King County Department of Permitting and Environmental Review
35030 SE Douglas Street, Suite 210
Snoqualmie, WA 98065-9266

Agent: Rick Cardoza, LDC Inc.
1851 Central Place S. #101, Kent, WA 98030
(253) 218-9017, Rcardoza@LDCcorp.com

RE: Puget Sound Emergency Radio Network (PSERN) Vashon V13
SEPA Environmental Checklist

A. Background

1. Name of proposed project: Puget Sound Emergency Radio Network (PSERN) Vashon V13

2. Name of Applicant: Ross Rembac, Pyramid Network Services
3131 Elliott Ave., Seattle, WA, 98121
(925) 705-0174 ross.rembac@motorolasolutions.com

Name of contact person: Rick Cardoza, LDC Inc.
1851 Central Place S. #101, Kent, WA 98030
(253) 218-9017 Rcardoza@LDCcorp.com

3. Date checklist prepared: April 2019

4. Agency requesting checklist: King County Department of Permitting and Environmental Review

6. Proposed Timing or schedule (including phasing, if applicable):
Summer/Fall 2019.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal?
Currently, there are no plans for future additions, expansion, or further activity related to or connected with this proposal.
8. List any Environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

Geotechnical investigation and soil resistivity test has been prepared. Also, SEPA review, NEPA will be prepared.

9. Do you know whether applications are pending governmental approvals of other proposals directly affecting the property affected by your proposal? If yes, explain.

FAA and King County DPER building permit.

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


11. Give a brief, complete description of your proposal, including the proposed uses and the size of the project and site.

PSERN proposes to replace an unmanned wireless communication tower, by constructing a new 170’ self-support tower for Emergency Wireless Communication that consists of (2) microwave antennas, (4) dipole omni antennas, and (1) TTA unit. Also an equipment shelter and convault fuel tank within a 50’x50’ fenced lease area. Please see the attached Construction Drawings and documentation for further details.

12. Location of the project: 18851 103rd Ave. SW., Vashon Island, WA 98070

Legal Description: SW ¾, SE ¾ of SEC. 31, T. 23 N., R. 3 E., W.M., King County, WA

2. Environmental Elements

1. Earth

   a. Terrain could be described as flat.

   b. The steepest Slope on the site= less than 2% slope.

   c. What general types of soils are found on the site? If you know the classification of agricultural soils then specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils?

      Presence of clayey sand, with a silty sand with trace clay underline extending to a depth of about 45 feet, per soil samples.

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

      None noted.
e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

Excavation for construction of tower foundation, foundation for equipment shelter and equipment slab for generator tank. Trenching required for power to be installed underground from power source to equipment building. All excavation for concrete construction will be backfill with clean material, if any. Total are of excavation for compound less than 2000 square feet. Approximately, 100 C.Y. of trenching for placement of power as proposed underground.

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

No, terrain is flat best management practices for temporary erosion and sediment control to be used.

g. About what percent of the site will be covered with impervious surfaces after project construction?

An approximate increase of impervious surfaces, 2500 square feet resulting from project.

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

Best management practices for temporary erosion and sediment control to be used.

2. Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Short term exhaust from construction equipment shall occur during construction phase.

b. Are there any off-site sources of emissions or odor that may affect your proposal?

None.

c. Proposed measures to reduce or control emissions or other impacts to air.

Minimized use of generator for periodic testing.

3. Water

a. Surface Water:

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)?

None noted.
2. Will the project require any work over, in, or adjacent to (within 200') the described waters?
   No.

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.
   None.

4. Will the proposal require surface water withdrawals or diversions?
   No. Emergency Wireless Services Facilities do not use water so there is no discharge of effluent.

5. Does the proposal lie within a 100-year flood plan?
   None noted.

6. Does the proposal involve any discharge of waste materials to surface waters?
   None.

b. Ground Water:

1. Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater?
   No.

2. Describe waste material that will be discharged into the ground from septic tanks or other sources, if any. Describe the general size of the system, the number of such systems, the number of houses to be served or the number of humans the systems is expected to serve.
   None.

c. Water runoff (including storm water):

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

   The project shall comply with King County grading requirements, and DOE storm water pollution control policy.

2. Could waste materials enter ground or surface waters?
   Not Applicable.

3. Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site?
Proposed work will result in a slight increase of impervious surfaces.

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

Drainage engineering plan to be provided.

4. Plants

a. Types of vegetation found at the site include: Evergreen trees, shrubs and grass

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

There may be minor removal of brush for excavation and trenching.

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

None noted.

c. Is the site part of a migration route?

Unknown.

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

None. The project is 911 emergency services for first responder and emergency communications.

