1. Greetings, everyone. My name is Lee First. I am the new outreach coordinator for the Spokane Riverkeeper, which is a program of the Center for Justice. I am really pleased to see you all tonight. This presentation is about stormwater pollution, and how to prevent it using a technique called low impact development, or LID. I welcome your questions. Please ask questions at any time during this presentation.
2. The Spokane Riverkeeper is comprised of a team of 3: a Riverkeeper, a scientist, and myself, an outreach specialist. We are part of a larger organization called the Waterkeeper Alliance. There are over 300 members of the Waterkeeper Alliance, all around the world. About 200 of these Waterkeepers work to protect waterways in the United States. The rest are oversees. We work to protect and defend the Spokane River and its watershed. Other waterkeepers in our bioregion include the Snake River Waterkeeper, the Columbia Riverkeeper, and the Puget Soundkeeper.
3. The purpose to this presentation is to explain why and how some basic LID techniques can be very useful in order to prevent water pollution from stormwater. I will explain what LID is, and why we need it, especially in urban areas of Washington State. I’ll showcase some local examples of LID, as well as explain some typical small, medium, large, and municipal scale LID projects. At the end, I’ll provide a list of resources and guides so that you can find out more information.
4. Stormwater runoff is a significant cause of water quality problems in our state. Stormwater runoff from roofs, paved and graveled roadways, highways, parking lots, lawns, playfields, and other hard surfaces is often polluted with toxic metals, organic compounds, and bacterial and viral compounds that can harm human health, drinking water, and fish habitat.
5. The Spokane Aquifer Joint Board (SAJB) is comprised of twenty-one water purveyors throughout the Spokane area dedicated to providing safe, clean drinking water to your homes, offices and industries every day. Collectively we operate 122 wells, supplying drinking water to more than 500,000 people in the Spokane area. Each purveyor draws water from the same source – the SPOKANE VALLEY – RATHDRUM PRAIRIE AQUIFER. Our collective priority is to protect the public water supply by coordinating efforts, performing and sponsoring studies and investigations, and providing a discussion forum with respect to developing and implementing public water supply programs.
6. Estimated red band trout populations in the upper Spokane River were between 2,000 and 19,000 fish according to surveys in the 1980s and 1990s. A 2008 survey found, however, fewer than 1,200 fish. Restoring and protecting this sentinel species that’s also considered a barometer of aquatic health has become a priority for agencies, non-profits, local anglers and others. Relevant to rainbow trout and cutthroat trout.
7. It’s important to understand the difference between stormwater and wastewater. In most cases, stormwater is collected and routed in a separate piping system from sewage. Wastewater is collected and routed to the wastewater treatment facility, where it is treated and discharged to the Spokane River. Spokane, and most large cities, also have some areas where stormwater is combined with wastewater in parts of our cities, especially during rain events. This can create problems especially if there are wastewater treatment plant capacity. One of the main things to remember about stormwater in many cases is discharged into our local waterways without any treatment.
8. In the case of CSOs, however, stormwater is routed with sewage to the WWTP, unless there is an overflow situation. I’ll discuss this in detail at the end of this presentation, if there is interest.
9. Traditional stormwater management involved collecting water from paved surfaces (into storm drains) and routing it to the nearest water body, without any treatment. In many cases, water is collected in stormwater ponds, which affords a limited amount of treatment for sediment, as well as water retention. Roads, parking lots, and other impervious surfaces are the most significant contributors to stormwater runoff. Stormwater from urban areas typically contains metals, nutrients, dirt, and oils.
10. LID is a stormwater management and land development strategy that may be used instead of, or in conjunction with conventional stormwater techniques to meet stormwater management regulations. LID practices manage stormwater by minimizing impervious surfaces and by using natural or man-made systems to slow down stormwater, and allow it to filter into the ground.

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2. Benefits of a green roof: retains stormwater, thermal surface control inside and outside of building. Ability to collect rainwater, ability to reuse rainwater.
3. “Pollution-generating impervious surface ” means those impervious surfaces considered to be a significant source of pollutants in drainage water. Such surfaces include those that are subject to: vehicular use; certain industrial activities; or storage of erodible or leachable materials, wastes, or chemicals, and which receive direct rainfall or the run-on or blow -in of rainfall; roofs subject to venting of significant sources of pollutants; and metal roofs unless coated with an inert, non-leachable material (e.g., baked-on enamel coating).
