CAMPUS ARCHITECTURE & PLANNING
UNIVERSITY of WASHINGTON
Facilities

January 26, 2024

City of Seattle
Department of Construction & Inspections
700 5th Ave, Suite 2000
Seattle WA 98104

RE: SEPA Lead Agency
Lot E18 Solar Canopy

Per RCW 43.21C, WAC 197-11 and WAC 478-324-020 through 210, the University of Washington is the Lead Agency responsible for compliance with the State Environmental Policy Act (SEPA) for projects which the University initiates. These rules state that when an agency initiates a proposal, it is the lead agency for the proposal and defines lead agency as the agency with the main responsibility for complying with SEPA's procedural requirements.

Per the SEPA Guidelines, as the SEPA lead agency, the University of Washington has the authority to prepare determinations of exemption, threshold determinations, scoping, preparing and issuance of environmental impact statements, etc.

The SEPA review has been completed for the Lot E18 Solar Canopy project as noted in the attached SEPA checklist.

Sincerely,

Julie Blakeslee, AICP
University Environmental & Land Use Planner
SEPA Responsible Official

Box 359571, Seattle WA 98195-9571

PUBLIC NOTICE
UNIVERSITY OF WASHINGTON

Pursuant to the provisions of WAC 197-11-340 and WAC 478-324-140, the University of Washington hereby provides public notice of: **DETERMINATION OF NON-SIGNIFICANCE**

Project Name: Lot E18 Solar Canopy Project
Proponent/Lead Agency: University of Washington–Seattle Campus

Comment Period Closes: February 14 2024

Description of Proposal: The University is proposing to install an approximately 4,820 SF solar canopy over 30 existing parking spaces in parking lot E18. The solar canopy would generate approximately 84kW of electrical power connecting to the City of Seattle and UW campus electrical grids.

Location of Proposal: The E18 lot is located east of Montlake Blvd, north of the UW Intramural Activities building, west of Walla Walla Rd NE, and south of NE 45th Street, at 2500 Wahkiakum Road.

Contact Person: Julie Blakeslee, Environmental and Land Use Planner, SEPA Responsible Official; UW Facilities Asset Management; Box 359571; Seattle, WA 98195-2205; jblakesl@uw.edu

ENVIRONMENTAL CHECKLIST

for the proposed

Parking Lot E18 Solar Canopy Project

UNIVERSITY of WASHINGTON

January 2024

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

PREFACE

The purpose of this Environmental Checklist is to identify and evaluate probable environmental impacts that could result from the proposed ***Parking Lot E18 Solar Canopy Project*** and to identify measures to mitigate those impacts. The ***Parking Lot E18 Solar Canopy Project*** would provide approximately 4,820 sq. ft. of solar canopy over existing parking spaces in lot E18. Underground electrical lines and equipment would also be provided. The solar canopy would generate approximately 84kW of electrical power that would be connected to City of Seattle and UW campus electrical grids, and would be capable of connection to future UW charging stations.

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; 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 proposed ***Parking Lot E18 Solar Canopy Project.*** Analysis associated with the proposed project contained in this Environmental Checklist is based on schematic plans for the project. While not construction-level detail, the schematic 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 8) 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 possible mitigation measures. *Section C* (page 31) contains the signature of the proponent, confirming the completeness of this Environmental Checklist.

Project-relevant analyses that served as a basis for this Environmental Checklist include: *Geotechnical Engineering Report* (GeoEngineers, September 2023); and, *Greenhouse Gas Emissions Worksheet* (EA, 2024).

[1] Chapter 43.21C. RCW

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PURPOSE

The State Environmental Policy Act (SEPA), Chapter 43.21 RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. The purpose of this checklist is to provide information to help identify impacts from the proposal (and to reduce or avoid impacts, if possible) and to help the University of Washington to make a SEPA threshold determination.

A. BACKGROUND

1. Name of Proposed Project:

University of Washington Parking Lot E18 Solar Canopy Project

2. Name of Applicant:

University of Washington

3. Address and Phone Number of Applicant and Contact Person:

Applicant
University of Washington
Facilities, Asset Management
Box 359571
Seattle, WA 98195-9571

Contact
Julie Blakeslee
Environmental and Land Use Planner
University of Washington
Facilities, Asset Management
Box 359571
Seattle, WA 98195-9571
jblakesl@uw.edu

4. Date Checklist Prepared

The Checklist was prepared on January 26, 2024 by the University of Washington as the lead agency under the authority of WAC 478-324

5. Agency Requesting Checklist

University of Washington

6. Proposed Timing or Schedule (including phasing, if applicable):

Construction of the proposed ***Parking Lot E18 Solar Canopy Project*** is anticipated to begin in March 2024, with completion and operation in August 2024.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

No future plans for further development of the project site are proposed. Installation and operation of the proposed project is a pilot project to evaluate the potential for future expansion.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal:

The following environmental review documents were prepared for the University of Washington 2018 Seattle Campus Master Plan:

- University of Washington 2018 Seattle Campus Master Plan Draft EIS (2016)
- University of Washington 2018 Seattle Campus Master Plan Final EIS (2017)

The following environmental review information was prepared in support of the proposed project:

- *Geotechnical Engineering Report* (GeoEngineers, 2023);
- *Greenhouse Gas Emission Worksheet* (EA Engineering, 2024);

These reports are included as appendices to this Checklist.

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:

There are no known other applications that are pending approval for the ***Parking Lot E18 Solar Canopy Project*** site.

10. List any government approvals or permits that will be needed for your proposal, if known:

University of Washington

- Project approval, design approval, authorization to prepare contract documents, and authorization to Call-for-Bids.

State of Washington

- *Washington State Department of Ecology*
    - Construction Stormwater Permit

City of Seattle

- *Department of Construction and Inspections*

  Permits/approvals associated with the proposed project, including:
  - Grading/Shoring Permit
  - Building Permit
  - Mechanical Permits
  - Electrical Permits
  - Drainage Permit

11. Give a brief, 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.

Existing Site Conditions

The proposed ***Parking Lot E18 Solar Canopy Project*** site is located in the East Campus area of the University of Washington Seattle campus and is the athletic center of the campus with substantial area in surface parking lots. The project site (including area for proposed solar canopy and underground electrical lines/equipment) encompasses approximately 37,500 sq.ft. (0.86 acre) consists of paved surface parking lot (containing approximately 140 parking spaces), paved drive area, and landscaped area with up to two mature trees. The site is generally bounded by sidewalk and the track and soccer facilities to the east, with surface parking lot area to the north, west and south. NE Wahkiakum Rd. is located farther to the south and NE Montlake Blvd is located farther to the west (see **Figure 1** for an aerial map of the site/vicinity and **Figure 2** for a map of the project site).

Proposed Project

The proposed ***Parking Lot E18 Solar Canopy Project*** is intended to be a pilot project to evaluate the potential for future expansion of solar canopies in the vicinity.

The proposed project includes the provision of an approximately 4,820 sq.ft. solar canopy over approximately 30 existing parking spaces in parking lot E18. The proposed solar canopy would generate approximately 84kW of electrical power that would be connected to the City of Seattle and UW campus electrical grids and would be capable of connection to future UW charging stations (see **Figure 2** for the proposed Site Plan and **Figure 3** for the proposed Canopy Elevation).

Project Site

Note: This figure is not to scale.

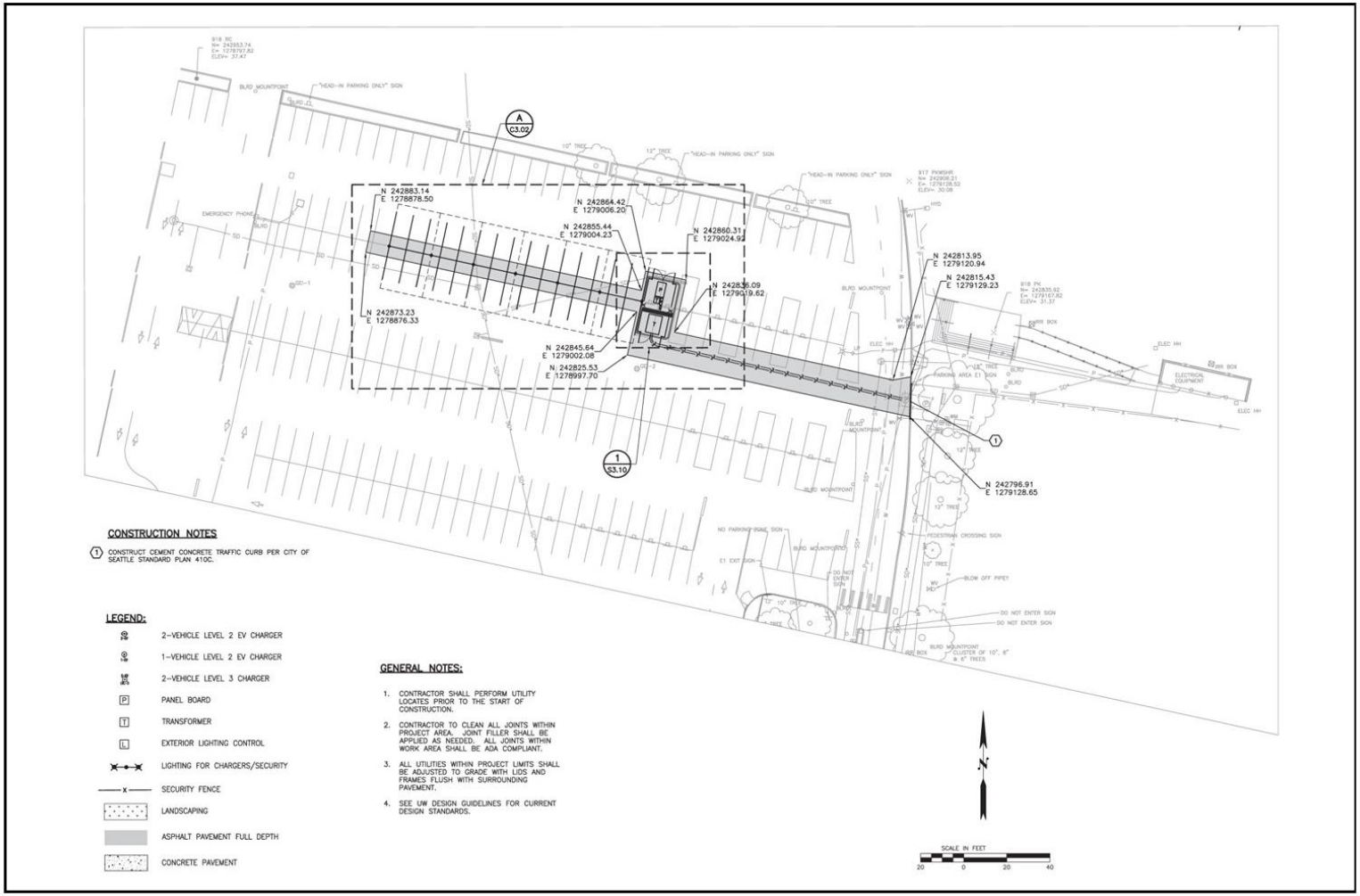
North

Source: Google Earth and EA Engineering, 2024.

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

Figure 1

Vicinity Map



Source: Reid Middleton, 2024.

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

Figure 2
Site Plan

DESIGN CRITERIA

Wind Load: 90 MPH minimum
Ground Snow Load: 30 psf minimum
All Federal, State and Local codes reviewed.

