LEED for Homes

Operations and Maintenance

Manual 2153 Kingsway at Gladstone

U.S. Green Building Council

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In the LEED for Homes program, the Project Team must educate the homeowner (and/or tenants) on the specific LEED for Homes-related equipment installed (per prerequisite AE 1.1 of the LEED for Homes Rating System). This training includes the unique operations and maintenance requirements for that equipment. USGBC developed this manual to complement the educational activities of the project team. However, the information in this manual is general in nature and may not address all of the features in a LEED-certified home. Further, this information is not intended to supersede the Project Team's instructions.

U.S. Green Building Council
2101 L Street, NW, Suite 500
Washington, DC 20037

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A description of each of these tips is presented in Parts 2 and 3 of this manual.

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Quick Look-Up (cont'd)

Summary of Suggested Operations and Maintenance Tips

A description of each of these tips is presented in Parts 2 and 3 of this manual.

	Maintenance Task	Season				Every Few Years
		Winter	Spring	Summer	Fall	
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Part 1

Introduction to Your Green Home

- ✓ What are Green Homes?
- ✓ Your Role in Keeping Your Home Green
- ✓ Emergency Information and Safety Tips
- ✓ Purpose and Structure of this Manual

What are Green Homes?

Generally speaking, a green home is designed and built to be:

Healthy,
Comfortable,
Durable,
Energy efficient, and
Environmentally responsible.

A common misconception is that all new homes, built to the minimum building codes, are high quality and high performance homes. However, many new homes do not achieve several of the benefits listed above. Green homes are built to substantially exceed the performance levels offered by conventional, code-compliant new homes.

Also, while many new homes may claim to be green, they differ in how thoroughly they achieve the benefits above. In other words, they achieve different degrees of green, depending on the degree to which they deliver these benefits.

Why Green Homes?

Homes have a very significant environmental impact. According to the U.S. Department of Energy, all homes in the U.S. account for:

22% of the total energy consumed; and
21% of carbon dioxide emissions.

Also, certain indoor air pollutants can often be four to five times higher than outdoor levels. Construction and demolition waste (including both residential and commercial buildings) represents 40% of the solid waste in the U.S. Homes also have a significant impact on the amount of water consumed, on the amount of chemicals (e.g., fertilizer, pest control chemicals) that can damage nearby water bodies, and other consequences.

Shifting towards the design and construction of more sustainable homes can have enormous benefits for the environment, as well as for the occupants.

What is LEED for Homes?

LEED for Homes is a voluntary rating system administered by the U.S. Green Building Council (USGBC). USGBC is a non-profit organization that promotes the design and construction of high performance green buildings. To be certified under the LEED for Homes program, a home must:

- Include several required green measures ("prerequisites") (e.g., achieve energy efficiency at least 15%[1] better than conventional homes), and
- Include many additional green measures. These are chosen by the builder from a variety of optional measures ("credits") to earn points. A project must earn a minimum number of points to achieve certification.

The program includes several additional requirements as well, such as verification by a LEED for Homes Green Rater. The LEED for Homes Green Rater is not associated with the project team (i.e., this person is a "third-party") and he or she has training in verifying green homes. In the verification process, the LEED for Homes Green Rater confirms that:

- All of the required green measures are installed in the home (by visual inspection), and
- The performance level of the home meets the program requirements (by physical testing of the home's air leakage, duct leakage, etc.).

For more information on the LEED for Homes program, go to:

www.usgbc.org/LEED/homes

[1] Homes must be 15% more efficient in mild & moderate climates and 20% more efficient in cold climates.

Your Role in Keeping Your Home Green

Most people know that cars need regular maintenance, like periodic oil changes and keeping tires properly inflated. Regular maintenance helps to keep a car running longer, more safely, and more efficiently. Similarly, your home needs regular maintenance to prevent equipment malfunctions, minimize health risks, and keep it operating as efficiently as possible.

A green home may also have special features that you may be unfamiliar with. Some of these special features have operations and maintenance requirements that will help to ensure that your home remains environmentally responsible and resource efficient throughout its lifetime.

This manual provides operations and maintenance tips on how to keep your new LEED-certified home healthy, comfortable, durable, efficient, and environmentally responsible.

Emergency Information and Safety Tips

This section offers emergency and safety tips that are important for any home. These tips are meant to be a brief summary and not a complete list.

Emergency Information

Immediately after moving into your home, take a few minutes to do the following. Don't wait until you have an emergency!

- Locate central shut-off valves for each of the following:
  - ✓ Water supply;
  - ✓ Electricity supply; and
  - ✓ Heating fuel (e.g., gas, oil, propane).
- Find the number for your local poison control center, especially if you have small children.
- Locate the nearest hospital emergency room(s).
- Contact local authorities for emergency suggestions for local and regional natural disasters (e.g. flood, hurricane, tornado, earthquake). Identify fire escape routes, particularly in large homes or multifamily buildings.

Safety Tips

- Regularly replace batteries in smoke alarms and check that they are functioning.
- Periodically check electrical cords, plugs, outlets, and other equipment for damage, and replace as needed. Also, don't overload electrical circuits.
- Keep the area around furnaces, hot water heaters, and other combustion equipment clean and free of clutter to help prevent fires.
- Never use any unvented combustion equipment inside your home or garage, such as barbeque grills, camping stoves, kerosene heaters, etc. These can release large amounts of deadly carbon monoxide inside your home.
- Inspect your hot water equipment annually for rust, disconnected vents, or other signs of a problem. For example, the pipe carrying exhaust from a hot water heater may become cracked or disconnected over time, which can cause carbon monoxide to be released into the home, or a fire.
- Set your hot water heater at or below 120^{o} F. This is recommended by the Home Safety Council for safety[2], and it will also save energy.

[2] http://homesafetycouncil.org/SafetyGuide/sg_water_w003.asp

Purpose and Structure of this Manual

A list of all of the measures installed in your LEED-certified home is shown in the Project Checklist in Appendix A of this document. Further information on these measures can be found in the LEED for Homes Rating System[3]. Note that builders have some flexibility in which green measures (or LEED credits) they install in each LEED-certified home. Some of the features described in this manual may not be included in your LEED-certified home. Review the LEED for Homes checklist that was filled out specifically for your home to find out which features are installed.

The purpose of this document is to:

Part 2. Highlight the operation and maintenance procedures for the LEED for Homes measures that are installed in your home. Note that many of the LEED for Homes measures installed in your home should not require any operations or maintenance. For example, insulation that is more effective than what is required by code is installed behind the drywall. This and other measures installed behind the drywall should provide their intended benefits throughout the life of your home, without the need for maintenance. Features that do not require maintenance are not included in this manual.

Part 3. Describe operation and maintenance information for special LEED features that your builder has installed in your home. Your builder has included these special features to substantially improve the overall performance of your home.

Part 4. Suggest resources if you decide to do a renovation or addition to your home.

Part 5. Provide green lifestyle tips. Your LEED-certified home includes many measures for *efficiency* (i.e., getting more useful output, such as light, hot water, etc. for the amount of energy supplied). You can further reduce energy and water bills, and your environmental footprint, by following basic measures for *conservation* (i.e., using less energy, water, and other resources). In addition, the day to day behavioral choices that you make in other areas of your life, such as transportation, cleaning, and purchasing, can greatly affect your overall environmental footprint. The green lifestyle tips suggest behavioral choices that will help you live more sustainably, and that will often help save you money as well.

[3] The LEED for Homes Rating System can be downloaded at no charge from www.USGBC.org/LEED/homes.

Part 2

How to Maintain the Green Features in Your Home

Operations and Maintenance Tips for:

- ✓ Indoor Pollutants
- ✓ The Exterior Structure or Envelope
- ✓ Interior Durability and Finishes
- ✓ Lighting and Appliances
- ✓ Heating, Cooling, and Ventilation Systems
- ✓ Plumbing
- ✓ Your Garage
- ✓ Your Yard

How to Maintain the Green Features in Your Home

This section includes operation and maintenance tips for LEED for Homes features installed in your home that require some upkeep or user operation. Keep in mind:

- The maintenance requirements for your home are specific to the types of systems that are installed in your home. It is very important for you to be familiar with the product manufacturer's specific recommendations for each system (see Appendix B).
- Many of the features in your LEED-certified home will not require maintenance, so they are not described here. But many still require that you use them properly in order to fully reap their benefits. For example, if your LEED-certified home includes dual flush toilets, this feature will only conserve water if everyone in your home uses the partial flush feature when appropriate. Review the LEED for Homes checklist (Appendix A) that was customized for your home to familiarize yourself with which green measures are installed in your home.

This section is organized by the systems in your home. Each section includes information on:

- Why this system is important;
- Tips for operating and maintaining the system; and
- Websites that provide additional information and maintenance tips for the system.

