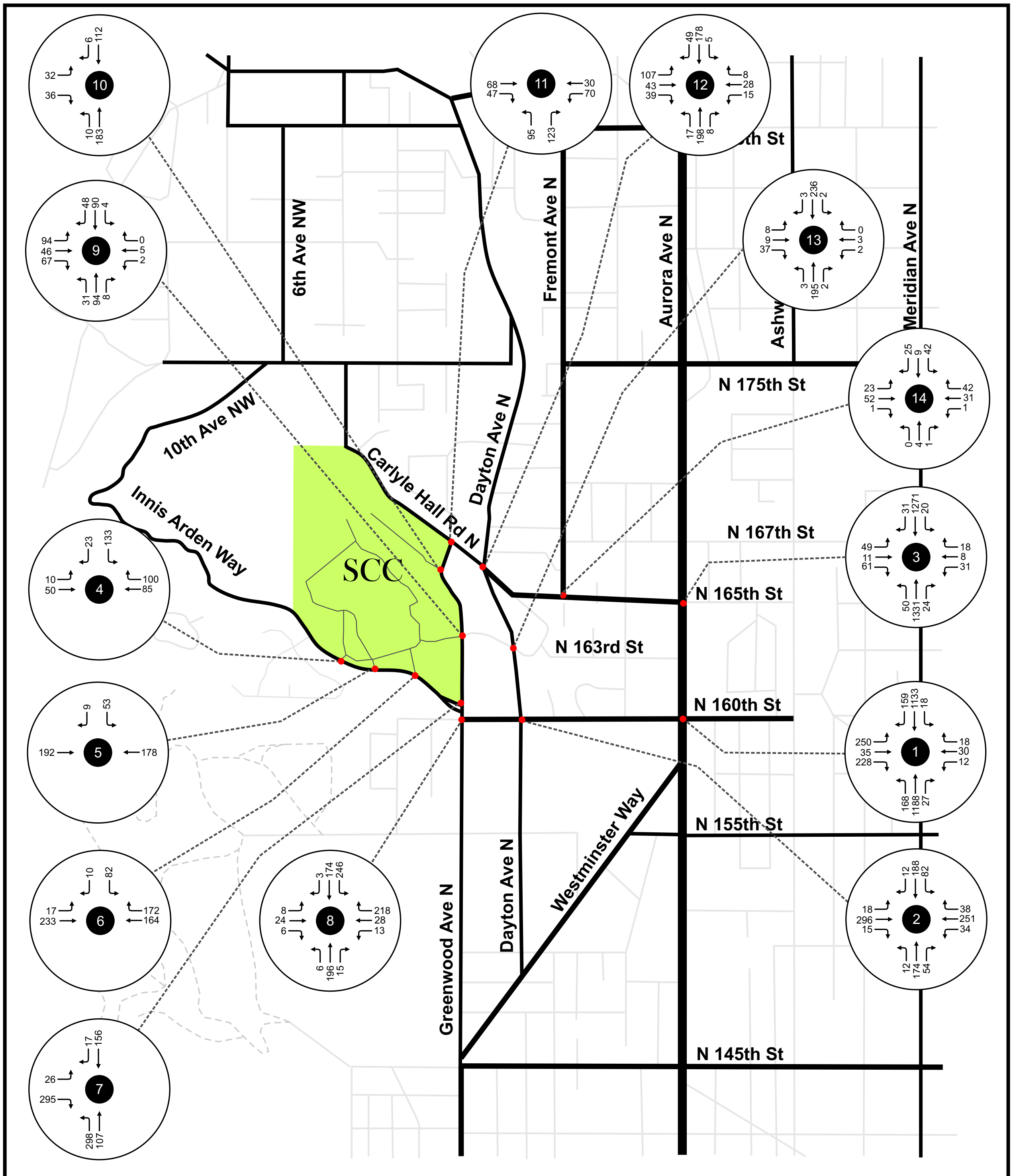
Figure 3: AM Peak Hour Traffic Volumes without the Master Plan (2025)
Figure 4: Midday Peak Hour Traffic Volumes without the Master Plan (2025)
Figure 5: AM Peak Hour Traffic Volumes without the Master Plan (2040)
Figure 6: Midday Peak Hour Traffic Volumes without the Master Plan (2040)



Shoreline COMMUNITY COLLEGE

Figure 3
AM Peak Hour (2025)
Background Turning Movement Volumes

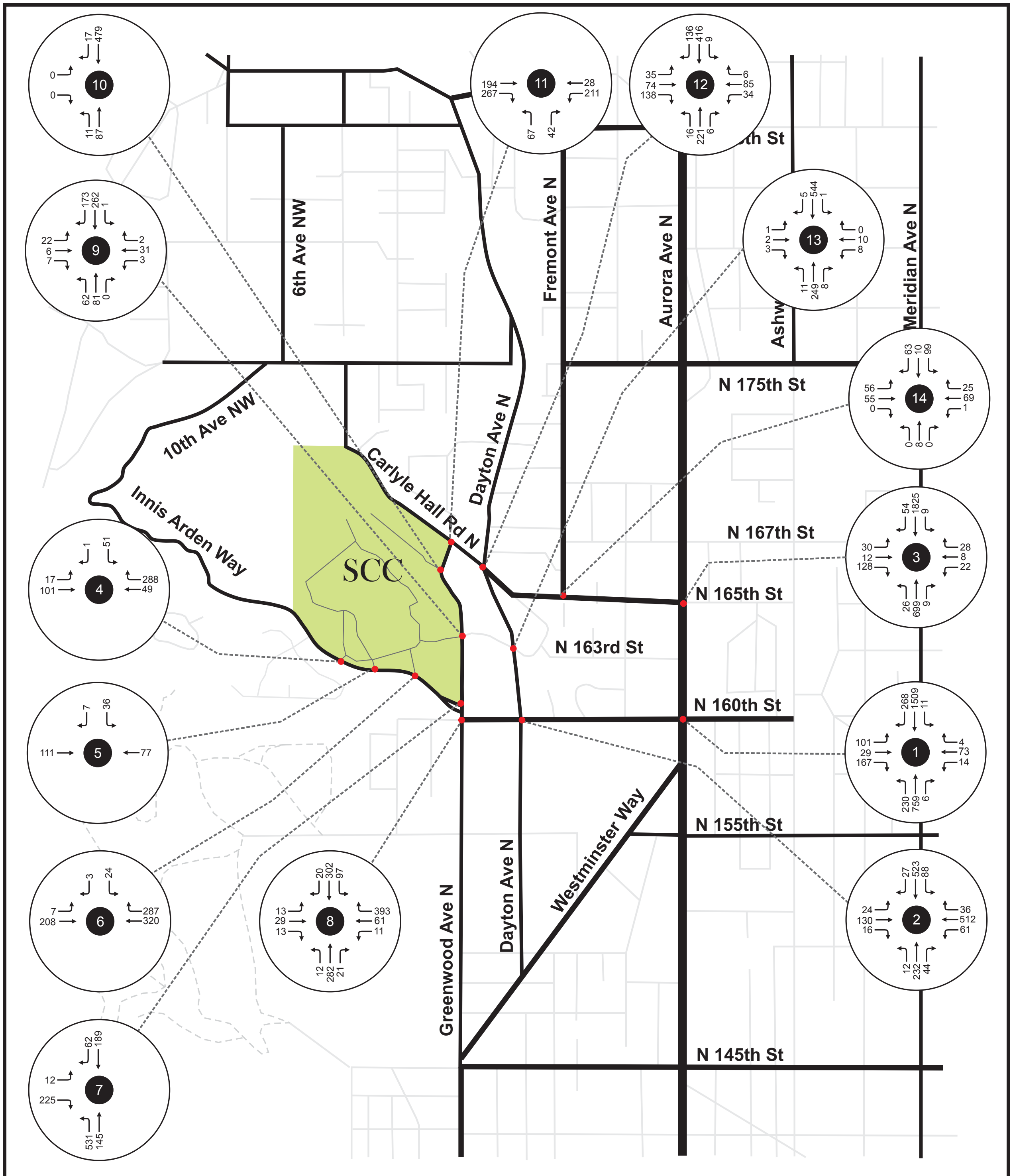
Master Plan
Transportation Technical Report



Shoreline COMMUNITY COLLEGE

Figure 4
Midday Peak Hour (2025)
Background Turning Movement Volumes

Master Plan
Transportation Technical Report



Shoreline
COMMUNITY COLLEGE

Figure 5
AM Peak Hour (2040)
Background Turning Movement Volumes

Master Plan
Transportation Technical Report

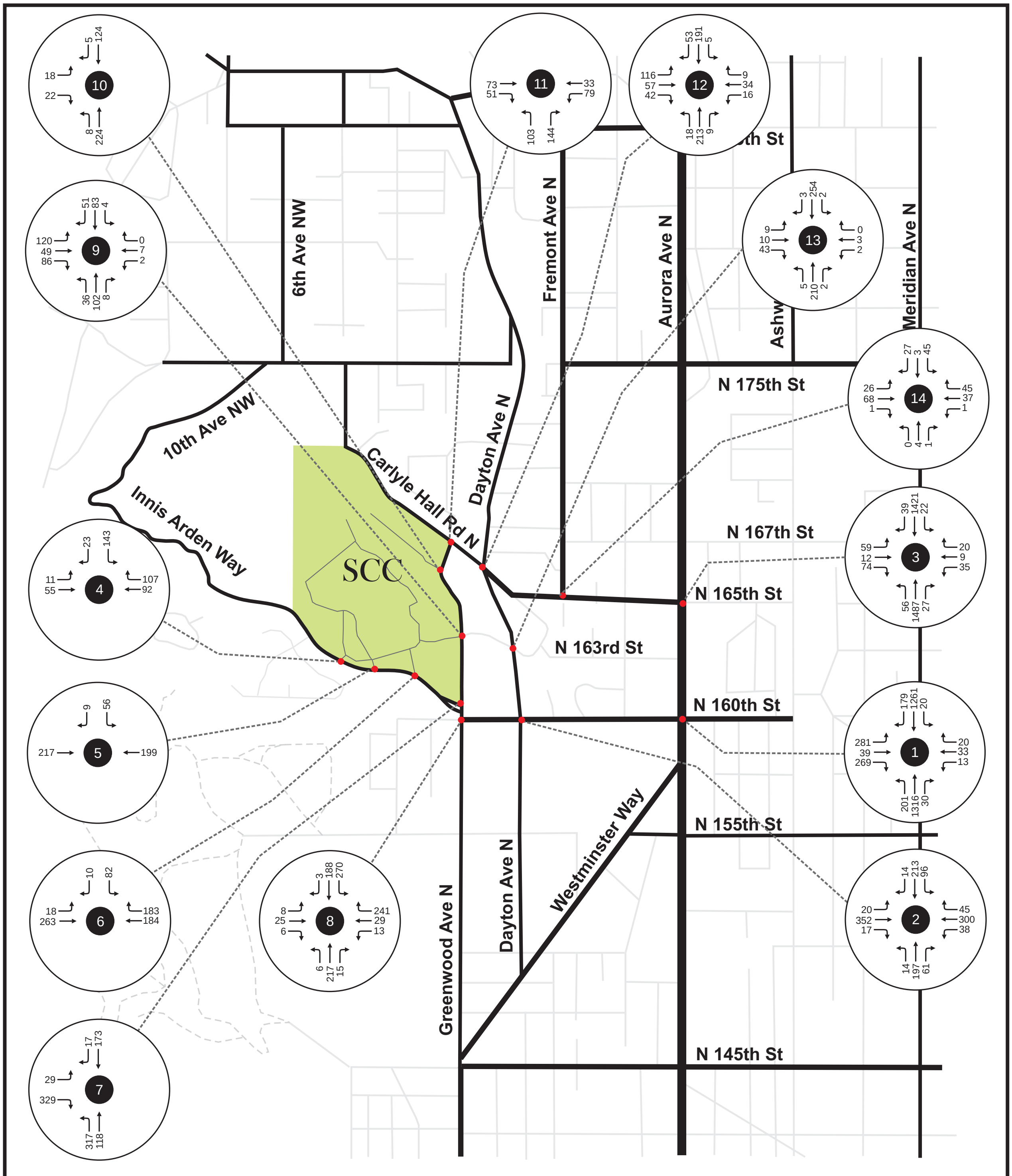


Figure 6
Midday Peak Hour (2040)
Background Turning Movement Volumes

Shoreline COMMUNITY COLLEGE

Master Plan Transportation Technical Report

Traffic Operations

The future without master plan traffic volumes were evaluated to establish levels of service at the analyzed intersections for the AM and midday peak hours.

