ENVIRONMENTAL CHECKLIST

for the proposed

South College Drive Improvements Project

prepared for

Western Washington University Capital, Planning and Development

August 2022

EA Engineering, Science, and Technology, Inc., PBC
Wilson Engineering, LLC
GeoEngineers, Inc.
Transpo Group

PREFACE

The purpose of this Environmental Checklist is to identify and evaluate probable environmental impacts that could result from the ***South College Drive Improvements*** project and to identify measures to mitigate those impacts.The ***South College Drive Improvements*** project would include the development of a 133-space surface parking area on the site.

The State Environmental Policy Act (SEPA)[1] requires that all governmental agencies consider the environmental impacts of a proposal before the proposal is decided upon. This Environmental Checklist has been prepared in compliance with the State Environmental Policy Act; and the SEPA Rules, effective April 4, 1984, as amended (Chapter 197-11, Washington Administrative Code), which implements SEPA.

This document is intended to serve as SEPA review for site preparation work, construction, and operation of the ***South College Drive Improvements*** project. Analysis associated with the proposed project contained in this Environmental Checklist is based on conceptual plans for the project. While not construction-level detail, the conceptual plans accurately represent the eventual size, location and configuration of the proposed project and is considered adequate for analysis and disclosure of environmental impacts.

This Environmental Checklist is organized into three major sections. *Section A* of the Checklist (beginning on page 1) provides background information concerning the *Proposed Action* (e.g., purpose, proponent/contact person, project description, project location, etc.). *Section B* (beginning on page 2) contains the analysis of environmental impacts that could result from implementation of the proposed project, based on review of major environmental parameters. This section also identifies proposed mitigation measures. *Section C* (page 18) contains the signature of the proponent's SEPA consultant confirming the completeness of this Environmental Checklist.

Project-relevant analyses that served as a basis for this Environmental Checklist include: *WWU Project Map* (WWU, 2022) *Geotechnical Report* (GeoEngineers, 2022); *Greenhouse Gas Emissions Worksheet* (EA, 2022); and, *Parking Utilization Study* (Transpo Group, 2020).

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[1] Chapter 43.21C. RCW

TABLE of CONTENTS

Page

LIST of FIGURES

ENVIRONMENTAL CHECKLIST

A. BACKGROUND

1. Name of proposed project, if applicable: ***South College Drive Improvements***
2. Name, address, and phone number of Owner / Decision maker:

   Rick Benner, Director

   Capital Planning and Development, MS 9122

   Western Washington University

   Bellingham, WA 98225

   (360) 650-3550
3. Name, address, and phone number of contact person:

   Sherrie Montgomery, Project Manager/Architect

   Capital Planning and Development, MS 9122

   Western Washington University

   Bellingham, WA 98225

   (360) 650-6519
4. Date checklist prepared: August 25, 2022
5. Department requesting checklist: WWU Capital Planning and Development
6. Proposed timing or schedule (including phasing, if applicable): Demolition for the project is anticipated to start in late October, and end in early November. Construction of the proposed parking is expected to be completed by the end of 2022.
7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain: Yes. The proposed parking that is the subject of this Environmental Checklist would replace parking permanently displaced by new WWU buildings and temporarily displaced by WWU construction projects over the next 6 to 8 years and would help maintain the minimum parking on campus established in the WWU Institutional Master Plan (IMP) (see A. Background, 11 and **Appendix A** for details).
8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal: The follow environmental analyses were prepared and support this Environmental Checklist:
   - WWU Project Map, 2022 – 2027 (WWU, 2022), see **Appendix A**;
   - Geotechnical Report (GeoEngineers, 2022), see **Appendix B**;
   - Greenhouse Gas Emissions Worksheet (EA, 2022), see **Appendix C**; and,
   - Parking Utilization Report (Transpo, 2020), see **Appendix D**.
9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain: The building permit

application BLD 2022-0565 for the WWU Electrical Engineering and Computer Science Building (EECS) was submitted on June 15, 2022. A stormwater permit application was submitted on August 15, 2022, to modify the regional detention vault to detain the additional stormwater runoff created by the ***South College Drive Improvements*** project.

10. List any government approvals or permits that will be needed for your proposal, if known: The following permits would be required for the proposed parking:

    City of Bellingham

    - Planned Development Permit;
    - Grading Process Type II Permit;
    - Street Tree Permit;
    - Temporary and Permanent Stormwater Management Plan Approvals;
    - Public Works Permit (for irrigation system); and
    - Public Facilities Construction Agreement (if work is proposed in the Bill McDonald Parkway right of way).

    Washington State Department of Ecology

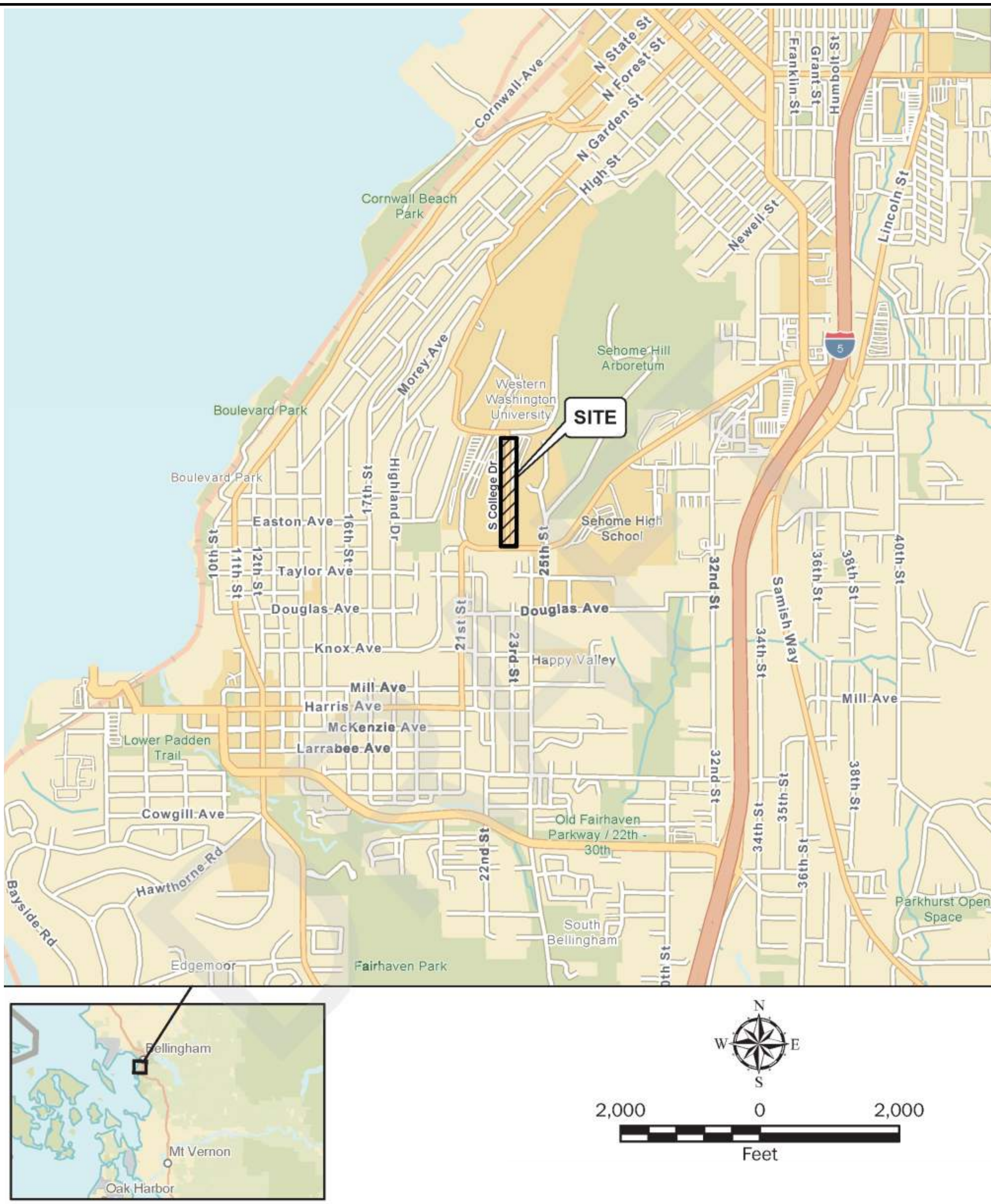
    - NPDES General Construction Permit

11. Give a brief and complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page: The approximately 3-acre[1] ***South College Drive Improvements*** site is located in the WWU neighborhood in Bellingham, Washington (see **Figure 1**, Vicinity Map). The site is situated in the southern portion of the WWU campus. The site is bounded by West College Way to the north, parking lots, open space, and student housing to the east, Bill McDonald Parkway to the south, and parking lots and multipurpose fields to the west (see **Figure 2**, Aerial Map). South College Drive is no longer a secondary arterial or a City street because the City vacated the right of way to WWU.

    The proposed ***South College Drive Improvements*** project would reconfigure South College Drive to remove the existing vegetated median and add angled parking along the east side of the roadway. The proposed project would provide a total of 133 parking spaces. The travel lanes would be reduced to 11 feet wide, and 5-ft. wide north and southbound bike lanes would be provided on the east and west edges of the proposed parking and roadway, respectively. New trees would be planted to replace those removed for the proposed project (see **Figure 3**, Site Plan and **Figure 4**, Roadway Cross-sections). The proposed parking would replace parking permanently displaced by new WWU buildings and temporarily displaced by WWU construction projects over the next 6 to 8 years. The WWU IMP establishes a minimum of 3,400 parking spaces to be maintained on the WWU campus. As of August 2022, there are 3,865 spaces on campus. With construction projects proposed at the University through 2027 (including the ***South College Drive Improvements*** project), 3,853 spaces will be provided (see **Appendix A** for details). An additional approximately 100 spaces will be

[1] The 3-acre site includes adjacent areas proposed for landscaping.

WWU South College Drive Improvements
Environmental Checklist



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Source: GeoEngineers, 2022.

EA Engineering, Science, and Technology, Inc., PBC

Figure 1

Vicinity Map

WWU South College Drive Improvements
Environmental Checklist

Source: Google Earth and EA Engineering, 2022.

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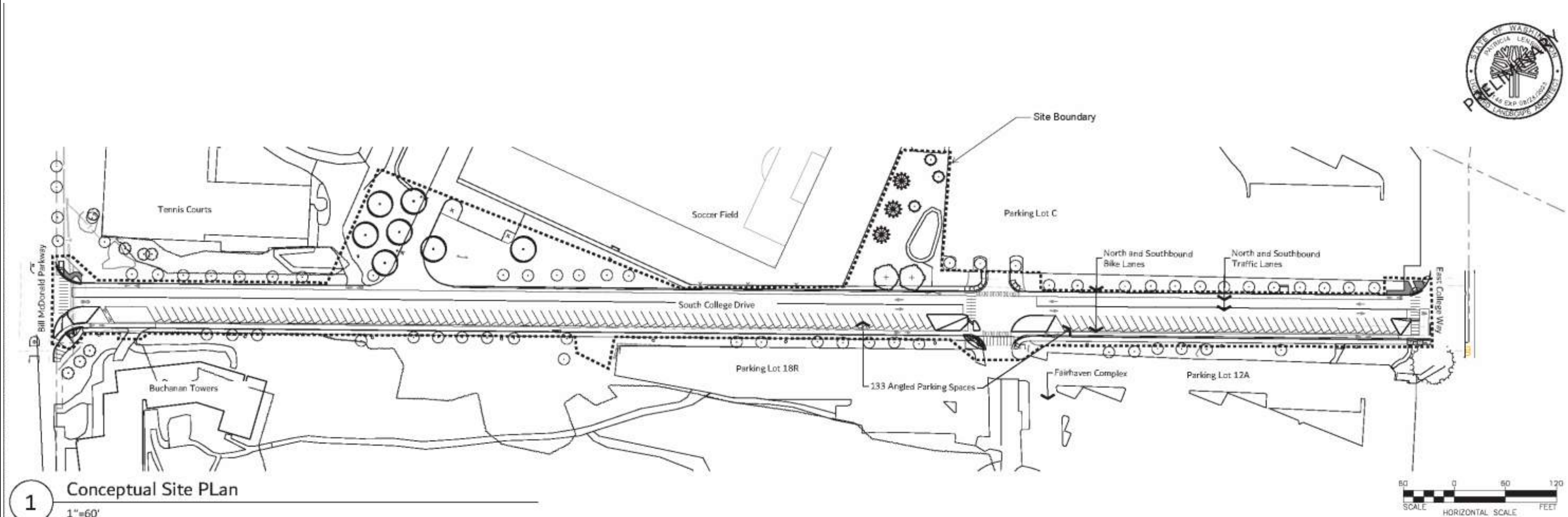
Figure 2

Aerial Map



1 Conceptual Site PLan
1"=60'

Tree Schedule

TREES	BOTANICAL NAME	COMMON NAME	SIZE	QTY
	Acer rubrum 'Frankered' TM	Red Sunset Maple	6' Ht.	2
	Ginkgo biloba	Maidenhair Tree	6' Ht.	7
	Metasequoia glyptostroboides	Dawn Redwood	6' B&B	3
	Pseudotsuga menziesii	Douglas Fir	6' B&B	3

Source: Wilson Engineering, 2022.

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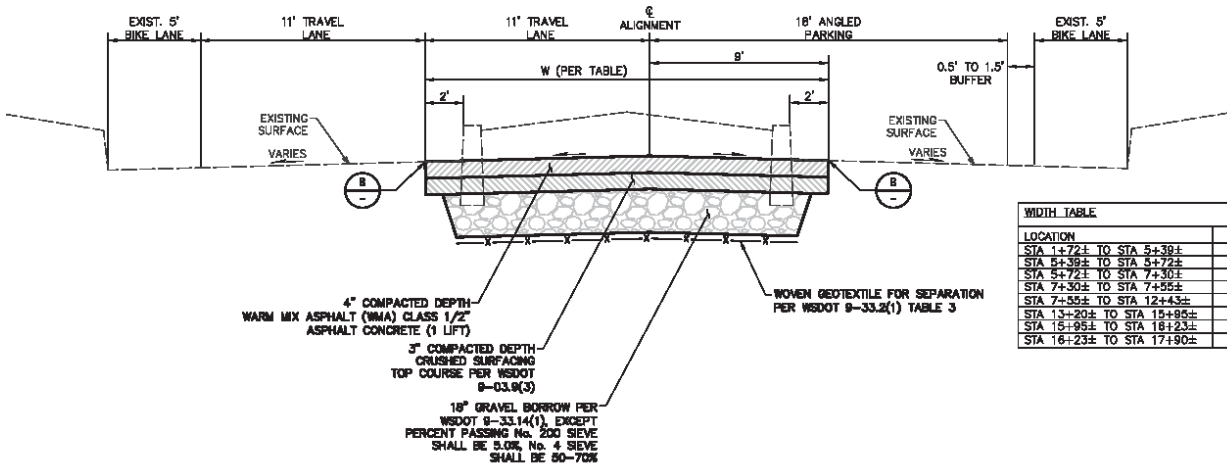
Figure 3

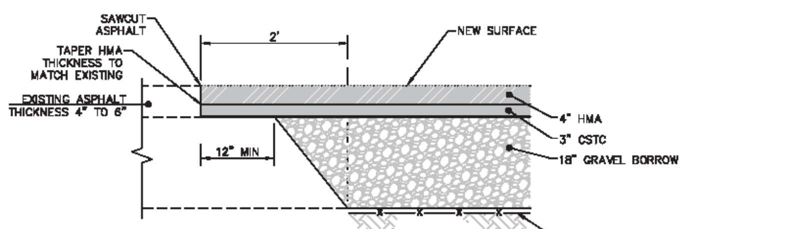
Site Plan



WIDTH TABLE

LOCATION	WIDTH
STA 1+72± TO STA 5+39±	W=20'
STA 5+39± TO STA 5+72±	TRANSITION WIDTH
STA 5+72± TO STA 7+30±	W=12.4
STA 7+30± TO STA 7+55±	TRANSITION WIDTH
STA 7+55± TO STA 12+43±	W=20'
STA 13+20± TO STA 15+95±	W=20'
STA 15+95± TO STA 16+23±	TRANSITION WIDTH
STA 16+23± TO STA 17+90±	W=11'

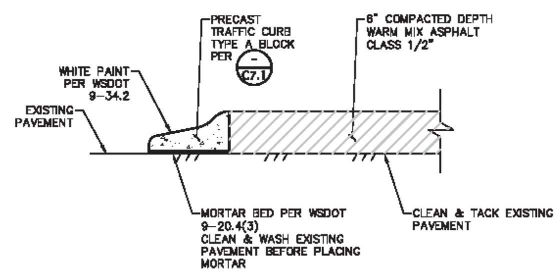
(A) ASPHALT PAVEMENT SECTION
NOT TO SCALE



NOTES:

1. CONTRACTOR SHALL APPLY CSS-1 TACK COAT ON ALL VERTICAL AND HORIZONTAL SURFACES WHERE OVERLAY ASPHALT MEETS EXISTING SURFACES, PER WSDOT 5-04.3(5)A AND 9-02.1(6).
2. SEAL PAVEMENT JOINTS WITH AR4000W AND PROVIDE SAND BLANKET TO ALLEVIATE TRAILING.

(B) TYPICAL PAVEMENT SEAM
NOT TO SCALE



(C) ISLAND ASPHALT OVERLAY
NOT TO SCALE

Source: Wilson Engineering, 2022.

EA Engineering, Science, and Technology, Inc., PBC

Figure 4

Roadway Cross Sections

available when the Environmental Studies and Student Development and Success projects are completed. Therefore, the parking minimum in the IMP is being maintained.

B. ENVIRONMENTAL ELEMENTS

C. EARTH

The following responses are based on the Geotechnical Report prepared by GeoEngineers in August 2022 (see **Appendix B**). GeoEngineers completed eight (8) explorations in the roadway or vegetated median for their study.

1. General description of the site (Choose one):
   a. ☒ Flat
   b. ☐ Rolling
   c. ☐ Hilly
   d. ☐ Steep Slopes
   e. ☐ Mountainous
   f. ☐ Other: ____________________
2. What is the steepest slope on the site (approximate percent slope): The steepest slope onsite is approximately 12%.
3. What general types of soils are found on the site (for example – clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland: The site is underlain by the Chuckanut Formation bedrock. Undifferentiated glacial deposits/continental glacial drift are also mapped nearby. The Chuckanut Formation consists of sandstone, conglomerate, shale, and coal deposits. The bedrock typically encountered in the area consists of sandstone or siltstone. The character of the bedrock at the WWU campus is known to vary considerably over short distances. The undifferentiated glacial deposits or continental glacial drift deposits can consist of a variety of soil types deposited in various glacial environments including glacial till, outwash and glaciomarine drift. Based on previous experience in the area, Bellingham (glaciomarine) Drift overlies the bedrock in this area. The Bellingham Drift is a glaciomarine drift deposit which consists of unsorted, unstratified silt and clay with varying amounts of sand, gravel, cobbles, and occasional boulders.
4. Are there surface indications or a history of unstable soils in the immediate vicinity? If so describe: There are no visible surface indications or history of unstable soils onsite or in the site vicinity. The City of Bellingham Environmental Critical Areas (ECA) maps show no existing ECAs (e.g., geotechnical hazards) on the project site. However, all western Washington is at risk of a strong seismic event.
5. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill: It is estimated that 2,300 CY of cut and 2,100 CY of fill would be required for the project. The fill would primarily be provided from off-site sources. Due to expected wet weather during the construction period, select import materials would be used for backfill.
6. Could erosion occur as a result of clearing, construction, or use? If so, generally describe: Construction of the ***South College Drive Parking Improvements*** would result in the temporary exposure of soils on the site, and erosion is possible in conjunction with any construction activity. The site soils have a moderate to high susceptibility to erosion when disturbed. However, the site is

generally flat which would limit the potential for erosion. The disturbed areas would also be isolated since the roadway excavation is below grade, at the crown of the road, and surrounded by pavement. Exposed subgrade soils would be limited to what could be covered with gravel borrow or protected within two days. Appropriate Temporary Erosion and Sedimentation Control (TESC) measures and Best Management Practices (BMPs) would be implemented, in accordance with City of Bellingham standards.

7. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)? Following construction, approximately 70% of the site would be covered in impervious surfaces (asphalt pavement), accounting for the adjacent areas that would be landscaped.