2.1 Indoor Pollutants

There are many potential sources of pollution in any home. For example, combustion equipment (anything that burns fuel, such as a gas-fired water heater or wood stove) releases carbon monoxide. Fireplaces and cooking can release small airborne particles, which can cause breathing problems, especially for people with asthma.

In general, indoor pollution can be controlled by:

- Reducing the amount of pollutants that are generated (for example, by not having a fireplace, or by using a fireplace that is cleaner burning); and
- Diluting pollutants once they are created, by bringing in fresh air (ventilation) or removing polluted air with exhaust fans and vents.

Combinations of these pollution control methods are used in LEED-certified homes. But you can further reduce pollutants in your home through operation and maintenance.

This section includes suggestions to help to control the following indoor pollutants:

- Carbon monoxide;
- Radon; and
- Airborne particles.

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas that is generally released during combustion (e.g., burning of a fuel in equipment like cars, gas-fired appliances, and fireplaces). At high levels, CO can cause health problems, such as headaches and nausea. At very high levels, CO will cause death. LEED-certified homes include CO monitors, which can help warn if there are dangerous levels in your home.

As mentioned in the Emergency Information and Safety Tips, **never bring an unvented combustion source, like a barbeque grill, into the home.** Vented combustion sources, such as hot water heaters, have a pipe that carries carbon monoxide and other combustion pollutants out of your home. Equipment, such as barbeque grills, camping stoves, kerosene heaters, etc., will create carbon monoxide and other dangerous pollutants. Because the equipment is unvented, the pollutants cannot escape the home. The carbon monoxide can quickly build up in the home and become dangerous.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Check/Replace batteries in smoke and carbon monoxide alarms.* Replace the batteries regularly in your carbon monoxide alarm. If the alarm goes off, contact a professional to find and fix the problem immediately.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credit:

- Indoor Environmental Quality (EQ) 2: Combustion Venting

Radon

Radon is a naturally occurring gas that is emitted from soil. Different soils emit radon at different rates. Exposure to radon is the #1 cause of lung cancer among non-smokers in the U.S.

Homes can be built with radon resistant construction techniques to reduce the amount of radon that enters your home from the soil below. This includes a radon vent pipe, which runs from below your home to the outside (generally through the roof). LEED-certified homes that are constructed in areas that have been found to have high levels of radon in the soil (in Radon Zone 1) are required to incorporate these radon-resistant construction techniques. LEED-certified homes in areas that have moderate or low levels of radon in the soil (in Radon Zones 2 and 3) are encouraged to be built with these techniques. In general, this system works without any maintenance on your part. However, periodically check that the radon vent pipe is not blocked (e.g., clear of leaves). In some homes, the pipe will vent out through the exterior wall, instead of through the roof.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Test your home for radon.* The best way to ensure that your home does not have a radon problem is to perform a simple test. Radon test kits are available at your local hardware store. The U.S. Environmental Protection Agency provides guidance on how to conduct the test. If the test shows high levels of radon (above 4 picoCuries per Liter of air [pCi/L]), you should hire a radon professional to install a radon mitigation system. If your home was built with radon resistant construction techniques, then it can be modified with an exhaust fan to make it more effective.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credit:

- Indoor Environmental Quality (EQ) 9: Radon Protection

Airborne Particles

Airborne particles are common pollutants in the home. Airborne particles eventually settle out of the air and become dust on a surface. But small particles take a long time to settle out, and they can easily be kicked up into the air again (i.e., re-suspended) with activity. Airborne particles can be inhaled, causing health problems such as asthma. Some particles contain allergens, lead, or other components that can cause additional health problems.

LEED-certified homes include several measures to reduce airborne particles:

- One way that particles are transported into homes is by people tracking them in on shoes. Many LEED-certified homes include walk-off mats and shoe storage areas at each entryway.
- Cooking – especially frying – generates particles[4]. All LEED-certified homes include kitchen exhaust systems that exhaust particles, humidity, and other pollutants from your home. Use this fan whenever you cook.
- Fireplaces are a common source of particles in the home. Many LEED-certified homes do not have fireplaces, or have a fireplace or woodstove with sealed combustion to reduce the amount of pollutants indoors.

Your use and maintenance of features installed in your home are important in keeping them working effectively.

[4] Wallace, L.A., et al. Environmental Science & Technology. 2004 Apr 15;38(8):2304-11. "Source strengths of ultrafine and fine particles due to cooking with a gas stove."

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Clean or replace walk-off mats at all entries.* Walk-off mats are designed to trap dirt and keep it out of the home, and by helping to remove dirt from shoes. However, if not cleaned and replaced regularly, walk-off mats can become a source of particles.

2. *Vacuum all carpets at least weekly, clean annually*. While it is common knowledge that carpets should be vacuumed, most homeowners vacuum far less frequently than what manufacturers recommend (at least once per week, and more often in high traffic areas). The Carpet and Rug Institute also recommends that carpets be professionally deep cleaned every 12 to 18 months.

3. *Check/clean fireplace and chimney.* If your home has a fireplace, check the chimney to ensure it is not blocked by leaves, nests, or other debris. In general, the U.S. Environmental Protection Agency (U.S. EPA) recommends that wood-burning appliances and chimneys should be professionally inspected and cleaned each year.[1] This will remove the build-up of soot, and keep it in a safe operating condition. If your fireplace is not drafting effectively (i.e., smoke enters the room when your fireplace is being used), stop using it immediately. Have a professional inspect it, and if needed, clean or repair it.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

- Indoor Environmental Quality (IEQ) 2: Combustion Venting
- Indoor Environmental Quality (IEQ) 8: Contaminant Control

Additional Information

For more information, resources, and tools related to minimizing your exposure to indoor pollutants, visit:

US EPA's Indoor Environments Division (EPA IED)

https://www.epa.gov/indoor-air-quality-iaq

https://www.epa.gov/radon

The Carpet and Rug Institute (CRI)

www.carpet-rug.org/residential-customers/cleaning-and-maintenance/basic-cleaning/index.cfm

2.2 The Exterior Structure or Envelope

Your home is designed to protect you from conditions outside, including heat, cold, wind, and rain. LEED for Homes focuses on improving the performance of 3 aspects of the exterior structure (or exterior envelope) of your home:

- The thermal performance (heat flow resistance);
- The air-tightness (air flow resistance); and
- The water-proofing (moisture flow resistance).

This section includes operations and maintenance suggestions for the exterior structure of your home. Additional sources of information on exterior structures are listed at the end of this section.

Overall Durability of Exterior Structure

The exterior of your home, including the roof and siding, acts like your body's skin. It is the first line of defense in protecting your home from rain, cold air, pests, and other things best kept outside. It is important to keep the exterior in good condition.

If water penetrates into the structure of the building, it can cause damage (e.g., wood rot), which is a major safety concern. It can also reduce the effectiveness of materials such as insulation. In general, water should drain away from your home, and it should do so as quickly as possible. Water that pools on a surface can eventually leak through cracks in the surface, potentially causing damage to the structure.

Your LEED-certified home's builder is required to consider the durability risks at your home's site, and to design and build your home to mitigate these risks. (See the LEED for Homes durability forms in Appendix A.) All LEED-certified homes also have water resistant materials in wet areas, such as bathrooms, kitchens, and entryways.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Check / repair all exterior caulking, weather-stripping, and paint.* Check and repair the sealing of the exterior of your home, especially around joints, windows, doors, trim, and plumbing and utility openings. Re-seal with caulk, window putty, weather-stripping, and other air sealing materials. Materials such as caulk and weather-stripping are inexpensive and can save you considerable money in energy bills. By keeping your home well sealed, you will also help prevent pests from entering.

   Check the paint, siding, and other materials on the exterior of your home for damage every few years. Peeling paint should be sanded and repainted. Follow manufacturer's instructions when repainting to avoid more paint peeling in the future. If peeling continues, there may be a moisture problem. If so, contact a professional that specializes in fixing moisture problems.

2. *Check roofing and flashing, and repair any damaged materials.* "Flashing" is sheet metal or other material laid over roof valleys, windows, or other areas where water often drains or collects. Many LEED-certified homes have flashing, because it helps prevent water from seeping into the building structure. Flashing and roof materials (e.g., shingles) become damaged over time. Check these materials at least once a year, particularly before the rainy season, to make sure that they are in good condition (e.g., not missing or damaged). Replace if needed. Materials such as flashing are inexpensive and can save money by reducing the need for costly repairs.

3. *Clean debris from gutters and downspouts.* Downspouts and gutters are important for draining water away from your home. They should be cleaned regularly (generally every spring and fall) to remove leaves, dirt, nests, and other debris.