COLUMNS

HSS ASTM A-500 Grade B A-500
Coating Options: Primed or Hot Dip Galvanized

BEAMS

Wide Flange A-992 Grade 50 Steel.
Coating Options: Primed or Hot Dip Galvanized

PURLINS

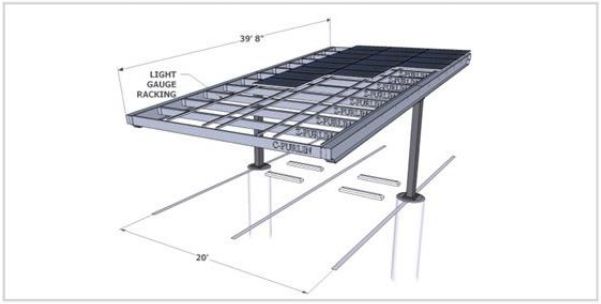
16 GA. Cold Rolled G-90 Galvanized Steel

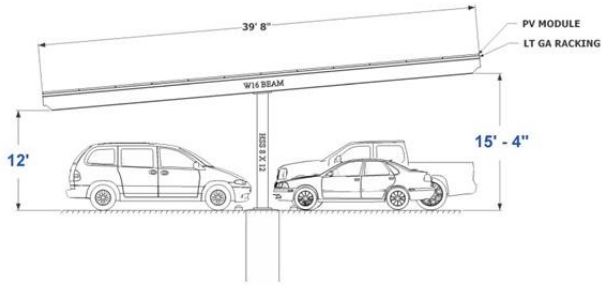
RACKING

16 GA. Cold Rolled G-90 Galvanized Steel
Cold formed Z or hat shaped section pre-punched to receive solar module.

OPTIONS

Fixed Tilt slope up to 10°
Hot Dip Galvanizing
Site Specific Layout and Configuration
Solar Racking
End Overhangs 1'
Roof Sheeting
Soffit Under Sheeting





Source: Carport Structures Corporation, 2024.

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

Figure 3
Canopy Elevations

Sections of the proposed solar canopy would be supported by two columns and would range in height from 12 to 15.4 feet. Underground features would include concrete foundations for the support columns, as well as electrical lines and equipment. Approximately 5,500 sq.ft. of existing asphalt pavement would be removed to accommodate the underground facilities; all demolished pavement would be replaced following installation of the underground facilities. Supporting electrical equipment would be installed within the landscaped area at the east edge of the site. Because conduit runs must connect to an electrical vault, there is a potential to disrupt tree roots. The University proposes to avoid the trees if at all possible. If the tree roots are disrupted, extra care would be taken to support the trees health or replace impacted trees at a ratio of 2:1, as necessary.

12.Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any. If a proposal would occur over a range of area, provide the range or boundaries of the site(s).

The proposed ***Parking Lot E18 Solar Canopy Project*** site is located in the southeast portion of the University of Washington Seattle campus. The project site (including area proposed for solar canopy and underground electrical lines/equipment) consists of paved surface parking associated with Lot E18, paved drive area, and landscaped area with up to two mature trees. The site is generally bounded by sidewalk and the track and soccer facilities to the east, with surface parking lot area associated with Lot E18 to the north, west and south (see **Figures 1** and **2**).

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site (circle one):
Flat, rolling, hilly, steep slopes, mountainous,
other:_____

The ***Parking Lot E18 Solar Canopy Project*** site is generally flat and currently contains a surface parking lot with a small area in landscape area.

b. What is the steepest slope on the site (approximate percent slope)?

According to the City of Seattle's Environmentally Critical Areas (ECA) Maps, there are no steep slope hazard areas located on the site. The site generally slopes from an elevation of 36 feet at the west edge of the site to an elevation of 31 feet at the east edge of the site.

c. 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 agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

The site and immediate vicinity is mapped as advance outwash and pre-Fraser deposits. Advance outwash generally consists of dense to very dense well sorted sand and gravel. In general, soils at the site consist of relatively shallow fill overlaying landfill refuse, peat, soft clay and glacially consolidated soils at depth. See **Appendix A** for the Geotechnical Report.

According to the publicly available City of Seattle's Environmentally Critical Areas (ECA) GIS Maps, the project site area is listed as a Peat-Settlement Prone Area, Liquefaction Prone Area, and within the footprint of the abandoned Montlake Landfill. The proposal is to support the solar canopy with deep foundations consisting of small-diameter steel piles. See **Appendix A** for the Geotechnical Report.

The proposed project site does not contain agricultural land areas of commercial significance.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

According to the publicly available City of Seattle's Environmentally Critical Areas (ECA) GIS Maps, the project site area is listed as a Peat-Settlement Prone Area, Liquefaction Prone Area, and within the footprint of the abandoned Montlake Landfill. The proposal is to

support the solar canopy with deep foundations consisting of small-diameter steel piles. The solar canopy would be designed to tolerate liquefaction-induced and static differential settlements. Flexible utility connections would be provided where electrical utilities tie into the structure to account for settlement. There are no steep slope areas or potential slide areas listed on the City of Seattle ECA GIS map at the project site (see **Appendix A** for details).

e. Describe the purpose, type, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

Construction of the proposed solar canopy and electrical lines/equipment would require some excavation for electrical utility trenching; subsequent to placement of underground electrical utilities, structural fill would be backfilled to the trench and new asphalt paving provided. Existing fill soil below the pavement and any landfill refuse would be treated as contaminated material and would be treated accordingly. Soil removed from the site would be transported to an approved location. The source of fill is unknown at this time but would also be from an approved source.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Temporary erosion is possible in conjunction with any construction activity. Site work would expose soils on the site, but the implementation of a Temporary Erosion Sedimentation Control (TESC) plan that is consistent with City of Seattle standards and the implementation of best management practices (BMPs) during construction would mitigate any potential impacts.

Once the project is operational, no erosion is anticipated.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

The majority of the site is currently covered with existing impervious surfaces, including existing surface parking and drive area. With the proposed project, the amount of impervious surface on the site would be the same as under existing conditions.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

The mitigation of erosion impacts are addressed in individual permit reviews under the *Grading and Drainage control codes* (*SMC 22.170*), and in critical area locations by the *Seattle Critical Areas ordinance*

(*SMC 25.09*), which prescribed best management practices for excavation and grading on critical areas. The 2018 Seattle Campus Master Plan EIS identifies the site areas as having a high potential for earth-related impacts. General methods to address impacts to earth are identified in Section 3.1.1 and Section 3.1.3 of the Final EIS, including the implementation of TESC measures.

According to the City of Seattle's Environmentally Critical Areas (ECA) GIS Maps, the project site area is listed as a Peat-Settlement Prone Area, Liquefaction Prone Area, and within the footprint of the abandoned Montlake Landfill. The proposal is to support the solar canopy with deep foundations consisting of small-diameter steel piles to limit settlement associated with peat and liquefaction prone conditions (see **Appendix A**).

Because the proposed ***Parking Lot E18 Solar Canopy Project*** does not include confined space (i.e. enclosed building) methane gas accumulation associated with the landfill is not anticipated.

Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

2. Air

a. What type of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

During construction, the ***Parking Lot E18 Solar Canopy Project*** could result in temporary increases in localized air emissions associated with particulates and construction-related vehicles. It is anticipated that the primary source of temporary, localized increases in air quality emissions would result from particulates associated with demolition of a paved surface, on-site excavation and site preparation. While the potential for increased, air quality emissions could occur throughout the construction process, the timeframe of greatest potential impact would be at the outset of the project in conjunction with the site preparation and excavation/grading activities. However, as described above under the Earth discussion, minimal amounts of excavation would be required for the project and air quality emission impacts are not anticipated to be significant.

Temporary, localized emissions associated with carbon monoxide and hydrocarbons would result from diesel and gasoline-powered construction equipment operating on-site, construction traffic accessing the project site, and construction worker traffic. However, emissions from these vehicles and equipment would be small and temporary and are not anticipated to result in a significant impact.

No emissions would be anticipated with operation of the solar canopy. In general, solar generated electricity is proposed to contribute to a reduction in emissions associated with fossil fuels, and as a result, significant adverse air quality impacts would not be anticipated.

Another consideration with regard to air quality and climate relates to Greenhouse Gas Emissions (GHG). In order to evaluate climate change impacts of the proposed project relative to the requirements of the City of Seattle, a Greenhouse Gas Emissions Worksheet has been prepared (**Appendix B** of this Environmental Checklist). This Worksheet estimates the emissions from the following sources: embodied emissions (construction); energy-related emissions; and, transportation-related emissions. In total, the estimated emissions for the proposed project would be limited to construction and be approximately 186 $MTCO_2e$[2]. As indicated, solar generated electricity is proposed to contribute to an overall reduction in emissions associated with fossil fuels.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

The primary off-site source of emissions in the site vicinity is vehicle traffic in the E18 parking lot and on surrounding roadways, including Montlake Boulevard NE which is approximately 300 feet to the west of the site. There are no known offsite sources of air emissions or odors that would affect the proposed project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for air quality impacts.

Short term impacts to air quality arising for construction, (fugitive dust and airborne particulates) are mitigated by adherence to *Puget Sound Clean Air Agency regulations PSCAA - Reg 1 - Section 9.15* (*1-9 Emission Standards*), *PSCAA – Reg 3 – Article 4 (Asbestos Control Standards)*, the *Seattle Stormwater Drainage Code 22.800*, and *Grading Code 22.170* and the best management practices for controlling erosion described above from the Seattle Municipal Code.

Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

2 $MTCO_2e$ is defined as Metric Ton Carbon Dioxide Equivalent and is a standard measure of amount of CO2 emissions reduced or sequestered.

3. Water

a. 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.

There are no surface water bodies on or in the immediate vicinity of the ***Parking Lot E18 Solar Canopy Project*** site. The nearest surface water body is Union Bay, which is located approximately 750 feet to the southeast of the project site (see **Figure 1**).

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

The proposed project will not require any work over, in, or adjacent (within 200 feet) to any water body.

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 or dredge material would be placed in or removed from any surface water body as a result of the proposed project.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

The proposed project would not require any surface water withdrawals or diversions.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

The proposed project site does not lie within a 100-year floodplain and is not identified as a flood prone area on the City of Seattle Environmentally Critical Areas map (*City of Seattle, 2022)*.

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.

There would be no discharge of waste materials to surface waters.

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

Excavations for utility trenches and other underground improvements would be above the regional groundwater. However, perched groundwater on top of less permeable layers within the existing fill could be encountered. Sumps and pumps would be provided in the trenches during construction to provide temporary dewatering. Permanent groundwater dewatering or discharge is not anticipated as part of this project.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources; industrial, containing the following 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.

Waste material would not be discharged into the ground from septic tanks or other sources as a result of the proposed project.

c. Water Runoff (including storm water):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Stormwater runoff from the site would not change and would continue to be controlled in accordance with the *City of Seattle Stormwater and Drainage Code, SMC Title 22* and similar to the rest of campus, stormwater would ultimately discharge to the University of Washington storm drainage system which drains to the Union Bay area of Lake Washington.

2) Could waste materials enter ground or surface waters? If so, generally describe.

The existing stormwater management system for the site would continue to ensure that waste materials would not enter ground or surface waters as a result of the proposed project.

3) Does the proposal alter or otherwise affect drainage patterns in *the vicinity of the site? If so, describe.*

The proposed project would not alter or otherwise affect drainage patterns in the site vicinity.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for stormwater impacts. Stormwater for the proposed project site would discharge to the University of Washington's storm drainage system which ultimately drains to the Union Bay area of Lake Washington. The existing on-site system at UW has adequate capacity for the proposed ***Parking Lot E18 Solar Canopy Project***.

Additionally, all existing local regulations under the Stormwater and Drainage Code, SMC Title 22, apply. Pursuant to the Overview Policy *SMC 25.05.665*, no further mitigation is warranted.

4. Plants

a. Check or circle types of vegetation found on the site:

X deciduous tree:
__evergreen tree:
__shrubs
__ grass
__ pasture
__ crop or grain
__ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
__ water plants: water lily, eelgrass, milfoil, other
_ other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

The majority of the ***Parking Lot E18 Solar Canopy Project*** site is in paved surface parking lot. The east edge of the site contains landscape planter area with two mature deciduous trees. Because conduit runs must connect to electrical vault, there is a potential to disrupt tree roots. The University proposes to avoid the trees if at all possible. If the tree roots are disrupted, extra care would be taken to support the trees health or replace impacted trees at a ratio of 2:1, as necessary.

c. List threatened or endangered species known to be on or near the site.

No known threatened or endangered species are located on or proximate to the project site.

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

The majority of the ***Parking Lot E18 Solar Canopy Project*** site is in paved surface parking lot. The east edge of the site contains landscape planter area with two mature deciduous trees. Because conduit runs must connect to electrical vault, there is a potential to disrupt tree roots. The University proposes to avoid the trees if at all possible. If the tree roots are disrupted, extra care would be taken to support the trees health or replace impacted trees at a ratio of 2:1, as necessary.

e. List all noxious weeds and invasive species known to be on or near the site.