AM Peak Hour (2025)

Table 11 summarizes LOS and average vehicle delay for the AM peak hour in 2025. All signalized intersections continue to operate at LOS-C or better. The unsignalized intersection at the intersection of Innis Arden Way/ Greenwood Ave N is forecasted to continue to operate at LOS-C. The intersection of Carlyle Hall Rd NW/ Greenwood Ave N continues to operate at LOS-D with a minor increase in delay. The all-way stop controlled intersection at Carlyle Hall Rd NW/ Dayton Ave drops to LOS-E because of the assumed growth rate for commuter traffic traveling southbound through the intersection.

Table 11: AM Peak Hour Intersection Level of Service (without Master Plan 2025)

Intersection	**LOS (sec.)[1]** Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	20.8			
N 160th St/ Dayton Ave	B	15.9			
N 165th St/ Aurora Ave	A	6.9			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	12.2
Innis Arden Way/ Central Campus Access			SB	B	13.4
Innis Arden Way/ Main Campus Access			SB	C	16.5
Innis Arden Way/ Greenwood Ave N[3]	C	16.1	SB	E	47.4
N 160th St/ Greenwood Ave N[3]	A	9.2	WB	B	12.8
Greenwood Ave N/ E Campus Access			WB	C	17.9
SCC N Parking Lot/ Greenwood Ave N			EB	B	11.2
Carlyle Hall Rd NW/ Greenwood Ave N			NB	D	32.8
Carlyle Hall Rd NW/ Dayton Ave	E	43.8	SB	F	76.2
N Greenwood Dr/ Dayton Ave			WB	C	19.2
N 165th St/ Fremont Ave N			SB	B	13.7

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

Midday Peak Hour (2025)

Table 12 summarizes LOS and average vehicle delay for the midday peak hour in 2025. All intersections are forecasted to operate at the same level of service as in 2009 with minor increases in delay.

Table 12: Midday Peak Hour Intersection Level of Service (without Master Plan 2025)

Intersection	LOS (sec.)[1]				
	Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	27.9			
N 160th St/ Dayton Ave	B	12.0			
N 165th St/ Aurora Ave	A	6.3			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	13.4
Innis Arden Way/ Central Campus Access			SB	B	12.6
Innis Arden Way/ Main Campus Access			SB	C	19.0
Innis Arden Way/ Greenwood Ave N[3]	C	24.7	EB	F	57.0
N 160th St/ Greenwood Ave N[3]	A	6.2	NB	A	8.4
Greenwood Ave N/ E Campus Access			EB	B	14.9
SCC N Parking Lot/ Greenwood Ave N			EB	B	11.0
Carlyle Hall Rd NW/ Greenwood Ave N			NB	B	13.4
Carlyle Hall Rd NW/ Dayton Ave	B	13.6	EB	B	13.1
N Greenwood Dr/ Dayton Ave			WB	B	13.6
N 165th St/ Fremont Ave N			NB	B	10.7

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

AM Peak Hour (2040)

Table 13 summarizes LOS and average vehicle delay for the AM peak hour in 2040. All signalized intersection are forecasted to operate at LOS –C or better with increases in delay. At unsignalized intersections, the all-way stop controlled intersection of Innis Arden Way/ Greenwood Ave N is forecasted to drop to LOS-E due to increases in commuter traffic traveling southbound who must stop for the uncontrolled northbound left turns. At Carlyle Hall Rd NW/ Greenwood Ave N the controlled northbound approach drops to LOS-F due to increases in through traffic volumes on Carlyle Hall Road which are free flowing. A similar situation exists at Carlyle Hall Rd NW/ Dayton Ave where increases in southbound commuter traffic volumes may cause the intersection to operate at LOS-F.

Table 13: AM Peak Hour Intersection Level of Service (without Master Plan 2040)

Intersection	LOS (sec.)[1] Intersection Average		Worst Approach[2]		
Signalized					
N 160th St/ Aurora Ave	C	23.3			
N 160th St/ Dayton Ave	C	20.1			
N 165th St/ Aurora Ave	A	8.3			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	12.7
Innis Arden Way/ Central Campus Access			SB	B	14.5
Innis Arden Way/ Main Campus Access			SB	C	18.5
Innis Arden Way/ Greenwood Ave N[3]	E	45.4	SB	F	166.0
N 160th St/ Greenwood Ave N[3]	A	8.6	NB	B	10.8
Greenwood Ave N/ E Campus Access			WB	C	20.2
SCC N Parking Lot/ Greenwood Ave N			NB	A	1.1
Carlyle Hall Rd NW/ Greenwood Ave N			NB	F	51.3
Carlyle Hall Rd NW/ Dayton Ave	F	68.0	SB	F	128.0
N Greenwood Dr/ Dayton Ave			WB	C	21.2
N 165th St/ Fremont Ave N			SB	B	14.9

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

Midday Peak Hour (2040)

Table 14 summarizes LOS and average vehicle delay for the midday peak hour in 2040. Under 2040 midday peak hour conditions without any college growth all intersection are forecasted to operate at the same level of service as under 2025 conditions with one exception. The SimTraffic analysis shows that the intersection of Innis Arden Way/ Greenwood Ave N is forecasted to operate at LOS-E with the problematic southbound movement operating at LOS-F. As stated previously, the southbound vehicles, which consist mostly of commuter traffic traveling south on Greenwood, must stop for the northbound vehicles making an uncontrolled left turn onto westbound Innis Arden Way.

Table 14: Midday Peak Hour Intersection Level of Service (without Master Plan 2040)

Intersection	LOS (sec.)[1] Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	31.8			
N 160th St/ Dayton Ave	B	12.4			
N 165th St/ Aurora Ave	A	6.9			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	14.3
Innis Arden Way/ Central Campus Access			SB	B	13.5
Innis Arden Way/ Main Campus Access			SB	C	22.5
Innis Arden Way/ Greenwood Ave N[3]	E	40.2	EB	F	89.2
N 160th St/ Greenwood Ave N[3]	A	6.6	NB	A	9.1
Greenwood Ave N/ E Campus Access			EB	C	19.7
SCC N Parking Lot/ Greenwood Ave N			EB	B	10.9
Carlyle Hall Rd NW/ Greenwood Ave N			NB	B	14.8
Carlyle Hall Rd NW/ Dayton Ave	B	13.7	EB	C	15.3
N Greenwood Dr/ Dayton Ave			WB	B	14.3
N 165th St/ Fremont Ave N			NB	B	11.1

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

Future Conditions with the Master Plan

As discussed in the Long Range Development Plan and the Master Development Plan, the campus population is forecasted to increase to 5,700 student FTE's in 2025 and 6,000 student FTE's in 2040. This represents a net increase from spring quarter 2009 levels of 741 student FTE's in 2025 and 1,041 student FTE's in 2040. Approximately 400 of the student FTE's are anticipated to be residents of the proposed student housing project. Except for the housing project, Master Plan projects focus on replacing outdated buildings and 'right sizing' the campus to accommodate growth in some programs and modest increases in enrollment.

Trip Generation, Distribution, and Assignment

In order to accurately assess the potential impacts of the Master Plan it is necessary to first determine the number of new trips that would be generated by the additional 741 student FTE’s in 2025 and 1,additional 300 student FTE’s in 2040. Secondly, those trips are distributed between the campus accesses and the public road network for the AM and midday peak hours. And finally, assignment of those new trips to the analyzed intersections and evaluation their operational characteristics. With this approach, the incremental effects of the additional trips can be quantified and potential impacts identified.

Trip Generation

As stated above, the master plan is designed to provide the facilities necessary to replace aging structures and ’right size’ the campus to better serve it students. Campus building area is not a good indicator for forecasting growth in the campus population. Academic buildings with classrooms have a fairly high density of students while specialized programs such as the Automotive Center require more space per student. In addition, some buildings such as the library and PUB are common areas that serve students that are already on-campus to attend class and generate few if any trips.

The best indicator for trip generation is the number of student FTE’s enrolled. Student FTE’s are the marker used by the state legislature to forecast growth and budget community colleges and is an accurate indicator of changes in campus activity levels including trip generation and parking demand. The number of peak hour trips generated per student FTE was established in the *Existing Conditions* section by dividing the number of existing student FTE’s into the documented number of existing trips generated during the AM and midday peak hours. It should be emphasized that the relationship between student FTE’s and vehicle trips incorporates all campus generated trips not just student trips. Student FTE’s are simply the most accurate statistic available to use as a basis for establishing trip generation rates.

The calculation described above results in a trip generation factor of 0.199 trips per student FTE’s during both the AM and midday peak hours. These factors are used to forecast the number of trips generated by the increase in student FTE’s as summarized in Table 15 below. The trip generation factor of 0.199 peak hour trips per student FTE should be considered conservative when it is applied to future campus population. Rising costs to operate motor vehicles will encourage more students to shift to transit and growth in on-line programs will further reduce the need to travel to campus.

Table 15: Trip Generation Forecast

Year	**Student FTE’s** (non-resident)	**Trips/ Student FTE** (AM & midday)	**Vehicle Trips** (AM & midday)
2009 (spring qtr.)	4,959	0.199	986
2025	5,300	0.199	1,055
2040	5,600	0.199	1,114

This forecast does not include trips generated by students residing in the proposed housing facility since they would have trip generation characteristics that are different from commuter students, faculty, and staff. Research into campus resident trip generation characteristics (Northeastern University Master Plan Amendment, February 11, 2011) identifies a person trip rate of 0.31 trips during the AM peak hour and 0.5 trips during the midday peak per residence hall bed. Of these trips, 5% of the AM trips and 1% of the midday trips were by automobile. Assuming that each of the 400 student FTE’s is the equivalent of a residence hall bed, the housing project would generate 6 AM peak hour and 2 midday peak hour vehicle trips. Because the number of trips generated by the housing project is so small the trip assignment and subsequent level of service analysis prepared in 2011 has not been updated.

Trip Distribution and Assignment (2025)

The distribution of campus generated trips between the campus accesses and to turning movements at analyzed intersections on the local street network is based on existing distribution patterns with adjustments to reflect changes in the location and size of the parking supply and its proximity to each campus access. Significant changes to the existing distribution pattern are due to the reduction of the parking supply (due to construction of a storm water detention facility) in the north lot accessed that is accessed from Greenwood Ave. Parking supplies on the north side of the upper campus will increase as part of a proposed building project. The distribution patterns depicted in the figures reflect the location and quantity of parking proposed in the master plan. Figure 7 depicts the distribution pattern for the AM peak hour while Figure 8 illustrates the pattern for the midday peak hour.

The distribution percentages presented in Figures 5 and 6 are applied to the number of trips generated during the peak hours (Table 15) to establish the assignment of campus generated trips to analyzed intersections. The assignment of new campus generated trips for 2025 conditions is illustrated in Figure 7 (AM peak hour) and Figure 8 (midday peak hour).

Traffic Operations (2025)

The SCC generated trips assigned to the analyzed intersections in Figures 7 and 8 are added to the forecasted without project traffic volumes (Figures 3 and 4) to establish future traffic volumes at analyzed intersections when the master plan projects are complete in 2025. The resulting turning movement volumes are illustrated in Figure 9 (AM peak hour) and Figure 10 (midday peak hour).

AM Peak Hour

Table 16 summarizes LOS and average vehicle delay for the AM peak hour in 2025 with the initial projects of the master plan complete. All signalized intersections are forecasted to operate at LOS-C or better during the AM peak hour. Two unsignalized intersections are forecasted to operate at LOS-E under 2025 AM peak hour conditions. The intersection of Innis Arden Way/ Greenwood Ave N is forecasted to operate at LOS-E due to the volume of southbound traffic that must stop and wait for a gap in the traffic stream making a northbound left turn. The increase in delay over the forecasted conditions for 2025 without the master plan is largely due to the 37 new campus generated trips making the uncontrolled northbound left turn movement, which increases delay for the southbound stop controlled movements. The intersection of Carlyle Hall Rd NW/ Dayton Ave, which is forecasted to continue operating at LOS-E, would experience a minor increase in delay but no change in level of service.