4. *Remove excess snow from roof to prevent ice dams.* Ice dams form when snow melts on the roof, and then re-freezes further down the roof before it can drain. Ice dams form when areas of your roof are colder than others, because some sections of the underside of the roof are better insulated than other sections. Ice dams cause water to pool on the roof, which can then leak into the home's structure.

   The best solution for handling ice dams is to prevent them from forming. Soon after a snowfall, use a broom to remove snow from the edges of your roof. Doing this prevents snow from becoming ice. Avoid using rakes or sharp tools, because these can damage the roof surface. If your roof is frequently forming ice dams, consult an ice dam specialist to diagnose and fix the problem. For example, your home may need additional insulation in some sections of the attic.

5. *Inspect basement/crawl space for seepage/leakage*. Periodically inspect the lowest part of your home (e.g., the basement or the crawlspace) for pooling water and damp areas. These may indicate that water is not draining properly away from the home. Contact a basement water proofing specialist to identify and fix the problem.

Related LEED for Homes Measures

- Innovation and Design (ID) 2: Durability Management Process
- Energy and Atmosphere (EA) 3: Air Infiltration

Additional Information

For more information, resources, and tools related to the durability of your home, visit:

Home Energy Resource (formerly Home Smart), Basic Care
www.homeenergyresourcemn.org/

University of Massachusetts, Building and Construction Technology, Preventing Ice Dams
bct.nrc.umass.edu/index.php/publications/by-title/preventing-ice-dams/

US EPA's ENERGY STAR Programs, Home Improvement – Peeling Paint
www.energystar.gov/index.cfm?c=home_solutions.hm_improvement_peelingpaint

2.3 Interior Durability and Finishes

The previous section highlighted the importance of maintaining the exterior structure of your home. The interior of your LEED-certified home is carefully designed and constructed as well. This section includes operations and maintenance suggestions related to the interior features of your LEED-certified home, including:

- Interior Durability (control of moisture); and
- Paints and Coatings (control of chemical emissions).

Interior Durability

Just as rain can cause damage if it enters your home's exterior, leaks and moisture originating within the home can also damage the structure. Your LEED-certified home includes measures such as proper drainage and drain pans for appliances that help prevent water from pooling on surfaces in your home. You should check periodically that everything is in working order (e.g., draining freely), and that materials such as bathtub grout are in good condition. This will help keep water from damaging materials below, and help reduce mold and mildew.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Check /repair caulking/grout in and around showers/baths.* For example, check and repair caulk and grout in wet rooms, such as around bathtubs and sinks, between walls and vanities, countertops, or bathtubs.

2. *Check for water leakage around water heaters, clothes washers and dish washers.* A small drip or leak is a sign that the appliance needs repair. Usually small leaks quickly evolve into major leaks that can cause major damage. If there is evidence of a leak, contact the appropriate equipment repairman immediately.

3. *Run bathroom fan for 30 minutes after showering.* Always turn on your bathroom fan while showering or bathing, and allow it to run for 30 minutes after you stop. By using this fan, you help remove moisture that can lead to mold and mildew, and that can damage the structure of the building. You should also run your kitchen fan while cooking, to remove pollutants and odors.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

Innovation and Design (ID) 2: Durability Management Process

Paints and Coatings (e.g., finishes, shellacs, stains)

Interior paints and finishes add to the beauty of homes, and help protect surfaces. However, many paints, coatings, and adhesives contain chemicals that slowly off-gas into the air. These chemicals are called Volatile Organic Compounds, or VOCs. Some of these VOCs (e.g., formaldehyde) can be harmful to your health. Most VOCs are released at the highest rate when they are applied – the "new paint smell". However, significant levels of VOCs will continue to off-gas long after application. Many LEED-certified homes include paint, adhesives, and other materials that are "low VOC". These have a lower content of these harmful, off-gassing chemicals than conventional products.

Furniture, cabinets, cleaning products, and other materials can also have high levels of VOCs. These are discussed in Part 5.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *If paint is needed for the interior of your home, use paint that is low emitting ("low VOC").* Several programs, such as the Green Seal Standard, will label products that have a low VOC content.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

- Materials and Resources (MR) 2: Environmentally Preferable Products
- Indoor Environmental Quality (IEQ) 8.3 Preoccupancy Flush

Additional Information

For more information, resources, and tools related to maintaining your home's interior, visit:

GREENGUARD Environmental Institute, Consumers
www.greenguard.org

2.4 Lighting and Appliances

According to the US Department of Energy's Residential Energy Consumption Survey (2001), lighting and appliances use 34% of energy consumed in homes and account for 47% of the energy costs. Many LEED-certified homes include energy efficient lights, and ENERGY STAR-rated appliances. You can help to control your energy bills by replacing these products with similar energy-efficient products as needed. You can also conserve energy by turning off lights when they are not in use, and by reducing the energy used by home electronics in stand-by mode by unplugging appliances, or by using power strips.

This section includes operations and maintenance suggestions related to your home's:

- Lighting; and
- Appliances.

Additional sources of information on maintaining your lighting fixtures and appliances are listed at the end of this section.

Lighting

Collectively, interior and exterior lighting typically accounts for 5% to 15% of a new home's total energy use. Energy efficient bulbs and fixtures can use 50-75% less energy, and can emit the same amount of light. These also require less frequent replacement.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *If replacing lights, use only ENERGY STAR-labeled lighting.* Choose bulbs and fixtures with the ENERGY STAR label, such as ENERGY STAR-labeled compact fluorescent lights. These bulbs may have a first cost that is more expensive than traditional, incandescent bulbs, but you will recover any cost difference quickly because of the bulbs' longer life and lower energy use. ENERGY STAR-labeled bulbs also achieve high standards for comfort issues (e.g., less flicker than other bulbs).

2. *Periodically check if exterior automated lighting controls are working.* Many LEED-certified homes include exterior lighting that is motion controlled. If the motion control detector stops working, have the detector fixed or replaced so that you can continue to save energy when lighting is not needed. If you feel that some continuous lighting is needed for safety reasons, consider installing a low level of light, with a sensor to trigger a high level of light when motion is detected.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

- Energy and Atmosphere (EA) 1: Optimize Energy Performance
- Energy and Atmosphere (EA 8): Lighting

Appliances

Household appliances typically use 20-30% of a home's total energy use and about 25% of a home's indoor water use. Many LEED-certified homes have ENERGY STAR-labeled appliances, which can use 10-50% less energy and water than standard models.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Clean/adjust direction of ceiling fans seasonally.* In the summer, ceiling fans can be used to make people feel cool by blowing air on them. Remember to turn off the fan when used for cooling if no one is in a room. Fans do not cool rooms – they only cool people.

   A ceiling fan can also be used to help warm a room when it is operated in reverse, by gently pushing warm air back to the floor. (Hot air rises.) Most ceiling fans have a switch that allows you to reverse its direction. Reverse the direction of fans each summer and winter. Use a very low speed for winter, and turn down your thermostat to capture the heating bill savings from using fans.

   Clean the fan blades at least annually, to reduce particles in your home and to keep the fan in good condition.

2. *Connect appliances (e.g., televisions, chargers) to a power strip and switch it off when not in use.* "Phantom loads" refer to energy that appliances (e.g., televisions, cell phone, laptop chargers) continue to draw when they are turned off. The U.S. Environmental Protection Agency estimates that households spend $100 per year to power devices in this standby mode[1]. Unplug appliances when they are not in use, or connect them to a power strip and turn off multiple appliances when they are not in use. Some power strips also serve as surge protection for appliances.

   The U.S. EPA has also begun to identify some products, such as power adaptors, with the ENERGY STAR label. Look for this label to identify products that are more efficient than conventional models.

3. *Clean lint screen after every use. Periodically clean dryer vent.* For dryers, cleaning the lint screen after every use helps reduce energy use, and it reduces the risk of fire. Also, periodically check the exhaust vent for the dryer on the outside of your home. Make sure that the vent screen is clean and free of leaves, debris, etc., so that exhaust can freely escape to the outside.

4. *Choose ENERGY STAR-labeled appliances.* ENERGY STAR-labeled appliances use less energy and/or water than conventional models. While these often have a slightly higher cost, they will save money in the long-run because of lower energy or water bills. Also make sure that you buy the right sized appliance for your household's needs. For example, refrigerators that are too full, or that are almost empty, will not perform at the rated efficiency.[1]

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credit:

- Energy and Atmosphere (EA) 1: Optimize Energy Performance
- Energy and Atmosphere (EA) 9: Appliances

Additional Information

For more information, resources, and tools related to maintaining your home's lighting and appliances, visit:

U.S. Environmental Protection Agency (USEPA) Energy Star program, resources for lighting and appliances:

https://www.energystar.gov/products/light_fixtures

Alliance to Save Energy

www.ase.org/section/topic/lights

Federal Trade Commission's How To Use the EnergyGuide Label To Shop for Home Appliances

https://consumer.ftc.gov/articles/how-use-energyguide-label-shop-home-appliances

Department of Energy, Energy Efficient Appliances

www1.eere.energy.gov/buildings/appliance_standards/pdfs/26468.pdf

2.5 Heating, Cooling, and Ventilation Systems

Well designed heating cooling and ventilation systems are essential elements of a comfortable and healthy LEED-certified home. More importantly, they also provide for significant energy savings (at least 30% in most LEED-certified homes).