Noxious weeds or invasive species that could be present in the vicinity of the site include giant hogweed, English Ivy and Himalayan blackberry.

5. Animals

a. Circle (underlined) any birds and animals that have been observed on or near the site or are known to be on or near the site:

birds: **songbirds,** hawk, heron, eagle**, other: seagulls, pigeons,**
mammals: deer, bear, elk, beaver**, other:** **squirrels,** raccoons, **rats, mice**
fish: bass, salmon, trout, herring, shellfish**, other:** **None.**

Birds and small mammals tolerant of urban conditions may use and may be present on and near the ***Parking Lot E18 Solar Canopy Project*** site. Mammals likely to be present in the site vicinity include: eastern gray squirrel, mouse, and rat.

Birds common to the area include: European starling, house sparrow, rock dove, American crow, seagull, western gull, Canada goose, American robin, and house finch.

In support of a previous project in the site vicinity (UW Basketball Training Facility) a Nesting Bird Survey was completed in 2022 to identify any active great blue heron or bald eagle nests in the site area (Shannon & Wilson, 2022). As part of that survey, no great blue heron

or bald eagle nests were observed at any location within the site vicinity area.

b. List any threatened or endangered species known to be on or near the site.

The following are listed threatened or endangered species by the U.S. Fish and Wildlife Service: marbled murrelet, streaked horned lark, yellow-billed cuckoo, bull trout, grey wolf and north american wolverine[3]. However, it should be noted that none of these species have been observed in the site vicinity and due to the urban location of the site, it is unlikely that these animals are present.

c. Is the site part of a migration route? If so, explain.

The entire Puget Sound area is within the Pacific Flyway, which is a major north-south flyway for migratory birds in America—extending from Alaska to Patagonia. Every year, migratory birds travel some or all of this distance both in spring and in fall, following food sources, heading to breeding grounds, or travelling to overwintering sites.

d. Proposed measures to preserve or enhance wildlife, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for wildlife impacts. As described under section 3.d, the UW campus has undergone Salmon Safe certification for installing campus-wide improvements and measures to protect water quality in nearby receiving waters. In addition, the 2018 Seattle Campus Master Plan contains an extensive open space element (section 1V, p. 54) which was analyzed in the 2018 Seattle Campus Master Plan Final EIS (Section 3.11). These preserved open space areas provide mitigation for encroachment of development on campus into areas which may provide habitat for native wildlife.

Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

e. List any invasive animal species known to be on or near the site.

Invasive species known to be located in King County include European starling, house sparrow and eastern gray squirrel.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy

[3] U.S. Fish and Wildlife Service. IPaC. https://ecos.fws.gov/ipac/location/index. Accessed January 2024.

needs? Describe whether it will be used for heating, manufacturing, etc.

Operation of the proposed ***Parking Lot E18 Solar Canopy Project*** would not have energy needs and would not utilize sources of energy. The proposal would provide solar generated energy to connect to the City of Seattle and UW campus grids.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

The proposal would provide solar generated energy to connect to the City of Seattle and UW campus grids and would act as a pilot project to evaluate the potential for future expansion. The proposed project would not affect the use of solar energy by adjacent properties.

d. 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:

The proposed ***Parking Lot E18 Solar Canopy Project*** would provide solar generated energy to connect to the City of Seattle and UW campus grids and would act as a pilot project to evaluate the potential for future expansion. The proposed project represents a measure to minimize use of fossil fuel generated energy.

Pursuant to the Overview Policy at *SMC* *25.05.665*, no further mitigation is warranted.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

As with any construction project, accidental spills of hazardous materials from equipment or vehicles could occur during the construction of the ***Parking Lot E18 Solar Canopy Project***; however, a spill prevention plan would minimize the potential of an accidental release of hazardous materials into the environment.

According to the City of Seattle ECA Maps, the project site is located within the footprint of the abandoned Mountlake landfill (see **Appendix A** for details).

1) Describe any known or possible contamination at the site from present or past uses.

As noted above, the site is located in an area of a former abandoned landfill. It is anticipated that the fill over the former landfill is at a depth where there is a possibility to encounter waste during excavation activities on the site. Debris piling, testing, and appropriate disposal and safety protocols would be followed in accordance with the University's Montlake Landfill Project Guide and no significant impacts would be anticipated. Because the proposed ***Parking Lot E18 Solar Canopy Project*** does not include confined space (i.e. building space) methane gas accumulation associated with the abandoned landfill is not anticipated.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

Other than the waste associated with the abandoned landfill described for 7.a.2., no existing hazardous materials anticipated to be encountered.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

During construction, gasoline and other petroleum-based products would be used for the operation of construction vehicles and equipment.

It is not anticipated that hazardous materials would be associated with solar panel instillation or operations.

4) Describe special emergency services that might be required.

No special emergency services are anticipated to be required as a result of the project.

5) Proposed measures to reduce or control environmental health hazards, if any:

Washington State occupational health and safety standards and local fire code requirements ensuring the use of toxic or flammable materials is adequately addressed in the campus setting.

Pursuant to the Overview Policy at *SMC* *25.05.665*, no further mitigation is warranted.

b. Noise

1) What types of noise exist in the area that may affect your project (for example: traffic, equipment operation, other)?

Traffic noise associated with adjacent roadways and parking areas (Montlake Boulevard NE, NE Wahkiakum Lane, Parking Lot E18), as well as activity associated with surrounding athletic facilities (Husky Track, Husky Soccer, Husky Stadium, Alaska Airlines Arena, and the Softball Stadium) are the primary source of noise in the vicinity of the project site. Existing noise in the site vicinity is not anticipated to adversely affect the proposed ***Parking Lot E18 Solar Canopy Project***.

2) 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 site.

Short-Term Noise

Temporary construction-related noise would occur as a result of on-site construction activities associated with the project. The proposed project would comply with provisions of Seattle's Noise Code (SMC, Chapter 25.08) as it relates to construction-related noise to reduce noise impacts during construction.

Long-Term Noise

The proposed ***Parking Lot E18 Solar Canopy Project*** would not be anticipated to result in any operational noise.

3) Proposed measures to reduce or control noise impacts, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a medium potential for noise impacts. Short term noise impacts deriving from construction projects are mitigated primarily through the adoption of construction noise control best practice, typically including limiting hours of construction. Measures such as the following are considered appropriate mitigation for this project:

- In accordance with City of Seattle regulations, construction activities would be limited to applicable noise levels per the City's noise regulations covering construction noise (*Seattle Municipal Code 25.08.425*).

- Given the level of existing environmental noise in the vicinity and the anticipated level of post-construction noise,

no measures would be necessary to reduce or control post-construction noise impacts from the proposed project.

Permanent onsite operations at the UW Campus are regulated by *Seattle Municipal Code Chapter 25.08* regarding maximal noise levels. Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The proposed ***Parking Lot E18 Solar Canopy Project*** site is located in the East Campus area of the University of Washington Seattle campus which is the athletic center of the campus with substantial area in surface parking lots. The project site (including area proposed for solar canopy and underground electrical lines/equipment) consists of paved surface parking lot, paved drive area, and landscaped area with up to two mature trees. The site is generally bounded by sidewalk and the track and soccer facilities to the east, with surface parking lot area to the north, west and south. NE Wahkiakum Rd. is located farther to the south and NE Montlake Blvd is located farther to the west (see **Figure 1** for an aerial map of the site and **Figure 2** for a map of the project site).

The site would be utilized for solar power generation use purposes and would not be anticipated to affect existing buildings and uses that are adjacent to the site. Once operational, the proposed solar canopy would not result in the loss of any parking or interfere with parking lot circulation.

Policies and standards under the 2019 Seattle Campus Master Plan related to minimizing potential impacts would be followed under the proposed project. Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

b. Has the site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

The project site has no recent history of use as a working farmland or forest land.

1) **Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:**

The project site is located in an urban area and would not affect or be affected by working farm or forest land; no working farm or forest land is located in the vicinity of this urban site.

c. Describe any structures on the site.

The Parking Lot E18 Solar Canopy site is in surface parking lot use and does not contain any structures.

d. Will any structures be demolished? If so, what?

No structures would be demolished as a result of the proposed project.

e. What is the current zoning classification of the site?

The site is currently zoned as Major Institution Overlay with a 65-foot height limit (MIO-65).

f. What is the current comprehensive plan designation of the site?

The current comprehensive plan designation for the site is Major Institution. (*City of Seattle, 2022*).

g. If applicable, what is the current shoreline master program designation of the site?

The project site is not located within the City's designated shoreline master program boundary.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

According to the City of Seattle Environmentally Critical Areas Map, the project site (and surrounding site vicinity) is located within the Peat Settlement-Prone Area, and Liquefaction-Prone Area (refer to Section 1, Earth, for additional information on earth conditions). The proposal is to support the solar canopy with deep foundations consisting of small-diameter steel piles to limit settlement associated with peat and liquefaction prone conditions (see **Appendix A**).

The City of Seattle ECA map also lists the site as being within the footprint of the former abandoned Montlake Landfill. Because the proposed ***Parking Lot E18 Solar Canopy Project*** does not include confined space (i.e. enclosed building) methane gas accumulation associated with the abandoned landfill is not anticipated. (see **Appendix A** for details). No other environmentally critical areas are located on or adjacent to the project site (*City of Seattle, 2022*).

i. Approximately how many people would reside or work in the completed project?

The proposed ***Parking Lot E18 Solar Canopy Project*** would not provide any employment or residential opportunities.

j. Approximately how many people would the completed project displace?

The proposed project would not displace any people.

k. Proposed measures to avoid or reduce displacement impacts, if any:

No displacement impacts would occur, and no mitigation measures are necessary.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The proposed ***Parking Lot E18 Solar Canopy Project*** would not interfere with parking or circulation associated with Lot E18 and would be compatible with parking lot use.

The 2018 Seattle Campus Master Plan EIS identifies the site areas as having a low potential for land use impacts. The site is designated as "Major Institution" under the City of Seattle Comprehensive Plan. Under the *1998 City-University Agreement*, the City of Seattle required the University of Washington to develop a conceptual Master Plan for its Seattle campus. The 2019 Seattle Campus Master Plan, developed pursuant to the Agreement and adopted by the University and the Seattle City Council, governs future development within the Major Institution Overlay zone. Pursuant to the Overview Policy at *SMC* *25.05.665*, no further mitigation is warranted.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

The project site is not located near agricultural or forest lands and no mitigation measures are necessary.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

No housing units would be provided as part of the ***B Parking Lot E18 Solar Canopy Project***.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

No housing presently exists on the site and none would be eliminated.

c. Proposed measures to reduce or control housing impacts, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for housing impacts. As noted above, the site is located with the Major Institution Overlay zone under the 2019 Seattle Campus Master Plan. Adherence to the 2019 Seattle Campus Master Plan is de facto compliance with the Seattle Comprehensive Plan policies and Map. Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Each section of the proposed 4,820 sq.ft solar canopy would be supported by two columns and range in height from 12 to 15.4 feet; the height of the solar canopy structure would be below the 65-foot height limit of the site zoning.

The rack (roof structure) of the solar canopy would consist of galvanized steel. The solar panels would be laid on top of the rack structure (see Figure 1).

b. What views in the immediate vicinity would be altered or obstructed?

Viewers to the site primarily include motorists utilizing Montlake Blvd NE., NE Wahkiakum Rd, other portions of Parking Lot E18 and Lot E1, as well as people attending events at the Track and Soccer facilities. The existing view of the site primarily consists of a surface parking lot, with mature trees at the east edge of the site.

The proposed ***Parking Lot E18 Solar Canopy Project*** would be visible and would be the tallest structure (12 to 15 feet in height) within the surface parking lot. The canopy structure would be relatively transparent (i.e. no structure walls) and would not substantially change the visual character of the area.