8. Proposed measures to reduce or control erosion, or other impacts to the earth, if any: The following measures are proposed to reduce or control erosion, or other earth-related impacts:

    - Erosion and sedimentation control would be implemented, in accordance with City of Bellingham standards, including:
        - Surface water would be prevented from flowing across disturbed areas and would not be directed toward the slopes during construction;
        - Temporary erosion protection would be implemented (e.g., straw, plastic, or rolled erosion control products), as necessary;
        - Pavement would be installed and new landscaping established as soon as practical after grading is complete;
        - Permanent drainage control would be installed as soon as possible.

    - As possible, site preparation would occur during periods of dry weather.

    - If earthwork must take place during wet weather, the following measures would be taken:
        - Construction activities would be scheduled so that the length of time that soils are left exposed to moisture would be reduced to the extent practical and the size of areas that are stripped of pavement and left exposed would be limited, including stockpiles;
        - Any slopes with exposed soils would be covered with plastic sheeting or similar means;
        - Up-gradient sand bags would be provided to direct surface water away from entering the construction trenches; and
        - Temporary sumps would be installed to collect water in trenches and prevent ponding and damaging exposed subgrades.

    - Construction staging would occur on the project site.

    - After site preparation activities have been completed, the new pavement subgrade would be thoroughly compacted to a firm condition. Compaction would be supervised by the geotechnical consultant.

    - Regardless of the soil type encountered in the excavation, either shoring, trench boxes, or sloped sidewalls would be required for excavations deeper than 4 feet per WAC 296-155.

D. AIR

1. What types of emission to the air would result from the proposal (i.e., dust, automobile, odors, and industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known: During dry months of construction, dust could be generated by excavation and sitework activities. Other construction emissions would be created by heavy equipment exhaust during grading activities, as well as from any potential lifts and forklifts used onsite. Following construction, automobile traffic would not increase as this parking area would provide replacement parking for parking permanently displaced by new WWU buildings and temporarily displaced by WWU construction projects over the next 6 to 8 years. Therefore, traffic emissions are expected to remain unchanged.

   The scale of global climate change is so large that a project's Greenhouse Gas (GHG) impacts can only be evaluated on a cumulative scale, and it is not anticipated that a single development project would cause an individually discernable impact on global climate change. To evaluate the climate change impacts of the ***South College Drive Improvements*** project, a GHG Emissions Worksheet has been prepared to estimate the emissions footprint for the lifecycle of the proposed project on a gross-level basis (see **Appendix C**). For this project, the emissions estimate is based on:

   - **Embodied Emissions** – extraction, processing, transportation, construction, and disposal of materials, and landscape disturbance.

   The Worksheet estimate is based on the size of the new paved area (approximately 21,400 sq. ft.). It is estimated that lifespan emissions from the new paved area would be approximately 1,070 $MTCO_2e$[2]. Note that this calculation is usually used for pavement associated with roadways. Because the parking component of the ***South College Drive Improvements*** project pavement would not be as heavily used as a roadway, it would likely use less material and have a longer lifespan, and the actual embodied emissions of this part of the project would likely be lower.

2. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe: Vehicle traffic in the vicinity of the site is the primary existing source of emissions and odors, including traffic on Bill McDonald Parkway, West College Way, and East College Way. Off-site emissions and odors are not anticipated to affect the proposed project.

3. Proposed measures to reduce or control emissions or other impacts to air, if any: Although no significant construction or operational air quality impacts are anticipated with the proposed project, the following measures are proposed to help reduce or control emissions:

   - Construction contractors would be required to comply with all applicable federal, state, and local air quality regulations, and would be required to prepare a plan to minimize dust and odors during construction. Examples of measures that would be implemented include: Construction work areas would be covered in crushed rock and the site would be watered from a hydrant or water truck to minimize or eliminate dust.

[2] $MTCO_2e$ is defined as Metric Ton Carbon Dioxide Equivalent; it equates to 2,204.62 pounds of CO_2. This is a standard measure of the amount of CO_2 emission reduced or sequestered. Carbon is not the same as CO_2. Sequestering 3.67 tons of CO_2 is equivalent to sequestering of one ton of carbon.

- Depending on the sensitivity of the adjacent buildings, and any nearby fresh air intakes, the exhaust odors (e.g., from heavy equipment, lifts, and forklifts) could be addressed with scrubbers on the equipment.

E. WATER – SURFACE

1. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into: No surface water body exists onsite or in the vicinity of the site
2. Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attached available plans: No, as no surface water body exists onsite or in the vicinity of the site.
3. Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material: No fill/dredge material would be placed in/removed from surface waters, as no surface water body or wetlands exist onsite or in the vicinity of the site.
4. Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known: No surface water withdrawals or diversions would occur, as no surface water body exists onsite or in the vicinity of the site.
5. Does the proposal lie within a 100-year floodplain? If so, note the location on the site plan: No, the site is not located in a 100-year floodplain
6. Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge: No discharge of waste materials to surface waters would occur, as no surface water body exists onsite or in the vicinity of the site.

F. WATER – GROUND

1. Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known: No ground water would be withdrawn or water discharged to ground water. Per the Geotechnical Report, more significant groundwater seepage could be present 8 to 10 feet below ground surface (bgs) at the site, which is anticipated to be below the depth of the proposed improvements. Groundwater conditions are expected to fluctuate based on season, precipitation, and other factors (see **Appendix B** for details).
2. Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial - containing chemicals; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve: No waste materials would be discharged into the ground from septic tanks or other sources.

G. WATER – RUNOFF (Including storm water)

1. Describe the source of runoff (including storm water) and method of collection and flow disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other water? If so, describe: Under the proposal, permanent stormwater management would be provided that would comply with City of Bellingham requirements. Stormwater from the proposed parking area would drain to the curbline where it would be collected in catch basins and routed downstream via an underground stormwater drainage system. Water quality treatment would be provided (e.g., with a BioPod) for the new and replacement surfaces, and flow control would continue to be provided by the existing regional detention vault located below the WWU tennis courts. Based on stormwater modeling conducted for the EECS project, changes to the control structure in the existing vault are proposed to add capacity to the vault that would allow for more conversions to impervious surface. Additional stormwater modeling for the ***South College Drive Improvements*** project indicates that no further modifications of the control structure would be needed for this project. The new flow control structure will be installed in approximately mid-October 2022, before the ***South College Drive Improvements*** project begins.

   Could waste materials enter ground or surface waters? If so, generally describe: Waste materials are not expected to enter ground or surface waters because stormwater quality treatment measures would be installed as part of the stormwater management system per City of Bellingham standards and the current edition of the Washington State Department of Ecology *Stormwater Management Manual for Western Washington*.

1. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any: The proposed project would comply with applicable City and the current edition of the *Stormwater Management Manual for Western Washington* requirements relating to surface water runoff control and water quality treatment. TESC and BMPs would be implemented during construction and the site would be stabilized following construction to minimize erosion and sedimentation. Permanent stormwater management would also be installed. Therefore, no significant impacts on surface or ground water are expected.

H. PLANTS

1. Check types of vegetation found on the site:

   a. ☒ Grass
   b. ☒ Shrubs
   c. ☐ Pasture
   d. ☐ Crop or Grain
   e. ☒ Deciduous Tree: **Maple**
   f. ☒ Evergreen Tree: **Douglas Fir**
   g. ☐ Wet Soil Plants: Cattail, Buttercup, Bullrush, Skunk Cabbage, or Other
   h. ☐ Water Plants: Water Lily, Eelgrass, Milfoil, or Other
   i. ☐ Other Types of Vegetation:

2. What kind and amount of vegetation will be removed or altered? All the grass, shrubs, and trees in the existing median onsite would be removed for construction of the ***South College Drive Improvements*** project. A total of 15 trees would be removed. None of the trees are "Trees of Interest", as identified by WWU.

3. List threatened or endangered species known to be on or near the site: No known threatened or endangered plant species are located on or near the site.

4. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any: Proposed landscaping plan would include:

   - The trees that would be removed from the median would be replaced in and adjacent to the parking corridor to provide a comparable tree canopy at a 1:1 replacement ratio. The planting plan includes two Red Sunset Maple, seven Maidenhair Trees, three Dawn Redwood, and three Douglas Fir.

   - Irrigation modifications would be made to support new and existing plantings, including the addition of an irrigation meter.

I. ANIMALS

1. Check any birds and animals which have been observed on or near the site or are known to be on or near the site:

a.	**Birds:**	☐ Hawk	☐ Heron	☐ Eagle	☒ Songbirds	
b.	**Mammals:**	☒ Deer	☐ Bear	☐ Elk	☐ Beaver	
c.	**Fish:**	☐ Bass	☐ Trout	☐ Salmon	☐ Herring	☐ Shellfish
d.	**Other:**					

   Birds- A variety of native birds are present or migrate across campus. **Mammals-** squirrels, rats, and racoons inhabit the campus; deer wander through campus; other animals come down to the WWU campus from the nearby Sehome Hill Arboretum and neighborhoods on occasion. **Fish-** No surface waters and associated fish are present onsite or near the site.

2. List any threatened or endangered species known to be on or near the site: No threatened or endangered animal species are known to be on or near the site.

3. Is the site part of a migration route? If so, explain: Yes. The entire Puget Sound area is within the Pacific Flyway, a major north-south flyway for migratory birds in America, extending from Alaska to Patagonia. Every year, migratory birds travel some or all this distance – in spring and in fall – following food sources, heading to breeding grounds, or travelling to overwintering sites.

4. Proposed measure to preserve or enhance wildlife, if any: Proposed measures to preserve or enhance wildlife include:

   - The proposal would comply with applicable City and the current edition of the *Stormwater Management Manual for Western Washington* requirements related to surface water management, which would protect aquatic species downstream of the site in Bellingham Bay.

   - The proposal would comply with applicable City requirements related to replacing trees removed to restore tree canopy and habitat for wildlife on campus.

J. ENERGY AND NATURAL RESOURCES

1. What kinds of energy (electric, natural gas, oil, wood-stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.: No new use of energy would be required for the ***South College Drive Improvements*** project. Lighting for the project would continue be provided by roadway lighting along the east side of South College Drive.
2. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe: No, the project would not affect the potential use of solar energy by adjacent properties.
3. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any: None required; however, the replacement trees to be planted would shade the paved surfaces and reduce the "heat island effect" (due to the parking lot surface absorbing and emitting the sun's heat). The project would also be constructed with Warm Mix Asphalt which is produced at lower temperatures, thereby using less energy and reducing fuel emissions, fumes, and odors during construction.

K. ENVIRONMENTAL HEALTH

1. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill or hazardous waste, which could occur as a result of this proposal? If so, describe:
   a. Describe special emergency services that might be required: No hazardous/toxic chemicals would be used, transported to, or stored in the proposed parking area. No special emergency services are expected to be required for the proposal. It is possible that normal fire, medical, and/or other emergency services may, on occasion, be needed from the City of Bellingham during construction and operation of the project
   b. Proposed measures to reduce or control environmental health hazards, if any: None required.
2. Noise
   a. What types of noise exist in the area which may affect your project (for example, traffic, equipment, operation, other): The predominant source of existing noise in the vicinity of the project site is from vehicular traffic on adjacent streets (e.g., Bill McDonald Parkway, West College Way, and East College Way). Existing traffic noise is not anticipated to affect the proposed project.
   b. What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site: During construction, noise would be generated by the following activities: back-up alarms on trucks, forklifts, aerial lifts, and earthwork equipment; and general heavy equipment engine noise during earthwork and underground utility work. Following construction, automobile traffic would increase to the project site, but an overall increase of traffic to the campus is not anticipated because the proposed parking would replace parking permanently displaced by new WWU buildings and temporarily displaced by WWU construction projects over the next 6 to 8 years.
   c. Proposed measures to reduce or control noise impacts, if any: The project would comply with the City of Bellingham's noise regulations, including hours of construction.

L. LAND AND SHORELINE USE

1. What is the current use of the site and adjacent properties: South College Drive is a vacated street and is maintained by WWU. It currently provides access to the Fairhaven and C parking lots as well as the tennis courts and sports fields. Through access between Bill McDonald Parkway and East College Way is also possible; however, the primary route is along Bill McDonald Parkway to West College Way.

   All adjacent uses and buildings are part of WWU campus. Land uses surrounding the site include: **North-** West College Way, **East-** parking lots, student housing (e.g., Buchanan Towers and the Fairhaven Complex), and open space (Outback Farm), **South-** Bill McDonald Parkway, and **West-** parking lots, sports fields, and tennis courts (see **Figure 2**, Vicinity Map)

2. Has the site been used for agriculture? If so, describe: No, the project site is located in an urban area and has not been used as a working farmland for over 100 years.
3. Describe any structures on the site: There are no existing structures onsite.
4. Will any structures be demolished? If so, describe: No structures would be demolished.
5. What is the current comprehensive plan designation of the site: The site is in WWU Neighborhood, Area 1, and its Comprehensive Plan Designation and zoning classification is Institutional. The area is in Districts 13 and 18 of the WWU Institutional Master Plan (IMP).

   The principles for circulation and parking detailed in the IMP would be reinforced by the ***South College Drive Improvements*** project. Per the Vehicular Circulation section of the plan:

   "The key element in the IMP is the elimination of South College Drive to free up the "valley" for the development of new fields and the new south academic district. With the City's cooperation, vacation of South College Drive and other street rights-of-way will allow the consolidation of University property to reconfigure circulation flow and optimize use."

   The City has vacated the South College Drive right of way to WWU. The ***South College Drive Improvements Project*** would not eliminate South College Drive. However, the proposed improvements would serve this goal from the IMP by converting the primary use of South College Drive to south campus parking and minimizing the importance of this roadway as a main entry to campus.

6. If applicable, what is the current shoreline master program designation of the site? The site is not located within a designated shoreline area.
7. Has any part of the site been classified as an "Environmentally Sensitive" area? If so, specify: According to the City of Bellingham Environmental Critical Areas (ECA) maps, there are no existing ECA's on the project site.
8. Approximately how many people would reside / work in the completed project? No people would reside/work in the project.
9. Approximately how many people would the completed project displace? No people would be displaced by the project.
10. Proposed measures to avoid or reduce displacement impacts, if any: None required.

11. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any: The use of the site would be generally compatible with the Comprehensive Plan, zoning, and IMP.

M. HOUSING

1. Approximately how many units would be provided, if any? Indicate whether high, middle. or low income housing: No housing units would be provided.
2. Approximately how many units, if any would be eliminated? Indicate whether high, middle, or low income housing: No housing units would be eliminated.
3. Proposed measures to reduce or control housing impacts, if any: None required.

N. AESTHETICS

1. What is the tallest height of any proposed structure(s), not including antennas? What is the principle exterior building material(s) proposed: No buildings are proposed.
2. What views in the immediate vicinity would be altered or obstructed: No views would be altered or obstructed by the project.
3. Proposed measures to reduce or control aesthetics impacts, if any: Landscaping, including new trees to replace trees that would be removed for the project, would be planted in and adjacent to the parking corridor.

O. LIGHT AND GLARE

1. What type of light or glare will the proposal produce? What time of day would it mainly occur: The paved surface of the proposed parking and the vehicles using the parking would generate glare during the daytime. The proposed parking would use the existing lighting on the east side of South College Drive, which would operate from dusk to dawn. The vehicles using the proposed parking would also produce light during the nighttime.
2. Could light or glare from the finished project be a safety hazard or interfere with views: Safety or views would not be affected by the light or glare generated by the project.
3. What existing off-site sources of light or glare may affect your proposal: No off-site sources of light or glare are anticipated to affect the proposed project.
4. Proposed measures to reduce or control light or glare impacts, if any: None required.

P. RECREATION

1. What designated and informal recreational opportunities are in the immediate vicinity: WWU Campus has many open green spaces, sports fields, and paths. A soccer field, baseball diamond, and tennis courts are located to the west of the site, and a number of paths pass through the Outback Farm to the east of the site and connect to residential halls and complexes in the area (e.g., Buchanan Towers and Fairhaven Complex).
2. Would the proposed project displace any existing recreational uses? If so, describe: No, the proposed project would not displace any recreational uses.

3. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any: The project would include north and southbound bike lanes.

Q. HISTORIC AND CULTURAL PRESERVATION

1. Are there any places (or objects) listed on / proposed for, national, state or local preservation registers known to be on or next to the site? If so, generally describe: There are no places or objects proposed or listed on an historic register on or next to the site.
2. Generally describe any landmarks or evidence of historic, archeological, scientific, or cultural importance known to be on or next to the site: No historic or cultural landmarks or evidence are known on or next to the site.
3. Proposed measures to reduce or control impacts, if any: Significant impacts to historic or cultural resources are not expected. However, in the unlikely event that cultural resources are inadvertently discovered during construction, all work would be halted and WWU, Washington State Department of Archaeology and Historic Preservation (DAHP), the City of Bellingham, and potentially affected tribes would be notified.

R. TRANSPORTATION

The following responses are based, in part, on the Parking Utilization Report prepared by Transpo in March 2020 (see **Appendix D**).

Identify public streets and highways serving the site and describe proposed access to the existing street system. Show on the site plans, if any: Access to the proposed project would be from West College Way to the north and Bill McDonald Parkway to the south (see **Figure 3**). South College Drive is no longer a City street because the City vacated the right of way to WWU.

1. Is the site currently served by public transit? If not, what is the approximate distance to the nearest transit stop: There are no public transit stops located on South College Drive. The closest transit stops are on Bill McDonald Parkway, less than a 5-minute walk to the west and south of the site.
2. How many parking spaces would the completed project have? How many would the project eliminate: The project would create 133 parking stalls. It would replace parking permanently displaced by new WWU buildings and temporarily displaced by WWU construction projects over the next 6 to 8 year and would help maintain the minimum parking on campus established in the WWU IMP (see A. Background, 11 and **Appendix A** for details). The project would not eliminate any parking.

   Traffic counts performed for the Traffic Utilization report found that the V/C lots designated for visitors and non-resident student parking had the highest occupancy at 52 - 93% during daytime hours on weekdays. Adding parking spaces near the highest occupancy V/C lots, such as proposed by the ***South College Drive Improvements*** project, would help reduce the occupancy rate at the peak hours (see **Appendix D** for details).
3. Will the proposal require any new roads or streets, or any improvements to existing roads or streets not including driveways? If so, generally describe (indicate whether public or private): No new roads

or streets would be required for the ***South College Drive Improvements*** project. The following improvements would be made as part of the project:

- Pavement repair and curb revisions would be made at the edge of the Bill McDonald Parkway right-of-way.
- Curb and channelization modifications would occur to accommodate parking and new traffic lane locations.
- Pending funding availability, existing failed asphalt sections would be ground, overlaid and repaired down to subgrade where necessary.

4. Will the project use (or occur in the immediate vicinity of) water, rail or air transportation? If so, generally describe: No, the project would not use or occur near water, rail, or air transportation.
5. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur: The proposed project would not generate any new trips to WWU campus as a whole.
6. Proposed measures to reduce or control transportation impacts, if any: Proposed measures to reduce transportation impacts include:
   - The sidewalk and uphill bicycle lane on the east side of the road would be separated from the traffic lanes by the parking aisle and a buffer strip to promote safety.
   - Bikeway markings including colored pavement would increase visibility at conflict areas including intersections.
   - An all way stop at the existing Parking Lot C would be provided to promote safety.

S. PUBLIC SERVICES

1. Would the project result in an increased need for public services (for example – fire or police protection, healthcare, schools, other)? If so, generally describe: The proposed project could generate the need for public services to the site due to the addition of parking; however, this would not represent an overall increase in the need for public services on the campus because the proposed parking would replace parking permanently displaced by new WWU buildings and temporarily displaced by WWU construction projects over the next 6 to 8 years. To the extent that emergency service providers have planned for service demands from WWU, no significant impacts are expected.
2. Proposed measures to reduce or control direct impacts on public services, if any: While those who park in the proposed parking area could generate demand for emergency services to the site, it is anticipated that adequate service capacity is available to preclude the need for additional public facilities/services.

T. UTILITIES

1. Choose which utilities are currently available at the site:

   a. ☐ Electricity
   b. ☐ Natural Gas
   c. ☒ Water

d. ☐ Refuse Service
e. ☐ Telephone
f. ☐ Sanitary Service
g. ☐ Septic System
h. ☐ Other

2. Describe the utilities that are proposed for the project, the utility providing the service and the construction activates on the site or in the immediate vicinity which might be needed: Existing irrigation lines would be removed and relocated to support existing and new plantings. An irrigation meter would also be added.