This section includes 2 related topics:

- Heating and Cooling Systems; and
- Ventilation Systems.

Additional sources of information on these systems are listed at the end of this section.

Heating and Cooling Systems

Heating and cooling systems are required to maintain comfortable temperatures within a home. They are also one of the major causes of excessive energy use in homes.

LEED-certified homes have heating and cooling equipment that is often 20 to 30% more efficient than equipment that meets the minimum efficiency standards. It is also correctly sized, based on the size of your home, how well your home is insulated, and other factors. This translates into lower energy bills.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Clean or replace filters in heating/cooling equipment*. Dirty filters are a common cause of equipment malfunction or damage. Clean filters will allow your equipment to run more efficiently. Filters are relatively inexpensive and easy to replace. According to the U.S. Department of Energy, keeping the filter clean on an air conditioner can lower the air conditioner's energy consumption by 5% to 15%.[1] How often you will need to replace your filter will vary depending on the product. Some units have an indicator light showing when the filter needs to be replaced. Generally, it is recommended that air filters should be replaced monthly during the heating or cooling season. Replace the filter with the same type of filter that was originally installed. This will keep the equipment operating as designed, and it will continue to remove particles for better indoor air quality.

2. *Adjust thermostat for season change*. Set your programmable thermostat to "reasonable" set-points to conserve energy. LEED-certified homes generally have programmable thermostats which allow you to set different set-point temperatures at different times of the day. Example settings are provided below.

Example Temperature Settings for Programmable Thermostat

Season	Time of Day		
	Night	Day	
		Occupied	Un-Occupied
Winter	60	70	60
Summer	75	75	85

3. *All components of the heating and cooling systems should be serviced by a qualified technician about every two years*. The technician should check settings, clean and lubricate parts inside the system, tighten electrical connections, and provide other services. This will help keep your equipment running in good order.

   One service that a technician can provide for an air conditioning system is recharging the refrigerant. All LEED-certified homes are required to have air conditioning systems tested at installation to ensure that it is correctly charged (i.e., has the right amount of refrigerant). The system should be tested periodically and recharged if needed. The American Council for an Energy Efficient Economy reports that fixing an incorrectly charged system can improve its efficiency by 20%.[1]

4. *Remove leaves and debris around the outdoor condenser of an air conditioner.* Conventional air conditioning systems include an outdoor condenser unit. Twice a year, make sure that the area around the condenser is clear of trash, plants, etc. The Department of Energy recommends trimming back any foliage so that it is at least 2 feet from the unit.[1] Clean any leaves or other debris from the "fins" – the metal slats through which air passes.

5. *Clean in and around grills and registers; vacuum inside of ducts.* For forced air systems (i.e., systems that blow hot or cold air through ducts), annually remove the heating registers and vacuum inside the ducts that are within reach.

6. *Clean in and around radiators, bleed air from radiators.* For hydronic systems (i.e., systems that circulate hot water through pipes and radiators), the U.S. Department of Energy reports that the most common problem is unwanted air in the system.[1] The problem occurs when a bubble of air becomes trapped in the system, which blocks the water from circulating. At the start of each heating season, a technician should check all of the radiators in your home, and bleed-out any trapped air. This will help improve the efficiency of and the comfort provided by your hydronic heating system.

7. *Check / adjust humidity levels.* As described in the section on Durability, wet building materials can lead to rot or other damage to the building's structure, and lead to mold or mildew growth. Monitor the relative humidity in your home. Relative humidity monitors are inexpensive and available at hardware stores. In general, the recommended relative humidity in the home should be between 30 to 60%. Use your home's systems (e.g., fans in wet rooms, and dehumidifiers, if present) to keep the relative humidity in this range. If the relative humidity is often well above 60%, or if your home shows other signs of high humidity (such as windows with condensation on the inside or a damp basement):

   - First check that everyone in the household is using local exhaust fans properly (e.g., turning on bathroom fans during bathing and kitchen fans when cooking); and
   - If your home still has high humidity, consider installing a dehumidifier (if your home does not already have one).

   If your home has low humidity levels, you may choose to install a humidifier. Continue to monitor the relative humidity closely. Do not operate a humidifier while the air conditioner is running.

8. *Check roof / soffit vents for flow and obstructions*. Many homes include vented attics. These vents allow hot air to escape during the hot summer months. In the winter, vented attics help to keep the attic cool, reducing the chance for ice dams to form.[1] If your home has vents in the attic, do not cover these with insulation or any other material. Periodically check that vents have not become covered or obstructed by items in the attic.

   Other homes are designed with unvented attics (i.e., the attic is conditioned). Your builder will have considered whether roof / soffit vents were beneficial for your particular home, as part of the program's durability requirements.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

- Indoor Environmental Quality (IEQ) 3: Moisture Control
- Energy and Atmosphere (EA) 6: Space Heating and Cooling
- Energy and Atmosphere (EA) 11: Appropriate HVAC Refrigerants
- Indoor Environmental Quality (IEQ) 7: Air Filtering

Ventilation Systems

Ventilation systems exhaust airborne pollutants from your home and also replenish your home with fresh air. Generally there are 2 types of ventilation systems that are used in your home:

1. Local Exhaust Systems (i.e., bath and kitchen fans); and
2. Whole-house ventilation systems.

All LEED-certified homes are required to have whole-house air ventilation systems, which provide the right amount of fresh air into your home. (The rate is based on the size of your home and number of bedrooms.) Also, all LEED-certified homes must have exhaust fans in kitchens and bathrooms, which must be vented directly to the outdoors. These measures help provide better indoor air quality, and they protect the structure from moisture damage. Even moist air can become a problem if it is not exhausted from your home, because it can cause damage structures and lead to mold growth. (In contrast, many code homes do not have ventilation systems and/or do not exhaust moist air directly to the outdoors.)

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Check operation of mechanical ventilation systems (for example, an HRV/ERV) and regularly replace filters.* Ventilation is often provided in the same system as heating or cooling. Such systems require regular filter changes and bi-annual service check-ups.

   However, some homes have a separate or dedicated ventilation system installed. For example, many LEED-certified homes include a Heat Recovery Ventilator (HRV) or an Energy Recovery Ventilator (ERV). An HRV brings in fresh air for ventilation, but transfers the heat from the outgoing stale air to incoming air. An ERV performs similarly, but it removes heat from the incoming air, using the cold stale air that it exhausts. These systems reduce energy for heating and cooling, and provide fresh air.

   If your home has a separate ventilation system, clean or replace the filter regularly. Check your manufacturer's information for your product's specific requirements, but a general rule of thumb is every one to three months.[1] Periodically check the intake and exhaust vents to ensure that they are clear from leaves, debris, etc.

2. *Check operation of local exhaust fans.* At least once a year, check all of the exterior vents (e.g., kitchen, bathroom) where air exits from your home. These are located on the roof, or may be located on exterior walls. Make sure that they are clear of leaves, debris, etc., and that the damper (the flap covering the opening) can move freely.

   Also, periodically check that your exhaust fans are operating: Hold a piece of toilet paper up to the exhaust fan in the bathroom while the fan is running. The paper should be held firmly against that fan grille, after you let it go. If you find a problem, contact a ventilation specialist.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

- Indoor Environmental Quality (IEQ) 4: Outdoor Air Ventilation
- Indoor Environmental Quality (IEQ) 5: Local Exhaust

Additional Information

For more information, resources, and tools related to maintaining your home's heating, cooling, and ventilation systems, visit:

Green Home Guide by the U.S. Green Building Council (USGBC)

https://www.usgbc.org/articles/home-green-home

U.S. Department of Energy (DOE), Energy Saver
https://www.energy.gov/energysaver/energy-saver

U.S. Environmental Protection Agency (USEPA), Energy Star program
https://www.energy.gov/eere/buildings/energy-starr#:~:text=ENERGY%20STAR%C2%AE%20is%20a,energy%2Defficient%20products%20and%20practices.

Natural Resources Canada, Maintaining Your Heat Recovery Ventilator (HRV)
https://publications.gc.ca/collections/collection_2011/schl-cmhc/nh18-24/NH18-24-9-2010-eng.pdf

2.6 Plumbing

Water is an important resource, and it takes considerable energy to move, treat, and heat water. The average family of four can use 400 gallons of water every day, and, on average, approximately 70% of that water is used indoors[5].