4. The goal of LID is to remove pollutants from stormwater, reduce flooding, preserve open space, and replenish wetlands. Depending on the technique, they also can provide for more cost effective development, take up less developable area, reduce construction and maintenance costs and improve the appearance of neighborhoods.
5. Lead, arsenic, cadmium, and zinc have been released into the Spokane watershed as a result of mining, milling, and ore processing. Some metals are also present in stormwater runoff. How effective is LID? It depends on the type, size, and setting. In general, the studies have found that properly designed and constructed bio retention cells are able to achieve excellent removal of heavy metals. Users of this technique can expect typical copper (Cu), zinc (Zn), and lead (Pb) reductions of greater than 90%, with only small variations in results. Removal efficiencies as high as 98% and 99% have been achieved for Pb and Zn. The mulch layer is credited with playing the greatest role in this uptake, with nearly all of the metal removal occurring within the top few inches of the bioretention system. Most interestingly, an experiment conducted in 2015 showed that stormwater runoff from a busy street in Seattle killed adult salmon in as little as 2.5 hours. In experiments conducted at the Suquamish tribal hatchery near Poulsbo, every coho exposed to the stormwater died. The scientists found that by passing the stormwater though 55-gallon drums packed with gravel, soil, and compost – none of the fish exposed to the filtered stormwater died.
6. Although banned, previous PCB releases still persist in our watershed. Products containing PCBs are still in use and may release this toxic chemical into the air, water, or soil. Current testing shows about 55% of PCBs enter the river through the City of Spokane’s combined sewer overflow and stormwater system, 25% at the Idaho border, 15% through industrial and wastewater treatment discharges, and 5% from the Little Spokane River. Little monitoring has been conducted to asses whether LID in urban areas can remove PCBs. Limited studies in the San Franciso Bay area who that around half of PCB particles settled out of stormwater in experiments. A study in Europe found that urban tree pits and associated bacteria have the capability to degrade PCBs in soil. The downside to these treatment technologies is that PCBs may accumulate in sediments, so that soils that sequestered PCBs may require special dispoal requirements.
7. Originally designed for providing an element of water quality control, bioretention cells can achieve quantity control as well. By infiltrating and temporarily storing runoff water, bioretention cells reduce a site's overall runoff volume and help to maintain the predevelopment peak discharge rate and timing. Many LID practices offer the advantage of reducing the volume and intensity of stormwater runoff, thereby reducing the volume and intensity of required overflow controls. LID infiltration and filtration practices also reduce the likelihood of flooding downstream of the stormwater controls, thereby reducing the burden on drainage infrastructure and reducing the potential for sewer overflows.
8. Engineers like to call raingardens BIORETENTION CELLS. Most bioretention cells are served by an underdrain that’s connected to a system of stormwater pipes (that convey stormwater towards the nearest waterbody). Most rain gardens are smaller systems, without an underdrain.
9. A huge variety – from small installations in our yards to large municipal projects. In the case of municipal projects, there are many limitations including but not limited to the presence of infrastructure, land ownership, traffic, proximity to receiving waters, aesthetics. Open stormwater ditches are great examples. Water is allowed to slow down and infiltrate. Make sure that any activities or planting that you undertake does not obstruct the flow of stormwater.
10. Here are a few examples of what homeowners can do in their own yards to help keep stormwater clean: pervious pavement, rain gardens, and filter planters.
11. Additional examples are illustrated here.
12. The City of Spokane is required to have a stormwater management plan that addresses stormwater quality and quantity issues and to comply with the Eastern Washington Phase II Municipal Stormwater Permit. The more water that is captured before entering the City sewer and stormwater pipes, the less flows to the river, and the less that requires treatment at the WWTP. In April, there is a huge LID project is going into the West Central Neighborhood. Silva Cells. City code encourages landscaping within parking areas. If considering a project, contact your planning department. Regular inspection and maintenance is critical to the effective operation of bioretention systems and tree filters to insure they remain clear of leaves and debris and free draining.
13. Maintenance: Individual systems may have more, or less, frequent maintenance needs, depending on a variety of factors including the occurrence of large storm events, overly wet or dry (I.E., drought), regional hydrologic conditions, and the upstream land use. The most common maintenance activity is the removal of leaves from the system and bypass structure. Visual inspections are routine for system maintenance. This includes looking for standing water, accumulated leaves, holes in the soil media, signs of plant distress, and debris and sediment accumulation in the system. Mulch and/or vegetation coverage is integral to the performance of the system, including infiltration rate and nutrient uptake. Vegetation care is important to system productivity and health.
14. Conclusion.