Table 16: AM Peak Hour Intersection Level of Service (2025)

Intersection	LOS (sec.)[1] Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	21.6			
N 160th St/ Dayton Ave	B	17.1			
N 165th St/ Aurora Ave	A	7.0			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	12.6
Innis Arden Way/ Central Campus Access			SB	B	13.9
Innis Arden Way/ Main Campus Access			SB	C	17.5
Innis Arden Way/ Greenwood Ave N[3]	E	48.8	SB	F	171.6
N 160th St/ Greenwood Ave N[3]	A	8.3	WB	B	11.1
Greenwood Ave N/ E Campus Access			WB	C	19.4
SCC N Parking Lot/ Greenwood Ave N			NB	A	1.1
Carlyle Hall Rd NW/ Greenwood Ave N			NB	E	35.8
Carlyle Hall Rd NW/ Dayton Ave	E	45.4	SB	F	79.7
N Greenwood Dr/ Dayton Ave			WB	C	19.5
N 165th St/ Fremont Ave N			SB	B	13.6

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

Midday Peak Hour

Table 17 summarizes LOS and average vehicle delay for the midday peak hour in 2025 with the initial projects of the master plan complete. All signalized intersections are forecasted to operate at LOS-C or better and the controlled approaches of all unsignalized intersections are also forecasted to operate at LOS-C or better with the exception of the eastbound approach to Innis Arden/Greenwood, which is forecasted to operate at LOS-E. The reason for this poor level of service is the volume of eastbound vehicles waiting to enter Greenwood. The majority of these vehicles are students leaving the campus after morning classes.

Table 17: Midday Peak Hour Intersection Level of Service (2025)

Intersection	LOS (sec.)[1] Intersection Average		Worst Approach[2]		
Signalized					
N 160th St/ Aurora Ave	C	28.7			
N 160th St/ Dayton Ave	B	12.4			
N 165th St/ Aurora Ave	A	6.6			
Unsignalized					
West Campus Access/ Innis Arden Way			SBL	B	14.0
Innis Arden Way/ Central Campus Access			SB	B	13.0
Innis Arden Way/ Main Campus Access			SB	C	21.0
Innis Arden Way/ Greenwood Ave N[3]	C	20.9	EB	E	42.0
N 160th St/ Greenwood Ave N[3]	A	6.5	WB	A	8.9
Greenwood Ave N/ E Campus Access			EB	C	18.8
SCC N Parking Lot/ Greenwood Ave N			EB	B	10.7
Carlyle Hall Rd NW/ Greenwood Ave N			NB	B	13.8
Carlyle Hall Rd NW/ Dayton Ave	B	12.6	EB	B	13.8
N Greenwood Dr/ Dayton Ave			WB	B	13.7
N 165th St/ Fremont Ave N			NB	B	10.9

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound
[3]Analyzed using SimTraffic

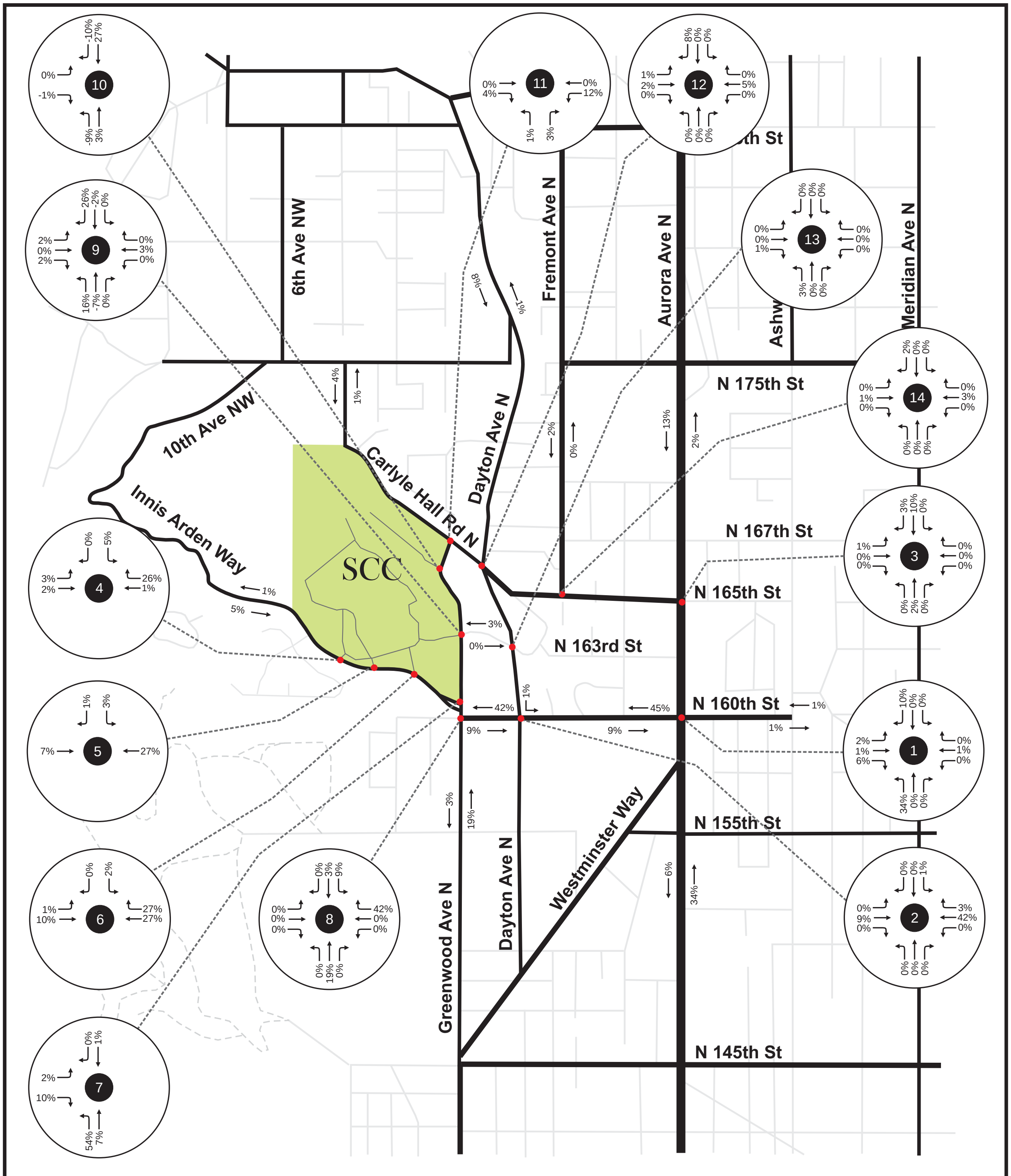


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Figure 7
AM Peak Hour (2025)
Distribution

Master Plan
Transportation
Technical Report

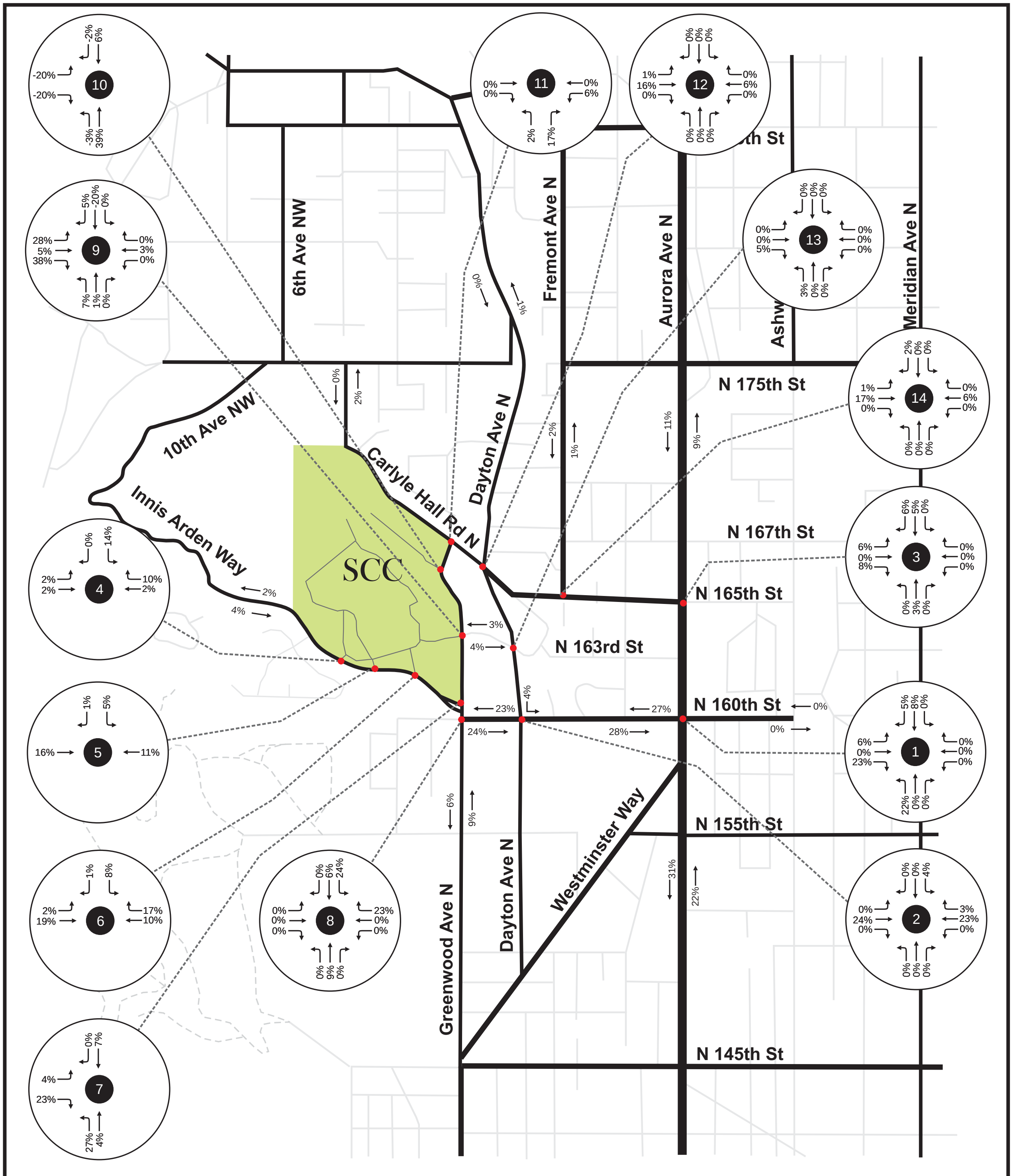

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Figure 8
Midday Peak Hour (2025)
Distribution