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

Wireless Communication Facilities (WCFs) use back-up batteries and diesel fuel generators for emergency back-up power to Emergency Facilities. The backup batteries commonly contain electrolyte fluids inside the battery cells. Please note the total electrolyte volume less than 50 gallons. The batteries are located inside electronic equipment shelters on racks, or in some cases inside cabinets. Diesel fuel is the most common type of generator fuel used for Emergency backup power generators, although propane and Natural Gas fueled generators are possible alternatives – diesel fuel is preferred due to the run time provided in a scenario of prolonged outage requiring Emergency Backup power. Natural Gas supply in regularly interrupted in seismic events and propane tanks require spark arrest setbacks from tanks so diesel fueled generators are preferred in most scenarios.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, explain.
The proposed Emergency telecommunications facility would not affect any potential use of solar energy by adjacent properties.

c. 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.

Equipment shelter meets energy code standards.

7. Environmental Health

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

For Emergency Wireless Services Facilities, battery rack connections to the shelters/foundations are structurally designed to avoid seismic overturn. In addition, all diesel fuel tanks inside shelter and buildings, or outside on concrete slab on grade (as well as the generator units) have anchors/connections that are also structurally designed for seismic overturn. Diesel fuel tanks are double lined with overfilling alarms to avoid release of fuel. Fill overflow catch basins located at the tank intake are used for refueling to avoid spillage at refueling. MSDS and other signage are posted at the site and all facilities are required to comply with County zoning, building, and other applicable regulations as well as all Fire Authority regulations.

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

None noted.

2. Describe exiting 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.

None noted.

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.

The proposed project includes the use of back-up batteries and diesel fuel generators for emergency back-up power to Emergency Facilities. The backup batteries commonly contain electrolyte fluids inside the battery cells. The batteries are located inside electronic equipment shelters on racks, or in some cases inside cabinets. Diesel fuel is the most common type of generator fuel used for Emergency backup power generators, although propane and Natural Gas fueled generators are possible alternatives — diesel fuel is preferred due to the run time provided in a scenario of prolonged outage requiring Emergency Backup power.

4. Describe special emergency services that might be required.

There is a fire suppression system in shelter.
5. Proposed measures to reduce or control environmental health hazards, if any.

Unmanned facility does not generate waste, best practices to be used during construction.

B. Noise

1. What type of noise exists in the area which may affect your project (for example: traffic, equipment, operation, etc.)

None noted.

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 the site.

There would be some noise generated when the backup generators are running however that would be when the facility is off line due to power outage or an Emergency event - which is the time/occurrence when the Emergency Wireless Services Facility is needed for peak demand of Emergency Public Services.

Also, during construction phase noise will be created by equipment on a short-term basis, between the times of Monday-Friday 8:00 a.m. until 5:00 p.m.

7. Proposed measures to reduce or control noise impacts, if any?

Generator shall be tested periodically, for short durations.

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.

Property currently used for residential use within residential portion of split zoned property, including house and out buildings. Property used for some gravel and other material storage on vacant land on industrial zone portion of split zoned property. The parcel is zoned Residential Use/ I-P-SO per King County.

Property to North includes a wireless communication facility with equipment building on forested area. This parcel is zoned I-P-SG per King County records.

Adjacent property to the North East is a vacant industrial property owned by a construction company. This parcel is zoned I-P-SO per King County records.

Present use of adjacent property to East consists of water tank and water supply operations with Vashon water district #19, this parcel is zoned I-P-SO.

Adjacent parcel to the Northwest is a single-family use property and the zoning designation is I-P-SO, RA-10-SO, A-10-SO (potential).
Adjacent property to the West is a single family residence with a RA-5 designation zone.

The adjacent property to the South West is used as a residential duplex, and is zoned I-P-SO, RA-5-USO.

Present use of adjacent property to South is a radio/T.V. transmitter location for KQIN. This parcel is zoned RA-5, A-10 (potential) and RA-10.

b. Has the project site been used as working farmlands or working forestlands? 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 non-farm or non-forest use?

No changes in use is proposed or affected by the project.

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?

The proposal shall not affect surrounding working farm or forest land normal business operations.

c. Describe any structures onsite.

Property currently used for residential use within residential portion of split zoned property, including house and out buildings.

1. Will any structures be demolished?

No structures shall be demolished.

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

Present Use is Single Family (Residential Use Zone) RA-10-SO with split designation of Industrial- parcel specific- special overlay district, per King County district report.

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

King County district report lists comprehensive plan designations “rt and ra”

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

Unknown.

h. Has any part of the site been classified as a critical area by the City or the County?

None noted.

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

The proposed Wireless Communication Facility would be unstaffed. Although it is anticipated that a technician will visit the site for maintenance purposes 2-3 times per month.
j. Approximately how many people would the completed project displace?

The proposed project would not displace any person, as this is the replacement of an existing tower for emergency communication purposes.

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

Not applicable.

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

Project only enhances 911 and Emergency Services Communications.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any.

None.

9. Housing

a. Approximately how many units would be provided, if any?

The proposed project would not include the addition of any housing units.

b. Approximately, how many units, if any would be eliminated?

The proposed project would not eliminate any units, as there is no existing presence of housing.

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

There are no housing units in the proposed project area or nearby vicinity, so this proposal does not address housing items mentioned above.

10. Aesthetics

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

170' self-support tower for 911 services by PSERN.

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

None noted.