U. SIGNATURE

1. The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: [signature] Gretchen Brunner, Senior Planner
EA Engineering, Science, and Technology, Inc., PBC

Date Submitted: August 25, 2022

APPENDIX A

WWU Project Map 2022 - 2027

IMP Minimum Parking spaces = 3,400

Existing parking spaces (August 2022) 3,865

Construction Impacts:
- A Minus 9 (net)
- B Plus 43
- C Plus 133
- D Minus 126
- E & F Plus 38
- G Minus 40
- H Minus 101

2027 Parking Count 3,853
After H is returned to WWU 3,954

NOTE: Western anticipates repeated use of parking lots for the next decade, for construction laydown or conversion to buildings.

KEY

A 2020-2021:
New Residence Hall removed parking which were reconstructed in 9G below Science facilities. Net difference was -34 spaces.

2021-2022:
Interdisciplinary Science Building completion added 27 spaces in 9G.

B 2022:
43 new permanent parking to be used for EECS, SDSC, and ES Renovation contractors (new lot 31V)

C Fall 2022:
S College - displacement parking project
creates 133 parking spaces.

D 2023-2025:
126 existing parking to be used by EECS contractor, then returned to university use until used by ES renovation contractor during 2025-2027.

E 2023-2025:
38 existing permanent parking will be permanently removed by EECS siting.

F 2023-2025:
Existing parking to be redesigned and used by EECS contractor.

G 2025:
40 existing parking will be permanently removed due to SDSC siting.

H 2025-2027:
101 existing parking to be used by SDSC and ES Renovation contractor.

ID	Property ID	Building Name
AA	1037	ART ANNEX
AB	1108	ARCHIVES BUILDING
AC	1126	ADMINISTRATIVE SERVICES CENTER
AH	1074	ARNTZEN HALL
AI	1145	ACADEMIC INSTRUCTIONAL CENTER - EAST
AL	1100	ALUMNI HOUSE
AN	1120	ANTENNA BUILDING
AW	1146	ACADEMIC INSTRUCTIONAL CENTER - WEST
BC	1043	BIRNAM WOOD COMMUNITY
BG	1119	BIOLOGY GREENHOUSE
BH	1036	BOND HALL
BI	1110	BIOLOGY BUILDING
BL	1044	BIRNAM WOOD LAUNDRY
BQ	1159	BUCHANAN TOWERS (EAST)
BS	1135	BUS SHELTER
BT	1069	BUCHANAN TOWERS (CLASSIC)
BW01	1045	BIRNAM WOOD BUILDING 1 (BA)
BW02	1046	BIRNAM WOOD BUILDING 2 (BD)
BW03	1047	BIRNAM WOOD BUILDING 3 (BE)
BW04	1048	BIRNAM WOOD BUILDING 4 (BJ)
BW05	1049	BIRNAM WOOD BUILDING 5 (BU)
BW06	1050	BIRNAM WOOD BUILDING 6 (BV)
BW07	1051	BIRNAM WOOD BUILDING 7 (BY)
CA	1010	CANADA HOUSE
CB	1109	CHEMISTRY BUILDING
CF	1136	COMMUNICATION FACILITY
CG	1172	ALMA CLARK GLASS HALL
CH	1007	COLLEGE HALL
CM	1038	COMMISSARY
CS	1131	CAMPUS SERVICES BUILDING
CV	1004	CARVER
EH	1002	EDENS HALL
EN	1012	EDENS NORTH
EQ	1083	EQUIPMENT SHED
ES	1072	ENVIRONMENTAL STUDIES
ET	1091	ROSS ENGINEERING TECHNOLOGY
EU	1092	ENGINEERING STORAGE
FA	1052	FAIRHAVEN COLLEGE
FI	1009	FINE ARTS BUILDING
FR	1023	FRASER HALL
FS	1017	FAIRHAVEN CABIN - SOUTH
FU	1066	FAIRHAVEN BRIDGE
FV	1065	FAIRHAVEN PLAYGROUND BUILDING
FX01	1053	FAIRHAVEN TOWER 1 (FB)
FX02	1054	FAIRHAVEN TOWER 2 (FP)
FX03	1055	FAIRHAVEN TOWER 3 (FD)
FX04	1056	FAIRHAVEN TOWER 4 (FE)
FX05	1057	FAIRHAVEN TOWER 5 (FF)
FX06	1058	FAIRHAVEN TOWER 6 (FQ)
FX07	1059	FAIRHAVEN TOWER 7 (FH)
FX08	1060	FAIRHAVEN TOWER 8 (FO)
FX09	1061	FAIRHAVEN TOWER 9 (FJ)
FX10	1062	FAIRHAVEN TOWER 10 (FK)
FX11	1063	FAIRHAVEN TOWER 11 (FL)
FX12	1064	FAIRHAVEN TOWER 12 (FM)
HG	1020	HIGGINSON HALL
HH	1018	HAGGARD HALL
HS	1067	HIGH STREET HALL
HU	1022	HUMANITIES BUILDING
IS	1171	INTERDISCIPLINARY SCIENCE BUILDING
MA	1034	MATHES HALL
MF	1040	MAINTENANCE FUEL STATION
MG	1093	MAINTENANCE GARAGE
MH	1006	MILLER HALL
MS	1116	MARSHALLING STORAGE
MU	1163	HARRINGTON FIELD
MW	1154	MAINTENANCE WAREHOUSE
MY	1099	MARSHALLING YARD
NA	1035	NASH HALL
OM	1001	OLD MAIN
OP	1155	OUTBACK PAVILION
PA	1011	PERFORMING ARTS CENTER
PH	1090	PARKS HALL
PP	1039	PHYSICAL PLANT
RA	1024	RIDGEWAY ALPHA
RB	1031	RIDGEWAY BETA
RC	1025	RIDGEWAY COMMONS
RD	1026	RIDGEWAY DELTA
RE	1112	RECYCLE CENTER
RG	1032	RIDGEWAY GAMMA
RK	1030	RIDGEWAY KAPPA
RO	1027	RIDGEWAY OMEGA
RS	1028	RIDGEWAY SIGMA
SB	1084	BASEBALL FIELD STORAGE
SE	1041	SERVICE STORAGE SHED
SL	1117	SMATE (SCIENCE FACILITY III)
SP	1008	STEAM PLANT
SV	1138	WADE KING RECREATION CENTER
TB	1082	TRACK BUNKER
TD	1142	TENNIS STORAGE
TE	1118	TRACK EQUIPMENT BUILDING
VC	1021	VIKING COMMONS
VU	1014	VIKING UNION
WL	1003	WILSON LIBRARY
WT	1076	AEROBIC CENTER

EECS Electrical Engineering and Computer Science (A.K.A. Kaiser Boseri Building)

SDSC Student Development & Success Center

ES Environmental Studies

LEGEND

	SPACE
A	ACCESSIBLE PARKING
C	COIN-METERED PARKING
EV	ELECTRIC VEHICLE PARKING
L	LOADING ZONE
M	MAINTENANCE PARKING
R	RESERVED PARKING
V	VISITOR

WESTERN WASHINGTON UNIVERSITY

5 October 2021
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APPENDIX B

Geotechnical Report

Geotechnical Engineering Services

Western Washington University
South College Drive Parking Improvements
Bellingham, Washington

for
Wilson Engineering, LLC

August 11, 2022

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

Western Washington University
South College Drive Parking Improvements
Bellingham, Washington

for
Wilson Engineering, LLC

August 11, 2022

GeoEngineers

554 West Bakerview Road
Bellingham, Washington 98226
360.647.1510

Geotechnical Engineering Services

Western Washington University
South College Drive Parking Improvements
Bellingham, Washington

File No. 0608-041-00

August 11, 2022

Prepared for:

Wilson Engineering, LLC
805 Dupont Street, Suite 7
Bellingham, Washington 98225

Attention: Danielle Johnston, PE

Prepared by:

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08/11/2022

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GeoEngineers

Table of Contents

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION AND PROJECT DESCRIPTION

GeoEngineers, Inc. (GeoEngineers) is pleased to provide this geotechnical report summarizing our geotechnical engineering services related to parking improvements along South College Drive for Western Washington University (WWU) in Bellingham, Washington. The project location is shown in the attached Vicinity Map, Figure 1. Our services have been completed in accordance with our proposal dated May 27, 2022 and authorized by Wilson Engineering, LLC (Wilson) on June 10, 2022.

The proposed parking improvements would reconfigure South College Drive to remove an existing vegetated median and add angled parking along the east side of the roadway. The existing pavement has exhibited signs of wear including various degrees of longitudinal and transverse cracking. Our scope of services included completing pavement coring and hand explorations within the roadway and vegetated median, laboratory testing on selected samples obtained from the explorations, and providing geotechnical conclusions and recommendations for the roadway and parking improvements.

2.0 SITE CONDITIONS

2.1. Surface Conditions

South College Drive is located at the south end of the WWU campus. The roadway is an asphalt paved two lane road divided by a median. The median consists of manicured lawn with small to medium sized deciduous trees. The site is bounded by West College Way to the north, parking lots and student housing to the east, Bill McDonald Parkway to the south and parking lots and a multipurpose field to the west. Underground utilities observed within the South College Drive right-of-way include power, cable, water, and storm and sanitary sewer.

2.2. Limited Pavement Observations

GeoEngineers completed a limited visual evaluation of the condition of the existing South College Drive pavement at the time of other site field work. The existing pavement is generally in good to fair condition with minor to moderate longitudinal and transverse cracking. Portions of the longitudinal cracking were observed to be previously crack sealed. Minor to moderate alligator cracking was observed to be forming in localized areas. Detailed evaluation and mapping of existing pavement condition was not within our scope of services.

2.3. Geology

We reviewed a Washington State Department of Natural Resources (DNR) map for the project area, “Geologic Map of The Bellingham 1:100,000 Quadrangle, Washington” by Lapen (2000). This map indicates that the site is underlain by the Chuckanut Formation bedrock. Undifferentiated glacial deposits/continental glacial drift are also mapped nearby.

The Chuckanut Formation consists of sandstone, conglomerate, shale, and coal deposits. The bedrock typically encountered in the study area consists of sandstone or siltstone. The character of the bedrock at the WWU campus is known to vary considerably over short distances.

The undifferentiated glacial deposits or continental glacial drift deposits can consist of a variety of soil types deposited in various glacial environments including glacial till, outwash and glaciomarine drift. Based on previous experience in the area, Bellingham (glaciomarine) Drift overlies the bedrock in this area. The Bellingham Drift is a glaciomarine drift deposit which consists of unsorted, unstratified silt and clay with varying amounts of sand, gravel, cobbles, and occasional boulders. Glaciomarine drift is derived from sediment melted out of floating glacial ice that was deposited on the sea floor. Glaciomarine drift was deposited during the Everson Interstade approximately 11,000 to 12,000 years ago while the land surface was depressed 500 to 600 feet from previous glaciations. The upper 5 to 15 feet of this unit in upland areas is typically stiff. The stiff layer possesses relatively high shear strength and low compressibility characteristics. The stiff layer oftentimes grades to medium stiff or even soft, gray, clayey silt or clay with depth. The entire profile can be stiff, likely from being partially glacially overridden, when it is a shallow profile over bedrock. The soft to medium stiff glaciomarine drift possesses relatively low shear strength and moderate to high compressibility characteristics. The unit typically has low permeability characteristics.

2.4. Subsurface Explorations

GeoEngineers completed eight explorations, including four pavement cores (C-1 through C-4) and four handholes (HA-1 through HA-4) at the site on June 20, 2022, as shown in the attached Site and Exploration Plan, Figure 2. The explorations were completed within the roadway or vegetated median.

In paved areas, the surfaces of the explorations were first cored by a subcontracted coring company using a 10-inch-diameter coring bit. Upon removal of the pavement core, the explorations were completed to the full depth using a post-hole digger and a 3-inch-diameter hand auger to depths of 1.7 to 2.1 feet below ground surface (bgs). Up to four representative soil samples were taken from each exploration. Dynamic cone penetration tests (DCPTs) were completed at the locations of each pavement core and hand auger exploration (labeled DCPT-1 through DCPT-8 in Figure 2).

The approximate locations of the explorations are shown in the Site and Exploration Plan, Figure 2. The locations of the explorations were determined by recreational-grade global positioning system (GPS) and therefore should be considered approximate. Details of the field exploration program are presented in Appendix A.

2.5. Subsurface Conditions

A full discussion and description of logged soil conditions is presented in Tables A-1 through A-8 in Appendix A. A summary of observed subsurface conditions is described in the following sections.

2.5.1. Pavement and Fill Conditions

Pavement cores (C-1 through C-4) were completed along South College Drive. The existing asphalt concrete pavement section at the cored locations was observed to be between 4 and 6½ inches thick. We observed a thin layer of crushed surfacing base course (CSBC), between less than 1 inch and 3 inches thick was encountered underlying the asphalt surfacing in the explorations. Dense coarse-grained subbase fill (typically referred to as pit run) was encountered underlying the crushed rock road base layer. The road subbase fill consisted of fine to coarse sand and gravel with silt and was observed to be approximately 15 to 18 inches thick at the C-1 and C-4 locations. We could not advance the hand explorations to the bottom of the pit run subbase layer due to large gravels encountered in C-2 and C-3. A summary of the observed pavement section layers is provided in Table 1 below. The underlying subgrade conditions are described in the following section.

TABLE 1: SUMMARY OF OBSERVED PAVEMENT SECTION LAYERS, PAVED ROADS

Exploration	Location	Asphalt Concrete Thickness (inches)	Crushed Surface Base Course Thickness (inches)
C-1	Northbound Lane	4	3
C-2	Northbound Lane	5½	<1
C-3	Southbound Lane	6	~1½
C-4	Southbound Lane	6½	1

Notes

[1] Digging refusal on large gravel encountered prior to excavating to bottom of road base layer

2.5.2. Subgrade Conditions

All road core explorations encountered 4 to 6½ inches of asphalt concrete (AC) pavement overlying a thin layer of crushed gravel base overlying granular subbase pit run fill. The cores generally terminated in the granular fill due to refusal on gravel, with the exception of C-1 and C-4, where medium stiff to stiff sandy clay with variable silt and gravel content was encountered representative of native undifferentiated glacial drift or native-derived historical fill.

All hand explorations encountered sod to depths 4 to 6 inches bgs. Underlying the sod, medium dense silty fine to medium sand with occasional gravel was encountered, interpreted to be fill soils. Hand exploration HA-2 encountered stiff sandy silt representative of weathered native undifferentiated glacial drift.

Dynamic cone penetration tests were extended to 4 to 5 feet bgs, except at C-3/DCPT-3 where shallow driving refusal was encountered. The DCPT explorations indicate the underlying native or historic fill subgrade soils are generally in a stiff to very stiff or medium dense condition.

2.5.3. Groundwater Conditions

Groundwater was not encountered during our explorations; however, we observed increased moisture at the base of exploration HA-4. Groundwater is often perched within sand and gravel fill layers overlying layers of fine grained (silt and clay) fill and native undifferentiated glacial soils. We do not anticipate roadway reconstruction will encounter significant perched groundwater if the work is done during the dry season, but perched groundwater could occur at and above the fill and native soil contact in the wet season. Based on our previous explorations in the area, more significant groundwater seepage could be present on the order of 8 to 10 feet bgs, which is anticipated to be below the depth of the proposed improvements. Groundwater conditions should be expected to fluctuate based on season, precipitation, and other factors.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1. Pavement Recommendations

Recommendations for new AC and existing pavement restoration are provided in the following sections. GeoEngineers was not scoped to provide a project specific pavement design (i.e., American Association of State Highway and Transportation Officials [AASHTO] pavement design based on assumed traffic loading) and is basing our recommendations on current City of Bellingham street standards, our knowledge of the use of South College Drive, and experience on other projects. We understand this portion of South College Drive is not currently considered an arterial or collector street per the City of Bellingham inventory, nor is the road currently on a bus route.

For all new pavement sections, it is imperative that the subgrade surface be prepared in accordance with the recommendations of Section 3.3.2 of this report and fill placement is completed in accordance with the recommendations of Section 3.3.4. Exposed subgrade soils should be compacted to 95 percent of the maximum dry density (MDD). Pavement materials should be in accordance with the most recent Washington State Department of Transportation (WSDOT) Standard Specifications, project plans and project specifications. The gravel base thickness recommended for pavements will not be suitable for protection of the subgrade for construction traffic, especially during wet conditions. We understand construction is planned to take place during the late fall season and wet weather construction has been assumed and taken into consideration in developing our pavement recommendations.

3.1.1. New Asphalt Concrete Pavement

We recommend that new pavements in South College Drive be designed to at least the Collector to Principal Arterial standard per Section 4-8 of the City of Bellingham Development Guidelines & Improvement Standards (City Standards). A representative suggested pavement section is provided below:

- 3 to 4 inches of AC surface course consisting of Class ½-inch PG58H-22. We understand warm mix asphalt will be specified and is acceptable for use with proper placement.
- 3 to 4 inches of crushed surfacing top course or base course (CSTC/CSBC) per WSDOT Standard Specification 9-03.9(3). The City Standards do not specify a thickness of crushed rock, but this layer is recommended for improved long term pavement performance.
- 18- to 24-inch-thick subbase course consisting of gravel base (WSDOT Standard Specification 9-03.10); we recommend the base course have at least 30 percent gravel retained on the U.S. No. 4 sieve. The subbase course thickness has been increased from the City standard to provide additional protection during wet weather construction. Even with this increased gravel base thickness, the contractor will need to use care and limit excessive traffic over prepared subgrade to avoid damaging the subgrade.
- We recommend a layer of nonwoven geotextile fabric for separation in accordance with Table 3, WSDOT Standard Specification 9-33.2(1), with a grab tensile strength (ASTM D 4632) of 160 pounds (e.g., Mirafi 160N), be used to provide separation at the interface between the gravel base and the native fine-grained subgrade soils. It is our experience that the use of the geotextile fabric is worth the expense because of the improved construction conditions, long-term performance, and protection provided, especially during wet season construction.

Alternatively, the pavement section could consist of full depth asphalt pavement, or the base and subbase courses could be substituted for asphalt treated base (ATB) material in accordance with the Section 4-8 of the City Standards. WWU and the design team should consider using the thicker Principal Arterial standard if significant delivery or other heavy trucks are anticipated now or in the future on South College Drive, or to improve design life/reduce long-term maintenance.

New AC thickness could also match existing AC thickness, which was observed to be thicker than the recommended section described above. We would recommend a thicker CSTC/CSBC layer than that observed underlying the existing pavement.

3.1.2. Pavement Restoration Recommendations

An overlay of the existing pavement is feasible with consideration for existing cracking. We do not recommend a direct overlay without mitigating existing cracking, as existing cracking will likely reflect through the new pavement in a few years.

In areas exhibiting minor to moderate longitudinal and transverse cracking, we recommend milling the upper 2 inches, filling cracks, and repaving the surface. Cracks larger than ¼-inch should be filled with crack sealant conforming to WSDOT Standard Specifications 9-04.1 or 9-04.2. Additionally, the use of a paving fabric such as a Tensar® Glaspave™ 50 or equivalent, will lengthen the time before cracks begin to propagate through the new overlay, typically by at least several years. Prior to overlay, the existing asphalt surface should be prepared by leveling or milling, cleaning, and tack coat placement. Based on our coring explorations, the existing South College Way pavement appears to have sufficient thickness (4 to 6½ inches) to support limited milling/grinding prior to overlay.

We recommend full section pavement removal and replacement in areas exhibiting moderate to severe alligator cracking or areas where longitudinal and transverse cracks are believed to extend to the full depth of the pavement. The pavement subgrade should be thoroughly compacted to a firm and non-yielding condition. Subgrade that cannot be compacted to a suitably firm condition should be overexcavated and replaced with an additional 12 inches of clean replacement gravel base, or depth as directed by the field engineer. As noted, we recommend a minimum of 3 to 4 inches of CSBC/CSTC per WSDOT Standard Specifications 9-03.9(3) be placed above firm subgrade prior to pavement reconstruction.