Master Plan
Transportation Technical Report

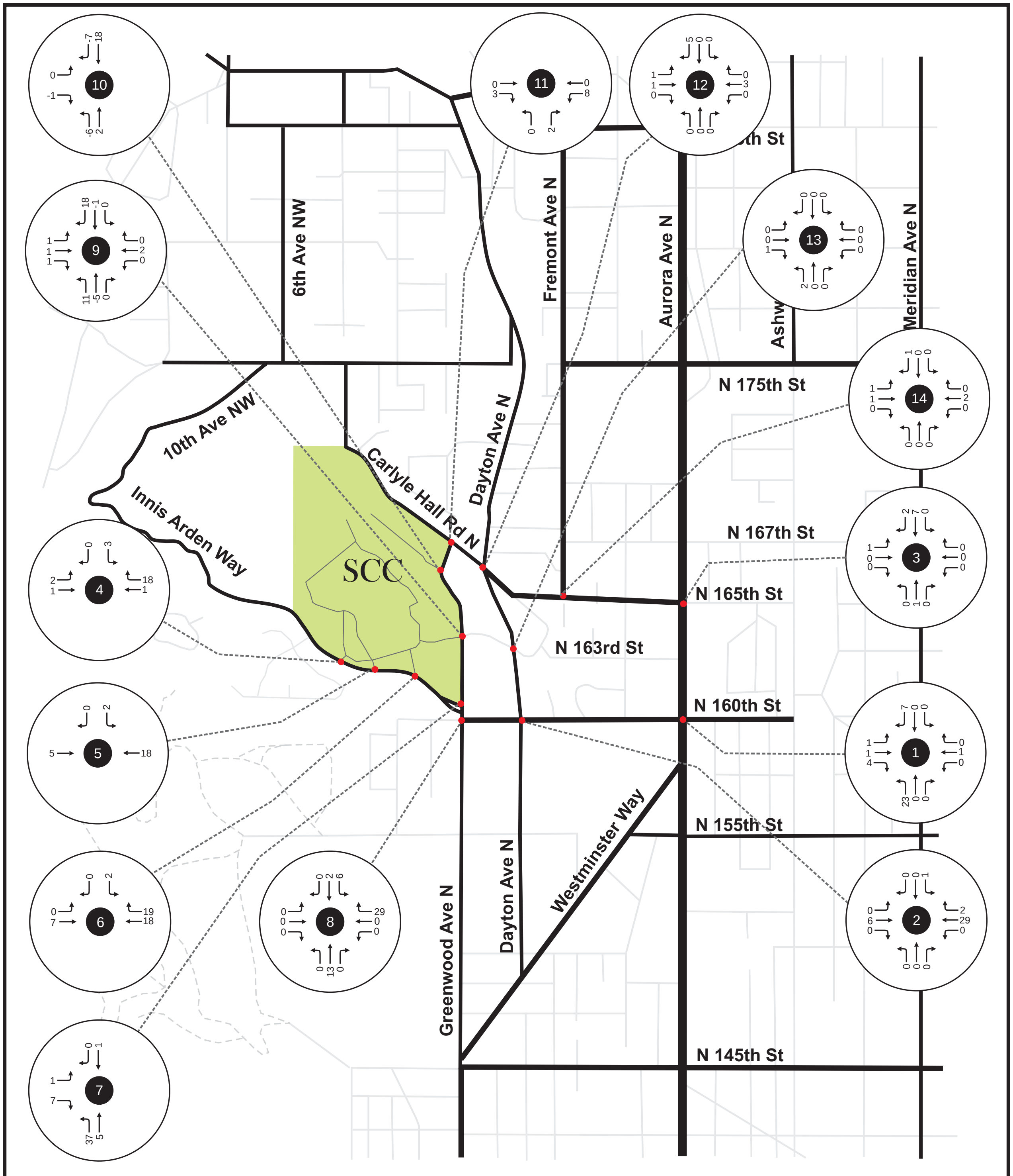

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Figure 9
AM Peak Hour (2025)
Trip Assignment

Master Plan
Transportation Technical Report

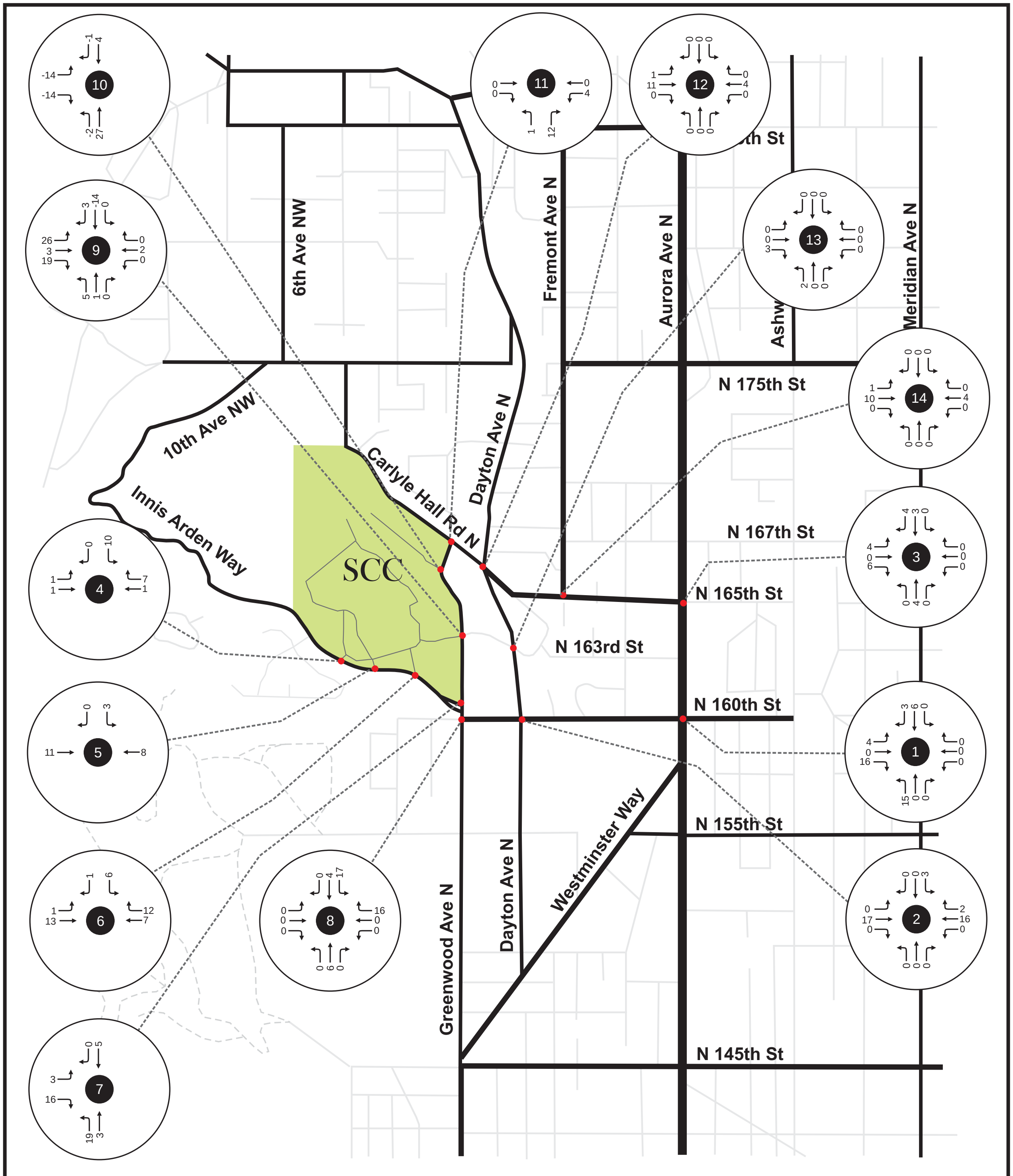

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Figure 10
Midday Peak Hour (2025)
Trip Assignment

Master Plan
Transportation Technical Report

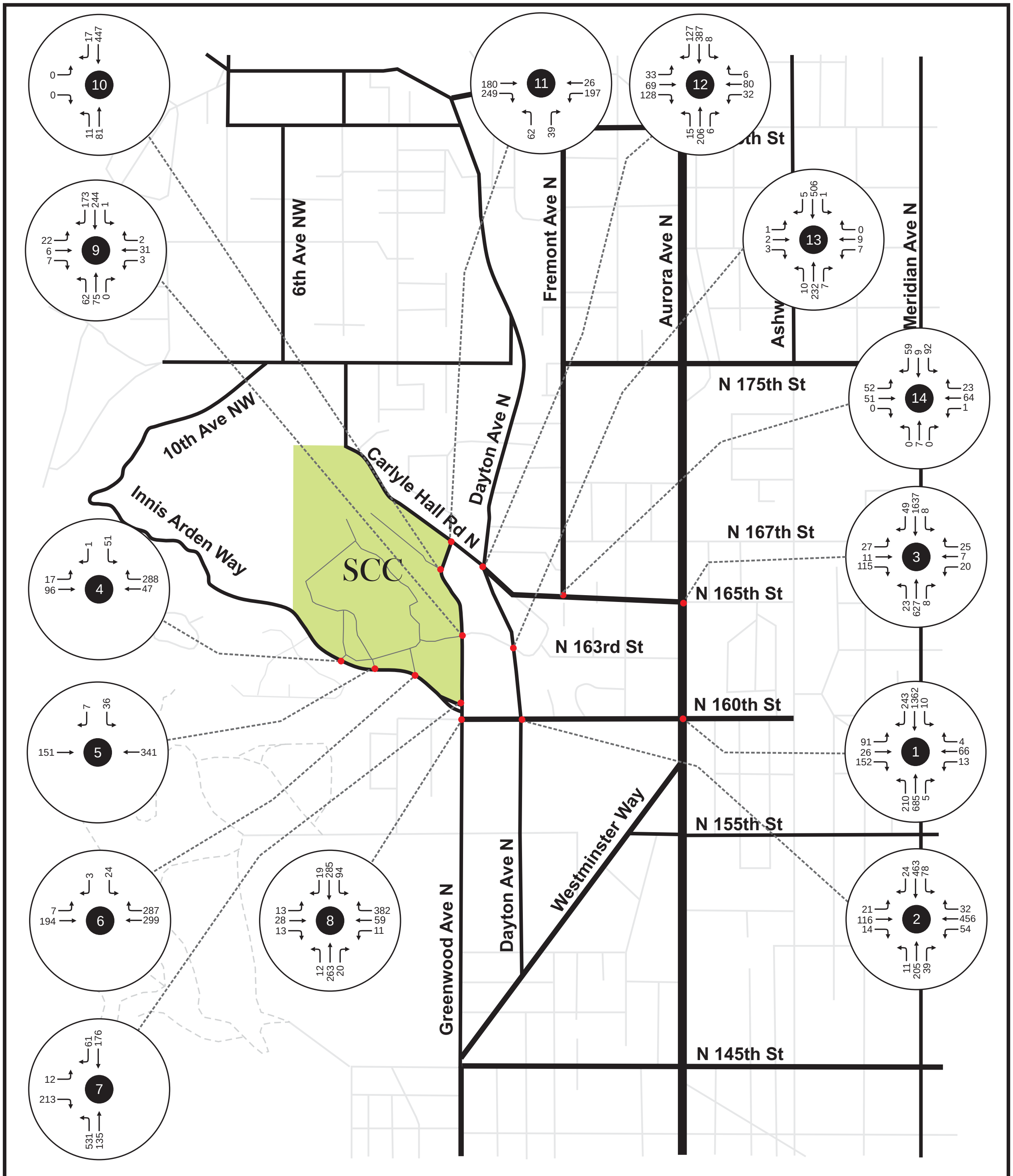

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Figure 11
AM Peak Hour (2025)
Turning Movement Volumes

Master Plan
Transportation
Technical Report

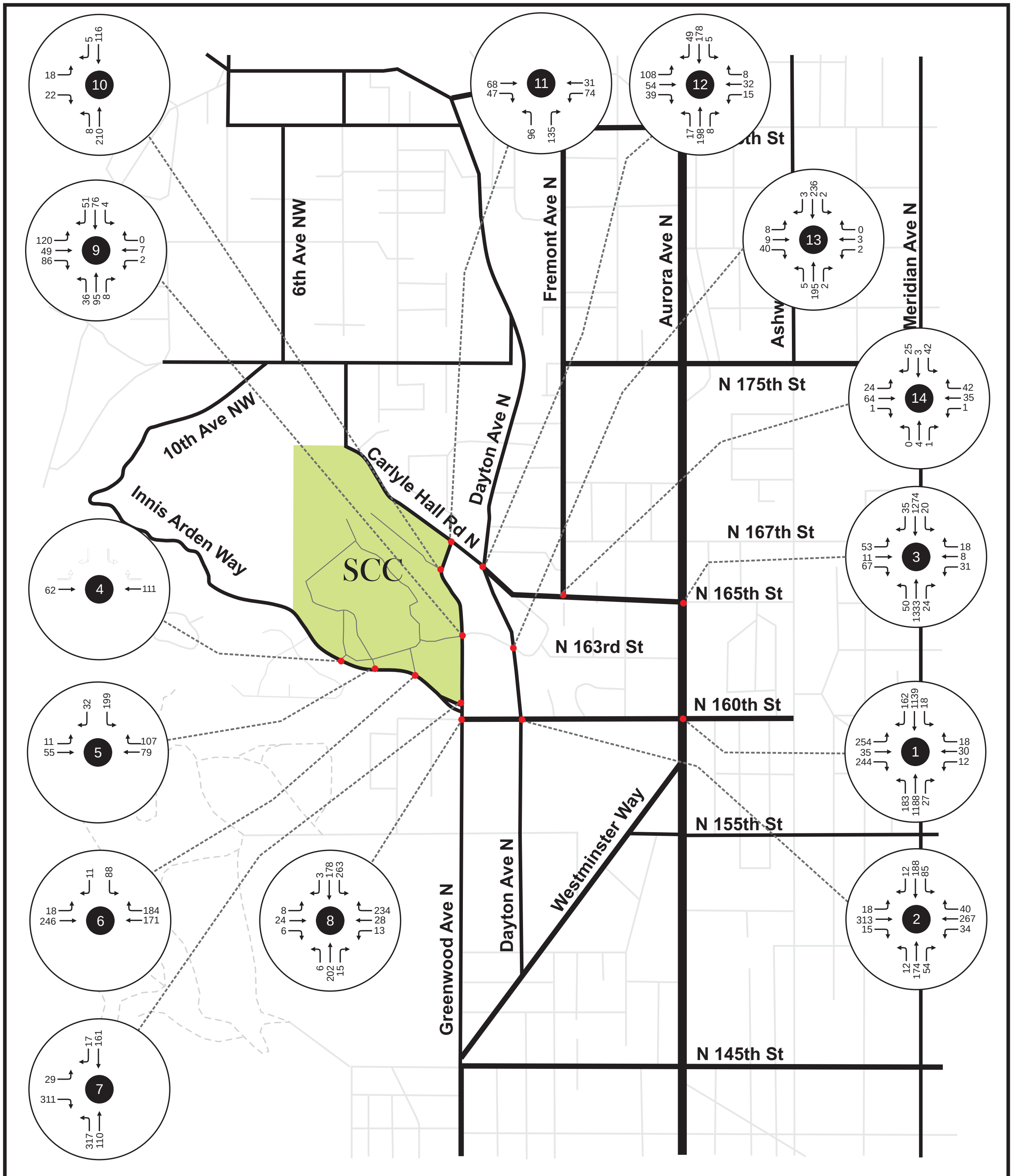

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Figure 12
Midday Peak Hour (2025)
Turning Movement Volumes