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

Tower can be painted dark green to blend in with trees in the area.
11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?
   Equipment can be non-glare materials.

b. Could light or glare from the finished project be a safety hazard or interfere with views?
   No.

c. What existing off-site sources of light or glare may affect your proposal?
   None noted.

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

Use of hooded worker light at shelter access shall be present for night time on call use during evening maintenance or emergencies.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?
   Natural area preserve is located in nearby area.

b. Would the proposed project displace any existing recreational uses? If so, describe.
   No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any.
   None.

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? Please list any professional studies conducted at the site to identify such resources.
   None noted.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Is 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.
   None noted.
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, archeological surveys, historic maps, etc.

NEPA 106 checklist.

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.

None noted.

14. Transportation

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

None noted.

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

Metro bus services on SW. 188th street, less than 1 mile from site.

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

The completed project would result in the creation of a parking space, which would allow RF technicians to visit the site for routine maintenance. The proposal would not eliminate any existing parking spaces.

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).

No.

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

No.

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 non-passenger vehicles). What data or transportation models were used to make these estimates?

One or two vehicle trips to site for routine maintenance.
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.

No.

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

None.

15. Public Services

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

The proposed project would not result in an increased need for public services. The proposed Emergency Wireless Services Facility will potentially increase benefits to the Emergency Service Providers and therefore the general public resulting in improved emergency services communications and response times.

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

Proposal would generate a small amount of traffic to the location, within normal business hours.

16. Utilities

a. Circle utilities currently available at the site:

Electricity, natural gas, water, refuse area, telephone, sanitary sewer, septic system, other.

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 which might be needed.

The proposed Emergency Wireless Communication facility will use electrical utilities. There may be some utility impacts to power services depending on the need to bring or upgrade power service to a proposed site. Service provider is Puget Sound Energy.

C. Signature

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

Signature: [Signature]

Name of signee: Rick Cardoza

Position and Agency/Organization: Site Acquisition Project Manager, LDC Inc.

Date Submitted: 4/5/19
CONSTRUCTION PLAN KEYED NOTES

- Proposed PSERN Lease Area.
- Proposed PSERN Pre-fabricated Equipment Shelter W/Vestibule Entrance, Engineered by Others.
- Proposed PSERN Equipment Shelter and Vestibule Concrete Slab. Structural Preening.
- Proposed 170.0' Self Support Tower, Engineered by Others.
- Proposed PSERN Sector Antenna Mount (1 Total).
- Proposed PSERN Microwave With Mount (2 Total).
- Proposed PSERN Dipole/Omni Antenna, Typ (4 Total).
- Proposed PSERN TTA Unit (6 Total).
- Proposed PSERN 10'0" Tall Pedestal Mounted Ice Bridge 16' W 16' Clear Below Ice Support.
- Proposed PSERN Cable Ladder.
- Proposed 2'6" Concrete Bollard (6 Total).
- Proposed 8'6" Tall Chain Link Fence W/ Barbed Wire.
- Proposed PSERN Convault Diesel Tank Concrete Pad, Structural Preening.
- Proposed PSERN 1,300 Gal Convault Diesel Tank.
- Proposed PSERN Landscaping Buffer.

SITE NOTES
1. Verify Antenna Model, Tip Height & Azimuths.
2. Analysis of Tower & Polarization Shall Be Performed by Others & Stamped By A Licensed Structural Engineer.

NOTE:
- All Construction Shall Be Done In Accordance With Motorola's R-5S Design Standards.

RAD CENTER OF PROPOSED PSERN MICROWAVE (MW 5)
RAD CENTER OF PROPOSED PSERN ANTEONNAS (RX, TX, TX, RX)
<table>
<thead>
<tr>
<th>PSERN Vashon V13:</th>
<th>Remote Site [FED]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building:</td>
<td>New Motorola-Supplied 12 x 30 Prefab Shelter + Genset + Diesel Fuel Tank</td>
</tr>
<tr>
<td>Updated:</td>
<td>01-29-2018</td>
</tr>
</tbody>
</table>

**Total Site 240VAC Power System Loads:**

| Full Site Load Watts Total: | 24,466W |
| Full Site Load (240VAC 1 phase) Amps Total: | 102A |
| Full Site Load with 50% DC Growth: Watts Total: | 26,550W |
| Full Site Load (240VAC 1 phase) with 50% DC Growth (Amps Total): | 111A |

**Site Commercial/Generator Power System**

| FNE Power Service Connection @ 240VAC (Amps): | 200A |
| Cummins-Onan Generator Size (KW): | 55KW |
| Diesel Tank Size (Gallons): | 1,000GAL |

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

Emissions created by Development
GHG emissions associated with development come from multiple sources:
- The extraction, processing, transportation, construction and disposal of materials and landscape disturbance (Embodied Emissions)
- Energy demands created by the development after it is completed (Energy Emissions)
- Transportation demands created by the development after it is completed (Transportation Emissions)

GHG Emissions Worksheet
King County has developed a GHG Emissions Worksheet that can assist applicants in answering the SEPA Checklist question relating to GHG emissions.