3.2. Stormwater Management Considerations

Stormwater management considerations for the project alignment are based on guidance from the Washington Department of Ecology’s 2019 Stormwater Management Manual for Western Washington (2019 SMMWW). Where encountered in the shallow hand explorations completed for this project, native undifferentiated glacial drift soils typically consist of silt and clay with variable sand and gravel content. The native undifferentiated glacial drift soils have a very low potential for infiltration because of the stiff soil matrix and a fines content typically greater than 50 percent.

Based on small-scale pilot infiltration tests (PITs) GeoEngineers has completed in the undifferentiated glacial drift and glaciomarine unit, it is our opinion that the short-term infiltration rate in these soils at the site will be less 0.3 inches per hour, which meets the “infeasibility criteria” as an impermeable layer for infiltration best management practice (BMP) systems as defined in Section V-5.6 of the 2019 SMMWW. The low infiltration rate of this unit also precludes the use of shallow systems such as rain gardens and bioretention swales without the implementation of other engineering controls such as undrains or overflow outlets. Depth to groundwater and the seasonal variability of perched groundwater must be considered in infiltration design. We anticipate that a layer of perched groundwater develops above the undifferentiated glacial drift during the wet season as was observed during our site explorations in June. It is our opinion undifferentiated glacial drift layer should not be considered suitable for groundwater infiltration. Our scope did not include completion of a PIT to measure in-situ infiltration rates.

3.3. Earthwork

3.3.1. Temporary Erosion Control

The site soils have a moderate to high susceptibility to erosion when disturbed. Temporary erosion control measures should be used during construction depending on the water, location, soil type, and other factors. Surface water should be prevented from flowing across disturbed areas and not directed toward the slopes during construction. Temporary erosion protection (e.g., straw, plastic, or rolled erosion control products [RECPs]) may be necessary to reduce sediment transport until vegetation is established or permanent surfacing applied. Appropriate BMPs should be incorporated into the temporary erosion and sediment control plan by the civil engineer. We are available to provide input if desirable.

3.3.2. Site Preparation

We recommend that any existing vegetation and sod be stripped from all new pavement areas. Assuming new pavement sections will mimic the grade of the existing pavement elevation, excavation depth required for the recommended for new pavement sections will be sufficient to remove the existing sod layer. If encountered, roots larger than 1-inch-diameter should be removed. The stripped material should be wasted off-site.

The subsurface conditions are expected to consist of variable fill soils including clay, silt, silty sand, sand and gravel, and potential limited native silt and clay undifferentiated glacial drift. A majority of the site soils are moisture sensitive and susceptible to disturbance by construction equipment during wet weather. Therefore, we recommend that site preparation occur during periods of dry weather to reduce earthwork costs.

After site preparation activities have been completed, we recommend that new pavement subgrade be thoroughly compacted to a firm condition with no significant yielding. We anticipate compaction will occur using small walk behind compactors or small steel drum rollers as suitable for the zone of the proposed improvements. The exposed subgrade soils should be evaluated and probed by a representative from our firm to identify soft or loose areas. If soft or otherwise unsuitable areas cannot be compacted to a stable and uniformly dense condition, excavation to firm soil or to 2 feet below the original ground surface, or as otherwise recommended by the geotechnical engineer, should be accomplished. The overexcavated material should be replaced with structural fill in accordance with recommendations provided in this report. During wet weather, the site should be stripped where necessary with lightweight equipment, and construction traffic kept off the exposed surface.

3.3.3. Excavation

Excavations at the site will extend into fill soils and potentially native undifferentiated glacial drift consisting, varying from loose to medium dense sand and gravel to medium stiff to stiff silt and clay. Excavation of these materials can be completed using conventional earthwork equipment. Although not observed directly in our explorations at the site, cobbles, boulders, other oversized materials, and debris can be present in fill and native soils. The contractor should be prepared to handle oversized materials if encountered.

3.3.4. Temporary Cut Slopes

Regardless of the soil type encountered in the excavation, either shoring, trench boxes or sloped sidewalls will be required for excavations deeper than 4 feet under Washington State Administrative Code

(WAC) 296-155, Part N. We expect the excavations will be made as open cuts in conjunction with the use of a trench box and/or sloped sidewalls for shielding workers. Based on our explorations, the fill soils encountered at the site should be classified as “Type C” and the regulations require a maximum of 1.5H:1V (horizontal to vertical) slopes. The native undifferentiated glacial drift soils encountered at the site may be classified as “Type A” and allow slopes up to ¾H:1V. Where soil type is uncertain, Type C soil classification should be used.

The above regulations assume that surface loads such as construction equipment and storage loads will be kept a sufficient distance away from the top of the cut so that the stability of the excavation is not affected. Flatter slopes and/or shoring will be necessary for those portions of the excavations which are subjected to significant seepage in order to maintain the stability of the cut. Temporary slopes in wet/saturated sand will be susceptible to sloughing, raveling and “running” conditions. It should be expected that unsupported cut slopes will experience some sloughing and raveling if exposed to surface water. Berms, hay bales or other provisions should be installed along the top of the excavation to intercept surface runoff to reduce the potential for sloughing and erosion of cut slopes during wet weather.

In our opinion, the contractor will be in the best position to observe subsurface conditions continuously throughout the construction process and to respond to the soil and groundwater conditions. Construction site safety is generally the sole responsibility of the contractor, who also is solely responsible for the means, methods, and sequencing of the construction operations and choices regarding temporary excavations and shoring. We are providing this information only as a service to our client. Under no circumstances should the information provided below be interpreted to mean that GeoEngineers, Inc. is assuming responsibility for construction site safety or the contractor’s activities; such responsibility is not being implied and should not be inferred.

3.3.5. Structural Fill

All fill placed on the site should be placed and compacted as structural fill. All structural fill material should be free of organic matter, debris, and other deleterious material. The maximum particle size diameter for structural fill should be the lesser of either 6 inches or one half of the loose lift thickness.

As the amount of fines (material passing the U.S. No. 200 sieve) increases in a soil, it becomes more sensitive to small changes in moisture content and during wet conditions, adequate compaction becomes more difficult to achieve. Generally, soils containing more than about 5 percent fines by weight cannot be properly compacted when the moisture content is more than a few percent from optimum.

3.3.5.1. Suitability of On-site Materials

Existing gravel base and pit run subbase soils, consisting of sand or sand with silt (SP or SP-SM) and gravel and gravel with silt (GP to GP-GM) can be reused as gravel subbase if these materials are properly segregated from finer grained fill and native soils. Fill soils or native soils consisting of silty sand (SM), silt (ML), and clay (CL) should not be reused in pavement sections or as structural fill.

3.3.5.2. Select Import Soils

During periods of wet weather and for other conditions requiring structural fill in excess to that available on-site, we recommend that select import be used for backfill. The select import fill should consist of sand or mixed sand and gravel with a fines content less than 5 percent based on that portion passing the ¾-inch sieve. Suitable WSDOT Standard Specifications include Gravel Borrow (9-03.14) with the fines content limited as noted. As noted, we also recommend the pavement subbase course have at least 30 percent gravel retained on the U.S. No. 4 sieve. Other specific fill parameters for pavement layers are described in Section 3.1.1 of this report.

3.3.5.3. Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm, non-yielding condition. The appropriate lift thickness will depend on the material and the compaction equipment being used. Loose lift thicknesses of 6 to 12 inches are typical when using heavy self-propelled vibratory equipment. Thinner lifts may be required with smaller walk-behind equipment. Each lift should be conditioned to the proper moisture content and thoroughly and uniformly compacted to the specified density before placing subsequent lifts. Structural fill should be compacted in accordance with WSDOT Standard Specifications Section 2-03.3(14) C, Method B. Alternatively, structural fill should be compacted to the following criteria:

- Structural fill in the pavement layer (including crushed surfacing base course and subbase layers) and other fill within 2 feet of finish grade should be compacted to 95 percent of the MDD (ASTM International [ASTM] D 1557).
- Any new structural fill placed below 2 feet below finish grade can be compacted to 90 percent of the MDD (ASTM D 1557).
- Any fill placed in non-settlement sensitive areas, such as landscape areas, we recommend that the backfill be compacted to at least 85 percent of its MDD.

3.3.6. Wet Weather Earthwork

During wet weather, silt/clay fill soils and the native undifferentiated glacial drift become muddy and more difficult to manage, and perched groundwater seepage could occur in sand and gravel soils overlying the clay. We provide the following wet weather considerations:

- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical and limit the size of areas that are stripped of pavement and left exposed, including stockpiles.
- Minimizing construction traffic over prepared subgrade, especially when the subgrade is wet. Excessive traffic can damage the prepared subgrade and require additional overexcavation and replacement.
- Any slopes with exposed soils should be covered with plastic sheeting or similar means.
- Providing up-gradient sand bags to direct surface water away from the subgrade.
- Using temporary sumps to collect water in low areas and prevent ponding and damaging exposed subgrades.

4.0 LIMITATIONS

We have prepared this letter report for use by Wilson Engineering, LLC, Western Washington University, and their authorized representatives for use in planning and design of the South College Drive Parking Improvements project in Bellingham, Washington

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared.

Please refer to the attachment titled Report Limitations and Guidelines for Use for additional information pertaining to use of this document.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to the appendix titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

5.0 REFERENCES

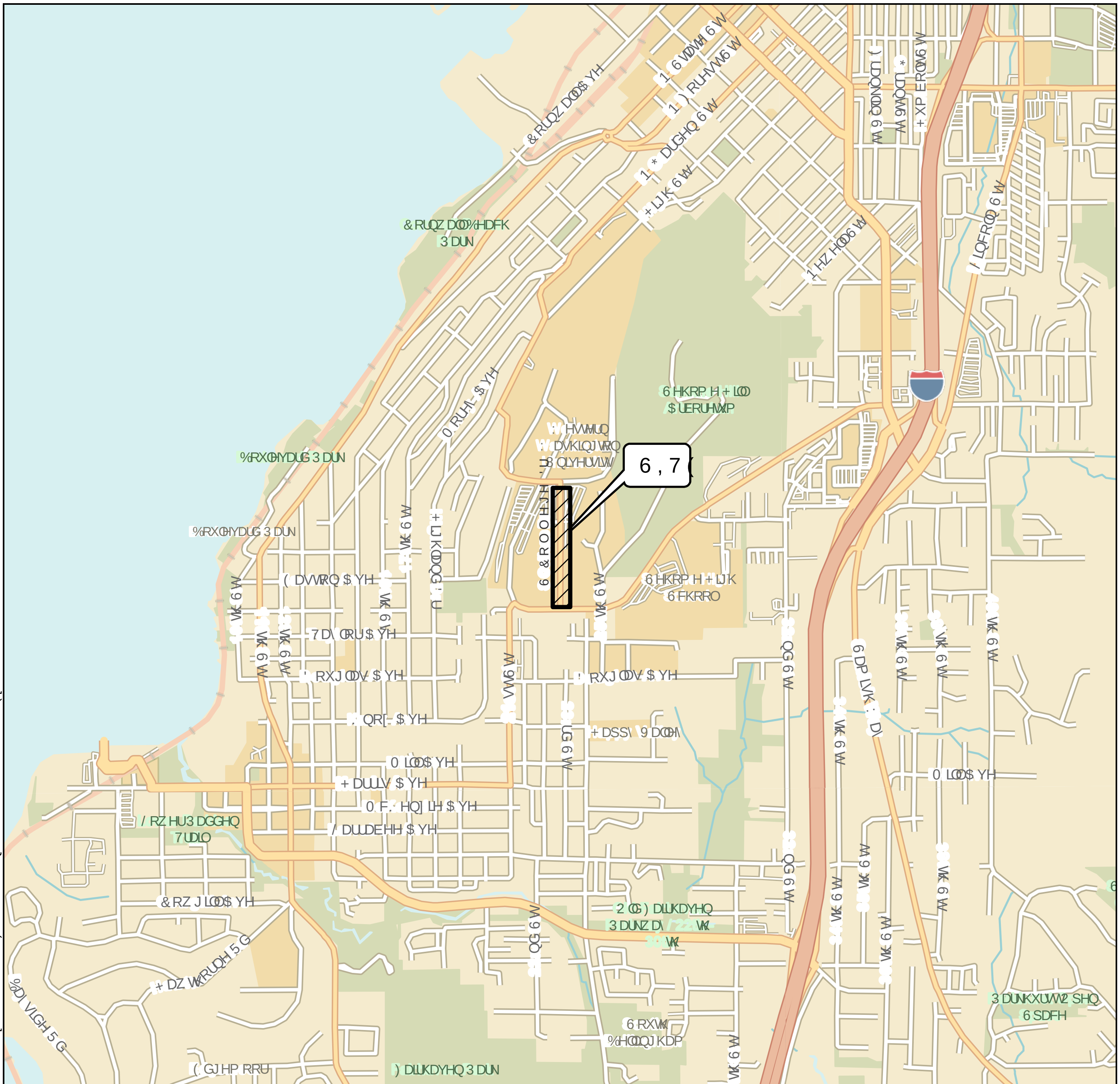
City of Bellingham. June 2018. Development Guidelines & Improvement Standards.

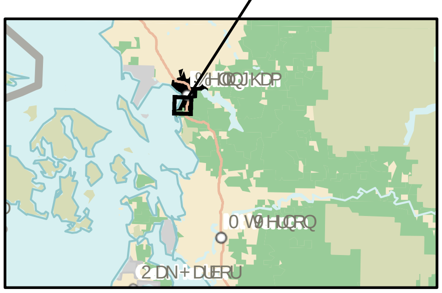
Lapen, T.J. 2000. "Geologic Map of the Bellingham 1:100,000 Quadrangle, Washington," Washington State Department of Natural Resources.

Washington State Department of Ecology. 2019. "Stormwater Management Manual for Western Washington" Publication No. 19-10-021.

Washington State Department of Transportation. 2022. "Standard Specifications for Road, Bridge, and Municipal Construction," Washington State Department of Transportation and the American Public Works Association.

FIGURES





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GeoEngineers

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Site and Exploration Plan

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Figure 2

1RWHV

7KH ORFDWLRQV RI DOO IHDWXUHV VKRZQ DUH DSSUR[LPDWH

7KLV GUDZLQJ LV IRU LQIRUPDWLRQ SXUSRVHV ,W LV LQWHQGHG WR DVVLVW LQ VKRZLQJ IHDWXUHV GLVFXVVHG LQ DQ DWWDFKHG GRFXPHQW *HR(QJLQHHUV ,QF FDQQRW JXDUDQWHH WKH DFFXUDF\ DQG FRQWHQW RI HOHFWURQLF ILOHV 7KH PDVWHU ILOH LV VWRUHG E\ *HR(QJLQHHUV ,QF DQG ZLOO VHUYH DV WKH RIILFLDO UHFRUG RI WKLV FRPPXQLFDWLRQ

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APPENDICES

GeoEngineers

APPENDIX A
Field Exploration Program and Laboratory Testing

APPENDIX A
FIELD EXPLORATION PROGRAM AND LABORATORY TESTING

Field Explorations

Subsurface conditions at the site were explored by completing eight explorations, including four road cores (C-1 through C-4) and four handholes (HA-1 through HA-4) at the site on June 20, 2022. Dynamic cone penetration tests (DCPTs) were completed at all locations (DCPT-1 through DCPT-8). The cores were completed in paved roadway areas using concrete coring equipment subcontracted to GeoEngineers, Inc. Hand explorations were also conducted below cored pavement sections and in the vegetated median. Hand explorations were completed to a maximum depth of about 2 feet below the existing road surface or until digging refusal was encountered. The approximate locations of the explorations are shown in the Site and Exploration Plan, Figure 2. The locations of the explorations were determined by hand-held global positioning system (GPS); therefore, the locations shown in the figures should be considered approximate.

The explorations were continuously monitored by an engineering geologist from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions, and prepared a detailed log of each exploration. Soils encountered were classified visually in general accordance with ASTM International (ASTM) D-2488-90, which is described in Figure A-1. An explanation of our exploration log symbols is also shown on Figure A-1.

The soil conditions encountered in our explorations are presented in Tables A-1 through A-8. The descriptions are based on our interpretation of the field and laboratory data and indicate the various types of soils encountered. They also indicate the depths at which these soils or their characteristics change, although the change might actually be gradual.

Hand-Auger Boring Profiles

The profiles for the four road cores and four hand-auger explorations are presented below. The depth range explored is presented adjacent to a description of the material encountered in that interval. The Unified Soil Classification System (USCS) symbol for the soil is presented in parentheses.

TABLE A-1. C-1 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 4	4	Asphalt concrete pavement		
4 to 7	3	Gray crushed rock (crushed granular road base)		
7 to 24	17	Brown fine to coarse sand with silt and gravel (SP-SM) (subbase pit-run fill)	6	Increased gravel content with depth
24		Gray silty sandy clay (CL) (possible undifferentiated glacial deposits/fill)	14	

TABLE A-2. C-2 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 5½	5½	Asphalt concrete pavement		
5½ to 6	<1	Gray crushed rock (crushed granular road base)		
6 to 24	18	Brown fine to coarse sand with silt and gravel and cobble (SP-SM) (subbase pit-run fill)		

TABLE A-3. C-3 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 6	6	Asphalt concrete pavement		
6 to 8	1-2	Gray crushed rock (crushed granular road base)		
8 to 24	17	Brown fine to coarse sand with gravel (SP) (subbase pit-run fill)	4	Larger gravel at 18 inches

TABLE A-4. C-4 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 6½	6½	Asphalt concrete pavement		
6½ to 7½	1	Gray crushed rock (crushed granular road base)		
7½ to 22¾	15¼	Brown fine to coarse sand with silt and gravel (SP-SM) (subbase pit-run fill)		
22¾ to 24		Gray sandy clay and silty fine to coarse sand (CL/SM) (fill)	10	

TABLE A-5. HA-1 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 4	4	Sod layer		
4 to 20½	16½	Dark brown and light brown silty fine to medium sand with occasional gravel (SM) (fill)		Gravel content and size increased at 18 inches Digging refusal on large gravel/cobble

TABLE A-6. HA-2 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 6	6	Sod layer		
6 to 18	12	Brown silty fine to medium sand with gravel (SM) (fill)		Gravel content and size increased with depth
18 to 24	6	Brown with iron staining sandy silt (ML) (weathered undifferentiated glacial deposits)	12	

TABLE A-7. HA-3 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 4	4	Sod layer		
4 to 20½	16½	Brown silty fine to medium sand with gravel and occasional organic matter (SM) (fill/topsoil)		Digging refusal on gravel/cobble

TABLE A-8. HA-4 SUBSURFACE PROFILE

Depth (inches)	Thickness (inches)	Material Description	Moisture Content	Comments
0 to 4	4	Sod layer		
4 to 21½	17½	Brown silty fine to medium sand with gravel and organic matter(roots and rootlets) (SM) (fill)		
21½ to 25¼	3¾	Brown fine to medium sand with gravel and silt (SP-SM) (fill)		Possible slight seepage/increased moisture content in the bottom of the hole

Dynamic Cone Penetrometer Testing

GeoEngineers also conducted eight DCPTs in the project alignment. The test records blow counts for 10 centimeter (cm) intervals from a 35 pound hammer falling a height of 15 inches. The blow counts can then be corrected to obtain equivalent Standard Penetration Test (SPT) blow counts. The logs of the DCPT soundings are presented in Figures A-1 through A-8. The DCPT completed at C-1/DCPT-1, the DCPT encountered shallow refusal. The exploration was excavated to 2 feet bgs and the DCPT was restarted. In explorations C-2/DCPT-2 through C-4/DCPT-4, the DCPTs were initiated 2 feet below ground surface due to difficult driving conditions encountered in the base and subbase layers during driving in C-1/DCPT-1. The exploration logs are based on empirical relationships developed by Triggs Technologies, Inc.

Laboratory Test Results

Soil samples obtained from the explorations were transported to our laboratory and examined to confirm or modify field classifications, as well as to evaluate index properties of the soil samples. Representative samples were selected for laboratory testing consisting of moisture content determination. The tests were performed in general accordance with ASTM test methods or other applicable procedures.

Moisture Content Testing

The natural moisture contents of selected soil samples obtained from the exploratory borings were determined in general accordance with ASTM D 2216 test procedures. The results from the moisture content determinations are displayed shown in the exploration tables A-1 through A-8 in Appendix A in the column labeled “Moisture Content %” adjacent to the corresponding sample interval.