Master Plan
Transportation Technical Report

Campus Access and Circulation (2025)

The initial phase of the master plan will include improvements to an existing parking area on the north side of the campus and modification of the north segment of the main road circulating though the campus. The development of the housing project on the existing athletic field will also require the redevelopment of adjacent parking areas as well as providing additional parking adjacent to the housing project.

Parking Supply and Demand (2025)

The parking supply will decrease due to a portion of the North Greenwood lot being converted into a storm water detention facility and the construction of a building and adjacent parking lot improvements on the north side of the upper campus. The Automotive Center will also be expanded and result in the loss of some surface parking. Preliminary plans call for parking to be provided below the Automotive Center expansion for vehicles used in the Center's program. In addition, parking would be provided adjacent to the proposed housing project and some nearby parking lots would be reconfigured to provide access to the project site. The on-campus parking supply for 2025 is summarized in Table 13. The total includes new parking provided as part of the housing project as well as the number of stalls anticipated to be lost due to the Automotive Center expansion. However, it does not include any new stalls that would be constructed below the Automotive Center's expansion to accommodate vehicles used in the program. It is anticipated that most if not all of the Automotive Center fleet of program vehicles will be housed below grade in the future and that the 2025 parking supply will be greater than the 1,888 stalls shown in Table 13.

Table 18: Proposed Parking Supply (2025)

Parking Zone		2010	2025	
		Existing	Change	Supply
1	Visitor Lot (south)	150	0	150
2	Southwest Lots	375	0	375
3	North and Northwest Lots	850	-58	792
4	East Lots	76	0	76
5	North Greenwood Lot	400	-115	285
6	Satellite Lot (Sears)	210	0	210
	Total	**2,061**	**-173**	**1,888**

Source: TSI

By 2025 the number of student FTE's would increase from the 2009 Spring Quarter baseline by 341 commuter and 400 resident students. In the existing conditions section of this analysis a peak parking demand factor of 0.33 stalls per student FTE was established. Applying this factor to the 5,300 future commuter student FTE's results in a peak parking demand of approximately 1,749 stalls. A parking supply of 1,836 stalls (5% greater than the forecasted demand) should adequately accommodate future faculty, staff, and commuter student demand. It should be noted that the parking demand factor of 0.33 stalls per student FTE incorporates SCC generated on-campus demand, on-street demand, and demand for parking at the satellite lot.

The housing project will exhibit parking demand characteristics that are different than commuter students. Survey data from Seattle University and Seattle Pacific University master plans indicates that 28% and 39% respectively of the resident students have access to an automobile. Preliminary planning for the housing project shows that while housing will be open to all students it is likely that a very high percentage of the beds will be used by foreign students that would have lower vehicle ownership than the four-year colleges referenced above. For this reason, it is assumed that the housing project will generate a parking demand of 40 vehicles that could be accommodated by a recommended supply of 44 stalls. The total recommended parking supply for 2025 is 1,880 stalls and is consistent with the proposed parking supply of 1,888 stalls.

Trip Distribution and Assignment (2040)

By 2040 it is anticipated that the remainder of the north parking lot accessed from Greenwood Ave N will be used for the expanded storm water detention facility. The distribution patterns depicted in the figures reflect the effects of this change. Figure 13 depicts the distribution pattern for the AM peak hour while Figure 14 illustrates the pattern for the midday peak hour.

The distribution percentages presented in Figures 13 and 14 are applied to the number of trips generated during the peak hours (Table 15) to establish the assignment of campus generated trips to analyzed intersections. This assignment for 2040 conditions is illustrated in Figure 15 (AM peak hour) and Figure 16 (midday peak hour).

Traffic Operations (2040)

The SCC generated trips assigned to the analyzed intersections in Figures 15 and 16 are added to the forecasted 2025 traffic volumes (Figures 9 and 10) to establish future traffic volumes at analyzed intersections when the master plan projects are complete in 2040. The resulting turning movement volumes are illustrated in Figure 17 (AM peak hour) and Figure 18 (midday peak hour).

AM Peak Hour

Table 19 summarizes LOS and average vehicle delay for the AM peak hour in 2040 with the master plan complete. All signalized intersections are forecasted to continue operating at LOS-C or better. The southbound approach to the intersection of Innis Arden/Greenwood is forecasted to drop to LOS-F due to increases in southbound through traffic and northbound vehicles making left turns onto Innis Arden. If the forecasted growth in southbound background traffic volumes does not materialize, the level of service would improve. The poor level of service (LOS-F) at the intersections of Carlyle Hall Road with Greenwood and Dayton are largely due to the forecasted increases in background traffic volumes on Carlyle Hall Road that would increase delays for vehicles on the controlled approaches.

Table 19: AM Peak Hour Intersection Level of Service (2040)

Intersection	**LOS (sec.)[1]** Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	24.0			
N 160th St/ Dayton Ave	C	21.8			
N 165th St/ Aurora Ave	A	8.3			
Unsignalized					
West Campus Access/ Innis Arden Way	(access closed)			A	0.0
Innis Arden Way/ Central Campus Access			SB	B	14.1
Innis Arden Way/ Main Campus Access			SB	C	19.5
Innis Arden Way/ Greenwood Ave N**	E	42.6	SB	F	172.9
N 160th St/ Greenwood Ave N**	B	11.6	WB	C	16.0
Greenwood Ave N/ E Campus Access			WB	C	22.6
SCC N Parking Lot/ Greenwood Ave N	(access closed)			A	0.0
Carlyle Hall Rd NW/ Greenwood Ave N			NB	F	57.2
Carlyle Hall Rd NW/ Dayton Ave	F	71.8	SB	F	136.0
N Greenwood Dr/ Dayton Ave			WB	C	21.4
N 165th St/ Fremont Ave N			SB	B	14.9

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound

Midday Peak Hour

Table 20 summarizes LOS and average vehicle delay for the midday peak hour in 2040 with the master plan complete. All signalized intersections are forecasted to operate at LOS-C or better and all approaches to the unsignalized intersections would operate at LOS-C or better with two exceptions. The intersection of Innis Arden/ Greenwood is forecasted to operate at LOS-F due to the volume of eastbound vehicles turning onto Greenwood Ave N. If the forecasted volume of background through traffic does not materialize intersection level of service and delays will improve. The east access onto the campus from Greenwood Ave N is forecasted to operate at LOS-D. The new parking lot that will be constructed on the existing soccer field will result in additional campus traffic using this access. The approaches to the intersection on Greenwood are not controlled and will operate at LOS-A.

Table 20: Midday Peak Hour Intersection Level of Service (2040)

Intersection	LOS (sec.)[1] Intersection Average		Worst Approach [2]		
Signalized					
N 160th St/ Aurora Ave	C	32.3			
N 160th St/ Dayton Ave	B	12.6			
N 165th St/ Aurora Ave	A	7.2			
Unsignalized					
West Campus Access/ Innis Arden Way	(access closed)			A	0.0
Central Campus Access/ Innis Arden Way			SB	C	15.9
Main Campus Access/ Innis Arden Way			SB	C	24.7
Innis Arden Way/ Greenwood Ave N	F	56.0	EB	F	128.8
N 160th St/ Greenwood Ave N	A	6.6	WB	A	9.1
E Campus Access/ Greenwood Ave N			EB	D	31.0
SCC N Parking Lot/ Greenwood Ave N	(access closed)			A	0.0
Carlyle Hall Rd NW/ Greenwood Ave N			NB	C	15.5
Carlyle Hall Rd NW/ Dayton Ave	B	14.3	EB	C	16.3
N Greenwood Dr/ Dayton Ave			WB	B	14.3
N 165th St/ Fremont Ave N			NB	B	11.3

Source: TSI
[1](sec.) = average vehicle delay in seconds.
[2]EB-eastbound, WB-westbound, NB-northbound, SB-southbound

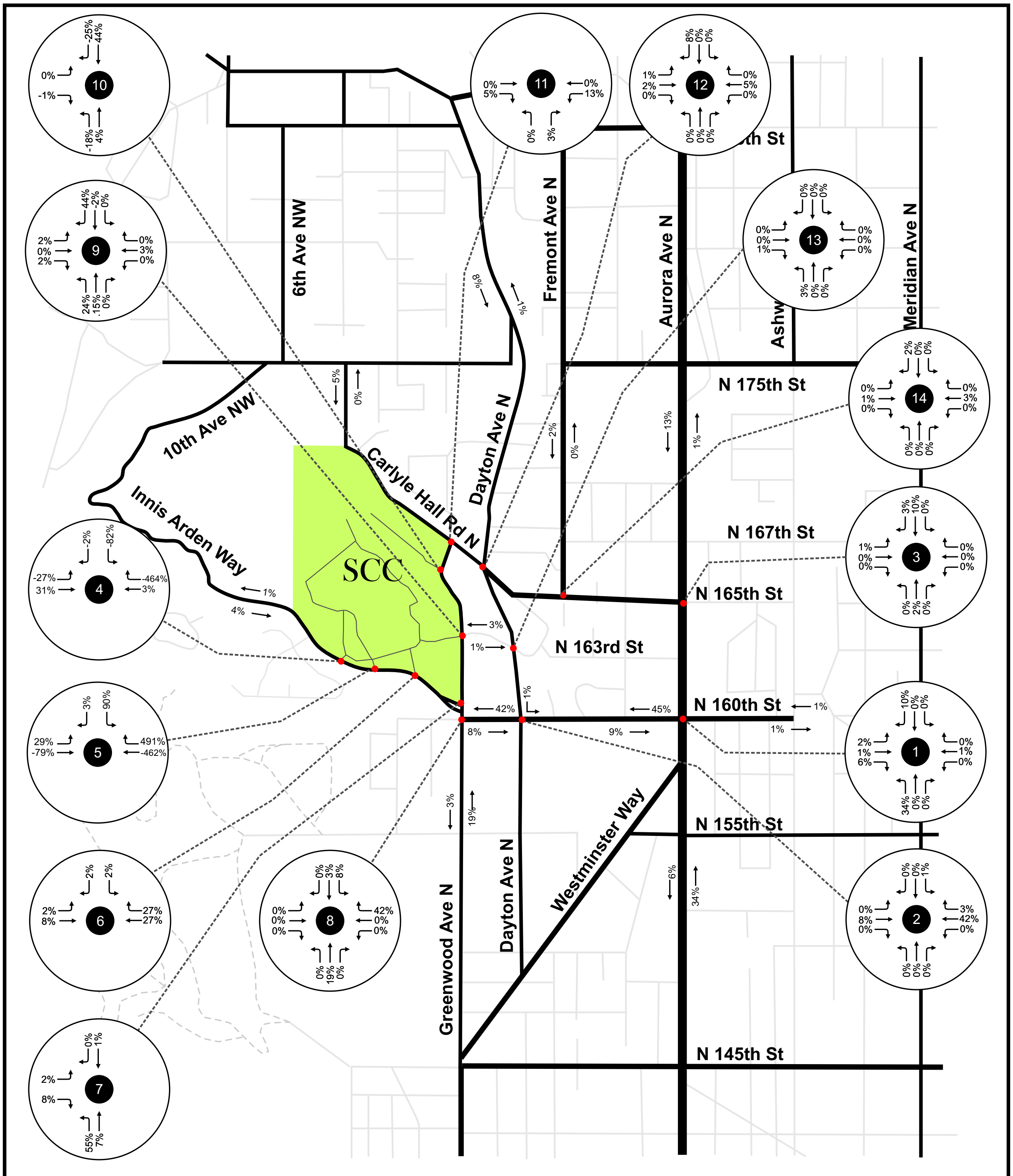

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Figure 13
AM Peak Hour (2040)
Distribution