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

The SEPA GHG Emissions worksheet should not be used to estimate GHG emissions from large, complex projects, such as urban planned developments, major infrastructure projects, or projects that require an Environmental Impact Statement (EIS). For more sophisticated tools that may help with assessing the GHGs of these actions, see the Washington State Department of Ecology's (Ecology) SEPA and climate change website: http://www.ecy.wa.gov/climatechange/sepa.htm

Using the Worksheet
1. Descriptions of the different residential and commercial building types can be found on the second tabbed worksheet ("Definition of Building Types"). If a development proposal consists of multiple projects, e.g. both single family and multi-family residential structures or a commercial development that consists of more than one type of commercial activity, the appropriate information should be estimated for each type of building or activity.
2. For paving, estimate the total amount of paving (in thousands of square feet) of the project.
3. The Worksheet will calculate the amount of GHG emissions associated with the project and display the amount in the "Total Emissions" column on the worksheet. The applicant should use this information when completing the SEPA checklist.
4. The last three worksheets in the Excel file provide the background information that is used to calculate the total GHG emissions.

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

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

Disclaimer – March 2011

This worksheet has not been updated 2007. Since then, new resources have become available that more accurately estimate the greenhouse gas emissions impacts of projects. This worksheet can still be used to provide a coarse estimate of a typical project's climate change impact, but should be used with caution. See Ecology's SEPA and climate change website for additional resources: http://www.ecy.wa.gov/climatechange/sepa.htm
Section I: Buildings

<table>
<thead>
<tr>
<th>Type (Residential) or Principal Activity (Commercial)</th>
<th># Units</th>
<th>Square Feet (in thousands of square feet)</th>
<th>Embodied</th>
<th>Energy</th>
<th>Transportation</th>
<th>Lifespan Emissions (MTC02e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family Home</td>
<td>0</td>
<td>98</td>
<td>672</td>
<td>792</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Multi-Family Unit in Large Building</td>
<td>0</td>
<td>33</td>
<td>357</td>
<td>766</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Multi-Family Unit in Small Building</td>
<td>0</td>
<td>54</td>
<td>681</td>
<td>766</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mobile Home</td>
<td>0</td>
<td>41</td>
<td>475</td>
<td>709</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>0</td>
<td>39</td>
<td>648</td>
<td>361</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Food Sales</td>
<td>0</td>
<td>39</td>
<td>1,541</td>
<td>282</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Food Service</td>
<td>0</td>
<td>39</td>
<td>1,944</td>
<td>581</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Health Care Inpatient</td>
<td>0</td>
<td>39</td>
<td>1,538</td>
<td>582</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Health Care Outpatient</td>
<td>0</td>
<td>39</td>
<td>737</td>
<td>571</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Lodging</td>
<td>0</td>
<td>39</td>
<td>777</td>
<td>117</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Retail (Other Than Mall)</td>
<td>0</td>
<td>39</td>
<td>577</td>
<td>247</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Office</td>
<td>0</td>
<td>39</td>
<td>723</td>
<td>588</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Public Assembly</td>
<td>0</td>
<td>39</td>
<td>733</td>
<td>153</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Public Order and Safety</td>
<td>0</td>
<td>39</td>
<td>899</td>
<td>374</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Religious Worship</td>
<td>0</td>
<td>39</td>
<td>339</td>
<td>129</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>0</td>
<td>39</td>
<td>599</td>
<td>266</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Warehouse and Storage</td>
<td>0</td>
<td>39</td>
<td>352</td>
<td>181</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>39</td>
<td>1,278</td>
<td>257</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Vacant</td>
<td>0</td>
<td>39</td>
<td>162</td>
<td>47</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Section II: Pavement

| Pavement                                          | 0.12  | 6                                      | 8                           |

**Total Project Emissions:**

**Amount of Pavement (sq. ft.)**

- Shelter Foundation: 360
- Vestibule Foundation: 108.94
- Tank 1 Foundation: 72
- Tower Foundation: 676
- Total (sq. ft.): 1216.94

Version 1.7 12/26/07
## Definition of Building Types

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

**Sources:**

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

- **Commercial**
  Commercial Buildings Energy Consumption Survey (CBECs),
  Description of CBECs Building Types
### Embodied Emissions Worksheet

