April 4, 2019

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.

ELEC19-0029

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.

Federal government requires an FCC NEPA compliance Report, Federal Aviation Administration (FAA) requires FAA lighting compliance and Washington State requires a SEPA report.

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 ¼, SE ¼ 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.

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

None noted.

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 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 l and 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-SO 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-5-0SO.

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.

d. 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? Pleas 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: _____

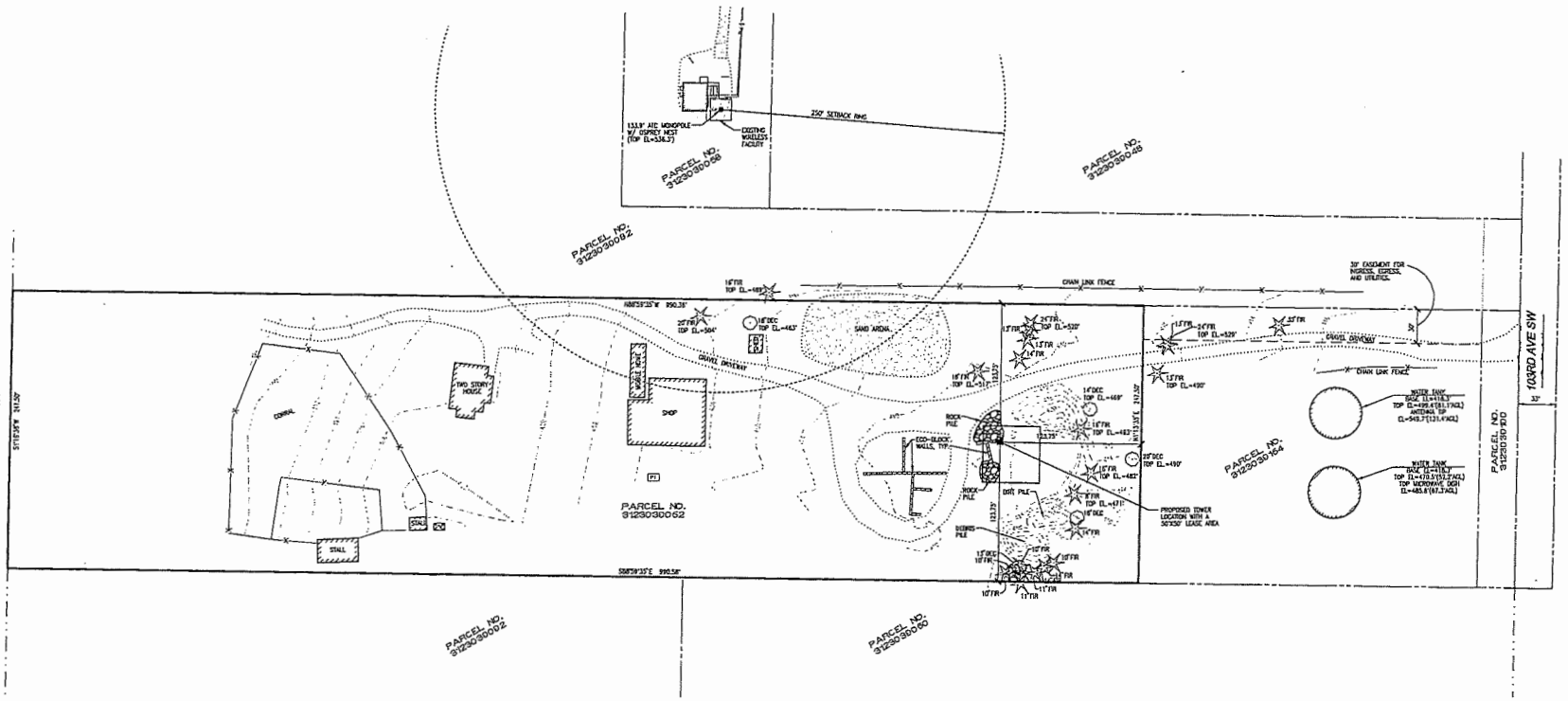
Name of signee: Rick Cardoza

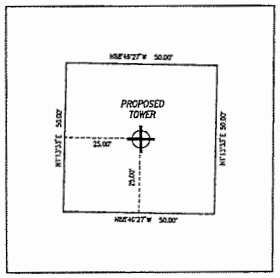
Position and Agency/Organization: Site Acquisition Project Manager, LDC Inc.

Date Submitted: 4/5/19

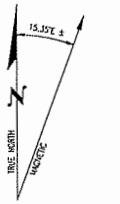
PSERN - VASHON V13

SW 1/4, SE 1/4 OF SEC. 31, T. 23 N., R. 3 E, W.M.
KING COUNTY, WASHINGTON





LEASE AREA
SCALE: 1"=20'



SCALE: 1" = 50'
50' 0 50' 100'

LEGEND

- TREE CONIFEROUS
- TREE DECIDUOUS
- UTILITY POLE
- POWER VAULT
- JUNCTION BOX
- POWER TRANSFORMER
- TELCO RISER
- EXISTING PAVEMENT
- EXISTING GRAVEL
- ASPHALT EDGE
- CURB
- CONTOUR MAJOR
- CONTOUR MINOR
- BOUNDARY LINE
- RIGHT OF WAY
- PROPERTY ADJACENT
- SECTION LINE
- EXISTING CONCRETE
- EXISTING DIRT

PSERN
PUGET SOUND EMERGENCY RADIO NETWORK
Coverage • Capacity • Capability • Connectivity

MOTOROLA SOLUTIONS

PYRAMID Network Services, LLC

LDC Surveying Engineering Planning
20210 142nd Avenue NE Ph. 425.806.1869
Woodinville, WA 98072 Fx. 425.482.2893
www.LDCcorp.com

DATE:	3-15-18
DRAWN BY:	NSY
CHECKED BY:	VJT

SUBMITTALS

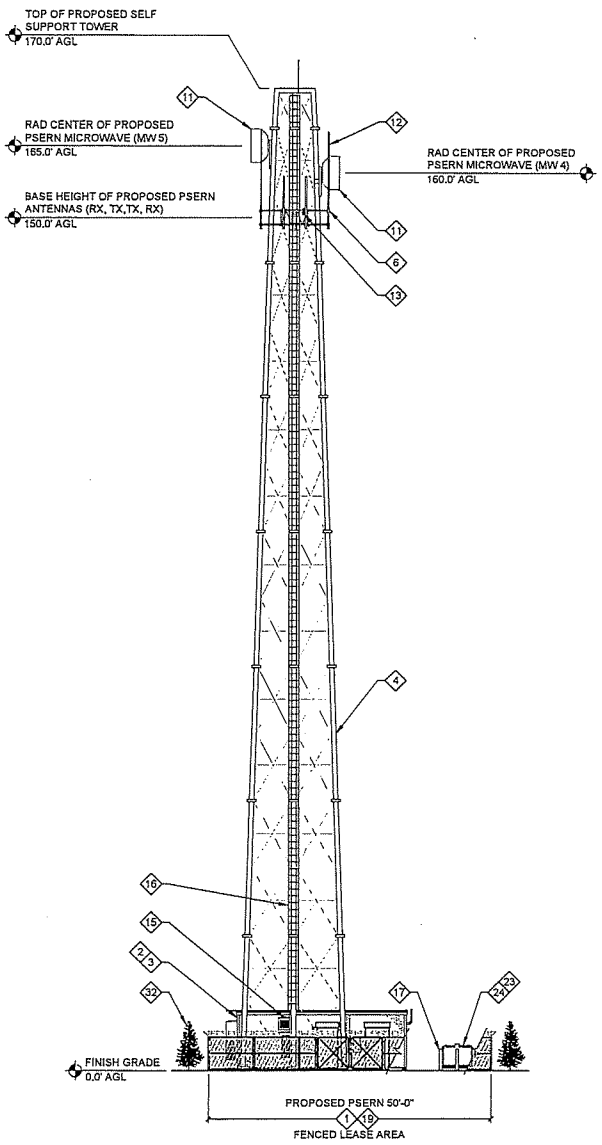
REV	DATE	DESCRIPTION	BY

MICHAEL ROBERT STEVENS — STATE OF WASHINGTON — 18851 — REGISTERED PROFESSIONAL LAND SURVEYOR — 3-15-18

SITE
PSERN
VASHON V13
18851 103RD AVENUE SW
VASHON ISLAND, WA 98070

SHEET TITLE
CIVIL SURVEY

SHEET NUMBER
SV-1.1



PROPOSED NORTHEAST ELEVATION (LOOKING SOUTHWEST) 1

22"x34" SCALE: 3/32" = 1'-0" | 11"x17" SCALE: 3/64" = 1'-0"