The 2019 Compiled Campus Master Plan identifies a view corridor (#3) from the Computer Science and Engineering Building in Central Campus to the east across East Campus toward Union Bay; the site in not located within this broad view corridor and would not impact the view from the Computer Science and Engineering Building viewpoint.

c. Proposed measures to reduce or control aesthetic impacts, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site areas as having a medium potential for aesthetics impacts. The 2019 Seattle Campus Master Plan contains adopted policies and development standards for the whole of the Campus. Pursuant to the Overview Policy at *SMC* *25.05.665*, no further mitigation is warranted.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Short-Term Light and Glare

At times during the construction process, area lighting of the project site (to meet safety requirements) may be necessary, which would be noticeable proximate to the project site. In general, however, light and glare from construction of the proposed project are not anticipated to adversely affect adjacent land uses.

Long-Term Light and Glare

Under the proposed ***Parking Lot E18 Solar Canopy Project***, there would be an increase in light and glare with the proposed solar canopy compared to the existing conditions due to glazing associated with the solar panels forming the roof of the canopy structure, and under canopy lights for parking space security and to eliminate dark

spots. Light and glare associated with the proposal would not be anticipated to be noticeable from beyond the immediate area.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Light and glare associated with the proposed project would not be expected to cause a safety hazard or interfere with views.

c. 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.

d. Proposed measures to reduce or control light and glare impacts, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for light and glare impacts. The proposed Softball Performance Facility is designed to be consistent with the University's existing internal design review process which considers the effect of architectural glazing, lighting, landscape designs to ensure that impacts from light and glare are adequately mitigated. Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

There are several University athletic/recreational facilities in the vicinity (approximately 0.5 miles) of the ***Parking Lot E18 Solar Canopy Project*** site, including:

- Husky Track to the immediate east;
- Husky Soccer to the immediate east;
- The Intermural Activities (IMA) Building, Tennis Courts, IMA Sports Fields to the south;
- Chaffey Field (Baseball) to the south;
- Alaska Airlines Arena (Hec Edmundson Pavilion) to the south;
- Husky Stadium to the south; and,
- Golf Driving Range to the north.

b. Would the proposed project displace any existing recreational uses? If so, describe.

The ***Parking Lot E18 Solar Canopy Project*** would not displace any existing recreational uses.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for park and recreation impacts. The University Campus is open to the public during normal daylight hours and provides an extensive network of public trails and open space. The City of Seattle Comprehensive Plan relies upon the UW campus as an element of the City's public open space inventory. The 2019 Seattle Campus Master Plan identifies and categorizes open space areas on campus.

Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

13. Historic and Cultural Preservation

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

No buildings or structures eligible for listing are located on or immediately adjacent to the site.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

The project site is not located within the designated City of Seattle Government Meander Line Buffer, with properties located within that area required to prepare an archaeological investigation as part of the SEPA and MUP processes. The cultural resources sensitivity analysis conducted for the 2018 Seattle Campus Master Plan EIS indicates that the site area has a low potential to encounter sensitive cultural resource conditions and standard best practices and code compliance would be adequate.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

The DAHP website, WISAARD, and the City of Seattle Department of Neighborhoods Landmarks Map and List were consulted to identify any potential historic or cultural sites in the surrounding area, as well as the potential for encountering archaeological resources in the area.

Additionally, the cultural resources sensitivity analysis in the 2018 Seattle Campus Master Plan EIS indicates that the site has a low potential for sensitive historic resources and medium for sensitive cultural resource conditions. Given that proposed site disturbance would be limited to shallow excavation within disturbed fill material, significant cultural resources impacts are not anticipated.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for historic and medium[4] potential for cultural resources impacts. Mitigation measures were identified in the 2018 Seattle Campus Master Plan Final EIS and would be applicable for this project, including:

- The University of Washington's existing site selection and internal design review processes (architectural, landscape, environmental review, and Board or Regents) would continue to review and authorize major building projects in terms of siting, scale, and the use of compatible materials relative to recognized historic structures.

Pursuant to the Overview Policy at *SMC 25.05.665*, no further mitigation is warranted.

[4] *Medium potential is primarily assigned to the shoreline and not in the E18/E1 lot areas given the paving over fill soil and landfill*

14. Transportation

a. Identify public streets and highways serving the site or affected geographic area and describe the proposed access to the existing street system. Show on site plans, if any.

The ***Parking Lot E18 Solar Canopy Project*** site is located immediately north of NE Wahkiakum Rd which is an internal campus roadway that connects with Montlake Blvd NE approximately 350 feet to the west.

No changes to site access or access to parking are proposed.

b. Is site or affected geographic area currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

The University of Washington Link Light Rail station is located approximately 0.25 mile to the southwest of the ***Parking Lot E18 Solar Canopy Project*** site and provides service to Capitol Hill, Downtown Seattle and SeaTac Airport. King County Metro Transit (Metro) provides bus service in the vicinity of the site. Numerous transit routes have stops in the vicinity of the site, including Route 43, 44, 48, 65, 73, 167, 255, 271, 542, 556 and 586.

c. How many additional parking spaces would the completed project have? How many would the project or proposal eliminate?

The approximately 140 parking spaces located within the site would be temporarily displaced during the approximately six-month construction period.

Upon completion of construction, the proposed ***Parking Lot E18 Solar Canopy Project*** would include new asphalt pavement with replacement of the approximately 140 parking spaces displaced during construction. Approximately 30 of the parking spaces would be located under the solar canopy.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

During construction a portion of the internal Parking Lot E18 drive aisles would be temporarily rerouted. Following construction, internal circulation within Parking Lot E18 would be restored and would not change from existing conditions. No other improvements to existing

roads, streets, pedestrian, bicycle or state transportation facilities are anticipated.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

The project would not use or occur in the immediate vicinity of water or air transportation. As noted above, the University of Washington Link Light Rail Station is located to the southwest of the site is utilized by University students and employees.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

Construction of the proposed project would temporarily generate some additional vehicle trips associated with construction workers and equipment/vehicles travelling to and from the site during the construction process. Construction activities would be in compliance with applicable University of Washington and City of Seattle regulations, which would include preparation of a Construction Management Plan to minimize potential construction-related transportation issues.

Once operational, the proposed project would not result in an increase in vehicle trips.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

There are no agricultural or forest product uses in the immediate site vicinity and the project would not interfere with, affect or be affected by the movement of agricultural or forest products.

h. Proposed measures to reduce or control transportation impacts, if any.

Construction activities would occur in compliance with applicable University of Washington and City of Seattle regulations and would include the preparation of a Construction Management Plan to control and minimize potential construction-related transportation issues.

Pursuant to the Overview Policy at *SMC* *25.05.665*, no further mitigation is warranted.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

The ***Parking Lot E18 Solar Canopy Project*** is not anticipated to generate an increase in the need for public services. To the extent that emergency service providers currently serve the surface parking lot site, the level of need for these services would continue.

b. Proposed measures to reduce or control direct impacts on public services, if any.

The 2018 Seattle Campus Master Plan EIS identifies the site area as having a low potential for public service impacts. General methods to address impacts to public services are identified in Section 3.14.3 of the EIS, including all development constructed in accordance with applicable Seattle Fire Code requirements; review of development projects for life/safety and security issues; and, UWPD could increase its staff capacity and operations, if necessary, to meet security needs for the campus. Pursuant to the Overview Policy at *SMC* *25.05.665*, no further mitigation is warranted.

16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

Electricity utility lines and equipment are located at or adjacent to the site. The proposed project would not affect natural gas, water, sanitary sewer, telephone, cable/internet services.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity that might be needed.

The proposal would provide solar generated electricity to connect to the City of Seattle and UW campus grids and would act as a pilot project to evaluate the potential for future expansion. The proposed project would not affect the use of solar energy by adjacent properties.

The proposal would not utilize or affect other utilities in the vicinity.

C. SIGNATURES

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

Signature:

Name of Signee:

Julie Blakeslee

Position and Agency/Organization:

SEPA Responsible Official

Date:

January 26, 2024

REFERENCES

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Appendix A

Geotechnical Report

Geotechnical Engineering Services

Parking Lot E-18 Solar Canopy
Seattle, Washington

for
University of Washington

September 20, 2023

GeoEngineers

17425 NE Union Hill Road, Suite 250
Redmond, Washington 98052
425.861.6000

Geotechnical Engineering Services

Parking Lot E-18 Solar Canopy
Seattle, Washington

File No. 0183-156-00

September 20, 2023

Prepared for:

University of Washington
Capital Planning & Development
Facilities Services Administration Building
UW Box 352205, Seattle, Washington 98105

Attention: Warren Phillips

Prepared by:

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Colton W. McInelly, PE
Geotechnical Engineer

_____

Robert C. Metcalfe, PE, LEG
Principal

CWM:RCM:mce

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APPENDICES

1.0 INTRODUCTION

This geotechnical engineering report presents the results of GeoEngineers, Inc.'s (GeoEngineers) geotechnical engineering services to support the Parking Lot E-18 Solar Canopy project at the University of Washington (UW) campus in Seattle, Washington. The location of the site and general configuration of the existing site features is shown on the Vicinity Map and Site Plan, Figures 1 and 2, respectively.

1.1. Project Description

We understand that the UW is planning to construct solar canopies in existing Parking Lot E-18 to provide solar charging stations for electric vehicles. The UW is planning to complete this work in multiple phases with Phase 1 consisting of a solar canopy in Parking Lot E-18 that will cover approximately 40 existing parking stalls. The canopy will provide 84kW of electrical power and will be connected to the City of Seattle and UW Campus electrical grids and will be capable of connections to future UW charging stations. Additional canopies may be constructed in the vicinity during future phases.

1.2. Purpose and Scope

The purpose of our services is to evaluate soil and groundwater conditions as a basis for developing design criteria for the geotechnical aspects of the project. Field explorations were performed to identify and evaluate subsurface conditions at the site to develop engineering recommendations for use in the design of the project. Our services were performed in general accordance with our contract with the UW for Project No. 208100, dated June 28, 2023.

2.0 FIELD EXPLORATIONS

Subsurface conditions were evaluated by reviewing existing explorations previously performed by others in the project area and through a field exploration program that consisted of drilling and sampling two hollow-stem auger borings (designated GEI-1 and GEI-2).

2.1. Explorations

The two borings were completed along the south side of the proposed Phase 1 canopy using track-mounted drilling equipment. The approximate locations of the borings are shown in Figure 2. The borings were located between the Phase 1 planned canopy footprint and the potential future expansion area.

Borings GEI-1 and GEI-2 were advanced to depths of about 26½ feet below the ground surface (bgs). Locations of the borings were determined in the field by measuring from physical features on site to the boring locations. Appendix A includes the logs of the borings (Figures A-2 and A-3) and details of the subsurface borings performed.

2.2. Previous Studies

The logs of selected explorations from previous site evaluations in the project vicinity were reviewed and the approximate location of one of these explorations (DH-2), which was closest to the project site, is shown in Figure 2. The log for boring DH-2 is presented in Appendix B.

3.0 SITE DESCRIPTION

3.1. Surface Conditions

The site is currently occupied by parking stalls within Parking Lot E-18 and is bounded by Parking Lot E-18 on all sides. Site grades slope gently to the south/southeast from approximately Elevation (El.) 36 feet on the west side of the parking stalls to El. 31 feet on the east side of the parking stalls. The entire site is surfaced with asphalt pavement.

3.2. Site Geology

We reviewed the Geologic Map of Northeastern Seattle (Part of the Seattle North 7.5'x15' Quadrangle), King County (Booth et al. 2009). The soils across most of the campus located upslope and west of Montlake Boulevard are mapped as glacial till, which generally consists of dense to very dense silty sand with gravel, cobbles and occasional boulders deposited below glaciers. Glacial till commonly includes an upper medium dense weathered zone.

The lower slope on the east side of the campus near Montlake Boulevard is mapped as advance outwash and pre-Fraser deposits. Advance outwash generally consists of dense to very dense well sorted sand and gravel which were glacially overridden. Pre-Fraser deposits generally consists of very dense interbedded sand, gravel, silt, and widely sorted sediment that was deposited prior to the last glaciation and subsequently consolidated by glaciers.