#### Section I: Buildings

<table>
<thead>
<tr>
<th>Type (Residential) or Principal Activity</th>
<th># thousand sq feet/unit or building</th>
<th>Life span related embodied GHG missions (MTCO2e/unit)</th>
<th>Life span related embodied GHG missions (MTCO2e/thousand square feet) - See calculations in table below</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family Home</td>
<td>2.55</td>
<td>98</td>
<td>39</td>
</tr>
<tr>
<td>Multi-Family Unit in Large Building</td>
<td>0.85</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>Multi-Family Unit in Small Building</td>
<td>1.29</td>
<td>44</td>
<td>39</td>
</tr>
<tr>
<td>Mobile Home</td>
<td>1.06</td>
<td>41</td>
<td>39</td>
</tr>
<tr>
<td>Education</td>
<td>29.2</td>
<td>991</td>
<td>39</td>
</tr>
<tr>
<td>Food Sales</td>
<td>6.6</td>
<td>217</td>
<td>39</td>
</tr>
<tr>
<td>Food Service</td>
<td>6.6</td>
<td>217</td>
<td>39</td>
</tr>
<tr>
<td>Health Care Inpatient</td>
<td>24.1</td>
<td>9346</td>
<td>39</td>
</tr>
<tr>
<td>Health Care Outpatient</td>
<td>10.4</td>
<td>403</td>
<td>39</td>
</tr>
<tr>
<td>Lodging</td>
<td>25.3</td>
<td>991</td>
<td>39</td>
</tr>
<tr>
<td>Public Safety</td>
<td>9.7</td>
<td>376</td>
<td>39</td>
</tr>
<tr>
<td>Police</td>
<td>12.8</td>
<td>575</td>
<td>39</td>
</tr>
<tr>
<td>Public Assembly</td>
<td>14.2</td>
<td>550</td>
<td>39</td>
</tr>
<tr>
<td>Public Order and Safety</td>
<td>15.5</td>
<td>592</td>
<td>39</td>
</tr>
<tr>
<td>Religious Worship</td>
<td>15.1</td>
<td>591</td>
<td>39</td>
</tr>
<tr>
<td>Service</td>
<td>6.5</td>
<td>252</td>
<td>39</td>
</tr>
<tr>
<td>Warehouse and Storage</td>
<td>15.9</td>
<td>594</td>
<td>39</td>
</tr>
<tr>
<td>Other</td>
<td>21.9</td>
<td>848</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>16.1</td>
<td>546</td>
<td>39</td>
</tr>
</tbody>
</table>

#### Section II: Pavement

<table>
<thead>
<tr>
<th>Columns and Beams</th>
<th>Intermediate Floors</th>
<th>Exterior Walls</th>
<th>Windows</th>
<th>Interior Walls</th>
<th>Roofs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average GWP (lbs CO2eq/kg): Vancouver, Low Rise Building</td>
<td>6.5</td>
<td>7.8</td>
<td>19.1</td>
<td>61.2</td>
<td>5.7</td>
</tr>
<tr>
<td>Average Materials in a 2,272-square foot single family home</td>
<td>MTC02e</td>
<td>0.0</td>
<td>2269.0</td>
<td>2269.0</td>
<td>727.4</td>
</tr>
</tbody>
</table>

**Sources**

- All data in black text
- King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov
- Residential floorspace per unit
  - 2001 Residential Energy Consumption Survey (National Average, 2001)
  - Square footage measurements and comparisons
    - http://www.eia.doe.gov/emeu/recs/sqfl-measure.html
- Floorspace per building
- Athena EcoCalculator
  - Athena Assembly Evaluation Tool v2.3-Vancouver Low Rise Building
  - Average GWP (kg) per square meter
    - Lbs per kg
    - 2.20
    - Square feet per square meter
    - 10.76
- Average Materials in a 2,272-square foot single family home
  - http://buildingsdatabook.eren.doe.gov/?id=view_book_index&TableID=2000.xls
Special Section: Estimating for Embodied Emissions for Pavement

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

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

The four studies, Mail (2001), Park (2003), Stripple (2001) and Treolar (2001) produced total GHG emissions of 4-34 MTC02e/ thousand square feet of finished paving (for similar asphalt and concrete based pavements). This estimate does not including downstream maintenance and repair of the highway. The average for all concrete and asphalt pavements in the studies, assuming each study gets one data point) is ~17 MTC02e/thousand square feet.

Three of the studies attempted to thoroughly account for the emissions associated with long term maintenance (40 years) of the roads. Stripple (2001), Park et al. (2003) and Treolar (2001) report 17, 81, and 58 MTC02e/thousand square feet, respectively, after accounting for maintenance of the roads.

Based on the above discussion, King County makes the conservative estimate that 50 MTC02e/thousand square feet of pavement (over the development’s life cycle) will be used as the embodied emission factor for pavement until better estimates can be obtained. This is roughly equivalent to 3,600 MTC02e per lane mile of road (assuming the lane is 13 feet wide).

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

Sources:

44/61/1ATK0013athenns420report%20Feb%20%2007.pdf


## Energy Emissions Worksheet

<table>
<thead>
<tr>
<th>Type (Residential) or Principal Activity (Commercial)</th>
<th>Energy consumption per building per year (million Btu)</th>
<th>Carbon Coefficient for Buildings</th>
<th>MTCO2e per building per year</th>
<th>Floorspace per building (thousand square feet) per year</th>
<th>MTCE per thousand square feet per year</th>
<th>Average Building Life Span</th>
<th>Lifespan Energy Related MTCO2e emissions per unit</th>
<th>Lifespan Energy Related MTCO2e emissions per thousand square feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family Home</td>
<td>107.3</td>
<td>0.108</td>
<td>11.61</td>
<td>2.53</td>
<td>4.6</td>
<td>16.8</td>
<td>57.9</td>
<td>672</td>
</tr>
<tr>
<td>Multi-Family Unit in Large Building</td>
<td>41.0</td>
<td>0.108</td>
<td>4.44</td>
<td>0.85</td>
<td>5.2</td>
<td>19.2</td>
<td>80.5</td>
<td>357</td>
</tr>
<tr>
<td>Multi-Family Unit in Small Building</td>
<td>78.1</td>
<td>0.108</td>
<td>8.45</td>
<td>1.39</td>
<td>6.1</td>
<td>22.2</td>
<td>80.5</td>
<td>691</td>
</tr>
<tr>
<td>Mobile Home</td>
<td>75.9</td>
<td>0.108</td>
<td>8.21</td>
<td>1.00</td>
<td>7.7</td>
<td>28.4</td>
<td>57.9</td>
<td>472</td>
</tr>
<tr>
<td>Education</td>
<td>2,126.0</td>
<td>0.124</td>
<td>264.2</td>
<td>25.6</td>
<td>10.3</td>
<td>37.8</td>
<td>62.5</td>
<td>16,526</td>
</tr>
<tr>
<td>Food Sales</td>
<td>1,110.0</td>
<td>0.124</td>
<td>138.0</td>
<td>5.6</td>
<td>24.6</td>
<td>90.4</td>
<td>62.5</td>
<td>8,632</td>
</tr>
<tr>
<td>Food Service</td>
<td>1,436.0</td>
<td>0.124</td>
<td>175.5</td>
<td>5.6</td>
<td>31.9</td>
<td>116.6</td>
<td>62.5</td>
<td>11,158</td>
</tr>
<tr>
<td>Health Care Inpatient</td>
<td>60,152.0</td>
<td>0.124</td>
<td>7,479.1</td>
<td>241.4</td>
<td>31.3</td>
<td>113.6</td>
<td>62.5</td>
<td>467,784</td>
</tr>
<tr>
<td>Health Care Outpatient</td>
<td>986.0</td>
<td>0.124</td>
<td>122.5</td>
<td>10.4</td>
<td>11.8</td>
<td>43.2</td>
<td>62.5</td>
<td>7,680</td>
</tr>
<tr>
<td>Lodging</td>
<td>3,578.0</td>
<td>0.124</td>
<td>444.9</td>
<td>35.8</td>
<td>12.4</td>
<td>45.6</td>
<td>62.5</td>
<td>27,928</td>
</tr>
<tr>
<td>Retail (Other Than Mall)</td>
<td>720.0</td>
<td>0.124</td>
<td>95.5</td>
<td>9.7</td>
<td>9.6</td>
<td>35.8</td>
<td>62.5</td>
<td>5,399</td>
</tr>
<tr>
<td>Office</td>
<td>1,376.0</td>
<td>0.124</td>
<td>171.1</td>
<td>14.8</td>
<td>11.6</td>
<td>42.4</td>
<td>62.5</td>
<td>10,701</td>
</tr>
<tr>
<td>Public Assembly</td>
<td>1,338.0</td>
<td>0.124</td>
<td>186.4</td>
<td>14.2</td>
<td>11.7</td>
<td>43.0</td>
<td>62.5</td>
<td>10,405</td>
</tr>
<tr>
<td>Public Order and Safety</td>
<td>1,791.0</td>
<td>0.124</td>
<td>222.7</td>
<td>15.5</td>
<td>14.4</td>
<td>52.7</td>
<td>62.5</td>
<td>13,928</td>
</tr>
<tr>
<td>Religious Worship</td>
<td>440.0</td>
<td>0.124</td>
<td>54.7</td>
<td>10.1</td>
<td>5.4</td>
<td>19.9</td>
<td>62.5</td>
<td>3,422</td>
</tr>
<tr>
<td>Service</td>
<td>501.0</td>
<td>0.124</td>
<td>62.3</td>
<td>8.5</td>
<td>9.6</td>
<td>35.1</td>
<td>62.5</td>
<td>3,899</td>
</tr>
<tr>
<td>Warehouse and Storage</td>
<td>764.0</td>
<td>0.124</td>
<td>95.0</td>
<td>16.9</td>
<td>5.6</td>
<td>20.6</td>
<td>62.5</td>
<td>5,942</td>
</tr>
<tr>
<td>Other</td>
<td>3,000.0</td>
<td>0.124</td>
<td>447.6</td>
<td>21.9</td>
<td>20.4</td>
<td>74.9</td>
<td>62.5</td>
<td>27,997</td>
</tr>
<tr>
<td>Vacant</td>
<td>294.0</td>
<td>0.124</td>
<td>36.6</td>
<td>14.1</td>
<td>2.6</td>
<td>9.5</td>
<td>62.5</td>
<td>2,296</td>
</tr>
</tbody>
</table>