Master Plan
Transportation Technical Report

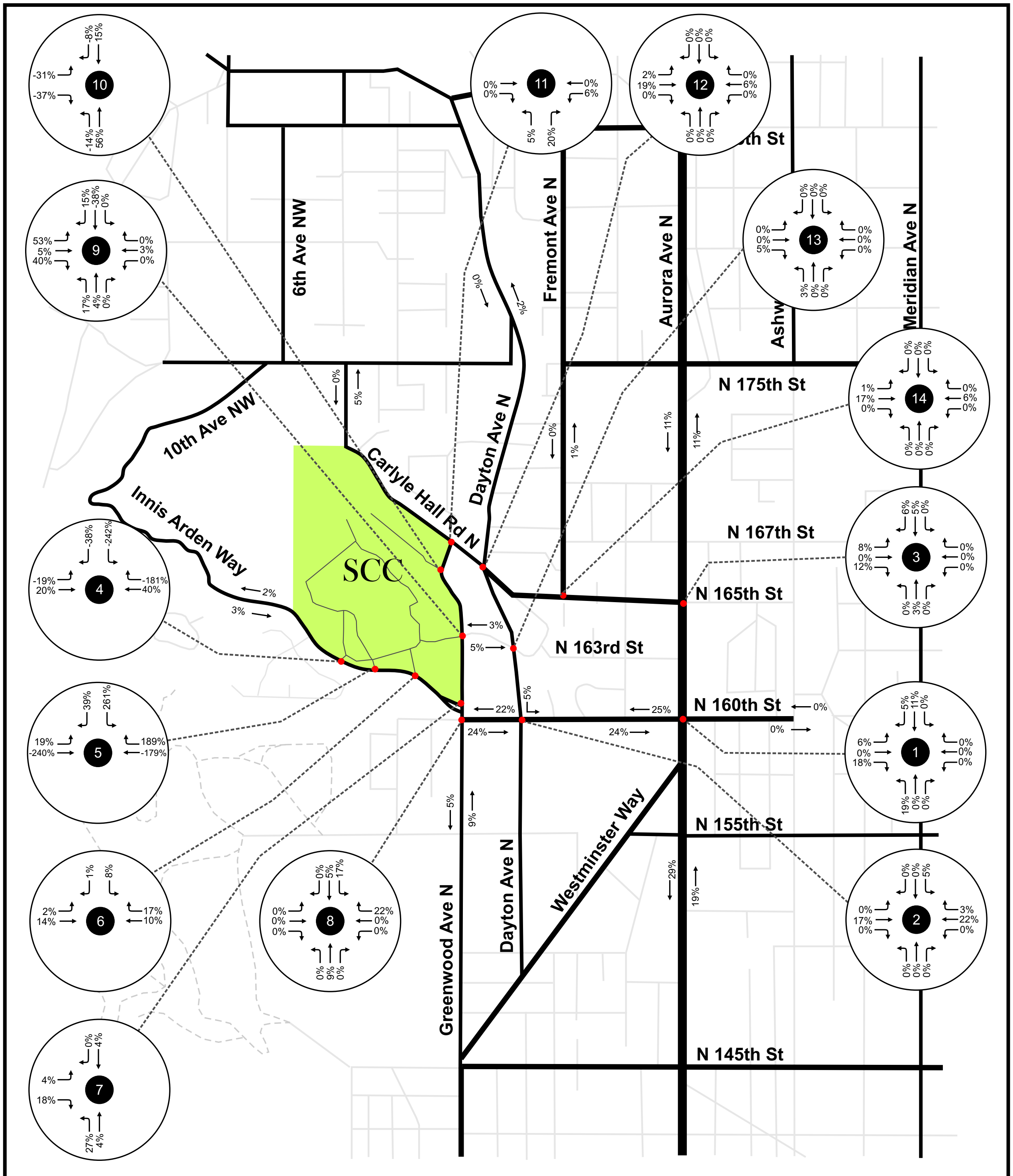

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Figure 14
Midday Peak Hour (2040)
Distribution

Master Plan
Transportation Technical Report

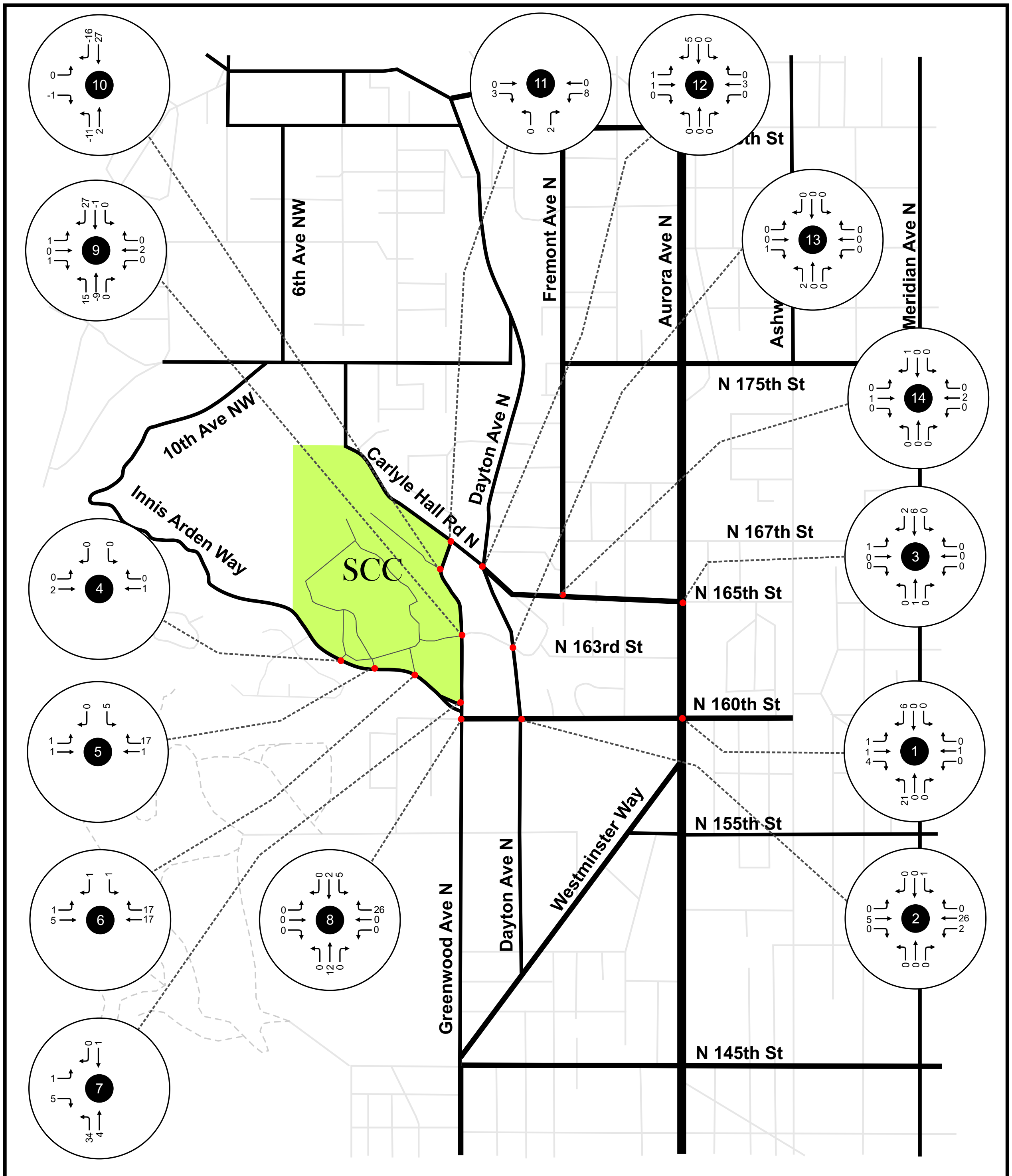

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Figure 15
AM Peak Hour (2040)
Trip Assignment

Master Plan
Transportation Technical Report

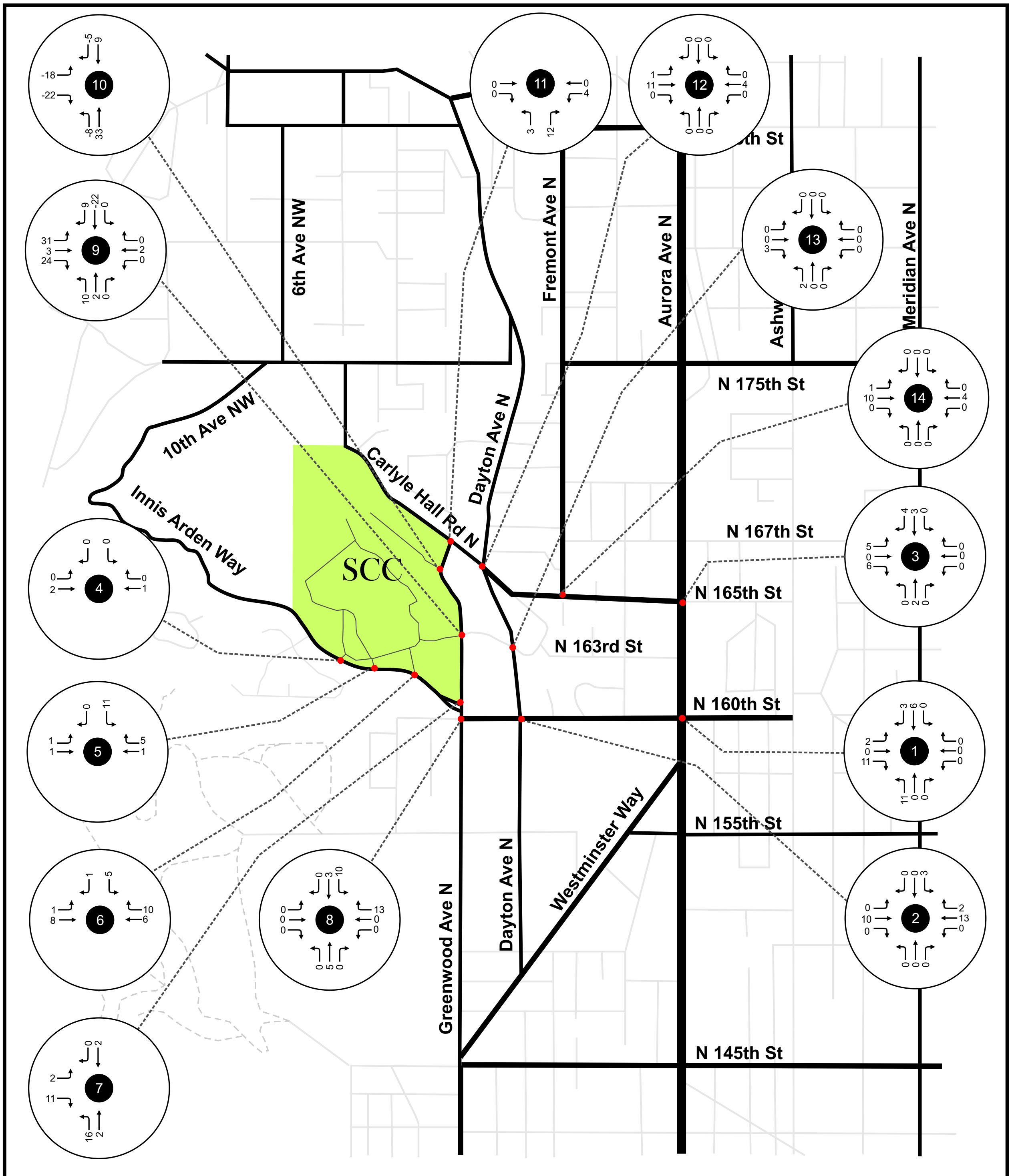

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Figure 16
Midday Peak Hour (2040)
Trip Assignment