The area east of Montlake Boulevard and in the project area is mapped as peat deposits, landfill debris and artificial fill. The highly compressible peat was deposited in shallow water at the north end of Union Bay, and these soils were exposed when the level of Lake Washington was dropped after the completion of the Ballard Locks. The Montlake (Ravenna) Landfill located immediately under Parking Lot E-18 was operated from about 1926 to 1966, and landfill materials were placed on top of the peat deposits. Artificial fill is mapped throughout the slope on the east side of campus and is associated with previous development of this portion of the campus. Fill was also placed over the landfill debris under the parking lot.

Soils mapped in the immediate vicinity of Parking Lot E-18 are mapped as peat deposits and landfill debris.

3.3. Geologic Hazards

Our assessment of the geologic hazards at the site includes reviewing the environmentally critical areas (ECAs) defined by the City of Seattle Department of Construction and Inspections (SDCI) as well as the Montlake Landfill map provided by the UW. Based on our review, the site is located in liquefaction prone and peat settlement prone areas as well as within the Montlake Landfill footprint. Further discussion on these ECAs is presented in Section 4.1.

3.4. Subsurface Soil Conditions

Our understanding of subsurface soil conditions is based on the results of our two borings (GEI-1 and GEI-2) and on our review of existing geotechnical information from previous studies in the vicinity of the site (see Figure 2 for the exploration locations). In general, the soils at the site consist of relatively shallow fill overlying landfill refuse, peat, soft clay and glacially consolidated soils at depth.

Asphalt concrete pavement exists at the ground surface and was measured at approximately 3½ and 2½ inches thick in borings GEI-1 and GEI-2, respectively. Fill was observed directly beneath the asphalt in both borings and consists of medium dense silty sand with gravel. The fill is associated with the landfill cap that was placed over landfill refuse after the Montlake Landfill was closed and was observed to be about 4½ and 1½ feet thick in GEI-1 and GEI-2, respectively. Varying landfill cap fill thickness should be expected across the Montlake Landfill and below Parking Lot E-18, based on our experience.

Landfill refuse was observed beneath the fill in both borings and varied significantly between the two borings. The landfill refuse observed in GEI-1 consisted of an approximately 5-foot-thick layer of very loose silty sand with wood and metal debris directly beneath the fill, underlain by very soft to stiff sandy silt with variable gravel content, organic matter, wood, glass and cardboard debris to the depth explored.

In GEI-2, the landfill refuse consisted of an approximately 5½-foot-thick layer of medium dense silty sand with occasional gravel, plastic and wood debris, underlain by a 6-foot-thick layer of wood debris. Stiff sandy silt with wood debris was encountered at depths of 13 to 18 feet bgs. Another layer of wood debris was observed beneath the sandy silt to a depth of about 23 feet. Medium dense silty sand with wood debris was observed beneath this additional wood layer to the depth explored.

Based on existing explorations, the refuse ranges from about 30 to 50 feet thick in the vicinity of the site. Soft peat underlies the refuse and ranges in thickness from about 10 to 25 feet. Beneath the peat is a layer of soft clay and silt that is anywhere from about 10 to 50 feet thick in the site vicinity. Glacially consolidated silt and sand exists beneath these deposits at depth, anywhere from about 70 to 110 feet below grades in the site vicinity.

3.5. Groundwater Conditions

Our understanding of the groundwater is based on groundwater measurements taken at the time of drilling of the two borings completed for this study. Groundwater was measured at about 14.2 and 11.4 feet beneath existing site grades in GEI-1 and GEI-2, respectively. Based on these measurements, groundwater is located around Elevation 19 to 21 feet which corresponds roughly with Lake Washington, which is located around Elevation 18 feet.

Groundwater observations represent conditions observed during drilling and may not represent the groundwater conditions throughout the year. Perched water should be expected above the groundwater table on top of less permeable fill and possibly within pockets of the landfill refuse. Therefore, groundwater seepage should be expected above the groundwater table, within the fill and refuse, and will fluctuate as a result of season, precipitation and other factors. The observed groundwater table is likely associated with Lake Washington and may fluctuate with the lake level, as well as in response to precipitation, season and other factors.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our field exploration program, on review of existing explorations and engineering analysis, we conclude that the proposed improvements can be completed as planned. Geotechnical considerations and our recommendations for the project are presented in the following sections of this report.

4.1. Environmentally Critical Areas

Based on our review of ECA maps on the SDCI GIS website and the Montlake landfill map provided by the UW, the site is located in liquefaction prone and peat settlement prone ECAs as well as within the Montlake Landfill footprint.

4.1.1. Liquefaction Prone ECA

The liquefaction prone ECA is associated with lake deposits around Lake Washington encountered in the explorations within the site vicinity. The solar canopy structure will be supported on either shallow foundations or on deep foundations that will be founded within the landfill refuse, which is above the liquefaction prone soil deposits. The canopy structure will be allowed to settle if liquefaction occurs during the design earthquake; therefore, the canopy structure should also be designed to handle differential settlement that may occur. Other planned improvements have no structures associated with them; therefore, in our opinion there is no need to mitigate liquefaction induced settlement for these improvements. The parking lots will settle with the soil around it. Some differential settlement may occur, and cracking and damage to hardscape features should be expected. Liquefaction is discussed in more detail in Section 4.2.2. Support of the solar canopy is discussed in Section 4.5.

4.1.1. Peat Settlement-Prone ECA

The peat settlement prone ECA is associated with historic peat deposits from Lake Washington and are present in the lowlands in the vicinity of Montlake Boulevard, including beneath the site. Based on existing explorations, peat is present below the landfill refuse at depths ranging from about 50 to 65 feet. The peat generally ranges in thickness between 10 to 25 feet.

Existing site grades will not be changed as part of this project; therefore, loading conditions of the peat will effectively remain the same (vertical loads from the new solar canopy will be distributed and dispersed above the peat, with very little new loading on the peat). Because of this, the improvements will not induce significant additional settlement of the peat. The peat will continue to settle over time at the same rate as existing conditions. If the recommendations in this report are followed for foundation support, the improvements will not significantly impact the peat any more than the existing conditions already impact the peat. Further discussion about peat settlement is discussed in Section 4.3.

4.1.1. Abandoned Landfill ECA

The site is located within the former Montlake Landfill, which is an abandoned methane-producing landfill. Seatle Municipal Code (SMC) 25.09.220 requires evaluation of methane gas accumulation.

The UW has methane mitigation measures in place in the vicinity that prevent the buildup of potential methane gas from below parking lots in the area. Passive ventilation of potential methane gas is provided by collection systems and vent pipes that are located in strategic locations throughout the area. The system

vents methane gas to the atmosphere. Furthermore, the parking lot is an open space which allows methane gas to be positively ventilated to the atmosphere naturally. No confined spaces, such as buildings, are planned as part of the improvements. Because of this, it is our opinion that methane gas accumulation is a low risk for the project.

4.2. Earthquake Engineering

We evaluated the site for seismic hazards, including liquefaction, lateral spreading, fault rupture and earthquake-induced landsliding.

4.2.1. 2018 IBC Seismic Design Information

The 2018 International Building Code (IBC) references the 2016 version of Minimum Design Loads for Buildings and Other Structures (American Society of Civil Engineers [ASCE] 7-16) for the Site Class determination and the development of seismic design parameters. Per ASCE 7-16 Section 20.3.1, the site is classified as Site Class F due to the presence of potentially liquefiable soils and peat layers that are greater than 10 feet in thickness. Site-response analysis is required for Site Class F sites per Section 11.4.8; however, Section 20.3.1 provides an exception for structures that have fundamental periods of vibration less than 0.5 seconds whereby the site class may be determined in accordance with Section 20.3 and the corresponding site coefficients determined based on mapped seismic parameters in Section 11.4.4. Given the small size of the solar canopy structure, we have assumed that the fundamental period of vibration will be less than 0.5 seconds and that the exception in Section 20.2.1 applies.

Based on the subsurface data from our borings and from previously completed borings in the site vicinity, the site is best classified as Site Class E. Per ASCE 7-16 Section 11.4.8, a ground motion hazard analysis is required for structures on Site Class E with S_S greater than or equal to 1.0 g or S_1 greater than or equal to 0.2 g (where g represents gravitational acceleration). The mapped S_S and S_1 values for this site are 1.308 g and 0.454g, respectively. Alternatively, mapped seismic design parameters may be used to determine the design ground motions, provided Exceptions 1 and 3 of Section 11.4.8 are used. Using these exceptions, F_a is taken as the value for Site Class C (equal to 1.2), and T is less than or equal to T_S and the equivalent static force procedure is used for design. T represents the fundamental period of the structure and T_S=0.66 sec.

If it is determined that the fundamental period of vibration of the solar canopy is greater than 0.5 seconds, we can complete a site-specific seismic response analysis or a ground motion hazard analysis, if needed. These analyses could provide reduced seismic demands relative to the parameters in Table 1 and the requirements of ASCE 7-16 Section 11.4.8 Exceptions 1 and 3 depend on structure configuration and site-specific subsurface conditions.

TABLE 1. 2018 IBC SEISMIC PARAMETERS

2018 IBC Parameter[1]	Value
Site Class	F
Mapped MCE_R Spectral Response Acceleration at Short Period, S_s (g)	1.308
Mapped MCE_R Spectral Response Acceleration at 1-second period, S_1 (g)	0.454
Short Period Site Coefficient, F_a	1.20[2]
Long Period Site Coefficient, F_v	2.29[3]
Design Spectral Acceleration at 0.2-second period, S_{DS} (g)	1.046
T_S (sec)	0.66

Notes:

1. Parameters developed based on latitude 47.6563 and longitude -122.3004 using the Applied Technology Council (ATC) Hazards online tool (https://hazards.atcouncil.org/).
2. Per ASCE 7-16 Section 11.4.8 Exception 1.
3. For calculating T_S only

4.2.2. Liquefaction Potential

Liquefaction refers to the condition by which vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore pressures in saturated soils with subsequent loss of strength in the deposit of soil so affected. In general, soils that are susceptible to liquefaction include very loose to medium dense, clean to silty sands that are below the water table.

The evaluation of liquefaction potential depends on numerous site parameters, including soil grain size, soil density, site geometry, static stresses and the design ground acceleration. Typically, the liquefaction potential of a site is evaluated by comparing the cyclic shear stress ratio (the ratio of the cyclic shear stress to the initial effective overburden stress) induced by an earthquake to the cyclic shear stress ratio required to cause liquefaction. We evaluated the earthquake-induced cyclic shear stress ratio at this site using an empirical relationship developed by researchers for this purpose.

Analysis of standard penetration test (SPT) data from our borings and from existing borings indicate that there is a potential for liquefaction in sand layers within the fill above and below the landfill refuse that are below the groundwater. In our analyses, we assumed that the landfill refuse and peat were not liquefiable.

Liquefaction-induced free-field ground settlement is estimated to range from about 1 to 6 inches across Parking Lot E-18 at the site for the design-level earthquake. The magnitude of liquefaction-induced ground settlement will vary as a function of the characteristics of the earthquake (earthquake magnitude, location, duration and intensity) and the soil and groundwater conditions.

The solar canopy will not be designed to mitigate the risk of liquefaction-induced settlement because it will be founded on shallow spread footings or on deep foundations that extend into the landfill refuse. It should be designed for life safety during an earthquake.

4.2.3. Lateral Spreading

Ground rupture from lateral spreading is associated with liquefaction. Lateral spreading involves lateral displacements of large volumes of liquefied soil and can occur on near-level ground as blocks of surface soils displace relative to adjacent blocks.

Preliminary analyses were performed to assess lateral spreading potential due to liquefiable soils during the design level earthquake. Lateral spreading analyses were performed based on bathymetry data shown in a nautical chart developed by the National Oceanic and Atmospheric Administration (NOAA). The chart provides rough bathymetry data in Union Bay. The solar canopy is located approximately 900 feet northwest of Union Bay. Based on our analyses, ground rupture due to lateral spreading is unlikely at the site and, therefore, piles supporting the solar canopy (if used) will not be impacted significantly by laterally spreading soils.

4.2.4. Ground Rupture

Because of the anticipated infrequent recurrence of earthquake events, the project site's location with respect to the nearest known fault (Seattle Fault, which roughly traverses Interstate I-90 corridor) and the relative thickness of the glacially consolidated soils below the site, it is our opinion that the risk of ground rupture at the site resulting from surface faulting is low.