### Sources

All data in black text
- King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov
- Energy consumption for residential buildings
    - Table 6.1.4: Average Annual Carbon Dioxide Emissions for Various Functions
      - http://buildingsdatabook.eren.doe.gov/
      - Data also at: http://www.eia.doe.gov/emeu/recs/recs2001_ce/ce1-4c_housingunits2001.html
- Energy consumption for commercial buildings and floorspace per building
      - Note: Data in plum color is found in both of the above sources (buildings energy data book and commercial buildings energy consumption survey).
  - Buildings Energy Data Book (National average, 2005)
    - Table 3.1.7. 2005 Carbon Dioxide Emission Coefficients for Buildings (MMTCE per Quadrillion Btu)
      - http://buildingsdatabook.eere.energy.gov/?id=view_book_table&TableID=2057
      - Note: Carbon coefficient in the Energy Data Book is in MTC per Quadrillion Btu.
      - To convert to MTCO2e per million Btu, this factor was divided by 1030 and multiplied by 44/12.
- Residential floorspace per unit
  - 2001 Residential Energy Consumption Survey (National Average, 2001)
    - Square footage measurements and comparisons
      - http://www.eia.doe.gov/emeu/recs/sqft-measure.html
average life span of buildings, estimated by replacement time method

<table>
<thead>
<tr>
<th></th>
<th>Single Family Homes</th>
<th>Multi-Family Units in Large and Small Buildings</th>
<th>All Residential Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Housing Construction, 2001</td>
<td>1,273,000</td>
<td>329,000</td>
<td>1,602,000</td>
</tr>
<tr>
<td>Existing Housing Stock, 2001</td>
<td>73,700,000</td>
<td>26,300,000</td>
<td>100,200,000</td>
</tr>
<tr>
<td>Replacement time</td>
<td>57.9</td>
<td>60.5</td>
<td>62.5 (national average, 2001)</td>
</tr>
</tbody>
</table>

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

Sources:

See also: http://www.census.gov/houst/www/newresconstindex.html

Existing Housing Stock, 2001 Residential Energy Consumption Survey (RECS) 2001
- Tables HC1: Housing Unit Characteristics, Million U.S. Households 2001
- Table HC1-4a: Housing Unit Characteristics by Type of Housing Unit, Million U.S. Households, 2001
## Transportation Emissions Worksheet

<table>
<thead>
<tr>
<th>Type (Residential) or Principal Activity</th>
<th># people/ unit or building</th>
<th># thousand sq feet/unit</th>
<th># people or employees/thousand square feet</th>
<th>vehicle related GHG emissions (metric tonnes CO₂e per person per year)</th>
<th>MTCO₂e/year/unit</th>
<th>MTCO₂e/year/thousand square feet</th>
<th>Average Building Life Span</th>
<th>Life span transportation related GHG emissions (MTCO₂e/thousand sq feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family Home</td>
<td>2.8</td>
<td>2.53</td>
<td>1.1</td>
<td>4.9</td>
<td>13.7</td>
<td>5.4</td>
<td>57.9</td>
<td>792</td>
</tr>
<tr>
<td>Multi-Family Unit in Large Building</td>
<td>1.9</td>
<td>0.06</td>
<td>2.3</td>
<td>4.3</td>
<td>5.5</td>
<td>11.2</td>
<td>80.5</td>
<td>706</td>
</tr>
<tr>
<td>Multi-Family Unit in Small Building</td>
<td>1.9</td>
<td>1.39</td>
<td>1.0</td>
<td>4.9</td>
<td>8.8</td>
<td>11.6</td>
<td>80.5</td>
<td>768</td>
</tr>
<tr>
<td>Mobile Home</td>
<td>2.5</td>
<td>1.06</td>
<td>2.3</td>
<td>4.9</td>
<td>12.2</td>
<td>11.6</td>
<td>57.9</td>
<td>709</td>
</tr>
<tr>
<td>Education</td>
<td>30.0</td>
<td>25.6</td>
<td>1.2</td>
<td>4.9</td>
<td>147.8</td>
<td>5.8</td>
<td>62.5</td>
<td>9247</td>
</tr>
<tr>
<td>Food Sales</td>
<td>5.1</td>
<td>6.6</td>
<td>0.9</td>
<td>4.9</td>
<td>25.2</td>
<td>4.5</td>
<td>62.5</td>
<td>1679</td>
</tr>
<tr>
<td>Food Service</td>
<td>10.2</td>
<td>6.3</td>
<td>1.9</td>
<td>4.9</td>
<td>50.2</td>
<td>0.0</td>
<td>62.5</td>
<td>3141</td>
</tr>
<tr>
<td>Health Care Inpatient</td>
<td>455.5</td>
<td>241.4</td>
<td>1.9</td>
<td>4.9</td>
<td>2246.4</td>
<td>9.3</td>
<td>62.5</td>
<td>140506</td>
</tr>
<tr>
<td>Health Care Outpatient</td>
<td>19.3</td>
<td>10.4</td>
<td>1.5</td>
<td>4.9</td>
<td>85.0</td>
<td>9.1</td>
<td>62.5</td>
<td>5841</td>
</tr>
<tr>
<td>Lodging</td>
<td>13.8</td>
<td>35.6</td>
<td>0.4</td>
<td>4.9</td>
<td>67.1</td>
<td>1.3</td>
<td>62.5</td>
<td>4194</td>
</tr>
<tr>
<td>Retail (Other Than Mall)</td>
<td>7.8</td>
<td>9.7</td>
<td>0.8</td>
<td>4.9</td>
<td>38.3</td>
<td>3.9</td>
<td>62.5</td>
<td>2394</td>
</tr>
<tr>
<td>Office</td>
<td>28.2</td>
<td>14.5</td>
<td>1.9</td>
<td>4.9</td>
<td>138.0</td>
<td>9.4</td>
<td>62.5</td>
<td>8696</td>
</tr>
<tr>
<td>Public Assembly</td>
<td>6.9</td>
<td>14.2</td>
<td>0.9</td>
<td>4.9</td>
<td>34.2</td>
<td>2.4</td>
<td>62.5</td>
<td>2137</td>
</tr>
<tr>
<td>Public Order and Safety</td>
<td>18.9</td>
<td>15.0</td>
<td>1.2</td>
<td>4.9</td>
<td>72.7</td>
<td>6.0</td>
<td>62.5</td>
<td>8796</td>
</tr>
<tr>
<td>Religious Worship</td>
<td>4.2</td>
<td>10.1</td>
<td>0.4</td>
<td>4.9</td>
<td>20.8</td>
<td>2.1</td>
<td>62.5</td>
<td>1208</td>
</tr>
<tr>
<td>Service</td>
<td>5.6</td>
<td>6.5</td>
<td>0.9</td>
<td>4.9</td>
<td>27.6</td>
<td>4.4</td>
<td>62.5</td>
<td>1729</td>
</tr>
<tr>
<td>Warehouse and Storage</td>
<td>9.9</td>
<td>16.9</td>
<td>0.6</td>
<td>4.9</td>
<td>46.0</td>
<td>2.9</td>
<td>62.5</td>
<td>3067</td>
</tr>
<tr>
<td>Other</td>
<td>18.3</td>
<td>21.9</td>
<td>0.8</td>
<td>4.9</td>
<td>20.0</td>
<td>4.1</td>
<td>62.5</td>
<td>8500</td>
</tr>
<tr>
<td>Vacant</td>
<td>2.1</td>
<td>14.1</td>
<td>0.2</td>
<td>4.9</td>
<td>10.6</td>
<td>0.7</td>
<td>62.5</td>
<td>657</td>
</tr>
</tbody>
</table>