Master Plan
Transportation Technical Report

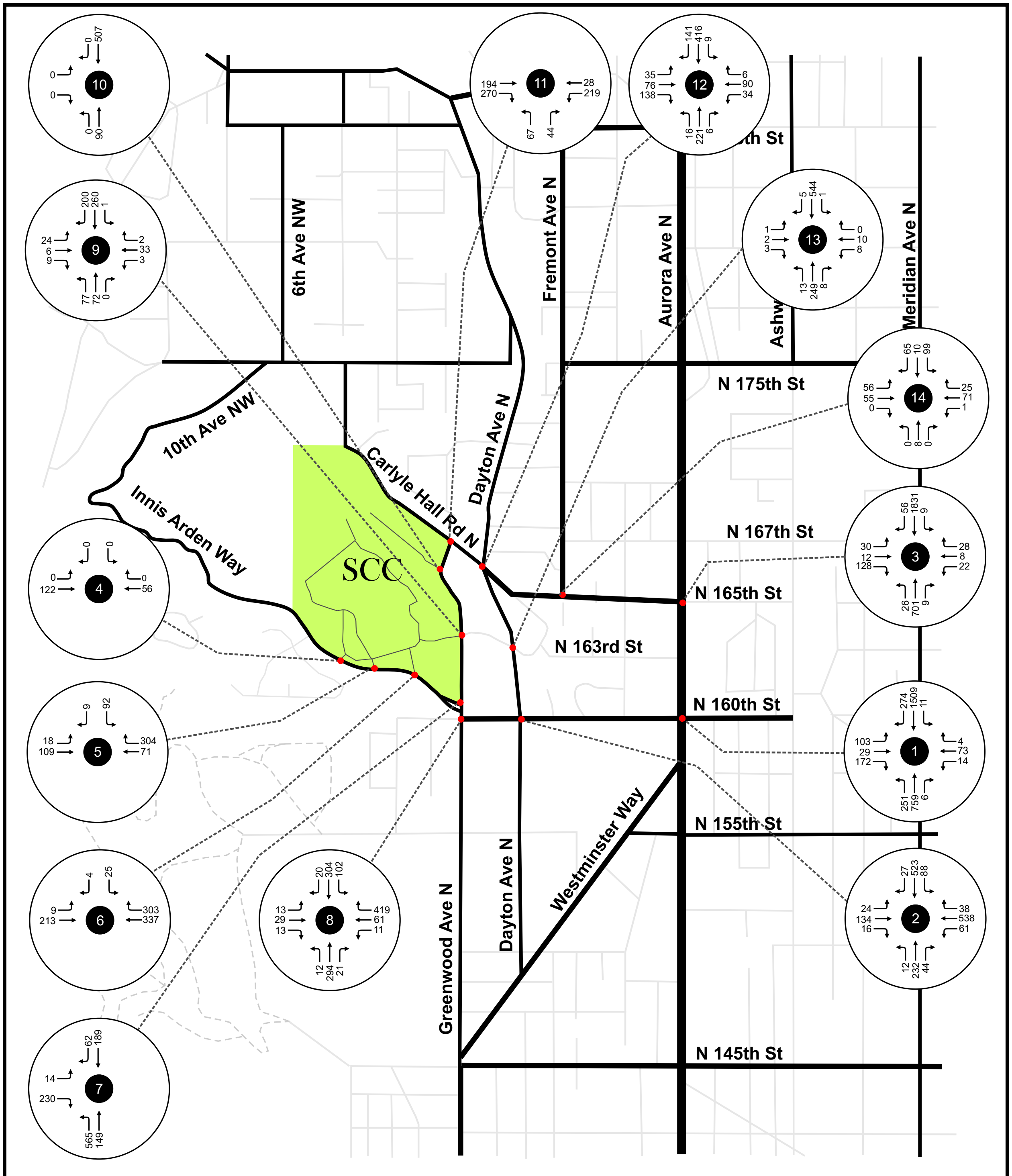

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Figure 17
AM Peak Hour (2040)
Turning Movement Volumes

Master Plan
Transportation Technical Report

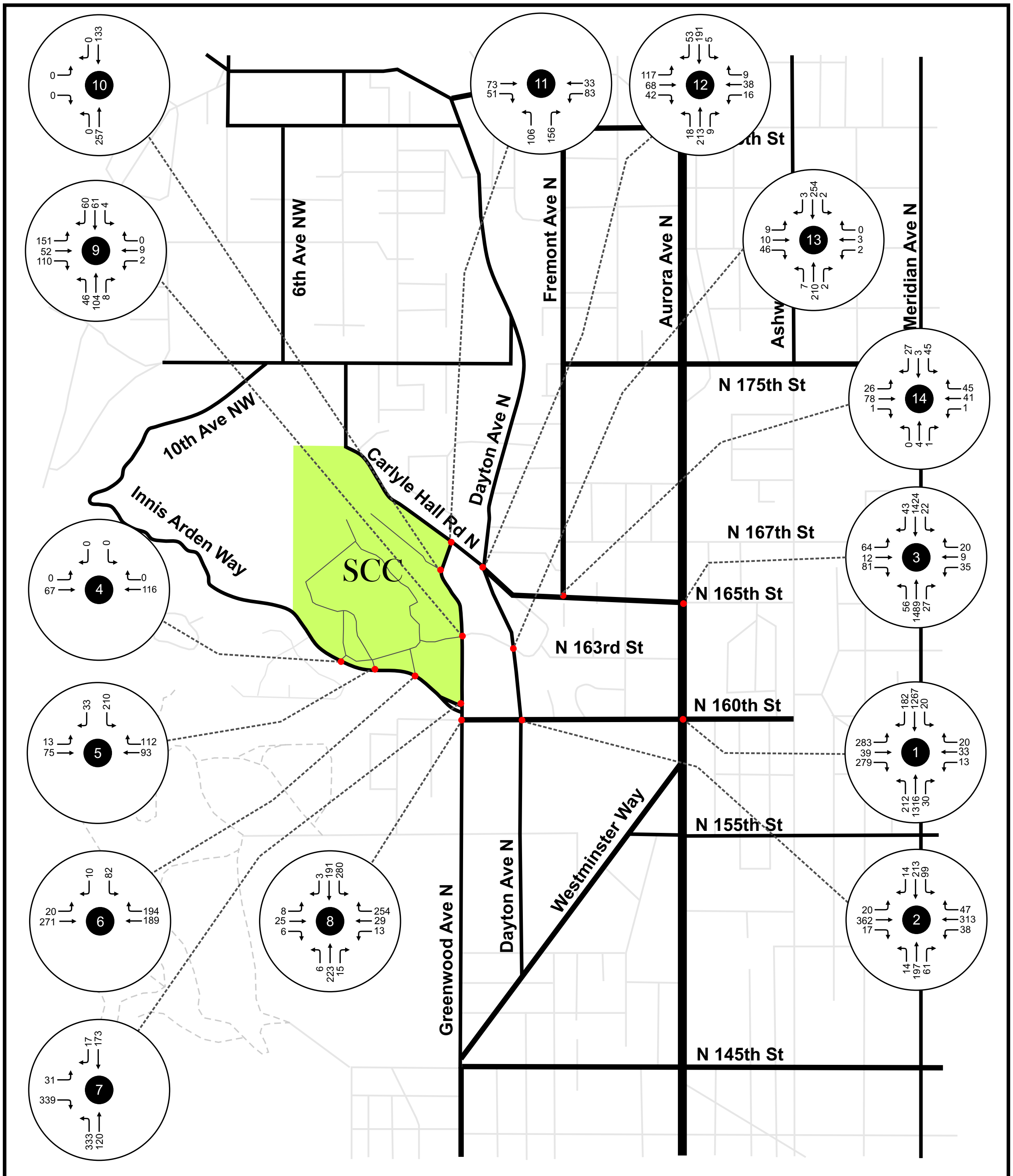

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Figure 18
Midday Peak Hour (2040)
Turning Movement Volumes

Master Plan
Transportation Technical Report

Campus Access and Circulation

By 2040 the campus master plan is forecasted to be complete and improvements to the circulating roadway and parking lots completed.

Parking Supply and Demand

By 2040 it is anticipated that the remainder of the north Greenwood Lot will be converted to an expanded storm water detention facility and no longer used for student parking. Existing lots would be improved to meet current code requirements to provide better lighting circulation, and landscaping. This would result to minor losses of parking in affected lots. The on-campus parking supply for 2040 is summarized in Table 21.

Table 21: Proposed Parking Supply (2040)

	Parking Zone	2025 Supply	2040 Change	2040 Supply
1	Visitor Lot (south)	150	-13	137
2	Southwest Lots	375	-16	359
3	North and Northwest Lots	792	0	792
4	East Lots	76	-15	61
5	North Greenwood Lot	285	-285	0
6	Satellite Lot (Sears)	210	0	210
	Total	**1,888**	**-329**	**1,559**

Source: TSI

By 2040 the number of student FTE's would increase from the 2025 forecast by 300 student FTE's. In the existing conditions section of this analysis a peak parking demand factor of 0.33 stalls per student FTE was established. Applying this factor to the 2025 to 2040 increase in student FTE's results in a peak parking demand of 99 stalls. A parking supply of 104 stalls (5% greater than the forecasted demand) should adequately accommodate the increase in demand. The 2025 recommended supply of 1,880 stalls increases to 1,984 stalls in 2040. The proposed supply of 1,559 stalls would be 425 stalls less than the recommended supply. It is anticipated that the parking demand ratio of 0.33 vehicles per student FTE would drop somewhat in the future in response to increasing fuel prices, increased transit use, and increased participation in on-line learning programs. Therefore, it is likely that the 2040 parking deficit will be less than forecasted. A portion of the deficit could also be mitigated by additional incentives in the trip reduction program, restrictions to on-campus parking, as well as providing additional off-campus parking.

Comparison of Transportation Related Findings with the 2006 Draft Plan FEIS

The 2006 Draft Plan contemplated significant growth in enrollment. The effects of this growth on transportation were analyzed in the FEIS and transportation related impacts identified. A comparison of the primary findings is summarized in Table 22. Following this table, key distinctions between the 2006 Draft Plan FEIS findings and this analysis are discussed.