4.2.5. Landslides

Given the relatively flat topography, it is our opinion that landsliding as a result of strong ground shaking is unlikely at this site.

4.3. Static Settlement

Based on our review of University of Washington records (including settlement points established in the vicinity of the site), our experience at the site, as well as the results of our recently completed and existing explorations at and within the site vicinity, there is a potential for large total and differential settlement at the site.

The landfill refuse, peat and soft clay that underly the site are highly compressible and have variable depths and thicknesses. These soils have and will continue to experience primary consolidation and secondary compression under the applied loads of fill that was placed over the landfill debris to develop the area. The thickness of this fill is highly variable and is as deep as 15 to 20 feet in some areas.

Landfill refuse and peat settle differently than clays. The refuse and peat compress not only in response to applied surface loads (such as new structures or fill), but also as a result of decaying organic matter located within these materials. Clay will consolidate when new loads are applied or when stress conditions change (such as fluctuating water levels which impacts the effective stresses).

Shannon & Wilson summarized a series of ground surface settlement measurements in the site vicinity over a 2-year period between 2006 and 2008. These measurements showed ground settlement caused by decaying organic matter of about ½ to 1 inch per year. The rate at which the organic material decays depends on numerous factors, including but not limited to the depth below the ground surface, the amount of oxygen the material is exposed to, and whether the material is below the groundwater table.

Primary consolidation begins when a load is applied and continues as excess pore pressures that are caused because of the applied load slowly dissipate over time. After primary consolidation is completed, which can take years, secondary compression occurs. Secondary compression is deformation of soil due to the reorientation of the soil structure and typically occurs in fine-grained and organic soils. Secondary compression occurs at a much slower rate than primary consolidation and can take decades to fully settle.

As discussed previously, existing site grades will not be changed as part of this project, only replacement of asphalt, installation of new utilities and minor additional loading from the new solar canopy will occur. If the recommendations for founding the solar canopy in this report are followed (whether supporting on shallow foundations or deep foundations founded within the landfill refuse), then the loading will essentially not impact the compressible material beneath the site. Therefore, the planned improvements will not induce significant additional settlement of the landfill refuse, peat or soft clay. That is not to say that these soils will not settle over time, just to say that the improvements will not induce significant additional settlement of these materials. The landfill refuse, peat and soft clay will continue to settle over time, whether it be from decaying organic matter, primary consolidation or secondary compression, as discussed above.

We estimate that settlement due to decaying organic matter will be similar to the measurements that Shannon & Wilson collected between 2006 to 2008, on the order of ½ to 1 inch per year. Settlement due to primary consolidation and secondary compression are estimated to be up to 1 inch after 1 year of time, up to 3 inches over 5 years, and up to 6 inches over 20 years. These primary and secondary compression settlement estimates are based on Shannon & Wilson's and Hart Crowser's reports for the Montlake Landfill and UW Track, respectively.

4.4. Temporary Dewatering

Excavations for new utility trenches and other improvements will be above the regional groundwater table at the site based on our explorations. However, based on the previous explorations and our experience in the area, perched groundwater should be expected on top of less permeable layers within the existing fill.

We anticipate that the contractor will be able to use sumps and pumps located within utility trench excavations for required temporary dewatering to control perched groundwater seepage encountered in the excavations.

Sump pumping involves removing water that has seeped into an excavation by pumping from a sump that has been excavated at one or more locations in an excavation. Drainage ditches that lead to the sump are typically excavated along the excavation sidewalls at the base of an excavation. The excavation for the sump and discharge drainage ditches should be backfilled with gravel or crushed rock to reduce the amount of erosion and associated sediment in the water pumped from the sump. In our experience, a slotted casing or perforated 55-gallon drum that is installed in the sump backfill provides a suitable housing for a submersible pump.

For planning purposes, perched groundwater flow rates of up to 10 gallons per minute (gpm) can be assumed for site excavations. Surface water from rainfall will contribute significantly to the volume of water that needs to be removed from the excavation during construction and will vary as a function of season and precipitation. Disposal of soil and water pumped from excavations should be in compliance with any environmental handling requirements for excavations in the landfill footprint.

4.5. Solar Canopy Support

Compressible and settlement sensitive soils consisting of fill, landfill refuse, peat and soft clay exist below the planned solar canopy footprint. Based on the borings completed as part of this study as well as existing explorations, we anticipate that competent glacially consolidated soils are 70 to 110 feet below site grades. Liquefaction-induced settlement from the design-level earthquake may impact the canopy structure as discussed in Section 4.2.2. Additionally, static settlement due to compression of these materials and decaying organic matter within the landfill refuse and peat will impact the structure, as discussed in Section 4.3.

We recommend that the solar canopy be supported on shallow foundations supported on a structural fill pad or on deep foundations consisting of small-diameter steel pipe piles embedded in the landfill refuse. The canopy should be designed to tolerate liquefaction-induced and static differential settlements because it is not a life-safety concern because there are no occupants within the structure. Flexible utility connections should be made where utilities tie into the structure, if pile supported, to account for settlement.

There are several options available for pile foundation support; however, in our opinion, displacement piles are best suitable for this site and project because no landfill refuse will be generated during installation of the piles. Generation and subsequent handling of landfill refuse, as well as the overlying cover fill will require special handling requirements and disposal at an approved landfill facility. Because the canopy structures are relatively light-weight, driven small-diameter steel pipe piles are likely the most economical driven pile option to support the canopy structures. Therefore, we provide recommendations for small-diameter steel pipe piles as a deep foundation option for the project.

4.5.1. Shallow Foundations

Supporting the canopy on shallow foundations is possible and will allow the structure to statically settle over time at approximately the same magnitude as the surrounding parking lot. The shallow foundations should be supported on a layer of structural fill as recommended below.

4.5.1.1. Allowable Bearing Pressure

The soils anticipated at foundation subgrade elevation for the canopy consist of unsuitable loose to medium dense fill and possibly some landfill refuse. Shallow foundations will require removal of at least 2 feet existing fill and/or refuse material and replacement with properly compacted structural fill. The structural fill should extend at least 2 feet beyond the edges of the footings and be placed over a geotextile separator such as Mirafi 600X. The exposed subgrade should be compacted to the extent practical with an excavator mounted hoe-pack prior to placing the geotextile separator. A maximum allowable bearing pressure of 1,500 pounds per square foot (psf) may be used for the design of the shallow foundations prepared as recommended. The allowable soil bearing pressure applies to the total of dead and long-term live loads and may be increased by up to one-third for wind or seismic loads.

4.5.1.2. Settlement Potential

As discussed in Section 4.3, the site will continue to settle from decaying organic matter in the landfill refuse and peat, as well as from primary and secondary compression of these materials (and soft clay) induced from the previous fill that was placed as part of development of the existing parking lot.

Static settlement induced from immediate loading on the footings will be less than 1 inch; however, long term settlement of the site will be much more than 1 inch, as discussed in Section 4.3. Loose fill or disturbed soil not removed from under the foundation excavation prior to placing concrete may result in increased settlement.

4.5.1.3. Lateral Resistance

Lateral forces on the foundation may be resisted by passive resistance on the sides of the foundation and by friction on the base of the foundation. Frictional resistance may be computed using a coefficient of friction of 0.35 applied to vertical dead-load forces. The passive pressure can be estimated using an equivalent fluid density of 250 pounds per cubic foot (pcf) (triangular distribution). The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

4.5.1.4. Construction Considerations

We recommend that the condition of foundation subgrades be observed by GeoEngineers to confirm that subsurface conditions are as anticipated, and that subgrade has been prepared in accordance with our recommendations.

4.5.2. Small-diameter Pipe Piles

In our opinion, 3-, 4- or 6-inch-diameter driven steel pipe piles may be used for support of the canopy. The pipe pile spacing and pile diameter should be determined by the project structural engineer.

4.5.2.1. Axial Capacity

Steel pipe piles should be installed using a pneumatic impact equipment capable of penetrating a sufficient depth to develop the design loads. McDowell Northwest Pile King of Kent, Washington has equipment capable of installing this type of pile. We recommend the pipe piles be driven a minimum of 20 feet below the pavement surface to develop the required capacity; however, deeper tip elevations may be needed based on structural requirements. The capacities will mainly be developed by side friction acting on the piles within the refuse and fill materials, with some additional capacity developing from end bearing. For pipe piles that are embedded at least 20 feet below the pavement surface, we recommend that the pipe piles be designed for a maximum allowable axial capacity of 2.5, 4, and 5.5 kips for 3-, 4-, and 6-inch-diameter pipe piles, respectively. These maximum allowable axial capacities include a factor of safety of about 2. These loads may be increased by one-third during seismic conditions.

We recommend that at least two static load tests be completed on pipe piles for each diameter to verify actual capacity. The piles should be galvanized, driven closed-ended and filled with grout up to the pavement elevation. Potential contractors should assess existing conditions, including subsurface conditions, to determine if driven pipe piles are compatible with their equipment and the project requirements.

4.5.2.2. Lateral Capacity

Lateral loads can be resisted by passive soil pressure on the vertical piles and by the passive soil pressures on the pile cap, if used. Because of the potential separation between the pile-supported foundation components and the underlying soil from settlement, base friction along the bottom of the pile cap (if used) should not be included in the calculations for lateral capacity.

We evaluated the lateral capacity for 3-, 4- and 6-inch-diameter pipe piles using LPILE v2019 by Ensoft, Inc. Evaluations for the lateral pile capacities were completed without liquefied conditions because we assume that the landfill refuse (which the piles will be embedded in) is not liquefiable.

Pile shear and bending moments were evaluated by controlling lateral deflections at the top of the pile. LPILE runs were completed for deflections of ¼, ½, 1 and 1½ inches for both the fixed- and free-head conditions. The results of our analyses are summarized in Table 2. The results represent ultimate values and do not include a factor of safety.

TABLE 2. SUMMARY OF LPILE ANALYSIS RESULTS

Pile Diameter (inches)	Pile Top Deflection (inches)	Free Head Condition		Fixed Head Condition	
		Maximum Shear (kips)	Maximum Moment (k-in)	Maximum Shear (kips)	Maximum Moment (k-in)
3	0.25	0.8	15	2.1	45
	0.5	1.3	28	3.2	73
	1.0	2.0	51	3.9	80
	1.5	2.5	68	4.3	81
4	0.25	1.3	25	3.2	78
	0.5	2.0	49	4.9	132
	1.0	3.0	88	6.0	148
	1.5	3.8	120	6.6	150
6	0.25	2.3	58	5.7	179
	0.5	3.8	112	9.4	325
	1.0	5.8	205	11.9	388
	1.5	7.3	284	13.1	392

We assume that piles will be spaced more than 5 pile diameters apart and therefore, group effects that would reduce the lateral load capacity of training piles will not apply to this project.

If a pile cap is constructed as part of the canopy construction, we recommend that the passive soil pressure acting on the pile cap be estimated using an equivalent fluid density of 250 pcf where the soil adjacent to the foundation consists of adequately compacted structural fill. This passive resistance value includes a factor of safety of 1.5 and assumes a minimum lateral deflection of 1 inch to fully develop the passive resistance. Deflections that are less than 1 inch will not fully mobilize the passive resistance in the soil.

4.5.2.3. Pile Settlement

Settlement discussions in Section 4.5.1.2 apply to steel pipe piles as they will be founded in landfill refuse. Supporting the canopy on steel pipe piles will allow the structure to statically settle over time at roughly the same magnitude as the surrounding parking lot.

Static settlement induced from immediate loading on the piles will be less than 1 inch; however, long-term settlement of the site will be much more than 1 inch, as discussed in Section 4.3.

4.6. Earthwork

Based on the subsurface soil conditions encountered in our explorations, we anticipate that the soils at the site may be excavated using conventional construction equipment. The materials encountered near the surface are generally very loose to medium dense fill or landfill refuse. The landfill refuse may contain variable debris typical of municipal solid waste (MSW) landfills and the contractor should be prepared to deal with MSW, if encountered.