Leaky pipes and fixtures can result in large amounts of wasted water, and cause damage to structures below. Plumbing can also serious damage it not maintained during the winter.

This section includes operations and maintenance suggestions related to your plumbing equipment. Note that tips on maintaining the efficient use of water outdoors are included in the "Your Yard" section below. Tips on conserving water both indoors are outdoors are provided in the Part 5.

Indoor Plumbing Fixtures and Fittings

All LEED-certified homes include measures that should reduce water use, relative to conventional homes that are built to the minimum building code. Measures that reduce hot water use will save both energy and water. Many of these measures will not require any special maintenance. For example, many LEED-certified homes include low flow fixtures (e.g., low-flow faucets or showers, dual-flush toilets), or the plumbing has been designed so that the hot water tank is close to the fixtures that require hot water.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Check / fix leaks immediately in pipes, fixtures, and appliances.* Immediately fix any leaks in pipes, equipment (e.g., water heaters, clothes washers), and plumbing fixtures (e.g., toilets, sinks). According to the U.S. EPA's WaterSense program, leaky faucets that drip at the rate of one drip per second waste more than 3,000 gallons of water each year.[1] Over time, water leaks may lead to structural problems.

   If your hot water tank is leaking, shut off the water supply to the tank, and shut off the fuel input (or electricity) until a plumber can repair or replace the system. The pressure relief valve may be clogged or not working, or there may be some other problem that should be addressed.

[5] http://www.epa.gov/watersense/pubs/indoor.html

2. *Prevent pipes from freezing: turn on/off outdoor faucets.* When water pipes run through the exterior walls of your home (e.g., to your irrigation system, outdoor faucets, or garden hoses), they are susceptible to freezing in the winter. As the water in the pipes freezes, it expands and can potentially cause the pipe to burst. To prevent this, in late fall, turn off the water supply to the outdoors. Then drain these fixtures to the outdoors to remove any water that remains in the pipes or hoses. Most homes have a separate shut-off valve for each outdoor faucet.

   If you go on vacation in the winter, turn the heat down, but not off, in your home. The home must be warm enough to keep the pipes inside from freezing.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

- Water Efficiency (WE) 3: Indoor Water Use
- Energy and Atmosphere (EA) 7: Water Heating
- Energy and Atmosphere (EA) 9: Appliances

Additional Information

For more information, resources, and tools related to maintaining your home's plumbing fixtures and fittings, visit:

H_2O Use, Household Water Efficiency Resources
http://www.h2ouse.org/resources/links/index.cfm

Urban Water Resources Management, Water Conservation Tips
http://www.gdrc.org/uem/water/conservation.html

Montana Weatherization Training Center, Water Heater Maintenance Tips
https://www.montana.edu/extension/weatherization/

2.7 Your Garage

Garages often act as a storage area for:

- Automobiles;
- Gas-powered appliances (lawn mowers, edging tools, chain saws, generators);
- Chemicals (fertilizers, pesticides, and herbicides); and
- Paints and cleaning solvents.

All of the above equipment and products can release different types of air pollution. While it is generally wise to store these items in the garage, instead of in your home, pollutants emitted in the garage can still find their way into your home. This is because the garage is often connected to the home by a doorway, and because pollutants can move through cracks in the garage walls or ceiling.

This section includes operations and maintenance suggestions related to your garage.

Additional sources of information on controlling pollutants in garages are listed at the end of this section.

Garage Pollutants

Garages are a useful place to store equipment and materials that are potential pollution sources. Cars release harmful pollutants, including carbon monoxide and volatile organic compounds (VOCs), particularly when they are started. Fuel (including fuel in equipment such as lawnmowers), paints and chemicals, and other equipment can release VOCs. These pollutants can cause health problems. Many LEED-certified homes are well sealed, have detached garages, or have no garages, to help prevent these pollutants from entering the living space of your home.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Check seal between garage and home, and exhaust fan.* A good seal between the garage and the living space of your home will help keep pollution out of the living space. It will also save energy, by keeping conditioned air from leaking out of the home. LEED-certified home are required to be carefully sealed during construction. Many LEED-certified homes have an additional check for sealing between the garage and living areas, or a fan in the garage. But most homes develop cracks as they age due to settling, so they will periodically need to be resealed.

   If your garage is attached to your home, annually inspect the walls and ceiling that are adjacent to the home for cracks. Seal any cracks in the garage with caulk. If there is a door between the garage and the living space, keep it closed as much as possible. Check that it closes tightly every few years, and replace weather stripping around the door if needed.

2. *Remove unneeded chemicals.* Minimize the storage of these materials by getting rid of old paints, fuels, or other chemicals that you no longer need. Dispose of these properly – most should be disposed of as hazardous waste. (See Part 5.)

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credit:

- Indoor Environmental Quality (IEQ) 10: Garage Pollutant Protection

Additional Information

For more information, resources, and tools related to minimizing your exposure to pollutants from your garage, visit:

USGBC Garage pollutant protection

https://www.usgbc.org/credits/homes-high-rise/v4-draft/eqp3?return=/credits/Mid-rise/v4

2.8 Your Yard

Your yard can provide useful environmental benefits, such as providing shade, erosion control, and managing storm water run-off. However, a poorly managed yard (e.g., one that is over-watered and treated with harmful chemicals) can be a drain on resources like water supplies, and cause damage to the local environment and to your home.

This section includes information on ways that you can minimize the environmental impact of your yard. Three general aspects of your yard are addressed:

- Landscaping;
- Irrigation; and
- Pest Control.

Additional sources of information on maintaining your yard are listed at the end of this section.

Landscaping

Landscaping can be a major use of water for your home, and it can have significant impacts on the local ecology. Every LEED-certified home is required to incorporate good landscaping practices during construction, such as conserving topsoil, controlling erosion, and not planting invasive species. Many LEED-certified homes also have less turf grass and more drought-tolerant plant species than conventional homes. These practices reduce the amount of silt that enters local bodies of water and reduce the amount of water that is needed to keep a yard looking attractive.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Replace and repair landscaping - mulch, permeability features.* Many LEED-certified homes include mulched areas. Mulch provides nutrients to plants, helps to retain moisture in the soil, and helps prevent weeds from growing. Replace or add mulch to planted areas when needed. A few inches of mulch to cover the ground is generally sufficient.

   Many LEED-certified homes include permeable features that capture water and allow it to infiltrate the ground below. These may include rain gardens, dry wells, swales, cisterns, permeable paving, and other features. Check these features periodically after a rainstorm to ensure that water is properly draining. For example, the porous layer below permeable hardscapes may clog with debris, and could need to be vacuumed. Rain gardens need to be regularly weeded.

   If plants die or need to be replaced for other reasons, consider replacing them with native or drought tolerant species. Check with your local university agricultural extension office, botanical garden, or other resource for guidance.

2. *Check for pooling of rain water on property*. Many LEED-certified homes have sloped areas on the property that are graded away from the home or include erosion control measures (e.g., swales, terracing or retaining walls). These features will help prevent water from flowing towards the foundation of the home, helping to keep it dry.

   If you notice pooling of rainwater, you may need to hire a landscape professional to re-grade the area to guide rain water away from your home. If your landscaping includes erosion control such as swales, terracing or retaining walls, inspect these features annually to make sure they are in good condition.

3. *Avoid damaging de-icers on hardscapes.* In winter months, shovel or plow sidewalks, driveways, and other hardscapes soon after a snow-fall. This will prevent ice build-up. If you must add chemical de-icers, use magnesium chloride or calcium chloride products instead of sodium chloride or potassium chloride products. All chloride products damage vegetation, but magnesium chloride and calcium chloride are less damaging to concrete and other man-made surfaces. Sand can also be used. Sand does not help melt ice, but it will provide traction.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credits:

- Sustainable Sites (SS) 2: Landscaping
- Sustainable Sites (SS) 3: Local Heat Island Effects
- Sustainable Sites (SS) 4: Surface Water Management

Irrigation

Water used to irrigate plants can have a major impact on total water use. For example, in California, 50% to 70% of household water is used outdoors[6]. By delivering water only when it is needed, and only to the plants that need it, you can help conserve water and reduce your water bills.

Collecting rainwater and using it to water plants or flush toilets provides several environmental benefits, such as reducing the demand for public water supply (and related electricity used for pumping).

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Check that sprinklers operate properly and that the spray doesn't hit your home.* At the beginning of every spring, briefly test your irrigation system. Turn it on, and check that all spray heads are operating, that the water is only hitting softscapes (not on hardscapes), and that the spray doesn't hit your home. Fix any problems. This will both save water and help prevent water damage to your home.