Table 22: Comparison of 2006 Draft Plan and Forecasted Campus Master Plan Conditions

Transportation Element	2006 Draft Plan FEIS		Campus Master Plan		
	Baseline (2003)	Expanded Alternative (2015)	Baseline (2009)	MDP (2025)	LRDP (2040)
Student FTE's	5,600	6,770	4,959	5,700	6,000
Campus Generated Vehicle Trips					
-AM Peak	1,142	1,381	984	1,055	1,114
-Midday Peak	1,257	1,520	986	1,055	1,114
Distribution of Vehicles to Campus Accesses					
AM Peak					
Main Access	26%	19%	31%	30%	33%
Central Access	4%	4%	4%	4%	40%
West Access	34%	18%	34%	33%	closed
East Access	26%	31%	27%	31%	27%
North Access	9%	4%	4%	2%	closed
West Access 2	N/A	24%	N/A	N/A	N/A
Midday Peak					
Main Access	26%	17%	29%	28%	27%
Central Access	4%	5%	6%	6%	31%
West Access	34%	30%	27%	24%	closed
East Access	26%	30%	30%	38%	42%
North Access	9%	5%	8%	4%	closed
West Access 2	N/A	13%	N/A	N/A	N/A

Table 22: Comparison of 2006 Draft Plan and Forecasted Campus Master Plan Conditions (con't)

Transportation Element	2006 Draft Plan FEIS		Campus Master Plan		
	Baseline (2003)	Expanded Alternative (2015)	Baseline (2009)	MDP (2025)	LRDP (2040)
AM Peak Hour LOS and Delays[1]	LOS (delay in seconds)		LOS (delay in seconds)		
160th/Aurora	D (35)	E (73)	C (21)	C (21)	C (24)
160th/Dayton	B (17)	C (26)	B (15)	B (17)	C (22)
165th/Aurora	unsignalized	unsignalized	A (6)	A (7)	A (8)
Innis Arden/ Greenwood	C (17)	E (43)	C (21)	E (49)	E (43)
160th/Greenwood	A (8)	B (14)	A (9)	A (8)	B (12)
Carlyle/Dayton	F (60)	F (126)	D (33)	E (45)	F (72)
Midday Peak Hour LOS and Delays[1]	LOS (delay in seconds)		LOS (delay in seconds)		
160th/Aurora	F (124)	F (173)	C (26)	C (29)	C (32)
160th/Dayton	B (12)	B (12)	B (12)	B (12)	B (13)
165th/Aurora	unsignalized	unsignalized	A (6)	A (7)	A (7)
Innis Arden/ Greenwood	A (6)	E (41)	C (17)	C (21)	F (56)
160th/Greenwood	A (6)	A (9)	A(6)	A (7)	A (7)
Carlyle/Dayton	B (15)	C (22)	B (12)	B (13)	B (14)
Parking Supply					
Total Supply (On campus/Off campus)	2,353 (2,153/ 200)	2,570 (2,570/ 0)	2,061 (1,851/ 210)	1,888 (1,678/210)	1,559 (1,349/210)
Recommended Supply (1.05 X demand)	2,252	2,858	1,737	1,880	1,984

[1] Comparisons of level of service (LOS) impacts between the FEIS and the Campus Master Plan are not equivalents. The Campus Master Plan considers a significantly longer time frame than the FEIS (through 2040 in the LRDP, as compared to 2015 for the FEIS), and must account for an additional 20 years of growth in non-campus generated traffic volumes. Accordingly, LOS impacts for the Campus Master Plan reflect many more additional years of growth in background traffic that is not attributable to SCC enrollment growth. This is reflected in the overall number of vehicle trips generated under the 2006 Draft Plan FEIS and the proposed Campus Master Plan.

Transportation Element	2006 Draft Plan FEIS		Campus Master Plan		
	Baseline (2003)	Expanded Alternative (2015)	Baseline (2009)	MDP (2025)	LRDP (2040)
Circulation					
Vehicular site access	Existing conditions	New access added on Innis Arden Way on the west edge of the campus.	Existing conditions	No change from existing conditions	West access on Innis Arden Way removed. Inbound movements added to central access.
Internal road circulation	Existing conditions	Improved connection provided between new west access and parking structure on north side of campus.	Existing conditions	Improvement to north campus vehicular circulation by reconfiguring parking areas and improving roadway as part of adjacent building project.	Improvement to campus-wide vehicular circulation with reconfiguratio n of parking areas, improvements to campus loop road, and consolidation of campus loading facilities.
Pedestrian access	Existing conditions	No change from existing conditions	Existing conditions	Pedestrian improvements are phased with building replacements to improve intra-campus circulation.	Pedestrian improvements , including open spaces, landscaped pedestrian spine, and properly graded paths, are phased with building replacements to improve intra-campus circulation.
Public Transportation	Existing conditions	Addition of transit stop on north side of campus.	Existing conditions	No change from existing conditions	Transit stops at main entrance loading area reconfigured to improve pedestrian safety and transit staging and circulation.

Student FTE's

The 2006 Draft Plan anticipated significant growth in student FTE's by 2015. Subsequent drops in enrollment between 2003 and 2009 have resulted in a much more modest growth scenario where the campus is forecasted to return to 2003 student FTE levels by 2040 with an additional 400 student FTE's living on-campus.

Campus Generated Vehicle Trips

Campus generated trip calculations are based on the ratio of student FTE's to the number of vehicles entering or leaving the campus at peak times. Based on these ratios, the number of peak hour campus generated trips generated under the LRDP (2040) would be somewhat less than what was generated in 2003 and significantly less than what was forecasted to be generated under the 2006 Draft Plan by 2015.

Vehicle Trip Distribution

The distribution of vehicle trips between campus accesses was similar in 2003 and 2009. The 2006 Draft Plan contemplated a new access on Innis Arden Way on the west edge of the campus which reduced the percentage of trips using the main access and north access. This access was intended to serve a parking garage located on the soccer field. Under the MDP (2025) there would be a decrease in the number of trips using the north parking lot access on Greenwood as the parking supply is reduced due to construction of the storm water detention facility. The percentage of trips using the east access on Greenwood would increase as new parking is constructed on the north side of the campus. Under the LRDP (2040) the north parking lot is closed due to expansion of the detention facility. The west access on Innis Arden Way is also closed when the parking lots on the south side of the campus are reconfigured. At this time the central access, which is currently one way outbound, would become both inbound and outbound. With fewer accesses than contemplated under the 2006 Draft Plan, the LRDP (2040) forecasts that each access would carry a higher percentage of campus generated trips but the number of trips would be lower than under the 2006 Draft Plan due to the smaller number of commuter student FTE's.

Level of Service

AM Peak Hour

All campus accesses are forecasted to operate at LOS-C or better in 2040. A comparison of off-campus intersection operation under the 2006 Draft Plan and the LRDP (2040) shows that the delay at all intersections would be less in 2040 than forecasted for 2015 with the exception of the Innis Arden/ Greenwood intersection where delay remains the same. The LRDP has a much longer time frame than the 2006 Draft Plan with an associated greater increase in background traffic volumes which have a greater impact on off-campus intersections that campus generated traffic volumes.

Midday Peak Hour

All campus accesses are forecasted to operate at LOS-C or better in 2040 with the exception of the east access which would operate at LOS-D due to the increase in outbound traffic entering Greenwood Avenue N. A comparison of off-campus intersection operation under the 2006 Draft Plan and the LRDP (2040) shows that the delay at all intersections would be unchanged or less in 2040 than forecasted for 2015 with the exception of the Innis Arden/ Greenwood intersection where delay increases and the level of service drops to LOS-F. The increase in delay is due to the volume of campus generated traffic that has left the campus and is waiting to turn right onto southbound Greenwood. The difference between 2006 Draft Plan findings and the LRDP forecast is problematic since there are fewer vehicles entering the intersection under the LRDP than under the 2006 Draft Plan and level of service should improve. A review of the *SimTraffic* analysis for the 2006 Draft Plan showed that shorter simulation times and fewer simulations were run than those used for LRDP analysis. A shorter simulation time reduces the potential for queues to materialize and results in less intersection delay than would be calculated with longer run times. The simulation used for the LRDP is a more accurate forecast of actual intersection operation than that provided for the 2006 Draft Plan. If the 2006 Draft Plan had been evaluated under the same simulation used for the LRDP, the level of service would likely have dropped to LOS-F for the Innis Arden/Greenwood intersection.

Parking

Under the 2006 Draft Plan, a parking supply of 2,858 stalls was recommended to serve the campus population in 2015. Under the LRDP, a supply of 1,984 is recommended to serve the smaller campus population.

Campus Circulation

The LRDP identifies the need to improve the internal circulation road and pedestrian routes as part of building projects. The 2006 Draft Plan included improvements to a roadway that would connect a new access on Innis Arden Way to a parking structure on the north side of the campus. The LRDP also identifies improvements to the main access to improve the loading area, transit stops, and pedestrian access. The LRDP also removes the west access and north parking lot access while the 2006 Draft Plan added an access on Innis Arden Way.

Public Transportation

The 2006 Draft Plan included additional transit stops on the north side of the campus. The LRDP improves the existing transit stop, provides for transit staging, and improves pedestrian safety and circulation at the transit stop.

Conclusions

Traffic Impacts

The LRDP (2040) anticipates a modest growth in commuter student FTE's from 2009 levels. This increase would restore the number of student FTE's to approximately the same enrollment level as 2003 with an additional 400 student FTE's living on-campus. The students living on-campus would have a negligible effect on traffic volumes and associated impacts. The effect of the growth in commuter students on the operation of intersections some distance from the campus is negligible. The effect of new campus generated trips on intersections adjacent to the campus is minor. The assumed growth in background traffic volumes appears to be the greatest factor affecting intersection operations. The assumed growth factors for intersections near the campus were set at 0.5% per year or less. However, given the compounded effect over 30 years this rate significantly increases traffic volumes at some locations and may not materialize as forecasted. The primary reason that background traffic volumes would not grow as contemplated in the City's Comprehensive Plan is that the land uses near the college are largely residential and there is very limited space for new development.

The most problematic intersection is at Innis Arden Way/Greenwood Ave N and its spillover effect on the adjacent intersection of N160th St/Greenwood Ave N. Poor operation during the AM peak hour is driven by the southbound through traffic largely made up of commuters conflicting with northbound vehicles making a left turn onto Innis Arden Way to enter the campus. At midday, it is the volume of eastbound traffic exiting the campus that is turning onto Greenwood Ave N that causes increased delays. The 2006 Draft Plan FEIS contains a though analysis of these intersections and a number of recommendations for potential improvements that were evaluated by the community. Because the campus growth that would occur under the LRDP merely restores enrollment to 2003 levels plus an additional 400 student FTE's associated with the housing project, it is unlikely that campus generated traffic volumes would increase in the foreseeable future to justify the implementation of any of the recommendations.

Because the proposed Campus Master Plan contemplates significantly less growth than projected for the alternatives in the 2006 Draft Plan, the traffic related impacts are proportionally less than stated in the 2006 Draft Plan FEIS.

Parking

Parking demand generated by SCC under the proposed master development plan would be accommodated by the proposed on-campus parking supply and the existing satellite lot at the Sears site through 2025. Parking on neighborhood streets has decreased due to the residential parking zone (RPZ) ordinance. By 2040, (Long Range Development Plan) the proposed parking supply would be less than recommended and a parking deficit of approximately 425 stalls could materialize.

Pedestrian Circulation and Safety

Pedestrian safety is compromised by the lack of sidewalks and traffic volumes generated by the SCC and local residents. There are a number of mitigating measures that would alleviate existing deficiencies and mitigate any impact resulting from increases in internal traffic volumes. These measures include:

- Ensure that the redesign of internal parking lots separates pedestrian and vehicular circulation routes.
- Improve primary internal vehicular circulation routes to reduce the number of locations where vehicles could back onto the roadway and minimize crossings and conflicts with pedestrian routes.

External to the campus the sidewalk system is incomplete. However, the sidewalk system that links the main campus entrance to the satellite parking lot on N 160th Street is complete except for the short link on Innis Arden Way between the main campus entrance and Greenwood Avenue North. This segment is paved but not curbed. Angle parking is present between the pedestrian path and travel lane and provides adequate separation between vehicles and pedestrians.

Trip Reduction

SCC has recently expanded its trip reduction program to include a transportation fee that funds parking operations that provides subsidized transit passes to faculty, staff, and students. The benefits of this program will continue to materialize as fuel costs increase and the percentage of the campus population relying on single occupant vehicles decreases.

Mitigation

The proposed Master Plan would result in minor increases in traffic volumes on nearby streets. Such increases are well within the capacity of existing facilities. No significant adverse impacts to the road system or intersection operations are anticipated.

Proposed parking supplies for 2040 would not meet the forecasted demand and a deficit of up to 425 parking stalls could occur. This impact could be mitigated by increased participation in the trip reduction program, increased opportunities for participation in on-line learning programs, restrictions on on-campus parking, and providing additional off-campus parking.

Appendices

Level of Service reports for the following conditions:

AM Peak Hour Intersection Level of Service (Existing 2009)
Midday Peak Hour Intersection Level of Service (Existing 2009)
AM Peak Hour Intersection Level of Service (without Master Plan 2025)
Midday Peak Hour Intersection Level of Service (without Master Plan 2025)
AM Peak Hour Intersection Level of Service (without Master Plan 2040)
Midday Peak Hour Intersection Level of Service (without Master Plan 2040)
AM Peak Hour Intersection Level of Service (with Master Plan 2025)
Midday Peak Hour Intersection Level of Service (with Master Plan 2025)
AM Peak Hour Intersection Level of Service (with Master Plan 2040)
Midday Peak Hour Intersection Level of Service (with Master Plan 2040)

Due to size and limited audience, the appendices are not included in the master plan documentation. They are available in electronic format from TSI and may be requested by calling TSI at 425-883-4134.