Percent Passing U.S. No 200 Sieve

Selected samples were “washed” through the U.S. No. 200 mesh sieve to determine the relative percentages of coarse- and fine-grained particles in the soil. The percent passing value represents the percentage by weight of the sample finer than the U.S. No. 200 sieve. These tests were conducted to verify field descriptions and to determine the fines content for analysis purposes. The tests were conducted in general accordance with ASTM D 1140, and the results are shown in the exploration logs in Appendix A in the column labeled “Fines Content %” adjacent to the corresponding samples.

Sieve Analyses

Sieve analyses were performed on selected samples in general accordance with ASTM D 422 to determine the sample grain size distribution. The wet sieve analysis method was used to determine the percentage of soil greater than the U.S. No. 200 mesh sieve. The results of the sieve analyses were plotted, classified in general accordance with the USCS, and are presented in Figure A-9.

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

PROJECT NUMBER: 0608-041-00
DATE STARTED: 06-20-2022
DATE COMPLETED: 06-20-2022

HOLE #: C-1/DCPT-1
CREW: AF2/WS
PROJECT: South College Drive Parking Improvements
ADDRESS: South College Drive
LOCATION: Bellingham, Wa

SURFACE ELEVATION: 245
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-	21	93.2	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	21	93.2	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 1 ft	25	111.0	•••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	80	355.2	••	25+	VERY DENSE	HARD
-	59	262.0	••	25+	VERY DENSE	HARD
- 2 ft	Driving Refusal. Core Excavated to 2 Feet BGS and DCPT Test Restarted Below					
-	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	9	40.0	•••••••••••	11	MEDIUM DENSE	STIFF
- 3 ft	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 1 m	15	66.6	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	15	57.9	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-1

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

PROJECT NUMBER: 0608-041-00
DATE STARTED: 06-20-2022
DATE COMPLETED: 06-20-2022

HOLE #: C-2/DCPT-2
CREW: AF2/WS
PROJECT: South College Drive Parking Improvements
ADDRESS: South College Drive
LOCATION: Bellingham, Wa

SURFACE ELEVATION: 291
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-						
-						
- 1 ft						
-						
-						
- 2 ft	16	71.0	•••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	23	102.1	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	24	106.6	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 3 ft	17	75.5	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 1 m	38	168.7	••	25+	DENSE	HARD
-	15	57.9	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 4 ft	36	139.0	••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	14	54.0	••••••••••••••	15	MEDIUM DENSE	STIFF
-	17	65.6	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-2

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

PROJECT NUMBER:	0608-041-00
DATE STARTED:	06-20-2022
DATE COMPLETED:	06-20-2022
HOLE #:	C-3/DCPT-3
CREW:	AF2/WS
PROJECT:	South College Drive Parking Improvements
ADDRESS:	South College Drive
LOCATION:	Bellingham, Wa
SURFACE ELEVATION:	259
WATER ON COMPLETION:	
HAMMER WEIGHT:	35 lbs.
CONE AREA:	10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-						
-						
- 1 ft						
-						
-						
- 2 ft						
-	50	222.0	••	25+	VERY DENSE	HARD
-	50	222.0	••	25+	VERY DENSE	HARD
- 3 ft						
- 1 m						
-						
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-3

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

PROJECT NUMBER: 0608-041-00
DATE STARTED: 06-20-2022
DATE COMPLETED: 06-20-2022

HOLE #: C-4/DCPT-4
CREW: AF2/WS
PROJECT: South College Drive Parking Improvements
ADDRESS: South College Drive
LOCATION: Bellingham, Wa

SURFACE ELEVATION: 237
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-						
-						
- 1 ft						
-						
-						
- 2 ft						
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	18	79.9	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 3 ft	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
- 1 m	21	93.2	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	24	92.6	•••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 4 ft	34	131.2	•••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-4

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

PROJECT NUMBER: 0608-041-00
DATE STARTED: 06-20-2022
DATE COMPLETED: 06-20-2022

HOLE #: HA-1/DCPT-5
CREW: AF2/WS
PROJECT: South College Drive Parking Improvements
ADDRESS: South College Drive
LOCATION: Bellingham, Wa

SURFACE ELEVATION: 233
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-	20	88.8	••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
- 1 ft	20	88.8	••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	31	137.6	•••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	24	106.6	•••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 2 ft	25	111.0	••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	26	115.4	•••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	28	124.3	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 3 ft	17	75.5	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 1 m	28	124.3	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	38	146.7	••	25+	DENSE	HARD
- 4 ft	38	146.7	••	25+	DENSE	HARD
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-5

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

PROJECT NUMBER: 0608-041-00
DATE STARTED: 06-20-2022
DATE COMPLETED: 06-20-2022

HOLE #: HA-2/DCPT-6
CREW: AF2/WS
PROJECT: South College Drive Parking Improvements
ADDRESS: South College Drive
LOCATION: Bellingham, Wa

SURFACE ELEVATION: 241
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 1 ft	18	79.9	•••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	15	66.6	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	18	79.9	•••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 2 ft	18	79.9	•••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
- 3 ft	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
- 1 m	14	62.2	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	15	57.9	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-6

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

PROJECT NUMBER: 0608-041-00
DATE STARTED: 06-20-2022
DATE COMPLETED: 06-20-2022

HOLE #: HA-3/DCPT-7
CREW: AF2/WS
PROJECT: South College Drive Parking Improvements
ADDRESS: South College Drive
LOCATION: Bellingham, Wa

SURFACE ELEVATION: 250
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-	6	26.6		7	LOOSE	MEDIUM STIFF
- 1 ft	17	75.5		21	MEDIUM DENSE	VERY STIFF
-	30	133.2		25+	DENSE	HARD
-	37	164.3		25+	DENSE	HARD
- 2 ft	53	235.3		25+	VERY DENSE	HARD
-	47	208.7		25+	VERY DENSE	HARD
-	33	146.5		25+	DENSE	HARD
- 3 ft	30	133.2		25+	DENSE	HARD
- 1 m	36	159.8		25+	DENSE	HARD
-	15	57.9		16	MEDIUM DENSE	VERY STIFF
- 4 ft	30	115.8		25+	DENSE	HARD
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-7

WILDCAT DYNAMIC CONE LOG

GeoEngineers
554 West Bakerview Road
Bellingham, WA 98226

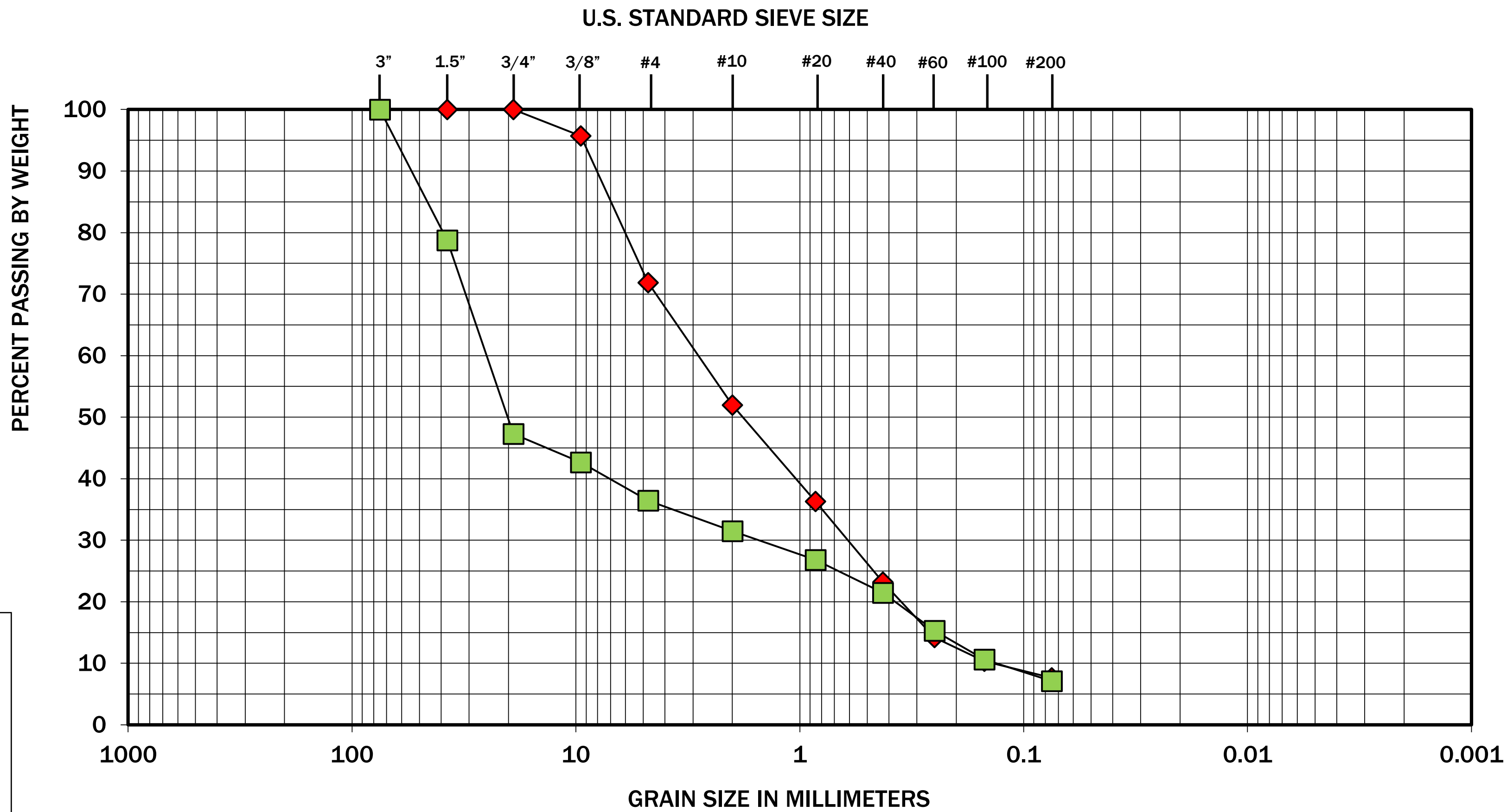
PROJECT NUMBER: 0608-041-00
DATE STARTED: 06-20-2022
DATE COMPLETED: 06-20-2022

HOLE #: HA-4/DCPT-8
CREW: AF2/WS
PROJECT: South College Drive Parking Improvements
ADDRESS: South College Drive
LOCATION: Bellingham, Wa

SURFACE ELEVATION: 280
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 1 ft	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 2 ft	33	146.5	••	25+	DENSE	HARD
-	20	88.8	•••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
- 3 ft	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
- 1 m	16	71.0	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	50	193.0	••	25+	VERY DENSE	HARD
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Figure A-8



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	C-1	0.8	9	Fine to coarse sand with silt and gravel (SP-SM)
■	C-3	1.5	4	Fine to coarse gravel with silt and sand (GP-GM)

Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM D 6913.

Sieve Analysis Results

South College Drive Parking Improvements
Bellingham, Washington

GEOENGINEERS

Figure A-9

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for Wilson Engineering, LLC and Western Washington University and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with Wilson Engineering, LLC dated May 27, 2022 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for the WWU South College Drive Parking Improvements project. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

1 Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to conduct additional study to obtain the specific types of information they need or prefer.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term “Biological Pollutants” includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

GeoEngineers

APPENDIX C

GHG Emissions Worksheet

City of Seattle Department of Planning and Development
SEPA GHG Emissions Worksheet
Version 1.7 12/26/07

Introduction

The Washington State Environmental Policy Act (SEPA) requires environmental review of development proposals that may have a significant adverse impact on the environment. If a proposed development is subject to SEPA, the project proponent is required to complete the SEPA Checklist. The Checklist includes questions relating to the development's air emissions. The emissions that have traditionally been considered cover smoke, dust, and industrial and automobile emissions. With our understanding of the climate change impacts of GHG emissions, the City of Seattle requires the applicant to also estimate these emissions.

Emissions created by Development

GHG emissions associated with development come from multiple sources:

- The extraction, processing, transportation, construction and disposal of materials and landscape disturbance (Embodied Emissions)
- Energy demands created by the development after it is completed (Energy Emissions)
- Transportation demands created by the development after it is completed (Transportation Emissions)

GHG Emissions Worksheet

This GHG Emissions Worksheet has been developed to assist applicants in answering the SEPA Checklist question relating to GHG emissions. The worksheet was originally developed by King County, but the City of Seattle and King County are working together on future updates to maintain consistency of methodologies across jurisdictions.

The SEPA GHG Emissions worksheet estimates all GHG emissions that will be created over the life span of a project. This includes emissions associated with obtaining construction materials, fuel used during construction, energy consumed during a buildings operation, and transportation by building occupants.

Using the Worksheet

1. Descriptions of the different residential and commercial building types can be found on the second tabbed worksheet ("Definition of Building Types"). If a development proposal consists of multiple projects, e.g. both single family and multi-family residential structures or a commercial development that consists of more than on type of commercial activity, the appropriate information should be estimated for each type of building or activity.

2. For paving, estimate the total amount of paving (in thousands of square feet) of the project.

3. The Worksheet will calculate the amount of GHG emissions associated with the project and display the amount in the "Total Emissions" column on the worksheet. The applicant should use this information when completing the SEPA checklist.

4. The last three worksheets in the Excel file provide the background information that is used to calculate the total GHG emissions.

5. The methodology of creating the estimates is transparent; if there is reason to believe that a better estimate can be obtained by changing specific values, this can and should be done. Changes to the values should be documented with an explanation of why and the sources relied upon.

6. Print out the “Total Emissions” worksheet and attach it to the SEPA checklist. If the applicant has made changes to the calculations or the values, the documentation supporting those changes should also be attached to the SEPA checklist.

WWU South College Drive Improvements Project

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# Units	Square Feet (in thousands of square feet)	Emissions Per Unit or Per Thousand Square Feet (MTCO2e) Embodied	Energy	Transportation	**Lifespan Emissions (MTCO2e)**
Single-Family Home............................	0		98	672	792	**0**
Multi-Family Unit in Large Building	0		33	357	766	**0**
Multi-Family Unit in Small Building	0		54	681	766	**0**
Mobile Home......................................	0		41	475	709	**0**
Education		0.0	39	646	361	**0**
Food Sales		0.0	39	1,541	282	**0**
Food Service		0.0	39	1,994	561	**0**
Health Care Inpatient		0.0	39	1,938	582	**0**
Health Care Outpatient		0.0	39	737	571	**0**
Lodging		0.0	39	777	117	**0**
Retail (Other Than Mall)........................		0.0	39	577	247	**0**
Office		0.0	39	723	588	**0**
Public Assembly		0.0	39	733	150	**0**
Public Order and Safety		0.0	39	899	374	**0**
Religious Worship		0.0	39	339	129	**0**
Service		0.0	39	599	266	**0**
Warehouse and Storage		0.0	39	352	181	**0**
Other		0.0	39	1,278	257	**0**
Vacant		0.0	39	162	47	**0**

Section II: Pavement..........................

Pavement..		21.40				**1070**

Total Project Emissions:	**1070**

Version 1.7 12/26/07

Definition of Building Types

Type (Residential) or Principal Activity (Commercial)	Description
Single-Family Home..................................	Unless otherwise specified, this includes both attached and detached buildings
Multi-Family Unit in Large Building	Apartments in buildings with more than 5 units
Multi-Family Unit in Small Building	Apartments in building with 2-4 units
Mobile Home...	
Education	Buildings used for academic or technical classroom instruction, such as elementary, middle, or high schools, and classroom buildings on college or university campuses. Buildings on education campuses for which the main use is not classroom are included in the category relating to their use. For example, administration buildings are part of "Office," dormitories are "Lodging," and libraries are "Public Assembly."
Food Sales	Buildings used for retail or wholesale of food.
Food Service	Buildings used for preparation and sale of food and beverages for consumption.
Health Care Inpatient	Buildings used as diagnostic and treatment facilities for inpatient care.
Health Care Outpatient	Buildings used as diagnostic and treatment facilities for outpatient care. Doctor's or dentist's office are included here if they use any type of diagnostic medical equipment (if they do not, they are categorized as an office building).
Lodging	Buildings used to offer multiple accommodations for short-term or long-term residents, including skilled nursing and other residential care buildings.
Retail (Other Than Mall)............................	Buildings used for the sale and display of goods other than food.
Office	Buildings used for general office space, professional office, or administrative offices. Doctor's or dentist's office are included here if they do not use any type of diagnostic medical equipment (if they do, they are categorized as an outpatient health care building).
Public Assembly	Buildings in which people gather for social or recreational activities, whether in private or non-private meeting halls.
Public Order and Safety	Buildings used for the preservation of law and order or public safety.
Religious Worship	Buildings in which people gather for religious activities, (such as chapels, churches, mosques, synagogues, and temples).
Service	Buildings in which some type of service is provided, other than food service or retail sales of goods
Warehouse and Storage	Buildings used to store goods, manufactured products, merchandise, raw materials, or personal belongings (such as self-storage).
Other	Buildings that are industrial or agricultural with some retail space; buildings having several different commercial activities that, together, comprise 50 percent or more of the floorspace, but whose largest single activity is agricultural, industrial/ manufacturing, or residential; and all other miscellaneous buildings that do not fit into any other category.
Vacant	Buildings in which more floorspace was vacant than was used for any single commercial activity at the time of interview. Therefore, a vacant building may have some occupied floorspace.

Sources: ....

Residential
2001 Residential Energy Consumption Survey
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

Commercial
Commercial Buildings Energy Consumption Survey (CBECS),
Description of CBECS Building Types
http://www.eia.doe.gov/emeu/cbecs/pba99/bldgtypes.html

Embodied Emissions Worksheet

Section I: Buildings

Type (Residential) or Principal Activity (Commercial)	# thousand sq feet/ unit or building	Life span related embodied GHG missions (MTCO2e/ unit)	Life span related embodied GHG missions (MTCO2e/ thousand square feet) - See calculations in table below
Single-Family Home................................	2.53	98	39
Multi-Family Unit in Large Building	0.85	33	39
Multi-Family Unit in Small Building	1.39	54	39
Mobile Home...	1.06	41	39
Education	25.6	991	39
Food Sales	5.6	217	39
Food Service	5.6	217	39
Health Care Inpatient	241.4	9,346	39
Health Care Outpatient	10.4	403	39
Lodging	35.8	1,386	39
Retail (Other Than Mall)..........................	9.7	376	39
Office	14.8	573	39
Public Assembly	14.2	550	39
Public Order and Safety	15.5	600	39
Religious Worship	10.1	391	39
Service	6.5	252	39
Warehouse and Storage	16.9	654	39
Other	21.9	848	39
Vacant	14.1	546	39

Section II: Pavement.............................

All Types of Pavement............................			50

	Columns and Beams	Intermediate Floors	Exterior Walls	Windows	Interior Walls	Roofs	Total Embodied Emissions (MTCO2e)	Total Embodied Emissions (MTCO2e/ thousand sq feet)
Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building	5.3	7.8	19.1	51.2	5.7	21.3		
Average Materials in a 2,272-square foot single family home	0.0	2269.0	3206.0	285.0	6050.0	3103.0		
MTCO2e	0.0	8.0	27.8	6.6	15.6	30.0	88.0	38.7

Sources

All data in black text — King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

Residential floorspace per unit — 2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

Floorspace per building — EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls

Average GWP (lbs CO2e/sq ft): Vancouver, Low Rise Building — Athena EcoCalculator
Athena Assembly Evaluation Tool v2.3- Vancouver Low Rise Building
Assembly Average GWP (kg) per square meter
http://www.athenasmi.ca/tools/ecoCalculator/index.html
Lbs per kg 2.20
Square feet per square meter 10.76

Average Materials in a 2,272-square foot single family home — Buildings Energy Data Book: 7.3 Typical/Average Household
Materials Used in the Construction of a 2,272-Square-Foot Single-Family Home, 2000
http://buildingsdatabook.eren.doe.gov/?id=view_book_table&TableID=2036&t=xls
See also: NAHB, 2004 Housing Facts, Figures and Trends, Feb. 2004, p. 7.

Average window size — Energy Information Administration/Housing Characteristics 1993
Appendix B, Quality of the Data. Pg. 5.
ftp://ftp.eia.doe.gov/pub/consumption/residential/rx93hcf.pdf

Pavement Emissions Factors MTCO2e/thousand square feet of asphalt or concrete pavement	50 (see below)

Embodied GHG Emissions……………………Worksheet Background Information

Buildings
Embodied GHG emissions are emissions that are created through the extraction, processing, transportation, construction and disposal of building materials as well as emissions created through landscape disturbance (by both soil disturbance and changes in above ground biomass).