NOTE:
- ALL CONSTRUCTION SHALL BE DONE IN ACCORDANCE WITH MOTOROLA'S R-56 DESIGN STANDARDS

CONSTRUCTION PLAN KEYED NOTES

1. PROPOSED PSERN LEASE AREA.
2. PROPOSED PSERN PRE-FABRICATED EQUIPMENT SHELTER W/ VESTIBULE ENTRANCE. ENGINEERED BY OTHERS.
3. PROPOSED PSERN EQUIPMENT SHELTER AND VESTIBULE CONCRETE SLAB. STRUCTURAL PENDING.
4. PROPOSED 170.0' SELF SUPPORT TOWER. ENGINEERED BY OTHERS.
6. PROPOSED PSERN SECTOR ANTENNA MOUNT (1 TOTAL).
11. PROPOSED PSERN MICROWAVE WITH MOUNT (2 TOTAL).
12. PROPOSED PSERN DIPOLE/ OMNI ANTENNA, TYP (4 TOTAL).
13. PROPOSED PSERN TTA UNIT (1 TOTAL).
15. PROPOSED PSERN 10'-0" TALL PEDESTAL MOUNTED ICE BRIDGE W/ 8'-0" CLEAR BELOW COAX SUPPORT.
16. PROPOSED PSERN CABLE LADDER.
17. PROPOSED 6"Ø CONCRETE BOLLARD (6 TOTAL).
19. PROPOSED 8'-0" TALL CHAIN LINK FENCE W/ BARBED WIRE.
23. PROPOSED PSERN CONVAULT DIESEL TANK CONCRETE PAD. STRUCTURAL PENDING.
24. PROPOSED PSERN 1,000 GAL CONVAULT DIESEL TANK.
32. PROPOSED PSERN LANDSCAPING BUFFER. (ALL L-1.0)

SITE NOTES

1. VERIFY ANTENNA MODEL, TIP HEIGHT & AZIMUTHS.
2. ANALYSIS OF TOWER & FOUNDATION SHALL BE PERFORMED BY OTHERS & STAMPED BY A LICENSED STRUCTURAL ENGINEER.

PSERN — PUGET SOUND EMERGENCY RADIO NETWORK

MOTOROLA SOLUTIONS

PYRAMID Network Services, LLC

LDC Surveying Engineering Planning
20210 142nd Avenue NE, Woodinville, WA 98072
Ph. 425.486.1869 Fx. 425.482.8931
www.LDCcorp.com

DATE:	3-1-19
DRAWN BY:	RJG
CHECKED BY:	RBH

SUBMITTALS

REV	DATE	DESCRIPTION	BY
1	3-1-19	PRELIMINARY ZONING	RJG
2	3-6-19	FINAL ZONING	RTL

STATE REGISTERED ARCHITECT
RICHARD T. HALL
STATE OF WASHINGTON
EXPIRES: 8-20-19

APPROVAL STAMP

SITE

T18-495

VASHON V13

18851 103RD AVE SW
VASHON ISLAND, WA 98070

SHEET TITLE

ELEVATION

SHEET NUMBER

A-3.0

GHG SUMMARY

PSERN Vashon V13

ELEC19-6029

PSERN Vashon V13:	Remote Site [FED]
Building:	New Motorola-Supplied 12 x 30 Prefab Shelter + Genset + Diesel Fuel Tank
Updated:	01-29-2018
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

King County Department of Development and Environmental Services
SEPA GHG Emissions Worksheet
Version 1.7 12/26/07 (Introduction Revised March 2011)

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 buildings 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 on type of commercial activity, the appropriate information should be estimated for each type of building or activity.
2. For paving, estimate the total amount of paving (in thousands of square feet) of the project.
3. The Worksheet will calculate the amount of GHG emissions associated with the project and display the amount in the "Total Emissions" column on the worksheet. The applicant should use this information when completing the SEPA checklist.

4. The last three worksheets in the Excel file provide the background information that is used to calculate the total GHG emissions.
5. The methodology of creating the estimates is transparent; if there is reason to believe that a better estimate can be obtained by changing specific values, this can and should be done. Changes to the values should be documented with an explanation of why and the sources relied upon.
6. Print out the "Total Emissions" worksheet and attach it to the SEPA checklist. If the applicant has made changes to the calculations or the values, the documentation supporting those changes should also be attached to the SEPA checklist.

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

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		0.0	39	1,278	257	0
Vacant		0.0	39	162	47	0

Section II: Pavement

Pavement		0.12				6

Total Project Emissions: 6

	Amount of Pavement (sq. ft.)
Shelter Foundation	360
Vestibule Foundation	108.94
Tank 1 Foundation	72
Tower Foundation	676
Total (sq. ft.)	1216.94

Definition of Building Types

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

Sources: .....

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

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

Embodied Emissions Worksheet

Section I: Buildings

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

Section II: Pavement

All Types of Pavement			50

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

Sources

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

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

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

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

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

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

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

Embodied GHG Emissions.....Worksheet Background Information

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

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

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

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

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

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

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

Special Section: Estimating the Embodied Emissions for Pavement

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

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

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

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

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

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

Sources:

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

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

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

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

Energy Emissions Worksheet

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

Sources

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

Energy consumption for residential buildings

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

Energy consumption for commercial buildings
and
Floorspace per building

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

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

Carbon Coefficient for Buildings

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

Residential floorspace per unit

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

average lief span of buildings, estimated by replacement time method

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

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

Sources:

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

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

Transportation Emissions Worksheet

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

Sources

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

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

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

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

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

vehicle related GHG emissions

Estimate calculated as follows (Washington state, 2006)_

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

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

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