   Many LEED-certified homes have irrigation systems that include controls, timers, or sensors so that the system operates only when water is needed and conditions are optimal for watering. (For example, they sense moisture in the air or provide water in the cooler parts of the day.) Review the product literature to learn how the system functions and how you can maximize the benefits of these features.

2. *Winterize your irrigation system: turn off water, drain*. If your irrigation system freezes, the underground pipes may burst. Locating and repairing such leaks can be very difficult and expensive. Turn your irrigation system off, usually with a central shut-off valve that is located in your home, and drain the system of any water.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credit:

- Water Efficiency (WE) 1: Water Reuse
- Water Efficiency (WE) 2: Irrigation System

[6] http://www.cpuc.ca.gov/PUC/Water/waterconservationInfo.htm

Pest Control

Pests such as termites, ants, and rodents can damage the structure and cause health problems. These can be controlled through strategies other than the use of toxic chemicals. Long term exposure to such chemicals can be harmful to your family and pets. Preventing pests from entering, or nesting in, your home is the best strategy. LEED-certified homes are often designed with physical barriers that block some of the common entry points for pests.

You can also follow pest prevention measures. In general, pests are drawn to shelter, water, and food. Keeping your home and yard dry and tidy will discourage pests.

Operations and Maintenance Tips

The following general maintenance strategies are highly recommended.

1. *Keep plantings at least 24" away from home.* Don't plant any vegetation within this area, and trim landscaping so that all branches are further than this from the home. Also maintain at least 12" of exposed concrete on all exterior walls between the ground and the beginning of the wood siding. This enables the visual checking for termite pathways from the soil to the wood siding.

2. *Store fire wood off the ground, away from home.* Store all fire wood at least 20 feet away from your home and several inches off the ground.

3. *Avoid overwatering your yard*. Standing water can attract insects, as can excessive nutrients.

4. *Avoid use of toxic chemicals for pest control and chemical fertilizer.* Insecticides and chemical fertilizers kill pests and weeds, but they can also harm people and pets. If you live in an area with a high risk for termites, consider getting a termite inspection annually. If your home does develop a pest infestation, select low toxicity insect and pest control systems.

This plan example meets the in-house IPM plan requirement (Option 1) of LEED v4 O+M EQ Credit Integrated Pest Management. The contents of this plan, including but not limited to the plan scope and goals, roles and responsibilities, standard operating procedures, implementation strategies, performance measurement and schedule for reassessment, and quality assurance, will vary by project based on the building's circumstances. Be sure to customize this plan example, tailoring it to your project's specifics. It will be reviewed as a part of your project's documentation submission.

Integrated Pest Management plan for Kingsway Rental

Effective date: June, 2024

i. Scope

This plan applies to all interior spaces in the building and all portions of the site and grounds for Kingsway Rental. This plan will be consulted prior to taking action on pest management in the building or on the building grounds. Pests include plants or animals that are detrimental to the property, a nuisance to building occupants, or unwanted on the building grounds for other reasons.

ii. Goals

Operational element	Goal	Performance measurement unit
Cases that do not warrant emergency treatment	Prior to applying chemical pesticides or baits, alternative pest control methods will be used in 100% of cases	Number of cases
Cases that do not warrant emergency treatment	If alternative methods fail, least-toxic pesticides will be used prior to resorting to the use of non-least toxic pesticides or baits in 100% of cases	Number of cases
Occupant notification	In 100% of non-least toxic pesticide applications, occupants will receive notification according to the notification procedures described below	Number of cases

iii. Roles and Responsibilities

Integrated Pest Management Team

Name/Title	Responsibilities
Overall responsible party: GEC Management Limited Partnership	1. Ensuring that this plan is executed 2. Ensuring that the contracted IPM vendor is fully trained on this plan and adheres to the plan procedures 3. Coordinating site visits by the vendor for regular inspections and as needed for implementation of pest controls 4. Overseeing work performed by the vendor 5. Approving the use of pesticides when they are necessary 6. Providing proper notification to occupants when non-least toxic pesticides are applied 7. Ensuring tenant contracts are aware of the procedures in this plan 8. Evaluating performance and making updates to the plan as necessary
Pest control vendor	1. Adhering to the procedures outlined in this plan 2. Identifying pests during site visits and inspections 3. Reporting the results of site visits and inspections to the overall responsible party 4. Notifying the overall responsible party when pest action thresholds are reached or exceeded 5. Obtaining approval to approve from the overall responsible party pesticides when necessary
Tenant contacts	1. Reporting pest issues in respective tenant spaces to the overall responsible party

The pest control vendor is responsible for adhering to the procedures outlined in this plan and reporting the results of site inspections to the Property Manager. If at any time integrated and alternative pest control methods fail and chemical pesticides are necessary, the pest control vendor must notify the Property Manager prior to using the chemical pesticides, and wait for approval from the Property Manager prior to applying the pesticides.

Each tenant in the building has a designated contact for communications regarding pest control. The tenant contacts are responsible for reporting pest issues in their space to the Property Manager. When the use of non-least toxic pesticides is necessary, the Property Manager will notify the tenant contacts, and the tenant contacts are then responsible for notifying the occupants in their space.

iv. Standard Operating Procedures and Implementation Strategies

Pest control strategies

The building interior and exterior will be periodically inspected for the presence of pests and preventive measures will be taken to avoid pests. If any pests are detected, integrated (nonchemical) methods will be implemented as the first control step, including sanitation measures, exclusion measures, and the use of traps.

Sanitation: Potential food and water sources available to pests will be evaluated and minimized or eliminated. This can be done by thoroughly cleaning and maintaining food service areas and break rooms, fixing leaking pipes and faucets, and altering landscape features to eliminate standing water.

Exclusion: Cracks, crevices, and holes in the building envelope will be sealed. A plant-free zone will be maintained immediately adjacent to the building.

Traps: For insects and rodents, non-chemical baits (such as peanut butter) will be used to trap pests. No chemical baits for rodents will ever be used indoors. If chemical rodent baits are necessary outdoors, they will only be used as solid blocks places in locked outdoor dispensers. No second-generation (single-feed) rodent baits will be used.

If integrated pest control measures are unable to resolve the problem, least toxic pesticides will be used prior to resorting to the use of non-least toxic pesticides. Least toxic pesticides include any pesticide product for which all active ingredients and known inert ingredients meet the least toxic Tier III hazard criteria under the San Francisco Hazard Review Process (http://sfenvironment.org/article/residents/leasttoxic-pesticides-for-green-buildings).

Products that are not regulated as pesticides by the EPA because they primarily contain low-risk ingredients, such as garlic oil, may also be considered least toxic options, even if they are not listed as Tier 3 by San Francisco. Nonrodent pesticides that exceed the Tier 3 criteria are considered least toxic if they are used in self-contained baits and placed in locations that are inaccessible to occupants. Rodent baits are not considered least toxic under any circumstances.

Non-least toxic pesticides include all chemical rodent baits and any product that meets the Tier 1 or 2 criteria according to the San Francisco Hazard Review Process. Non-least toxic pesticides may only be used under the following circumstances:

1. Alternative, integrated, and least toxic pest control measures have been exhausted and the pest action threshold is still exceeded
    a. In this situation, notification (according to the procedures below) must be given to building occupants at least 24 hours before the pesticide is applied to the building or grounds
2. The emergency action threshold has been exceeded
    a. In this situation, notification (according to the procedures below) must be given to building occupants no more than 24 hours after the pesticide is applied to the building or grounds

The use of non-least toxic pesticides or rodenticides as pest control in areas requiring frequent treatment on a permanent basis is not an acceptable strategy for this credit. Non-least toxic pesticides will not be continuously applied in the building and on the site. Integrated and alternative pest control measures will be resumed once the action threshold specified below for the applicable pest is no longer exceeded.

Pesticide application notification

The overall responsible party will notify the tenant contacts via email of the pesticide application, including the pesticide name, the EPA registration number, the treatment location, and the date of the application. The tenant contacts are then responsible for distributing the notification to the occupants in their space. In addition, the overall responsible party will post a sign at the application site, such that an occupant reading the sign can choose to avoid the application area (for example, if the pesticide is applied in a break room, all entrances to the break room shall have a sign posted). The sign will also include the pesticide name, the EPA registration number, the treatment location, and the date of the application.

Tenant Communication plan

If pests are observed in a tenant space, it is the responsibility of the tenant to notify the overall responsible party of the pest via email. Within one business day, the overall responsible party will contact the pest control vendor to inspect the situation and determine whether the regular action threshold or the emergency action threshold has been met. The pest control vendor will then take the appropriate actions.