Estimating embodied GHG emissions is new field of analysis; the estimates are rapidly improving and becoming more inclusive of all elements of construction and development.

The estimate included in this worksheet is calculated using average values for the main construction materials that are used to create a typical family home. In 2004, the National Association of Home Builders calculated the average materials that are used in a typical 2,272 square foot single-family household. The quantity of materials used is then multiplied by the average GHG emissions associated with the life-cycle GHG emissions for each material.

This estimate is a rough and conservative estimate; the actual embodied emissions for a project are likely to be higher. For example, at this stage, due to a lack of comprehensive data, the estimate does not include important factors such as landscape disturbance or the emissions associated with the interior components of a building (such as furniture).

King County realizes that the calculations for embodied emissions in this worksheet are rough. For example, the emissions associated with building 1,000 square feet of a residential building will not be the same as 1,000 square feet of a commercial building. However, discussions with the construction community indicate that while there are significant differences between the different types of structures, this method of estimation is reasonable; it will be improved as more data become available.

Additionally, if more specific information about the project is known, King County recommends two online embodied emissions calculators that can be used to obtain a more tailored estimate for embodied emissions: www.buildcarbonneutral.org and www.athenasmi.ca/tools/ecoCalculator/.

Pavement
Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle. For specifics, see the worksheet.

Special Section: Estimating the Embodied Emissions for Pavement

Four recent life cycle assessments of the environmental impacts of roads form the basis for the per unit embodied emissions of pavement. Each study is constructed in slightly different ways; however, the aggregate results of the reports represent a reasonable estimate of the GHG emissions that are created from the manufacture of paving materials, construction related emissions, and maintenance of the pavement over its expected life cycle.

The results of the studies are presented in different units and measures; considerable effort was undertaken to be able to compare the results of the studies in a reasonable way. For more details about the below methodology, contact matt.kuharic@kingcounty.gov.

The four studies, Meil (2001), Park (2003), Stripple (2001) and Treolar (2001) produced total GHG emissions of 4-34 MTCO2e per thousand square feet of finished paving (for similar asphalt and concrete based pavements). This estimate does not including downstream maintenance and repair of the highway. The average (for all concrete and asphalt pavements in the studies, assuming each study gets one data point) is ~17 MTCO2e/thousand square feet.

Three of the studies attempted to thoroughly account for the emissions associated with long term maintenance (40 years) of the roads. Stripple (2001), Park et al. (2003) and Treolar (2001) report 17, 81, and 68 MTCO2e/thousand square feet, respectively, after accounting for maintenance of the roads.

Based on the above discussion, King County makes the conservative estimate that 50 MTCO2e/thousand square feet of pavement (over the development's life cycle) will be used as the embodied emission factor for pavement until better estimates can be obtained. This is roughly equivalent to 3,500 MTCO2e per lane mile of road (assuming the lane is 13 feet wide).

It is important to note that these studies estimate the embodied emissions for roads. Paving that does not need to stand up to the rigors of heavy use (such as parking lots or driveways) would likely use less materials and hence have lower embodied emissions.

Sources:

Meil, J. A Life Cycle Perspective on Concrete and Asphalt Roadways: Embodied Primary Energy and Global Warming Potential. 2006. Available: http://www.cement.ca/cement.nsf/eee9ec7bbd630126852566c40052107b/6ec79dc8ae03a782852572b90061b914/$FILE/ATTK0WE3/athena%20report%20Feb.%202%202007.pdf

Park, K, Hwang, Y., Seo, S., M.ASCE, and Seo, H. , "Quantitative Assessment of Environmental Impacts on Life Cycle of Highways," Journal of Construction Engineering and Management , Vol 129, January/February 2003, pp 25-31, (DOI: 10.1061/(ASCE)0733-9364(2003)129:1(25)).

Stripple, H. Life Cycle Assessment of Road. A Pilot Study for Inventory Analysis. Second Revised Edition. IVL Swedish Environmental Research Institute Ltd. 2001. Available: http://www.ivl.se/rapporter/pdf/B1210E.pdf

Treloar, G., Love, P.E.D., and Crawford, R.H. Hybrid Life-Cycle Inventory for Road Construction and Use. Journal of Construction Engineering and Management. P. 43-49. January/February 2004.

Energy Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	Energy consumption per building per year (million Btu)	Carbon Coefficient for Buildings	MTCO2e per building per year	Floorspace per Building (thousand square feet)	MTCE per thousand square feet per year	MTCO2e per thousand square feet per year	Average Building Life Span	Lifespan Energy Related MTCO2e emissions per unit	Lifespan Energy Related MTCO2e emissions per thousand square feet
Single-Family Home............................	107.3	0.108	11.61	2.53	4.6	16.8	57.9	672	266
Multi-Family Unit in Large Building	41.0	0.108	4.44	0.85	5.2	19.2	80.5	357	422
Multi-Family Unit in Small Building	78.1	0.108	8.45	1.39	6.1	22.2	80.5	681	489
Mobile Home..	75.9	0.108	8.21	1.06	7.7	28.4	57.9	475	448
Education	2,125.0	0.124	264.2	25.6	10.3	37.8	62.5	16,526	646
Food Sales	1,110.0	0.124	138.0	5.6	24.6	90.4	62.5	8,632	1,541
Food Service	1,436.0	0.124	178.5	5.6	31.9	116.9	62.5	11,168	1,994
Health Care Inpatient	60,152.0	0.124	7,479.1	241.4	31.0	113.6	62.5	467,794	1,938
Health Care Outpatient	985.0	0.124	122.5	10.4	11.8	43.2	62.5	7,660	737
Lodging	3,578.0	0.124	444.9	35.8	12.4	45.6	62.5	27,826	777
Retail (Other Than Mall).......................	720.0	0.124	89.5	9.7	9.2	33.8	62.5	5,599	577
Office	1,376.0	0.124	171.1	14.8	11.6	42.4	62.5	10,701	723
Public Assembly	1,338.0	0.124	166.4	14.2	11.7	43.0	62.5	10,405	733
Public Order and Safety	1,791.0	0.124	222.7	15.5	14.4	52.7	62.5	13,928	899
Religious Worship	440.0	0.124	54.7	10.1	5.4	19.9	62.5	3,422	339
Service	501.0	0.124	62.3	6.5	9.6	35.1	62.5	3,896	599
Warehouse and Storage	764.0	0.124	95.0	16.9	5.6	20.6	62.5	5,942	352
Other	3,600.0	0.124	447.6	21.9	20.4	74.9	62.5	27,997	1,278
Vacant	294.0	0.124	36.6	14.1	2.6	9.5	62.5	2,286	162

Sources

All data in black text — King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

Energy consumption for residential buildings — 2007 Buildings Energy Data Book: 6.1 Quad Definitions and Comparisons (National Average, 2001)
Table 6.1.4: Average Annual Carbon Dioxide Emissions for Various Functions
http://buildingsdatabook.eren.doe.gov/
Data also at: http://www.eia.doe.gov/emeu/recs/recs2001_ce/ce1-4c_housingunits2001.html

Energy consumption for commercial buildings and Floorspace per building — EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)
Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls

Note: Data in plum color is found in both of the above sources (buildings energy data book and commercial buildings energy consumption survey).

Carbon Coefficient for Buildings — Buildings Energy Data Book (National average, 2005)
Table 3.1.7. 2005 Carbon Dioxide Emission Coefficients for Buildings (MMTCE per Quadrillion Btu)
http://buildingsdatabook.eere.energy.gov/?id=view_book_table&TableID=2057
Note: Carbon coefficient in the Energy Data book is in MTCE per Quadrillion Btu.
To convert to MTCO2e per million Btu, this factor was divided by 1000 and multiplied by 44/12.

Residential floorspace per unit — 2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

average lief span of buildings,
estimated by replacement time method

	Single Family Homes	Multi-Family Units in Large and Small Buildings	All Residential Buildings	
New Housing Construction, 2001	1,273,000	329,000	1,602,000	
Existing Housing Stock, 2001	73,700,000	26,500,000	100,200,000	
Replacement time:	57.9	80.5	62.5	(national average, 2001)

Note: Single family homes calculation is used for mobile homes as a best estimate life span.
Note: At this time, KC staff could find no reliable data for the average life span of commercial buildings.
Therefore, the average life span of residential buildings is being used until a better approximation can be ascertained.

Sources:

New Housing Construction, 2001
Quarterly Starts and Completions by Purpose and Design - US and Regions (Excel)
http://www.census.gov/const/quarterly_starts_completions_cust.xls
See also: http://www.census.gov/const/www/newresconstindex.html

Existing Housing Stock, 2001
Residential Energy Consumption Survey (RECS) 2001
Tables HC1:Housing Unit Characteristics, Million U.S. Households 2001
Table HC1-4a. Housing Unit Characteristics by Type of Housing Unit, Million U.S. Households, 2001
Million U.S. Households, 2001
http://www.eia.doe.gov/emeu/recs/recs2001/hc_pdf/housunits/hc1-4a_housingunits2001.pdf

Transportation Emissions Worksheet

Type (Residential) or Principal Activity (Commercial)	# people/ unit or building	# thousand sq feet/ unit or building	# people or employees/ thousand square feet	vehicle related GHG emissions (metric tonnes CO2e per person per year)	MTCO2e/ year/ unit	MTCO2e/ year/ thousand square feet	Average Building Life Span	Life span transportation related GHG emissions (MTCO2e/ per unit)	Life span transportation related GHG emissions (MTCO2e/ thousand sq feet)
Single-Family Home..................................	2.8	2.53	1.1	4.9	13.7	5.4	57.9	792	313
Multi-Family Unit in Large Building	1.9	0.85	2.3	4.9	9.5	11.2	80.5	766	904
Multi-Family Unit in Small Building	1.9	1.39	1.4	4.9	9.5	6.8	80.5	766	550
Mobile Home...	2.5	1.06	2.3	4.9	12.2	11.5	57.9	709	668
Education	30.0	25.6	1.2	4.9	147.8	5.8	62.5	9247	361
Food Sales	5.1	5.6	0.9	4.9	25.2	4.5	62.5	1579	282
Food Service	10.2	5.6	1.8	4.9	50.2	9.0	62.5	3141	561
Health Care Inpatient	455.5	241.4	1.9	4.9	2246.4	9.3	62.5	140506	582
Health Care Outpatient	19.3	10.4	1.9	4.9	95.0	9.1	62.5	5941	571
Lodging	13.6	35.8	0.4	4.9	67.1	1.9	62.5	4194	117
Retail (Other Than Mall)............................	7.8	9.7	0.8	4.9	38.3	3.9	62.5	2394	247
Office	28.2	14.8	1.9	4.9	139.0	9.4	62.5	8696	588
Public Assembly	6.9	14.2	0.5	4.9	34.2	2.4	62.5	2137	150
Public Order and Safety	18.8	15.5	1.2	4.9	92.7	6.0	62.5	5796	374
Religious Worship	4.2	10.1	0.4	4.9	20.8	2.1	62.5	1298	129
Service	5.6	6.5	0.9	4.9	27.6	4.3	62.5	1729	266
Warehouse and Storage	9.9	16.9	0.6	4.9	49.0	2.9	62.5	3067	181
Other	18.3	21.9	0.8	4.9	90.0	4.1	62.5	5630	257
Vacant	2.1	14.1	0.2	4.9	10.5	0.7	62.5	657	47

Sources

All data in black text — King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov

people/ unit — Estimating Household Size for Use in Population Estimates (WA state, 2000 average)
Washington State Office of Financial Management
Kimpel, T. and Lowe, T. Research Brief No. 47. August 2007
http://www.ofm.wa.gov/researchbriefs/brief047.pdf
Note: This analysis combines Multi Unit Structures in both large and small units into one category;
the average is used in this case although there is likely a difference

Residential floorspace per unit — 2001 Residential Energy Consumption Survey (National Average, 2001)
Square footage measurements and comparisons
http://www.eia.doe.gov/emeu/recs/sqft-measure.html

employees/thousand square feet — Commercial Buildings Energy Consumption Survey commercial energy uses and costs (National Median, 2003)
Table B2 Totals and Medians of Floorspace, Number of Workers, and Hours of Operation for Non-Mall Buildings, 2003
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set1/2003excel/b2.xls

Note: Data for # employees/thousand square feet is presented by CBECS as square feet/employee.
In this analysis employees/thousand square feet is calculated by taking the inverse of the CBECS number and multiplying by 1000.

vehicle related GHG emissions

Estimate calculated as follows (Washington state, 2006)_

56,531,930,000	2006 Annual WA State Vehicle Miles Traveled	
		Data was daily VMT. Annual VMT was 365*daily VMT.
		http://www.wsdot.wa.gov/mapsdata/tdo/annualmileage.htm
6,395,798	2006 WA state population	
		http://quickfacts.census.gov/qfd/states/53000.html
8839	vehicle miles per person per year	
0.0506	gallon gasoline/mile	
		This is the weighted national average fuel efficiency for all cars and 2 axle, 4 wheel light trucks in 2005. This includes pickup trucks, vans and SUVs. The 0.051 gallons/mile used here is the inverse of the more commonly known term “miles/per gallon” (which is 19.75 for these cars and light trucks).
		Transportation Energy Data Book. 26th Edition. 2006. Chapter 4: Light Vehicles and Characteristics. Calculations based on weighted average MPG efficiency of cars and light trucks.
		http://cta.ornl.gov/data/tedb26/Edition26_Chapter04.pdf
		Note: This report states that in 2005, 92.3% of all highway VMT were driven by the above described vehicles.
		http://cta.ornl.gov/data/tedb26/Spreadsheets/Table3_04.xls
24.3	lbs CO2e/gallon gasoline	
		The CO2 emissions estimates for gasoline and diesel include the extraction, transport, and refinement of petroleum as well as their combustion.
		Life-Cycle CO2 Emissions for Various New Vehicles. RENew Northfield.
		Available: http://renewnorthfield.org/wpcontent/uploads/2006/04/CO2%20emissions.pdf
		Note: This is a conservative estimate of emissions by fuel consumption because diesel fuel,
2205		with a emissions factor of 26.55 lbs CO2e/gallon was not estimated.
4.93	lbs/metric tonne	
	vehicle related GHG emissions (metric tonnes CO2e per person per year)	

average lief span of buildings, estimated by replacement time method — See Energy Emissions Worksheet for Calculations

Commercial floorspace per unit — EIA, 2003 Commercial Buildings Energy Consumption Survey (National Average, 2003)

Table C3. Consumption and Gross Energy Intensity for Sum of Major Fuels for Non-Mall Buildings, 2003

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003excel/c3.xls

APPENDIX D

Parking Utilization Study

Western Washington University Parking Utilization Study

March 2020

transpogroup

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March 2020

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Contents

Introduction

The purpose of this Western Washington University (WWU) Parking Utilization Study is to satisfy WWU's agreement with the City to monitor on-campus parking lot utilization rates over time. The study summarizes total campus parking supply and observed occupancy rates for the 2020 count, and also compares the 2020 data with historical data, available from the year 2000. In addition, the study of parking lot utilization at the Lincoln Creek Park and Ride was completed. Utilization associated with this lot has been provided in a separate section and is not included in the on-site analysis.

The total parking supply is defined as the number of available stalls within the study area. The study area includes all parking located on campus as well as campus owned parking lots off campus. A total of 3,229 stalls on campus were included in the survey for this study – designated loading and maintenance stalls were not surveyed. The study does not include motorcycle parking or off-campus parking that may occur on streets or in designated areas such as the Samish drive-in.

Parking occupancy rates are calculated in this report for an average weekday (average of Monday through Thursday observation days), for each individual weekday, for all parking lots and for individual parking lot types. A parking occupancy rate can be defined as the percentage of the parking supply that is observed to be occupied during a given time period. Parking occupancy is reported on an hourly basis.

Methodology

Parking occupancy data was collected for this study by a firm that specializes in traffic data collection. The campus was divided into three areas with three staff members assigned to individual routes through a given area, such that the same person collected data in the same area each day. The data collection staff began their designated routes each hour, on the hour, with counts beginning at 9:00 a.m. each day.

The 2020 parking counts were conducted during the week of January 27th, 2020, which has been identified by WWU as one of the busiest weeks during the school year. Counts were collected from 9:00 a.m. to 5:00 p.m. on Monday, Thursday, and Friday. Twelve-hour counts (9:00 a.m. to 9:00 p.m.) were conducted on Tuesday and Wednesday. Since class schedules often coincide on Mondays and Wednesdays, and again on Tuesdays and Thursdays, the evening counts on a Tuesday and Wednesday represent data from both potential evening class schedules.

Weather during the week of the study consisted of cool temperatures with periods of rain.

R LOTS	CAPACITY
1R	33
3R	118
4R	81
15R	32
18R	96
20R	40
27R	226
Total	**626**

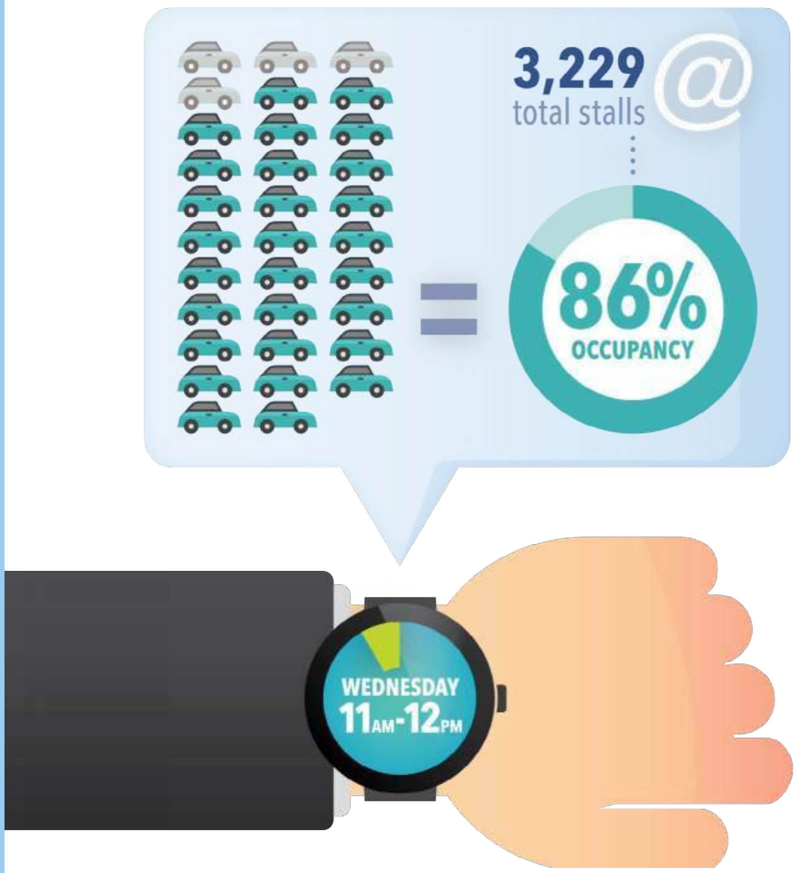
V/C LOTS	CAPACITY
6V	57
23V	26
C (16CR)	1,117
Total	**1,200**

G LOTS	CAPACITY
5G	24
7G	173
8G	26
10G	72
11G	55
12A	319
26 CP	8
13A	31
9G	128
17G	139
19G	99
22G	24
24G	80
25G	18
29G	8
30G	6
32G	80
33G	24
Total	**1,314**

MISC. LOTS	CAPACITY
Armory	8
Edens Service Rd	3
CBS	14
Alumni House	3
Arntzen Ramp	
Bond Hall	7
Fairhaven Service Rd	4
Fuel Dock (10G)	* in 10G
Nash Turnaround	1
Viking Union Service Rd	7
Art Annex (10G)	* in 10G
Ridgeway Service Road	*service vehicles/ ADA only*
VU Dock/VU SRV/Alley	*service vehicles/ ADA only*
Bio Green House	*service vehicles/ ADA only*
ARCHIVES	*service vehicles/ ADA only*
AIC	17
Engineering	25
Total	**89**