The fill contains a high percentage of fines (material passing the U.S. Standard No. 200 sieve) that is extremely moisture-sensitive and susceptible to disturbance, especially when wet. Ideally, earthwork should be undertaken during extended periods of dry weather. We recommend that all earthwork equipment be routed on the surrounding asphalt pavement and not track on the fill or landfill materials, if at all possible. Where new pavement is planned and the existing pavement is to be removed, the contractor should only track on the fill soils as needed to complete the work.

4.6.1. Subgrade Preparation

Prior to placing new fills, pavement or base course materials, and structural fill below structures, exposed subgrade areas should be compacted to the extent practical using a hoe-pack mounted on an excavator and then probed and evaluated by the geotechnical engineer. .

If deep pockets of soft or pumping soils are encountered, it may be possible to limit the depth of overexcavation by placing a woven geotextile such as Mirafi 600X (or equivalent material) on the exposed subgrade prior to placing structural fill or subbase materials. The geotextile will provide additional support by bridging over the soft material.

Exposed subgrade areas should be compacted to a firm condition, if possible. The achievable degree of compaction will depend on the subgrade materials and when construction is performed. If the work is performed during dry weather conditions, we recommend that all subgrade areas in existing fill be recompacted to at least 95 percent of the maximum dry density (MDD) in accordance with the ASTM International (ASTM) D 1557 test procedure (modified Proctor), if possible. If the work is performed during wet weather conditions, it may not be possible to recompact the subgrade to 95 percent of the MDD. In this case, we recommend that the subgrade be compacted to the extent possible without causing undue weaving or pumping of the subgrade soils. If landfill refuse is exposed, it should be compacted to the extent practical prior to placing the woven reinforcement geotextile.

Subgrade disturbance or deterioration could occur if the subgrade is wet and cannot be dried. If the subgrade deteriorates during compaction, it may become necessary to modify compaction criteria or methods.

4.6.2. Subgrade Protection

Site soils contain significant fines content (silt/clay) and will be highly sensitive and susceptible to moisture and equipment loads. The contractor should take necessary measures to prevent site subgrade soils from becoming disturbed or unstable. Construction traffic during the wet season should be restricted to specific areas of the site, preferably areas that are surfaced with existing pavement or crushed rock materials not susceptible to wet weather disturbance.

4.6.3. Structural Fill

All fill which will support pavement areas, foundations or in utility trenches should generally meet the criteria for structural fill presented below. The suitability of soil for use as structural fill depends on its gradation and moisture content.

4.6.3.1. Materials

Materials used as backfill for foundations, utility trenches and paved areas are classified as structural fill for the purpose of this report. We recommend specifying materials using the 2023 City of Seattle Standard Specifications (Seattle Mineral Aggregate). Structural fill material quality varies depending upon its use as described below:

1. **Gravel backfill for foundations and site fill.** Gravel backfill placed beneath structure foundations, placed to support pavement areas, or to backfill utility trenches should meet the requirements of Mineral Aggregate Type 17 (bank run gravel) or Type 2, City of Seattle Standard Specification 9-03.14, unless approved otherwise by GeoEngineers.
2. **Crushed surfacing base course.** Crushed surfacing base course (CSBC) placed below pavements and sidewalks should meet the requirements of Mineral Aggregate Type 2 (1¼-inch-minus crushed rock), City of Seattle Standard Specification 9-03.14.
3. **Subbase.** The 6-inch subbase layer below the CSBC layer should meet the requirements of Mineral Aggregate Type 17 (bank run gravel) or Type 2, City of Seattle Standard Specification 9-03.14, unless approved otherwise by GeoEngineers.

4.6.3.2. Reuse of On-site Soils

The site is located within the former Montlake Landfill; therefore, all existing on-site soils, including fill below the existing pavement and landfill refuse, will be treated as contaminated and will be handled and disposed of accordingly. Therefore, on-site soils should not be re-used on site. All structural fill should be imported to the site.

4.6.3.3. Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm, non-yielding condition. Structural fill should be placed in loose lifts not exceeding 12 inches in thickness when using heavy compaction equipment and not more than 6 inches when using hand-operated compaction equipment. The actual thickness will be dependent on the structural fill material used and the type and size of compaction equipment. Each lift should be moisture-conditioned to within about 2 percent of the optimum moisture content to achieve proper compaction to the specified density before placing subsequent lifts. Compaction of all structural fill at the site should be in accordance with the ASTM D 1557 (modified proctor) test method. Structural fill should be compacted to the following criteria:

1. Structural fill placed below foundations should be compacted to at least 95 percent of the MDD.
2. Structural fill in new pavement and hardscape areas, including utility trench backfill, should be compacted to at least 90 percent of the MDD, except that the upper 2 feet of fill below final subgrade should be compacted to at least 95 percent of the MDD as shown in Compaction Criteria for Trench Backfill, Figure 3.

4.6.3.4. Weather Considerations

Disturbance of exposed subgrade soils should be expected if earthwork is completed during periods of wet weather. During dry weather, the soils will: (1) be less susceptible to disturbance; (2) provide better support for construction equipment; and (3) be more likely to meet the required compaction criteria.

The wet weather season generally begins in October and continues through May in Western Washington; however, periods of wet weather may occur during any month of the year. For earthwork activities during wet weather, we recommend that the following steps be taken:

- Exposed fill and landfill refuse should be limited to areas requiring pavement removal.
- Exposed subgrade soils, especially exposed landfill refuse, should be covered daily with plastic sheeting in accordance with the environmental requirements for the project.
- Surface water on the parking lot should be directed away from the excavated work areas. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Earthwork activities should not take place during periods of moderate to heavy precipitation.
- The contractor should take necessary measures to prevent soils to be used as fill from becoming wet or unstable. These measures include covering stockpiles with plastic sheeting. The site's soils should not be left uncompacted and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent that these soils become wet or unstable.
- Construction traffic should be restricted to areas that are surfaced with the existing asphalt, except as necessary to perform the earthwork activities.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.

4.6.1. Excavations

We do not envision needing temporary cut slopes for the project. We anticipate that all cuts will be shallow and less than 4 feet deep.

The contractor performing the work has the primary responsibility for the protection of workers and adjacent improvements. In our opinion, the contractor will be in the best position to observe subsurface conditions continuously throughout the construction process and to respond to variable soil and groundwater conditions. Therefore, the contractor should have the primary responsibility for deciding whether or not to use open cut slopes for much of the excavations rather than some form of temporary excavation support, and for establishing the safe inclination of the cut slope. Acceptable slope inclinations for utilities and ancillary excavations should be determined during construction. Because of the diversity of construction techniques and available shoring systems, the design of temporary shoring is most appropriately left up to the contractor proposing to complete the installation. Temporary cut slopes and shoring must comply with the provisions of Title 296 Washington Administration Code (WAC), Part N, "Excavation, Trenching and Shoring."

4.6.2. Utility Trenches

Trench excavation, pipe bedding and trench backfilling should be completed using the general procedures described in the City of Seattle Municipal Code or other suitable procedures specified by the project civil engineer. The fill soils and landfill refuse encountered under the pavement at the site generally have moderate and high corrosion potential, respectively, based on our experience.

Utility trench backfill should consist of structural fill and should be placed in loose lifts not exceeding 12 inches in thickness when using heavy compaction equipment and not more than 6 inches when using hand-operated compaction equipment such that adequate compaction can be achieved throughout the lift. Each lift must be compacted prior to placing the subsequent lift. Prior to compaction, the backfill should be moisture-conditioned to within 2 percent of the optimum moisture content, if necessary. The backfill should be compacted in accordance with the criteria in Section 4.6.3.3. Figure 3 illustrates recommended trench compaction criteria under pavement and non-structural areas.

4.6.3. Sedimentation and Erosion Control

In our opinion, the erosion potential of the on-site soils is low. Construction activities, including removal of existing asphalt pavement, will expose soils to the erosional effects of wind and water. The amount and potential impacts of erosion are partly related to the time of year that construction actually occurs. Wet weather construction will increase the amount and extent of erosion and potential sedimentation.

Erosion and sedimentation control measures may be implemented by confining the work areas to areas where the asphalt pavement has been removed and not routing equipment on the exposed soils, except when necessary. The vertical cuts in the pavement should help contain surface water during storm events and for temporary erosion protection of exposed soils. However, the contractor will need to implement other TESC measures as need to prevent stormwater from leaving the site. All disturbed areas should be finish graded and paved as soon as practicable to reduce the risk of erosion. Erosion and sedimentation control measures should be installed and maintained in accordance with the requirements of the City of Seattle, and handling of all stormwater and sediment should be in accordance with the UW environmental requirements for the project.

4.7. Pavement Recommendations

4.7.1. Subgrade Preparation

We recommend the subgrade soils in new pavement areas be prepared and evaluated as described in Section 4.6. We recommend placing a 6-inch-thick granular subbase layer below the pavement sections described below. The subbase material should meet the requirements of Mineral Aggregate Type 17 (City of Seattle Standard Specification, 9-03.14). Prior to placing the subbase layer, the exposed subgrade should be thoroughly compacted with a hoe-pack mounted to an excavator or with another piece of heavy compaction equipment. If the subgrade soils are excessively loose or soft, it may be necessary to excavate localized areas and replace them with additional gravel borrow or gravel base material, as approved by the geotechnical engineer. After compacting the exposed subgrade, a woven reinforcement geotextile such as Mirafi 600X should be placed over the subgrade prior to placing the subbase layer. Geotextile panels should be overlapped a minimum of 12 inches.

4.7.2. New Hot Mix Asphalt Pavement

In light-duty pavement areas such as the existing Parking Lot E-18, we recommend the pavement section consist of at least a 3-inch thickness of ½-inch hot-mix asphalt (HMA) (PG 58-22) per City of Seattle Standard Specifications Sections 5-04 and 9-03.8 and 9-03, over a 4-inch thickness of densely compacted CSBC per Mineral Aggregate Type 2, City of Seattle Standard Specification 9-03.14. The CSBC should be placed over the 6-inch subbase layer and reinforcement geotextile as described above.

The CSBC should be compacted to at least 95 percent of the MDD (ASTM D 1557). We recommend that a proof-roll of the compacted base course be observed by a representative from our firm prior to paving. Soft or yielding areas observed during proof-rolling may require overexcavation and replacement with compacted crushed rock.

4.8. Recommended Additional Geotechnical Services

Throughout this report, recommendations are provided where we consider additional geotechnical services to be appropriate. These additional services are summarized below:

- GeoEngineers should be retained to review the project plans and specifications when complete to confirm that our design recommendations have been implemented as intended and submit a review letter to the City of Seattle as required.
- During construction, GeoEngineers should observe and evaluate the suitability of the foundation subgrades, observe and evaluate deep foundation installation (if used), observe removal of unsuitable soils, evaluate the suitability of pavement subgrades, observe and test structural backfill, and provide a summary letter of our construction observation services, as required by the City of Seattle. The purposes of GeoEngineers construction phase services are to confirm that the subsurface conditions are consistent with those observed in the explorations, are required by the City of Seattle, and other reasons described in Appendix C, Report Limitations and Guidelines for Use.

5.0 LIMITATIONS

We have prepared this report for use by the UW for design and construction of the proposed Parking Lot E-18 Solar Canopy project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments are only 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 Appendix C for additional information pertaining to the use of this report.

6.0 REFERENCES

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ASCE 7-16, 2016, "Minimum design loads for buildings and other structures."

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Washington State Department of Transportation, Geotechnical Design Manual, 2022.

Washington State Department of Transportation, 2023, "Standard Specifications for Road, Bridge and Municipal Construction."

Source(s):
- ESRI

Coordinate System: NAD 1983 UTM Zone 10N

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

Vicinity Map

Parking Lot E-18 Solar Canopy
Seattle, Washington

GeoEngineers

Figure 1

P:\0\0183156\GIS\0183156_Project\0183156_Project.aprx\0183156_F01_VicinityMap Date Exported: 08/22/23 by ccabrera

Legend

GEI-1 Boring by GeoEngineers, Inc., 2023

DH-2 Boring by Others, 1963

Sources:

- Aerial from Bing, dated 2023
- Proposed site features from Reid Middleton, dated May 1, 2023

Projection: WA State Plane, North Zone, NAD83, US Foot

N

0 40

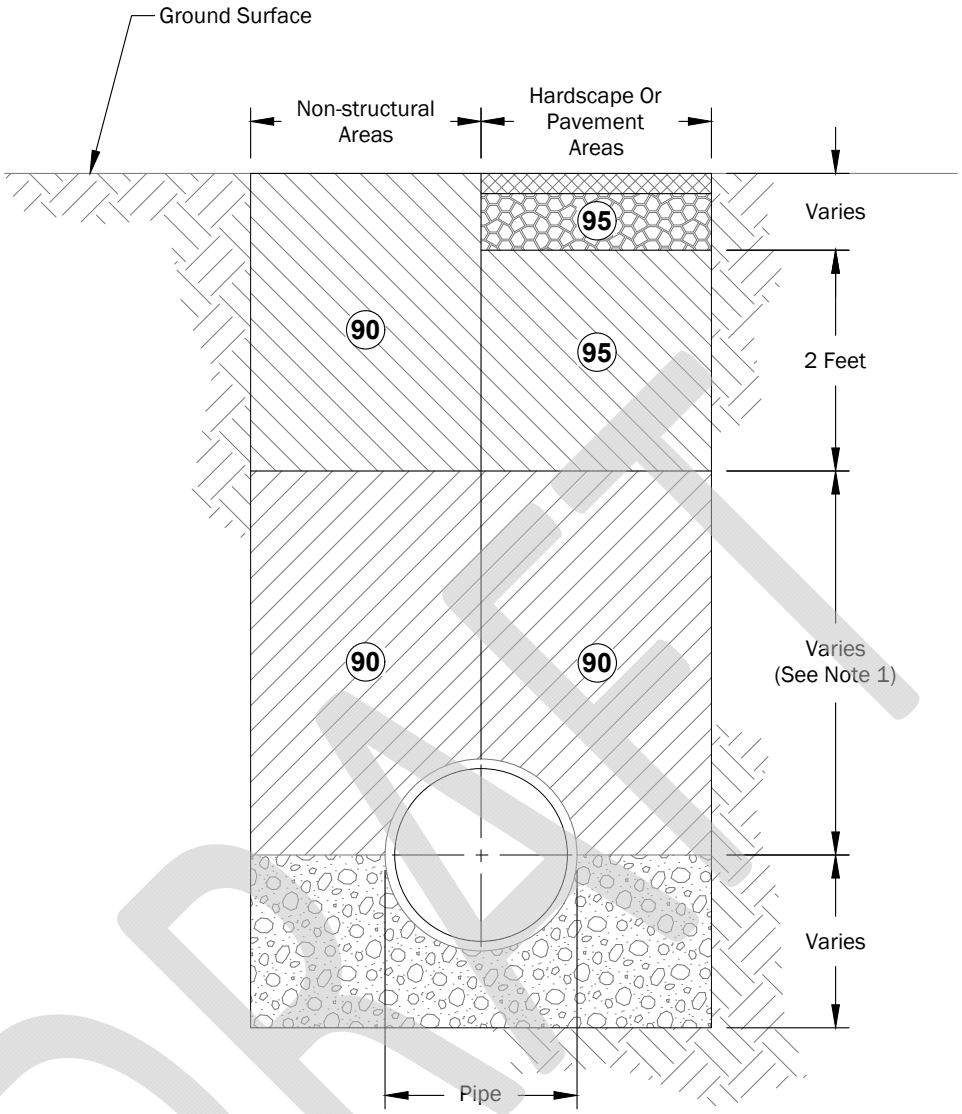
Feet

Site Plan

Parking Lot E-18 Solar Canopy
Seattle, Washington

GeoEngineers

Figure 2



Not To Scale

Legend

95 — Recommended Compaction as a Percentage of Maximum Dry Density, by Test Method ASTM D1557 (Modified Proctor)

Concrete or Asphalt Pavement

Base Course

Trench Backfill

Pipe Bedding

Notes:

1. All backfill under building areas should be compacted to at least 95 percent per ASTM D1557.

Compaction Criteria for Trench Backfill

Parking Lot E-18 Solar Canopy
Seattle, Washington

GeoEngineers

Figure 3

APPENDIX A
Field Explorations

APPENDIX A
FIELD EXPLORATIONS

Borings GEI-1 and GEI-2 were completed on July 11, 2023, at the approximate locations shown in the Site Plan, Figure 2. The borings were advanced to depths of approximately 26½ feet below ground surface (bgs). The borings were completed using a track mounted Diedrich Turbo D-50 drill rig owned and operated by Advanced Drill Technologies, Inc.

The borings were continuously monitored by a geologist from our firm who evaluated and classified the soils encountered, obtained representative soil samples, and observed groundwater conditions. Our representative maintained a detailed log of each boring. Disturbed samples of the representative soil types were obtained from the borings using standard penetration test (SPT) sampling procedures. SPT sampling was performed using a 2-inch outside diameter split-spoon sampler driven with a standard 140-pound hammer in accordance with ASTM International (ASTM) D 1586.

The soils encountered in the borings were typically sampled at 2½- to 5-foot vertical intervals with the SPT split spoon sampler. Samples were obtained by driving the sampler 18 inches into the soil with an automatic hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration is recorded. The standard penetration resistance ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration (blows per foot). This value is shown on the boring logs. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. If the high penetration resistance encountered in the very dense soils precluded driving the total 18-inch sample interval, the penetration resistance for the partial penetration is entered on logs as follows: if the penetration is greater than 6 inches and less than 18 inches, then the number of blows is recorded over the number of inches driven; 30 blows for 6 inches and 50 for 3 inches, for instance, would be recorded as 80/9". The blow counts are shown on the boring logs at the respective sample depths. The SPT is a useful quantitative tool from which soil density/consistency was evaluated.

Soils encountered in the borings were classified in the field in general accordance with ASTM D 2488, the Standard Practice for Classification of Soils, Visual-Manual Procedure, which is summarized in Figure A-1. Logs of the borings are provided in Figures A-2 and A-3.

Boring locations were determined in the field by measuring from physical features on site. Boring locations should be considered accurate to the degree implied by the method used. Ground surface elevations at the boring locations were not surveyed.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel / Dames & Moore (D&M)

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure A-1

Drilled: Start 7/11/2023 End 7/11/2023	Total Depth (ft): 26.5	Logged By: JYE Checked By: CWM	Driller: Advance Drill Technologies, Inc.	Drilling Method: Hollow-stem Auger	
Surface Elevation (ft): 35 Vertical Datum: NAVD88		Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: Diedrick D58 Truck-mounted RigDiedrick D50 Turbo	
Easting (X): 1278837 Northing (Y): 242861		System Datum: WA State Plane North NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0	6			1		AC	Approximately 3½ inches asphalt pavement			
							SM	Dark brown silty fine to medium sand with gravel (medium dense, moist) (fill)			
		12	14		2		SM	Brown/gray silty fine to coarse sand with gravel (medium dense, moist)			
30	5	16	9		3		SM	Gray silty fine to medium sand; wood and metal debris (moist to wet) (landfill refuse)			
		6	2		4						
25	10	6	2		5		ML	Brown sandy silt with occasional gravel; organic matter and plastic debris (wet)			
20	15	6	9		6						Groundwater observed at 14.2 feet at time of drilling
							ML	Dark gray/black sandy silt; wood, glass and cardboard debris, heavy oxidation staining (wet)			
15	20	4	3		7						
10	25	4	3		8						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Google Earth.

Log of Boring GEI-1

GeoEngineers

Project: Parking Lot E-18 Solar Canopy
Project Location: Seattle, Washington
Project Number: 0183-156-00

Drilled Start 7/11/2023 End 7/11/2023	Total Depth (ft) 26.5	Logged By JYE Checked By CWM	Driller Advance Drill Technologies, Inc.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) 30 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Diedrick D58 Truck-mounted RigDiedrick D50 Turbo	
Easting (X) 1278998 Northing (Y) 242826		System Datum WA State Plane North NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0	6			1		AC	Approximately 2½ inches of asphalt pavement			
							SM	Brown/gray silty fine to medium sand with gravel (medium dense, moist) (fill)			
		18	10		2		SM	Gray/brown silty fine to medium sand with occasional gravel; plastic and wood debris (moist) (landfill refuse)			
-5	5	6	14		3						
		6	10		4		WD	Wood debris			
-10	10	8	13		5						Groundwater observed at 11.4 feet at time of drilling
							ML	Dark gray/black sandy silt; wood debris (wet)			
-15	15	11	13		6A 6B						
							WD	Wood debris			
-20	20	18	19		7						
							SM	Dark gray/black silty fine to medium sand; heavy wood debris (wet)			
-25	25	18	13		8						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Google Earth. Vertical approximated based on Google Earth.

Log of Boring GEI-2

GeoEngineers

Project: Parking Lot E-18 Solar Canopy
Project Location: Seattle, Washington
Project Number: 0183-156-00

APPENDIX B
Exploration Logs from Previous Studies

APPENDIX B
EXPLORATION LOGS FROM PREVIOUS STUDIES

Appendix B includes relevant exploration logs from the following reports within the immediate project vicinity:

- Geo-Recon, Inc., 1963, "Intramural Athletic Building, University of Washington, Seismic Profiles," dated September 1963.

SHANNON AND WILSON
SOIL MECHANICS & FOUNDATION ENGINEERS
SEATTLE, WASHINGTON

PROJECT Intermediate Athletic Building JOB NO. W-63-741
SUBJECT Borings 1 & 2
BY WHJ CK DATE 30 August 63

DH-2

Elev.

0			
2	Dark brn. SAND & SILT	1	10
	Mottled gray firm silty CLAY, w/ numerous roots. The clay is iron stained.		
7	Brown medium sandy SILT, w/some gravel (TILL)	2	29
▽ 9-9-63 10			
	Brown dense to very dense silty SAND, w/ gravel & occasional layer of medium to coarse clean sand plus streaks of silt (TILL)	3	46
		4	>75
22.7		5	>75
23	Gray very hard SILT, s/i. sandy w/ scattered pebbles		

Completed 8-29-63

* not recorded

0			
	Light brown loose SAND and GRAVEL (FILL)	1	14
4			
▽ 9-9-63		2	38
	GARBAGE	3	25
		4	11
19	Gray medium clean SAND		
23		5	>75
		6	39
		7	41
		8	44
	Dark very hard SILT with stringers of very fine sand cutting diagonally through the sample and light gray streaks of silt	9	46
		10	46
		11	62
		12	43
		13	50
67			

Completed 8-29-63

Legend

0 / 2 Boring

1 I 10 Split Spoon Sampler, number to left is sample no., number to right indicates number of blows required to drive sampler 12" with 140# hammer falling 30" unless otherwise noted.

APPENDIX C
Report Limitations and Guidelines for Use

APPENDIX C
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.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for use by the University of Washington for design of the Parking Lot E-18 Solar Canopy project. This report may be made available to prospective contractors for bidding or estimating purposes; but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers, Inc. (GeoEngineers) structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. No one except the University of Washington and members of the design team should rely on this report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or geologic Report is Based on A Unique Set of Project-Specific Factors

This report has been prepared for the proposed Parking Lot E-18 Solar Canopy project at the University of Washington in Seattle. 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, do not 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.

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;

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

- Composition of the design team; or
- Project ownership.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

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 manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Most 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 subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

Do not over-rely on the construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the borings, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by 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. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

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 to adjacent properties.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and Environmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, or assessment of the presence of Biological Compounds which are Pollutants in or around any structure. Accordingly, this report includes no interpretations, recommendations, findings, or conclusions for the purpose of detecting, assessing, or abating Biological Pollutants. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, and/or any of their byproducts.

Appendix B

GHG Emissions Worksheet

University of Washington Parking Lot E18 Solar Canopy 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)			Lifespan Emissions (MTCO2e)
			Embodied	Energy	Transportation	
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		4.8	39	1,278	257	**186**
Vacant		0.0	39	162	47	**0**

Section II: Pavement

Pavement		0.00				**0**

Total Project Emissions: **186**