Action thresholds

Regular treatment includes the use of first non-chemical controls (sanitation, exclusion, traps using non-chemical baits), followed by the use of least-toxic control methods if the situation is not resolved, and then non-least toxic control methods is the situation is still not resolved.

Emergency treatment includes the use of the most effective control method as a first step, which may be non-least toxic.

Pest Type	Action thresholds
Ants	Regular treatment will be performed if any ants are noted in the building and their presence is confirmed through monitoring. Emergency treatment may be used if there are ten or more reported cases or complaints of ants within a two day period.
Other insects	Regular treatment will be performed if nuisance insects are noted in the building and their presence is confirmed through monitoring. Emergency treatment may be used if there are ten or more reported cases or complaints of nuisance insects within a two day period.
Cockroaches	Regular treatment will be performed if any cockroaches are noted in the building and their presence is confirmed through monitoring.

	Emergency treatment may be used if the presence of cockroaches is confirmed in two different spaces within the building OR if the presence of a large population of cockroaches is confirmed in one space in the building.
Rat, Mouse	Regular treatment will be performed if rats or mice are noted in the building and their presence is confirmed through monitoring. Emergency treatment may be used if the presence of rats or mice is confirmed in two or more different spaces within the building.
Bed bugs	Emergency treatment may be used if the presence of bed bugs is confirmed in the building.
Other occasional invaders	If the pests pose a threat to occupants' health, emergency treatment may be sought. Otherwise, regular treatment will be performed.

v. Performance measurement and schedule for reassessment

All pest control activity, including inspections, will be recorded in the IPM tracking tool. The following items will be tracked:

- Pest type and name
- Pest population density and monitoring frequency
- Pest action threshold observed
- Prevention measures implemented
- Product applied (name)
- Toxicity of the product (the tier level as determined by the San Francisco Hazard Review Process)
- Date and time of product application (if applicable)
- Date and time of occupant notification (if applicable)
- Emergency application? (Y/N). If yes, an explanation of the emergency will be included.

The overall responsible party will record each pest that is reported by tenants in the IPM tracking tool. The pest control vendor will record the applicable items from each site visit in the IPM tracking tool.

On an annual basis, performance will be evaluated against the goals specified above. If the goals are not being met adjustments will be made to this plan in order to facilitate goal achievement. If adjustments to the action thresholds are necessary, the overall responsible party will work with tenant contacts and the IPM vendor as necessary in order to appropriately adjust the action thresholds.

vi. Quality Assurance/Quality Control Processes

On an annual basis, the overall responsible party will evaluate performance against the goals specified earlier in this plan. If the goals are not being met, adjustments will be made to this plan in order to facilitate goal achievement, and the pest vendor and tenant contacts will be educated on the adjustments made to the plan.

Related LEED for Homes Measures

For more information on this LEED measure, please look-up the following credit:

- Sustainable Sites (SS) 5: Non-Toxic Pest Control

Additional Information

For more information, resources, and tools related to maintaining the sustainability of your yard, visit:

U.S. EPA's "GreenScapes"

https://archive.epa.gov/wastes/conserve/tools/greenscapes/web/html/brochure.html

https://archive.epa.gov/wastes/conserve/tools/greenscapes/web/html/owners.html

The H_2ouse Garden Guide

www.h2ouse.org/gardensoft/index.aspx

The USDA's National Resource Conservation Service

http://www.nrcs.usda.gov/feature/backyard/

The Irrigation Association

www.irrigation.org/

Statewide Integrated Pest Management Program, University of California

www.ipm.ucdavis.edu/WATER/U/alternative.html

Part 3
Resources for Sustainable Additions and Retrofits

The REGREEN Program

If you decide to add-on to your home or retrofit part of it, it is important to do so in a thoughtful, sustainable way. This is to ensure that any remodel does not affect any of the green features or systems installed in your LEED-certified home. Ideally, the remodel itself should also be green, to continue in the direction of sustainability set by the original LEED for Homes builder.

The REGREEN residential remodeling program provides a valuable starting point for green remodels. This resource was designed by the U.S. Green Building Council (USGBC) and the American Society for Interior Designers (ASID). It provides:

- Information;
- Case studies;
- A strategy generator; and
- Guidelines.

The program is designed to serve both homeowners and building professionals.

Information on the REGREEN program is available at:

www.regreenprogram.org

Green Home Guide

The people that you hire to do a retrofit or remodel play a critical role in the quality and overall sustainability of the project. It is important to select professionals carefully, especially because different professionals have varying experience with remodeling green homes.

The USGBC created the Green Home Guide resource for sustainability-related consumer resources. This website includes the "Find a Pro" feature which helps you find a qualified green professional in your area.

Green Home Guide is also a valuable resource for learning about, and maintaining, your green home. The website includes:

Information on the Green Home Guide is available at:

www.greenhomeguide.com

Part 4
Suggestions on How to Live More Sustainably

This section includes a summary of suggestions for living more sustainably, such as conserving water and energy, reducing waste, and protecting local bodies of water. Many of these suggestions will also save you money. These lifestyle suggestions can be adopted by residents of any home, whether LEED-certified or not. However, several of the lifestyle suggestions overlap the information provided in other sections of this manual.

While the list provided here is a good start, there are countless other opportunities. There are additional resources listed after the table with websites that can provide further discussion of how to live more sustainably.

Green Lifestyle Tips

Suggestions
Energy Efficiency
Purchase green power (generated by renewable energy)
Use ENERGY STAR programmable thermostat
Keep unoccupied rooms closed (doors and heating / cooling vents)
Keep radiators and vents clear of furniture, rugs, etc.
Use occupant sensors for lighting in areas that are used infrequently
Use insulated draperies
Use energy-saving mode for electronics when not in use, or powerstrips
Turn off lights in rooms when not in use
Use cold/warm settings for laundry
Water Efficiency
Take shorter showers
Use dish- and clothes-washers only when full
Turn water off while teeth brushing
Adjust programmable irrigation settings for rainfall
Avoid watering landscaping at mid-day
Install an automatic shut-off nozzle on garden hose
Waste Management
Properly recycle gas, kerosene, paint, and other hazardous waste
Donate items instead of throwing them away
Buy second-hand products, or products with recycled content
Use re-usable shopping bags
Reduce paper waste (e.g., use cloth napkins)
Use unbleached coffee filters, paper towels, etc.
Opt-out of junk mailings if possible
Find out what can be recycled in your area and recycle these products
Indoors and Cleaning
Use nontoxic, biodegradable detergents and cleaners
Have home tested for radon
Buy furniture and furnishings with low VOC content.
Food Purchases
Grow your own food or participate in community garden
Purchase locally grown, and organic food
Participate in a Community Supported Agriculture (CSA) program
Eat less meat
Purchase seafood from sustainable seafood programs

Green Lifestyle Tips (cont'd)

Suggestions
Transportation
Bike or walk for short trips
Use public transportation
Carpool and/or run errands in fewer trips
Avoid idling cars unnecessarily
Regularly maintain cars, other vehicles
Purchase carbon offsets from flying or commuting
Your Yard
Refrain from use of toxic chemicals, insecticides, fertilizers, etc.
Plant natives trees and plants
Place hardwood mulch around trees and gardens
Use composting from kitchen on gardens and landscapes
Leave grass clippings on yard to provide nutrients back to soil
Add rain barrel for rainwater harvesting
Home Office and Study
Use electronic format instead of paper as much as possible
Recycle paper, used print cartridges, and old electronics
Use recycled paper, and recycled print cartridges

Additional Resources

Sharing Utility Data

Information on sharing utility data with USGBC via a USGBC-approved third party can be found here:
https://portfoliomanager.energystar.gov/pm/login?testEnv=false

Energy Efficiency

The Energy Star program from the U.S. EPA and U.S. Department of Energy:
www.energystar.gov

The Consumer Energy Center from the California Energy Commission:
www.consumerenergycenter.org

Water Efficiency

The WaterSense program from the U.S. EPA
www.epa.gov/watersense/

Indoors & Cleaning

The GREENGUARD Environmental Institute
www.greenguard.org/

The Monterey Bay Aquarium
www.montereybayaquarium.org/

Your Yard

The Lady Bird Johnson Wildflower Center
www.wildflower.org

The Plant Native Organization
www.plantnative.org

Home Office & Study

The Forest Stewardship Council
http://fscus.org/

Many local or state government offices, water districts, and utilities provide local or regionally specific recommendations. Contact these organizations or find their websites to discover information specific to your area.