### Sources

- All data in black text: King County, DNRP. Contact: Matt Kuharic, matt.kuharic@kingcounty.gov
- # people/unit
  - Washington State Office of Financial Management
  - Note: This analysis combines Multi Unit Structures in both large and small units into one category; the average is used in this case although there is likely a difference
- Residential floorspace per unit
  - 2001 Residential Energy Consumption Survey (National Average, 2001)
  - Square footage measurements and comparisons
  - http://www.eia.doe.gov/emeu/recs/sqft-measure.html
- # employees/thousand square feet
  - Commercial Buildings Energy Consumption Survey commercial energy uses and costs (National Median, 2003)
  - Table B2 Totals and Medians of Floorspace, Number of Workers, and Hours of Operation for Non-Mall Buildings, 2003
  - Note: Data for # employees/thousand square feet is presented by CBECs as square feet/employee.
  - In this analysis employees/thousand square feet is calculated by taking the inverse of the CBECs number and multiplying by 1000.
vehicle related GHG emissions

Estimate calculated as follows (Washington state, 2006)

56,531,930,000 2006 Annual WA State Vehicle Miles Traveled
Data was daily VMT. Annual VMT was 365*daily VMT.
http://www.wsdot.wa.gov/Mapdata/Ido/annualmileage.htm

6,395,798 2006 WA state population
http://quickfacts.census.gov/qfd/states/53000.html

8839 vehicle miles per person per year
0.0506 gallon gasoline/mile

This is the weighted national average fuel efficiency for all cars and 2 axle, 4 wheel light trucks in 2005. This
includes pickup trucks, vans and SUVs. The 0.051 gallons/mile used here is the inverse of the more commonly
known term "miles/per gallon" (which is 19.75 for these cars and light trucks).
based on weighted average MPG efficiency of cars and light trucks.
http://cta.oml.gov/data/edb28/SpreadSheets/Table3_04.xls
Note: This report states that in 2005, 92.3% of all highway VMT were driven by the above described vehicles.

24.3 lbs CO2e/gallon gasoline
The CO2 emissions estimates for gasoline and diesel include the extraction, transport, and refinement of petroleum
as well as their combustion.
Life-Cycle CO2 Emissions for Various New Vehicles. RENew Northfield.
Note: This is a conservative estimate of emissions by fuel consumption because diesel fuel,
with a emissions factor of 26.55 lbs CO2e/gallon was not estimated.

2205
4.93 lbs/metric tonne
average life span of building, estimated
vehicle related GHG emissions (metric tonnes CO2e per person per year)

See Energy Emissions Worksheet for Calculations

Commercial floorspace per unit

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