Grand Total	**3,229**


Armory
4R
6V
25G
11G
Bond Hall
15R
CBS
9G
19G
20R
16CR
23V
30G
7G
3R
5G
8G
10G
Art Annex
Fuel Dock
Engineering
Artnzen Ramp
Bio Green House
17G
AIC
27R
26CP
29G
12A
18R
22G
1R
33G
Archives
13A
24G
Lincoln Creek Park & Ride
32G
Sehome Hill Arboretum
Red Square
Ridgeway
Fairhaven
Birnam Wood
5
LEGEND
Parking Lots
WWU Buildings
Water
Parks
Feet
0
500
1,000

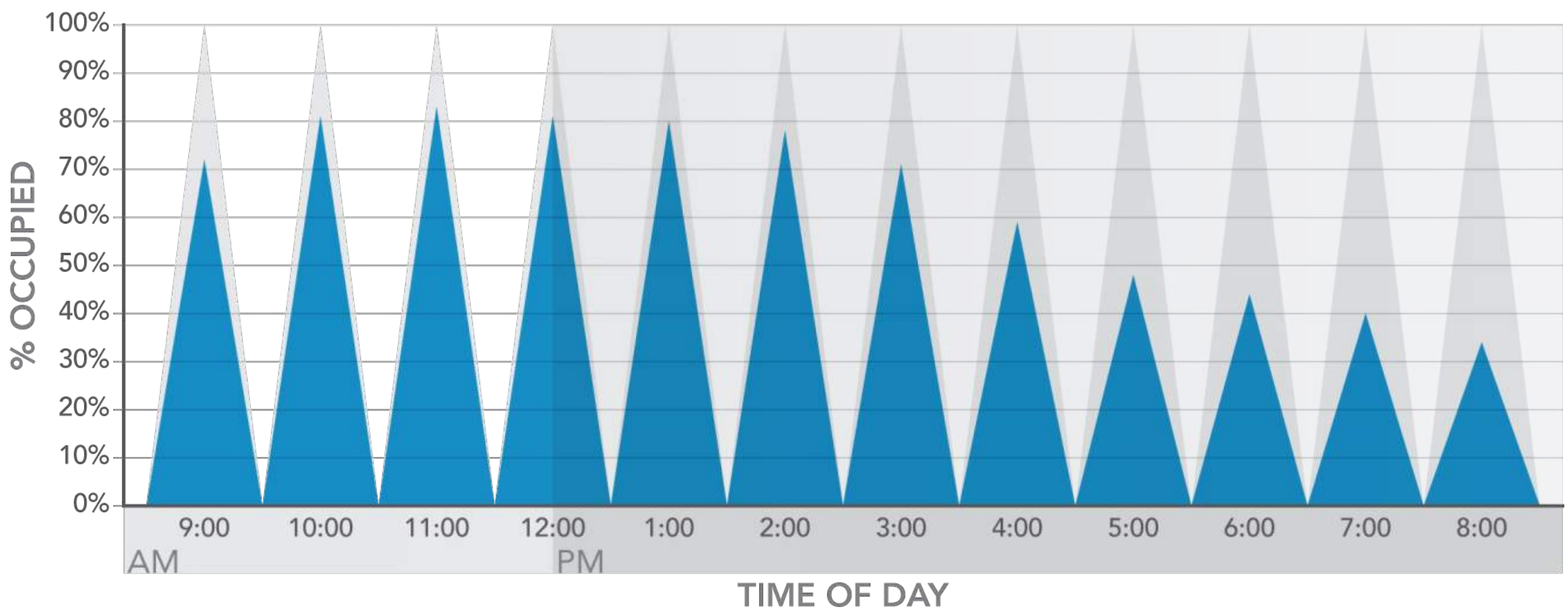


2020 Count Summary

Hourly parking occupancy counts for each individual parking lot on campus were observed during the week of January 27, 2020 and are tabulated by day of week in Appendix A. The total parking supply at the time of the counts (not including motorcycles) for this study was 3,229 stalls.

The day during which the highest parking occupancy was observed was Wednesday, January 29th. The peak hour of the day during which the highest occupancy was observed was 11:00 AM to 12:00 PM; 2,785 parking stalls were observed to be occupied, representing approximately 86 percent of the total parking capacity. The observation of 11:00 AM to 12:00 PM as the peak hour is consistent with observations made in previous years, and has historically occurred on a Wednesday. A more detailed comparison with historic data is presented later in this report.

***Figure 1 Campus Parking** – Average Weekday Hourly Occupancy Rate*



Figures 1 through 6 summarize the results of the 2020 counts. Detailed count data is provided in Appendix A. Figure 1 shows the average weekday occupancy rate of all the parking lots studied (Monday through Friday). The peak occupancy at approximately 83 percent occurs during the 11:00 AM – 12:00 PM time period. During the evening from 5:00 PM to 9:00 PM, less than 50 percent of the stalls are occupied.

Figure 2 illustrates the parking occupancy rate by day of week. The peak hourly occupancy is observed between 11:00 AM to 12:00 PM on every day of the week. The graph illustrates that during that peak time Wednesday; approximately 86 percent of the total WWU campus parking lot supply was observed to be occupied. During the afternoon, after 4:00 p.m. the occupancy rates on Monday through Thursday were observed to be relatively similar. The occupancy rates observed on Friday were lower than other weekdays. During the evening hours observed on Tuesday and Wednesday, the occupancy rate remained at, or below 52 percent.

Figure 2 *Campus Parking: Hourly Occupancy by Day of Week*

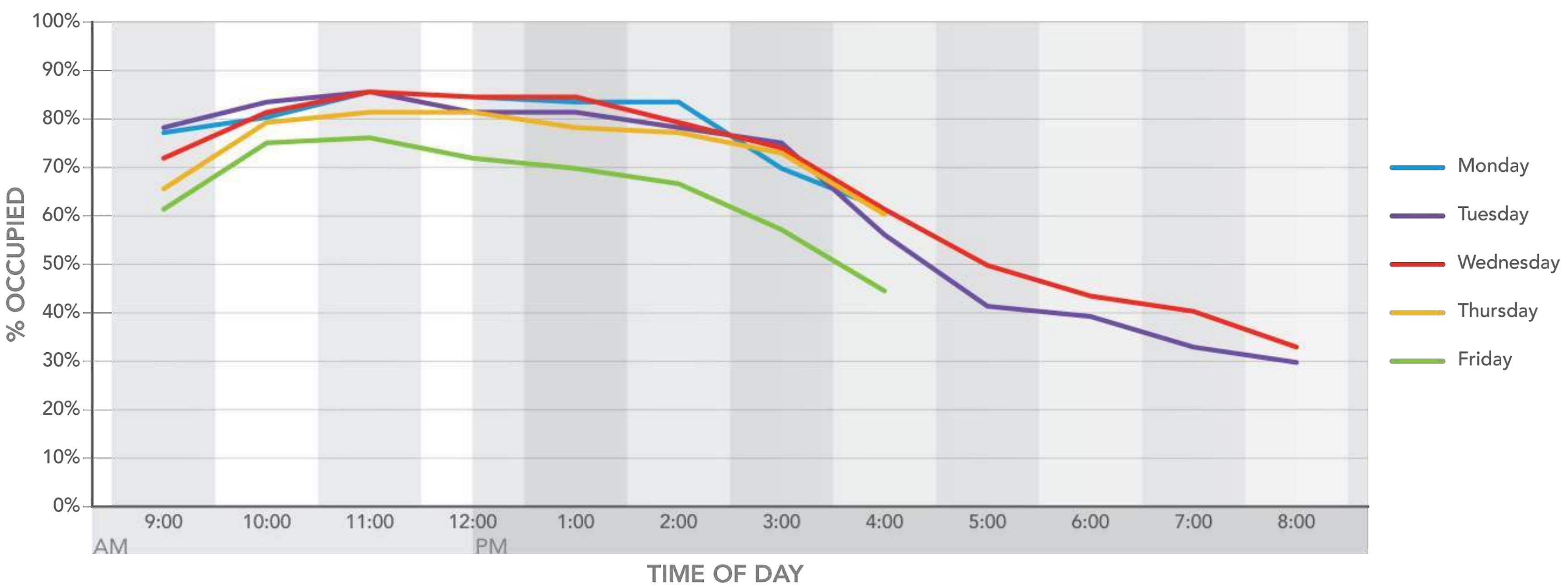


Figure 3 shows the average weekday parking occupancy by lot type - “R”, “G” and “V/C”. In general, R lots are designated for residential student permits, G lots are designated for staff and visitor permits are also sold to a few G lots, and V/C lots include assigned non-resident student parking and short-term visitor parking. As shown in Figure 3, both the R and G lot types are below 85 percent capacity throughout the day, while the V/C lot types reach 93 percent capacity during the 11:00 am – 12:00 pm hour. The R lots are occupied approximately 76 to 83 percent throughout the day, the G lots are occupied approximately 62 to 81 percent during the daytime hours (9:00 AM to 5:00 PM) and less than 36 percent during the evening hours (after 5:00 PM), and the V/C lots are occupied approximately 52 to 93 percent during the daytime hours (9:00 AM to 5:00 PM) and less than 46 percent during the evening hours (after 5:00 PM).

Figure 3 *Average Weekday Hourly Occupancy by Parking Lot Type*

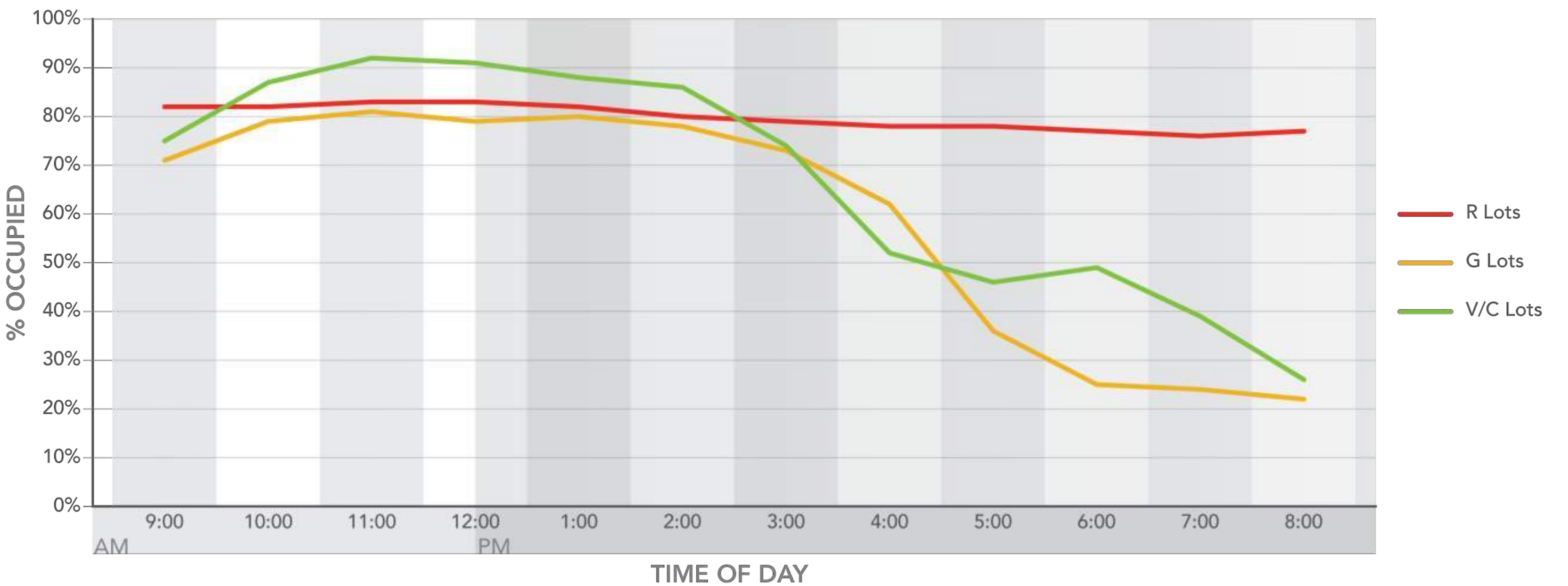
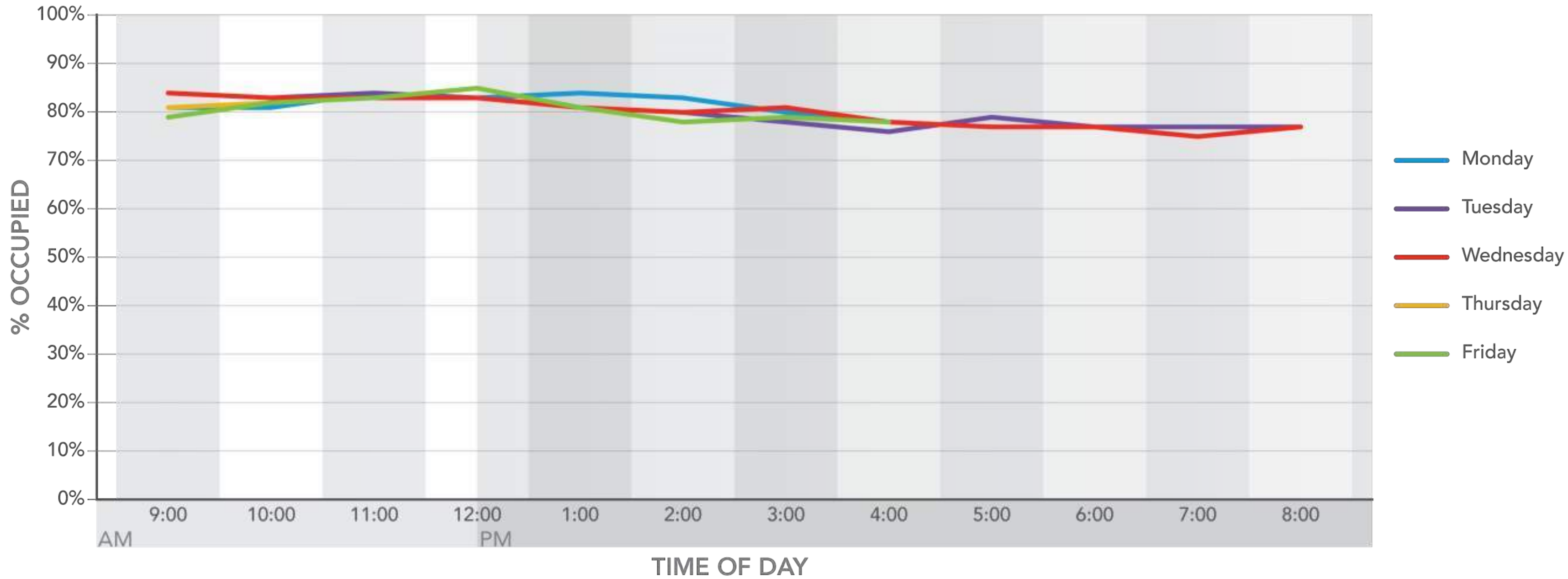


Figure 4 *R Lots: Hourly Occupancy by Day of Week*



Figures 4 through 6 display the observed occupancy by day of week for each lot type – R, G and V/C. Figure 4 shows observed hourly occupancy rates for R lots. Approximately 19 percent (626 stalls) of the campus parking supply is designated R. Observed occupancy rates in the R lots peaked at 85 percent during the week of observations.

Figure 5 *G Lots: Hourly Occupancy by Day of Week*

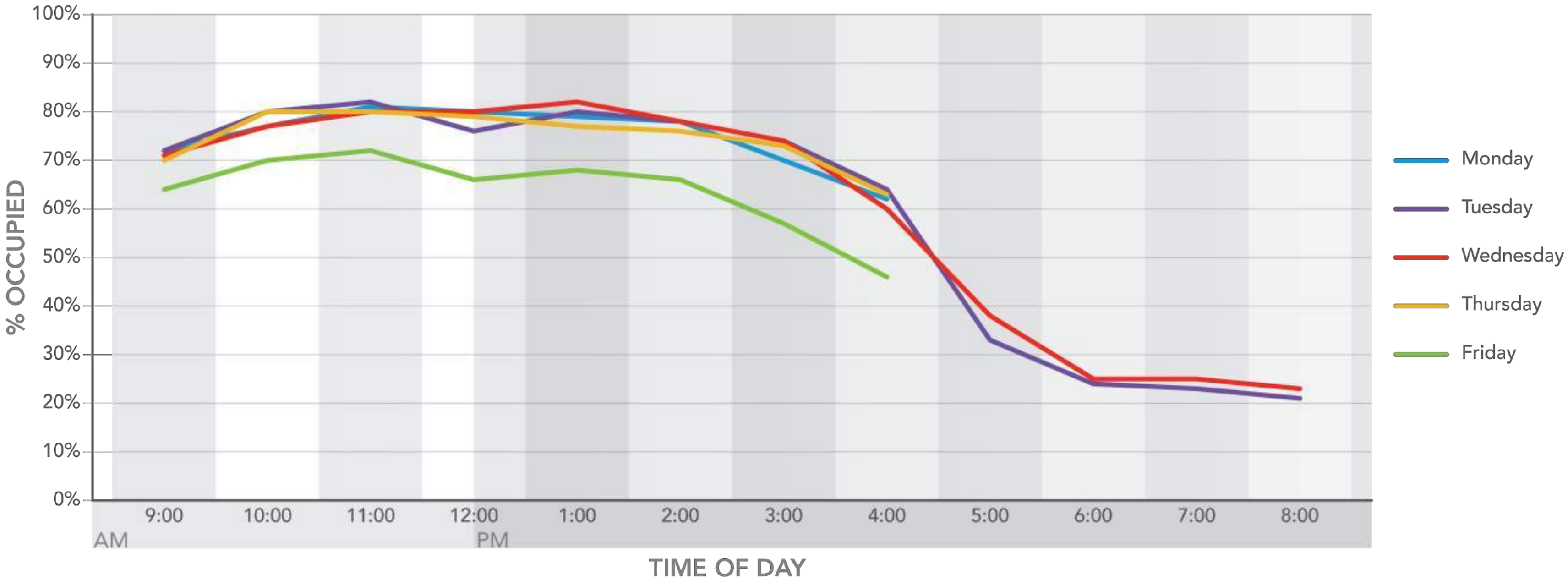


Figure 5 shows observed hourly occupancy rates for G lots. Approximately 41 percent of the campus parking supply (1,314 stalls) is allocated to the G lots. Observed occupancy rates in these lots do not exceed 83 percent on any of the observed days.

Figure 6 *V/C Lots: Hourly Occupancy by Day of Week*

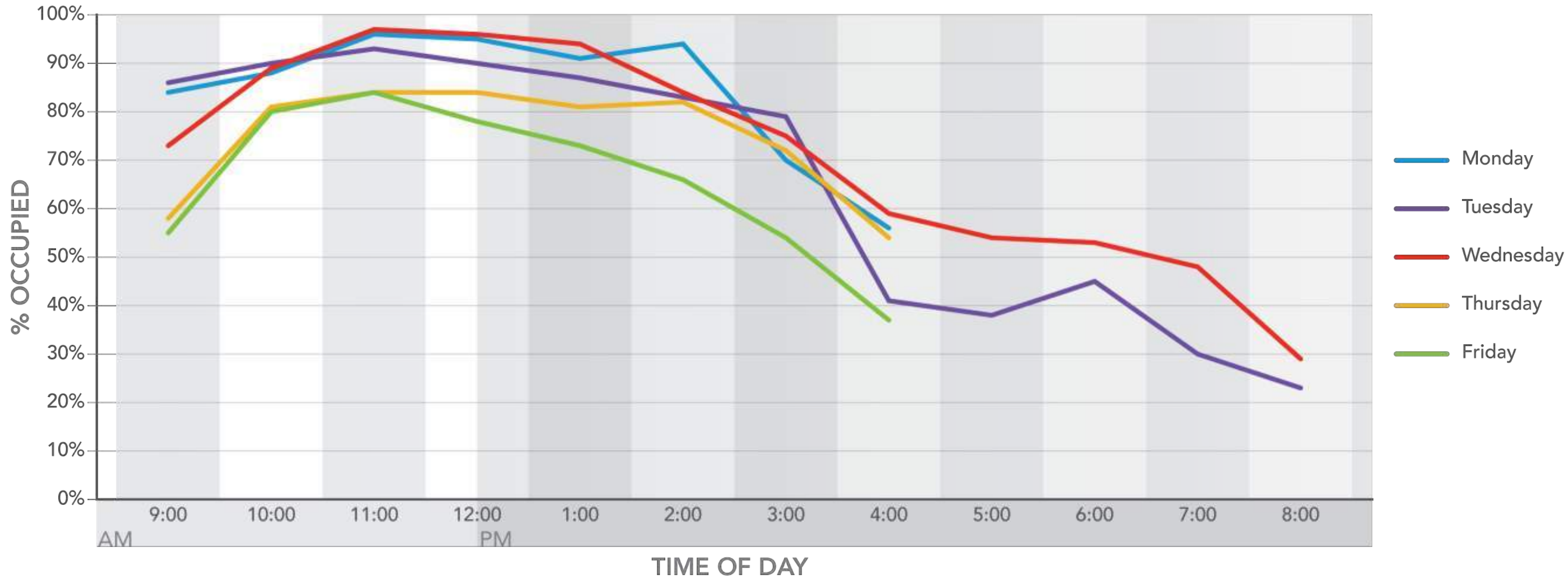
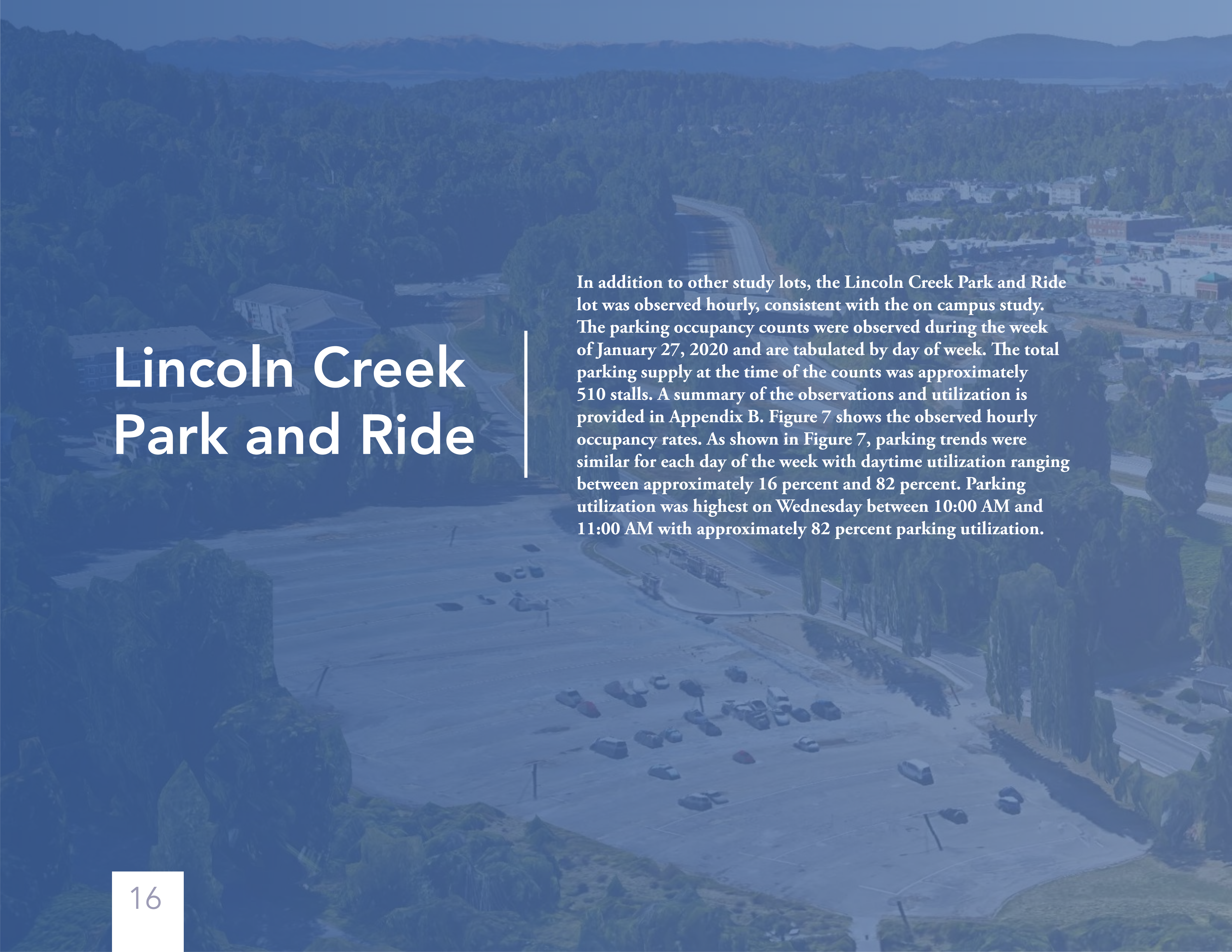


Figure 6 shows observed hourly occupancy rates for V/C lots. Approximately 37 percent of the campus parking supply (1,200 stalls) is allocated to V/C lots. Occupancy rates in these lots do not exceed 97 percent on any of the days observed.

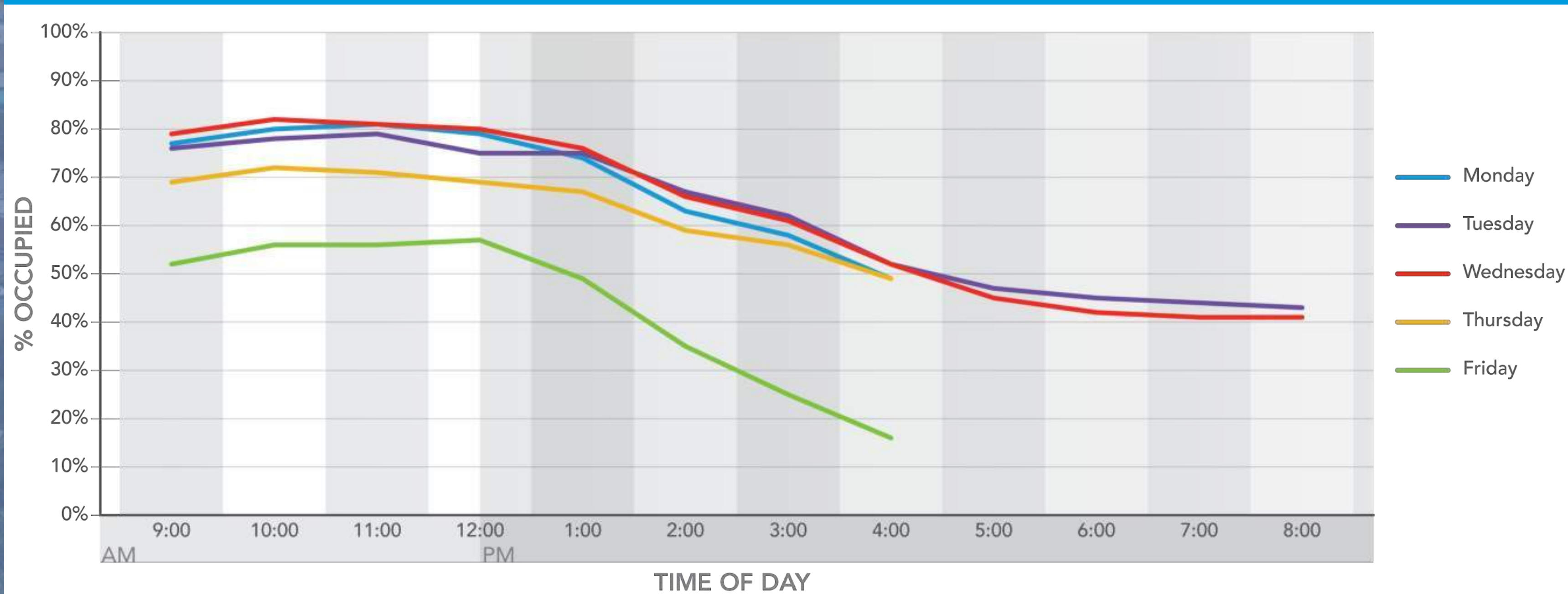

younglife



Lincoln Creek Park and Ride

In addition to other study lots, the Lincoln Creek Park and Ride lot was observed hourly, consistent with the on campus study. The parking occupancy counts were observed during the week of January 27, 2020 and are tabulated by day of week. The total parking supply at the time of the counts was approximately 510 stalls. A summary of the observations and utilization is provided in Appendix B. Figure 7 shows the observed hourly occupancy rates. As shown in Figure 7, parking trends were similar for each day of the week with daytime utilization ranging between approximately 16 percent and 82 percent. Parking utilization was highest on Wednesday between 10:00 AM and 11:00 AM with approximately 82 percent parking utilization.

Figure 7 Lincoln Creek Park and Ride: Daily Parking Utilization



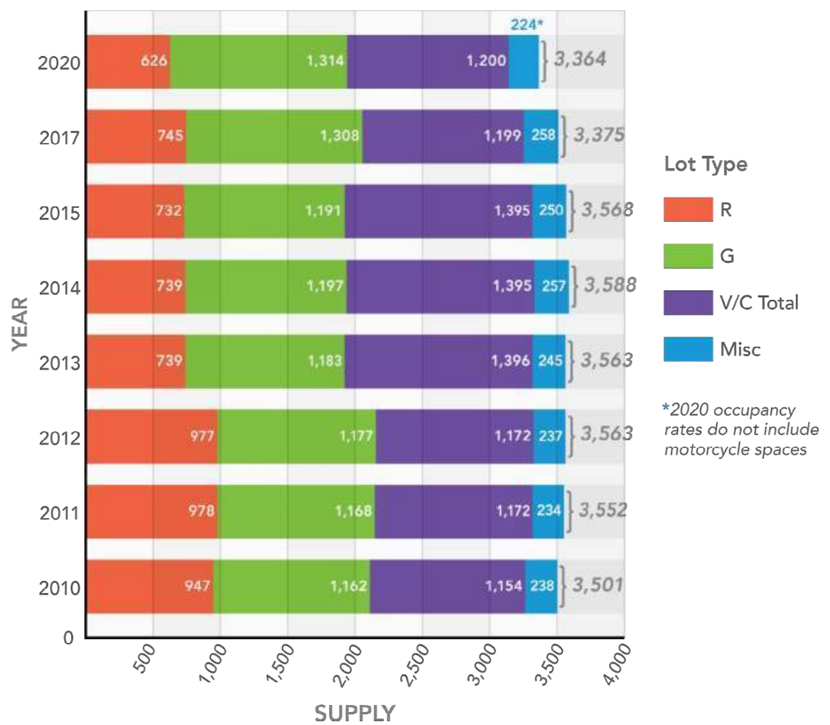
Count Comparison with Prior Years

Comparative historical parking occupancy data has been collected at WWU since 2000. Changes in parking supply and in observed peak occupancy rates observed over the past 10 years are summarized in this section. Hourly occupancy is compared by day and lot type. Historic data is reported based on the *Western Washington University 2017 Parking Utilization Study* (The Transpo Group, Inc., January 2018).

Parking Supply

As the WWU campus has grown and changed over the years, the total parking supply has also fluctuated. The total campus parking supply by parking lot type for the previous ten years is shown in Table 1. A detailed breakdown of parking supply by type for each of the parking lots in the WWU campus for all years is included in the Appendix. Over this same time period, the resident and non-resident student populations at WWU have increased from approximately 11,000 in 2000 to over 15,000 full-time-equivalents. It is noteworthy that according to WTA, transit service and ridership has increased over this time period. WWU has also

***Figure 8** Parking Supply Comparison*



provided approximately 510 off-site parking stalls at Lincoln Creek Transportation Center (LCTC). Transit service from LCTC is provided by Whatcom Transportation Authority (WTA).

Occupancy Rates

The average weekday hourly occupancy rates for 2020 were summarized in Figure 1. Figure 9 compares the 2020 data with the previous ten years. The weekday occupancy patterns have remained similar throughout the 2010-2020 study period, with parking occupancy peaking in the late morning. The 2020 shows an increase in occupancy rates as compared to 2017. Since the parking supply has varied by year, comparisons are made based on rates, rather than actual number of stalls. All supporting data tables are provided in Appendix C.

Figure 9 Average Weekday Parking Occupancy Rate Comparison 2010-2020

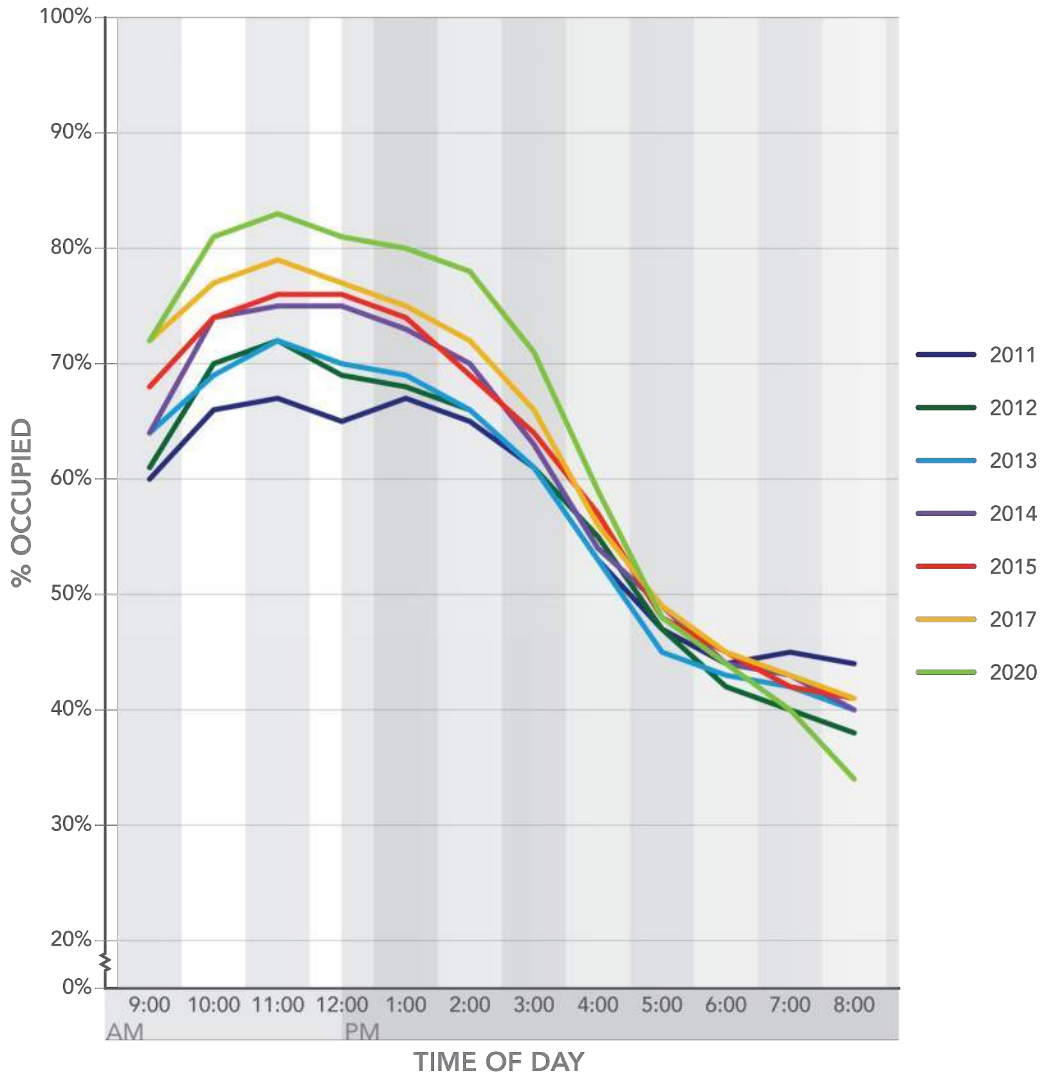


Figure 10 Peak Hourly Occupancy Comparison (2010 – 2020)

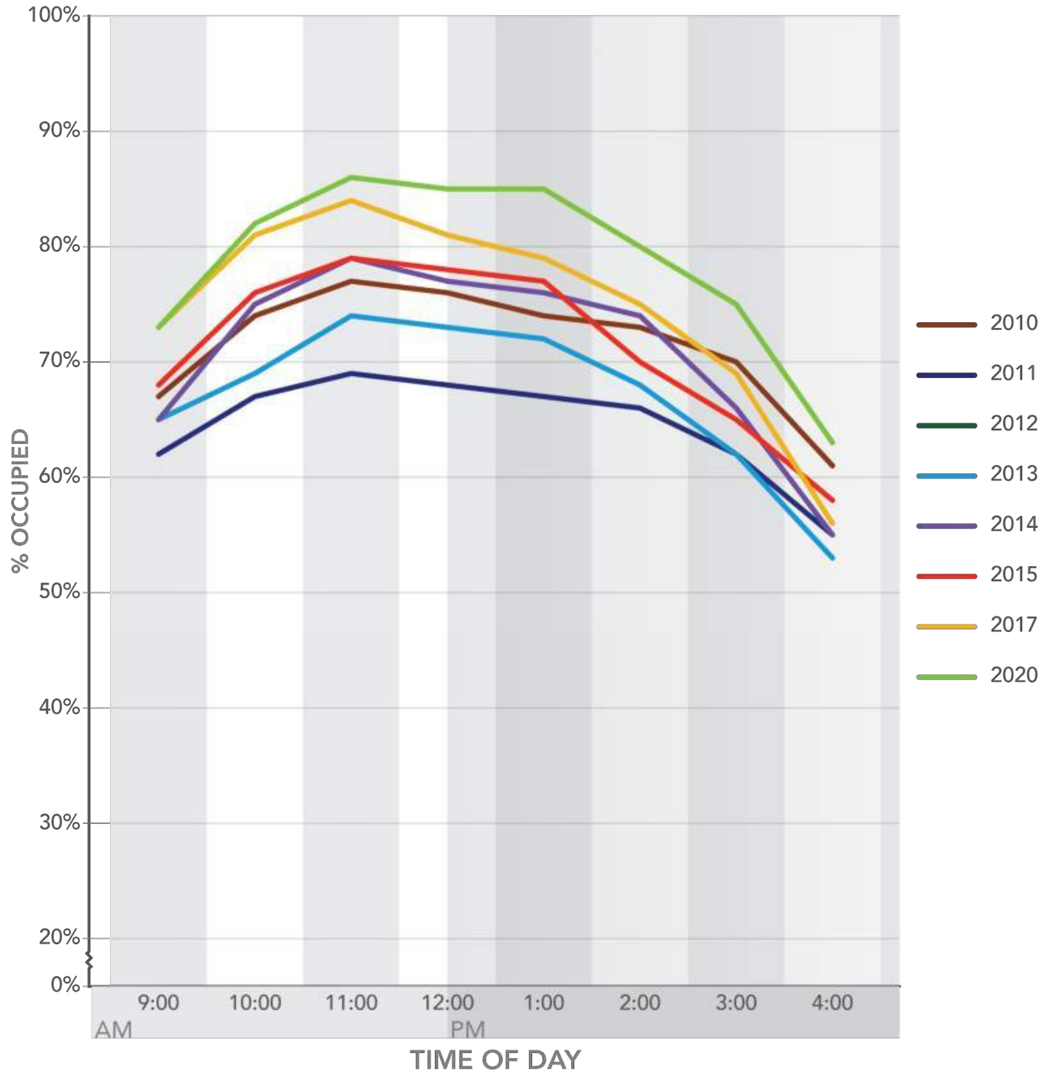


Figure 10 illustrates the hourly occupancy rates on the peak day, which has historically been on Wednesday. Evening data was not available for all years, so is not included. The peak observed parking occupancy rate on campus during the last 10 years was highest in 2020, at approximately 85 percent.

Figures 11 illustrates the average weekday evening occupancy rates for evening observation periods from the counts conducted since the year 2010. Counts have traditionally been collected on either a Monday or Wednesday and either a Tuesday or Thursday. The Tuesday/Thursday data show a very slight trend of a higher occupancy by a few percent. Since the difference is minor, results for Monday/Wednesday data and Tuesday/Thursday data have been averaged and the corresponding weekday evening parking occupancy rates are shown in Figure 11. The figure shows that evening occupancy rates are below 45 percent for 2020.

The parking supply for WWU campus parking lots was observed to be occupied at a peak of approximately 86 percent during the 11:00 a.m. to 12:00 p.m. time period on Wednesday, January 29th, 2020. The data observed during the 2020 count exhibited trends that were higher than those observed over the last couple of years.

Data tables for 2020 and prior year counts are provided in the Appendices. Individual lot occupancies can be found in these tables and may be used for future campus parking planning.

***Figure 11** Weekday Average Evening Parking Occupancy Rate Comparison*