Appendix A
LEED for Homes Documentation

The green measures installed in every LEED-certified home must be verified by a third-party verification organization (other than the project team that designed and built your home). This organization is called a LEED for Homes Provider, which includes or oversees the LEED for Homes Green Rater. At the completion of the verification process, these verifiers prepare the following three documents:

- ✓ Project Checklist; and
- ✓ Durability Forms;

LEED for Homes Project Checklist

Y	?	N			
2	0	0	Credit	Integrative Process	2

15	0	0	**Location and Transportation**		15
Y			Prereq	Floodplain Avoidance	Required
			PERFORMANCE PATH		
0	0	15	Credit	LEED for Neighborhood Development Location	15
			PRESCRIPTIVE PATH		
8	0	0	Credit	Site Selection	8
3	0	0	Credit	Compact Development	3
2	0	0	Credit	Community Resources	2
2	0	0	Credit	Access to Transit	2

1.5	0.5	5	**Sustainable Sites**		7
Y			Prereq	Construction Activity Pollution Prevention	Required
Y			Prereq	No Invasive Plants	Required
0	0	2	Credit	Heat Island Reduction	2
0	0	3	Credit	Rainwater Management	3
1.5	0.5	0	Credit	Non-Toxic Pest Control	2

8	1	3	**Water Efficiency**		12
Y			Prereq	Water Metering	Required
			PERFORMANCE PATH		
0	0	2	Credit	Total Water Use	12
			PRESCRIPTIVE PATH		
4	1	1	Credit	Indoor Water Use	6
4	0	0	Credit	Outdoor Water Use	4

30	0	7	**Energy and Atmosphere**		37
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Energy Metering	Required
Y			Prereq	Education of the Homeowner, Tenant or Building Manager	Required
29	0	1	Credit	Annual Energy Use	30
0	0	5	Credit	Efficient Hot Water Distribution	5
1	0	1	Credit	Advanced Utility Tracking	2

1.5	0	7.5	**Materials and Resources**		9
Y			Prereq	Certified Tropical Wood	Required
Y			Prereq	Durability Management	Required
1	0	0	Credit	Durability Management Verification	1
0.5	0	4.5	Credit	Environmentally Preferable Products	5
0	0	3	Credit	Construction Waste Management	3

5.5	7	5.5	**Indoor Environmental Quality**		18
Y			Prereq	Ventilation	Required
Y			Prereq	Combustion Venting	Required
Y			Prereq	Garage Pollutant Protection	Required
Y			Prereq	Radon-Resistant Construction	Required
Y			Prereq	Air FIltering	Required
Y			Prereq	Environmental Tobacco Smoke	Required
Y			Prereq	Compartmentalization	Required
0	2	1	Credit	Enhanced Ventilation	3
0.5	0	1.5	Credit	Contaminant Control	2
2	1	0	Credit	Balancing of Heating and Cooling Distribution Systems	3
0	3	0	Credit	Enhanced Compartmentalization	3
2	0	0	Credit	Enhanced Combustion Venting	2
1	0	0	Credit	Enhanced Garage Pollutant Protection	1
0	0	3	Credit	Low Emitting Products	3
0	1	0	Credit	No Environmental Tobacco Smoke	1

2	2	2	**Innovation**		6
Y			Prereq	Preliminary Rating	Required
1	2	2	Credit	Innovation	5
1	0	0	Credit	LEED AP Homes	1

4	0	0	**Regional Priority**		4
1	0	0	Credit	Regional Priority: Community Resources	1
1	0	0	Credit	Regional Priority: Compact Development	1
1	0	0	Credit	Regional Priority: Annual Energy Usage	1
1	0	0	Credit	Regional Priority: Durability management verification	1

69.5	10.5	30	**TOTALS**	Possible Points:	**110**

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

LEED for Homes Durability Inspection Checklist

ENERGY STAR Qualified Homes, Version 3 (Rev. 05)
Water Management System Builder Checklist [1,2,3]

Home Address: 4589 Gladstone St. City: Vancouver, BC State: ____

Inspection Guidelines	Must Correct	Builder Verified	Rater Verified	N/A
1. Water-Managed Site and Foundation				
1.1 Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less. [4]	☐	☑	☐	☐
1.2 Back-fill has been tamped and final grade sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. See footnote for alternatives. [4]	☐	☑	☐	☐
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1" extruded polystyrene insulation with taped joints. [5]	☐	☑	☐	☐
1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., and installed using one of the following three options: [3]				
1.4.1 Placed beneath a concrete slab; OR,	☐	☑	☐	☐
1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,	☐	☑	☐	☐
1.4.3 Secured in the ground at the perimeter using stakes.	☐	☐	☐	☐
1.5 Exterior surface of below-grade walls finished as follows: • For poured concrete, concrete masonry, and insulated concrete forms, finish with damp-proofing coating. • For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.	☐	☐	☐	☑
1.6 Class 1 vapor retarders not installed on the interior side of air permeable insulation in exterior below-grade walls. [6]	☐	☐	☐	☑
1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.	☐	☑	☐	☐
1.8 Drain tile surrounded with clean gravel and fabric filter. [7]	☐	☑	☐	☐
2. Water-Managed Wall Assembly				
2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system.	☐	☑	☐	☐
2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. [8]	☐	☑	☐	☐
2.3 Window and door openings fully flashed. [9]	☐	☑	☐	☐
3. Water-Managed Roof Assembly				
3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated with drainage plane above. [10]	☐	☑	☐	☐
3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that deposits water on sloping final grade ≥ 5 ft. from foundation or to underground catchment system ≥ 10 ft. from foundation. [11]	☐	☐	☐	☑
3.3 Self-sealing bituminous membrane or equivalent at all valleys & roof deck penetrations. [12]	☐	☑	☐	☑
3.4 In 2009 IECC Climate Zones 5 and higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall. [12]	☐	☐	☐	☑
4. Water-Managed Building Materials				
4.1 Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers.	☐	☐	☐	☑
4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. [13]	☐	☑	☐	☐
4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. [6]	☐	☐	☐	☑
4.4 Building materials with visible signs of water damage or mold *not* installed. [14]	☐	☑	☐	☐
4.5 Interior walls *not* enclosed (e.g., with drywall) if either the framing members or insulation products have high moisture content. [15]	☐	☐	☐	☑

Builder Employee: ____
Builder Signature: [signature] Date: Mar 8, 2024

Builder has completed Builder Checklist in its entirety, except for items that are checked in the Rater Verified column (if any). [2]
Rater Signature: ____ Date: ____

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Appendix B

Detailed Manufacturer's Info about Products in Your Homes

Equipment:

VRF:

Qty	Description	Tag
1	3.0 Ton VRV-IVS Heat Pump (RXTQ36TAVJU)	CU-P2-3
2	4.0 Ton VRV-IVS Heat Pump (RXTQ48TAVJU)	CU-P2-1,2
11	8 ton, 230V, VRV IV X HR (REYQ96XATJA)	Part of Various CU's
2	10 ton, 230V, VRV IV X HR (REYQ120XATJA)	Part of Various CU's
1	12 ton, 230V, VRV IV X HR (REYQ144XATJA)	Part of CU-R-7
1	Flex Branch Selector Box (4-Port)	BS-L1-1
1	Flex Branch Selector Box (6-Port)	BS CRU
5	Flex Branch Selector Box (8-Port)	Various
6	Branch Selector Box (10-Port)	Various
1	3.0-Ton DC-Ducted Concealed Ceiling Unit (FXMQ36PBVJU)	FC-P2-3
4	4.0-Ton DC-Ducted Concealed Ceiling Unit (FXMQ48PBVJU)	FC-C2-3,FC-C3-3,FC-C4-2,3
26	0.75-Ton MSP Concealed Ducted Unit	FC-A-09
62	1.0-Ton MSP Concealed Ducted Unit	FC-B-12
15	1.5-Ton MSP Concealed Ducted Unit	FC-C-18
4	2.0-Ton MSP Concealed Ducted Unit	FC-C1-1,2, FC-C2-2, FC-C3-2
1	2.5-Ton MSP Concealed Ducted Unit	FC-L1-1
5	4.0-Ton MSP Concealed Ducted Unit	FC-C2-1, FC-C3-1, FC-C4-1
2	2.0 Ton Concealed Ducted Unit (FDMQ24/RX24)	FC-CU-P2-1,4
120	Navigation Remote Controller	

HRV:

"ERV-L1-1, HRV-C1-1, HRV-C1-2"
3 - Lifebreath 330 ERV
300 CFM
c/w MERV 8 filter

"HRV-C2-1, HRV-C4-1"
2 - Lifebreath 650 FD
440 CFM
c/w MERV 8 filter

"HRV-C3-1, HRV-C5-1"
2 - Lifebreath 650 FD
600 CFM
c/w MERV 8 filter

"HRV-C6-1"
1 - Lifebreath 1200 FD
1,100 CFM
c/w MERV 8 filter

Fans:

"EF-1"
11 - Ortech washroom exhaust fans OD-9005PB
50 CFM @ 0.4" sp.
fractional HP 120/1/60 motor

Appliances: