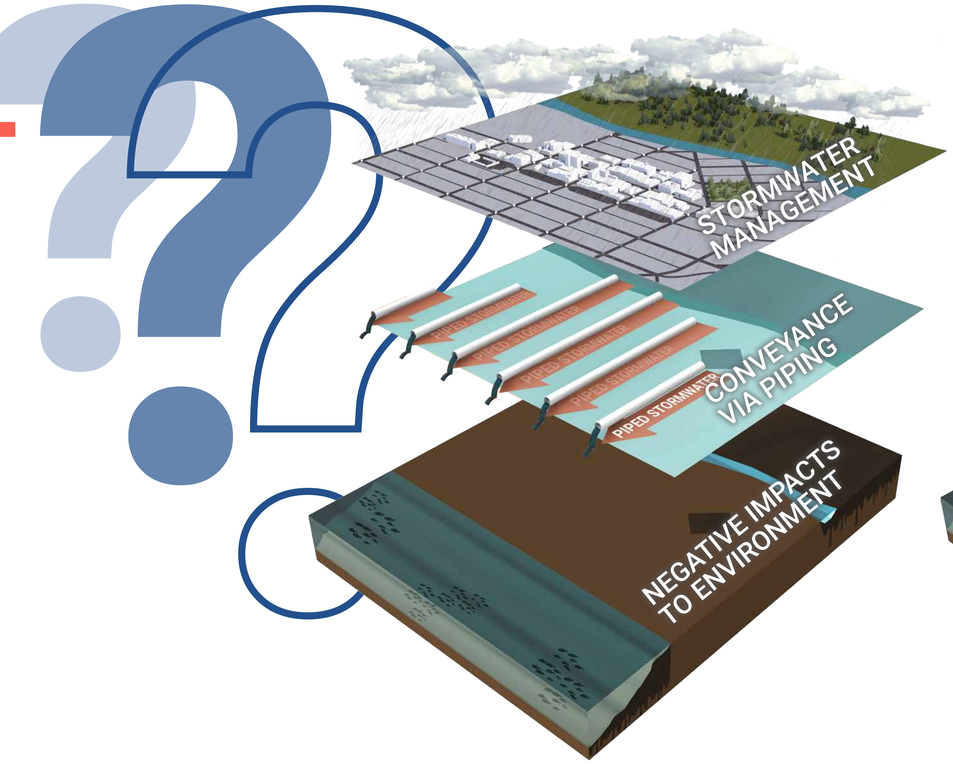
what is LOW IMPACT DEVELOPMENT

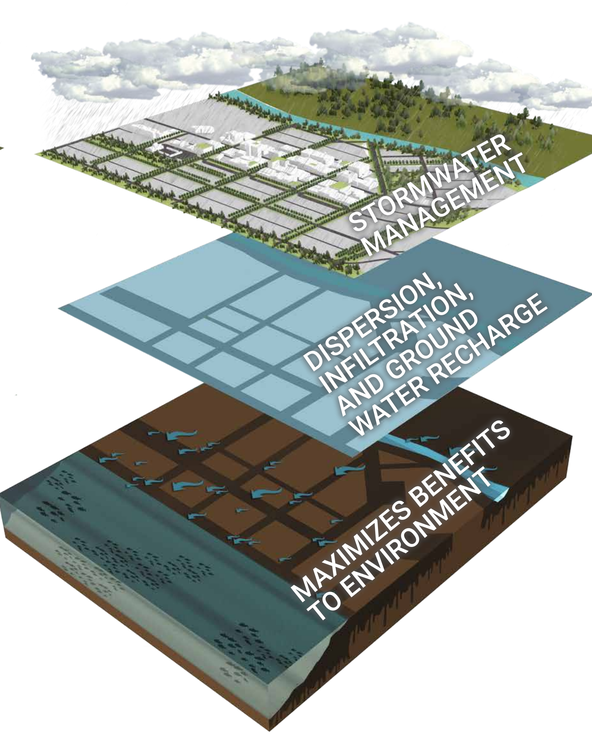
By mimicking natural water cycles, LID reduces the negative impacts of stormwater runoff and pollution on streams and rivers. Small-scale best management practices (BMPs) such as rain gardens and swales allow for collection, retention, storage, infiltration, and filtering near where the rain falls. As much runoff as possible is infiltrated into the ground.

Low Impact Development (LID) manages rainfall in ways similar to nature. Rather than using big storm water ponds, vaults, and pipes, LID introduces more dispersion, infiltration, transpiration, and evaporation into the design and development of sites and streets. Stormwater management functions are provided in ways that mimic the natural hydrologic processes prior to disturbance and development.

LID is implemented through land use, design, and stormwater management strategies and techniques, including:

- Conserving natural on-site features such as existing streams, ponds, trees, and native soils and landscape areas
- Site planning to minimize the “footprint” of impervious surfaces and the amount of clearing and grading
- Features that slow stormwater runoff and allow it soak into the ground such as rain gardens and bioretention planters
- Distributing small-scale BMPs across the landscape and adjacent to areas of flow, rather than centralizing stormwater storage
- Integrating site planning and stormwater management considerations at the initial design phases of a project to create a more hydrologically functional landscape





What’s the Difference?

CONVENTIONAL

- Sends stormwater to the storm sewer or storm drainage system, taking pollutants with it
- Expensive infrastructure: piping, vaults, ponds, etc.
- Techniques haven’t been updated in over 50 years
- Minimizes opportunities for groundwater infiltration and aquifer recharge
- Does not succeed in eliminating stream erosion or impacts to water quality

LOW IMPACT DEVELOPMENT

- Manages stormwater on-site, cleaning and reducing the amount of water that flows into drainage systems and streams
- Mimics natural hydrologic processes
- Best management practices are based on significant amounts of current research
- Less expensive bioretention systems naturally treat runoff and replenish aquifers
- Improves water quality, stream flows, and wetland hydrology; enhances the natural environment

why is LID BENEFICIAL?

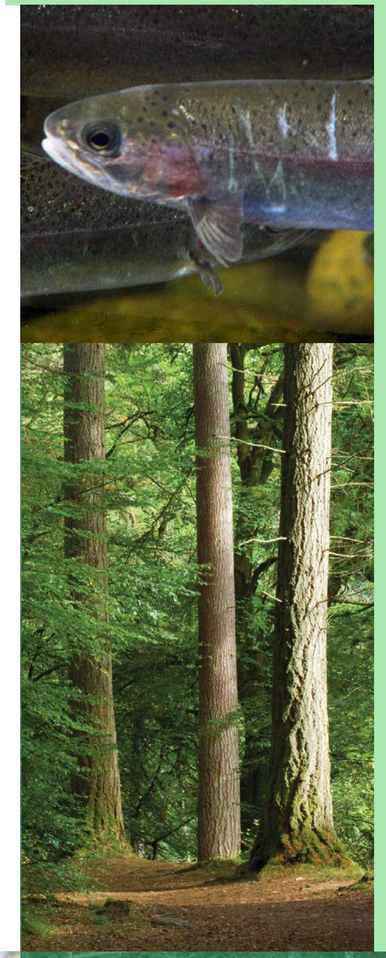
environment: LID protects our natural ecosystems and provides improved water quality, increased groundwater recharge, improved air quality, enhanced aesthetics, increased open space, and carbon sequestration.

LID also brings **community** and **economic** benefits.

- Clean water and reduced flooding enhance the communities we live in and our quality of life.
- Protecting streams, rivers, and Puget Sound from pollutants is usually less expensive than cleaning contaminated water.
- Lower infrastructure and maintenance costs reduce capital burdens.
- Landscapes enhance property values and are easier to maintain.
- Reducing the need for large stormwater detention ponds can increase the amount of buildable area within a development.

Did you know that Tukwila is home to the following salmon and trout species?

- Chinook
- Coho
- Sockeye
- Pink
- Chum
- Steelhead
- Bull Trout



LID *is good for* FISH

Several species of salmon, trout, and other aquatic wildlife are endangered, threatened, or otherwise at risk in the Puget Sound region. Studies have shown that untreated runoff and poor water quality can be lethal to juvenile salmon. Poor water quality and high velocity flows in streams can harm all aquatic species and the upland wildlife that are part of the food chain.

Uncontrolled runoff from expansive impervious surfaces and massive site grading worsens these problems. LID is the best solution for addressing these issues. This is the reason that the Washington State Department of Ecology is now requiring that LID best management practices be integrated into development projects in many cities and counties.

LID *is good for* PEOPLE

TREES PROTECT STREAMS

Research in King County shows that preserving and restoring trees and other native vegetation along streams helps maintain healthy habitat conditions for salmon and other fish and the bugs they eat.

Washington State Department of Ecology and King County already require LID techniques. The City of Tukwila intends to adopt LID requirements by December 31, 2016.

For more information, refer to:

- *2016 King County Surface Water Design Manual*
- *LID Technical Guidance Manual for Puget Sound*

best MANAGEMENT PRACTICES

LID Best Management Practices (BMPs)

include a variety of treatments and techniques for managing surface water runoff as part of site development and street improvements. These solutions help to slow runoff down, spread it out so it is not concentrated in one location, and soak it into the ground:

- **Bioretention areas** such as swales, cells, planters, or rain gardens can hold water and allow it to soak into the ground and evaporate.
- **Permeable pavements** such as pavers with joints or pervious concrete or asphalt surfaces that allow water to flow through can be used on driveways, sidewalks, parking areas, and streets.
- **Reducing the "footprint"** of paved areas and impermeable surfaces also helps by reducing how much runoff is generated and by creating more space for trees, landscaping, and natural areas where water can soak into the ground.

Reducing the Paved Area Footprint

- **Smaller parking spaces -** reducing dimensions for parking stalls and drive aisle widths
- **Getting by with the minimum** amount of disturbance and pavement needed
- **Build up instead of out -** allowing buildings in the urban center to be taller

SLOW IT DOWN **SPREAD IT OUT** **SOAK IT IN**

OTHER LID TECHNIQUES

In addition to minimizing impervious surfaces and providing bioretention, LID includes a full spectrum of solutions that can be applied in design and development as well as later maintenance and management activities, such as:

A. **Dispersion** that spreads out stormwater in a wider path across the landscape or yard areas or through natural vegetation

B. **Infiltration** trenches, chambers, and other features that store runoff and allow it to soak into the ground over time

C. **Preserved trees and natural landscapes** that continue to function as places for water to flow into the ground

D. **Vegetated swales, buffers, and strips** with plant roots that help to absorb and slow down water flows

E. **Green street systems and parking areas** that integrate bioretention and permeable pavements into the design of the network

F. **Reduced clearing and grading** as part of site development

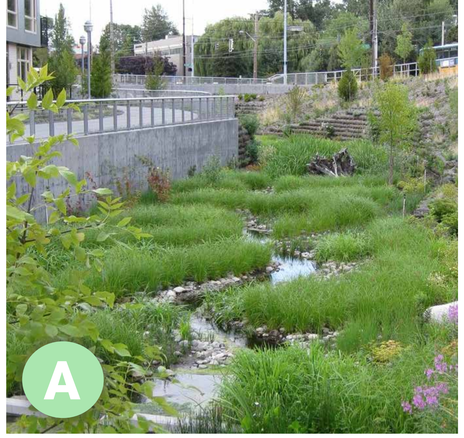
G. **Soil amendments** that maximize the soil's capacity to hold moisture

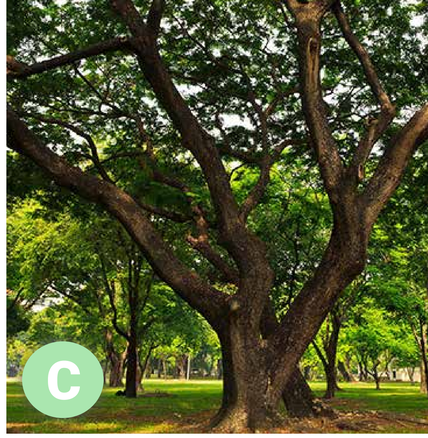
H. Rainwater from roofs flowing to **cisterns and rain barrels** that can then hold water to later irrigate the landscape **(rainwater harvesting)**

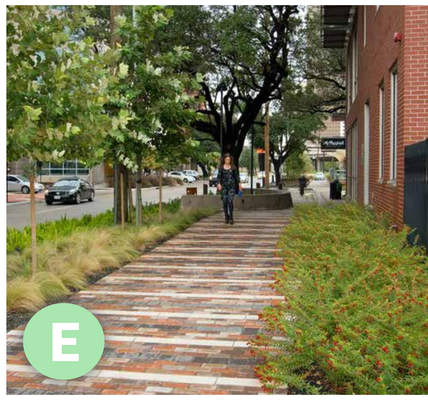
I. **Disconnecting roof drains** from the stormwater system and allowing the runoff to flow into rain gardens and the landscape

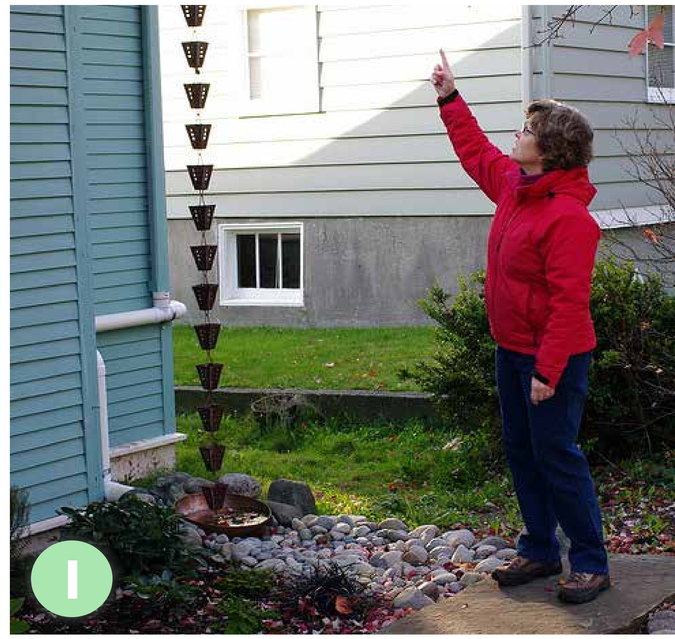
J. **Vegetated or green roofs** that act like sponges to hold and absorb rainwater

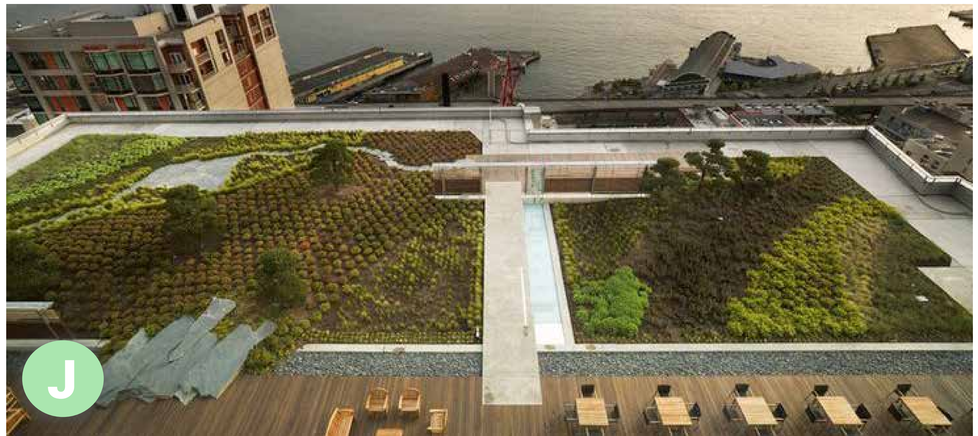
K. **Preventing pollution** that can drain into stormwater systems at residential and commercial sites (from car washing, landscape fertilizers and pesticides, grease, and other sources)

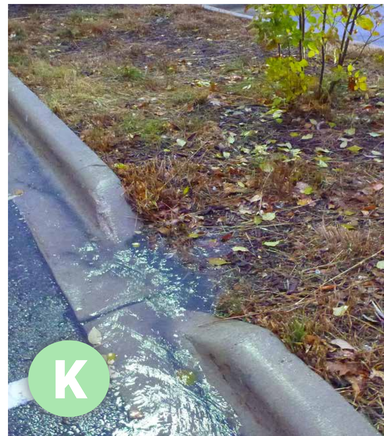












integrated best MANAGEMENT PRACTICES

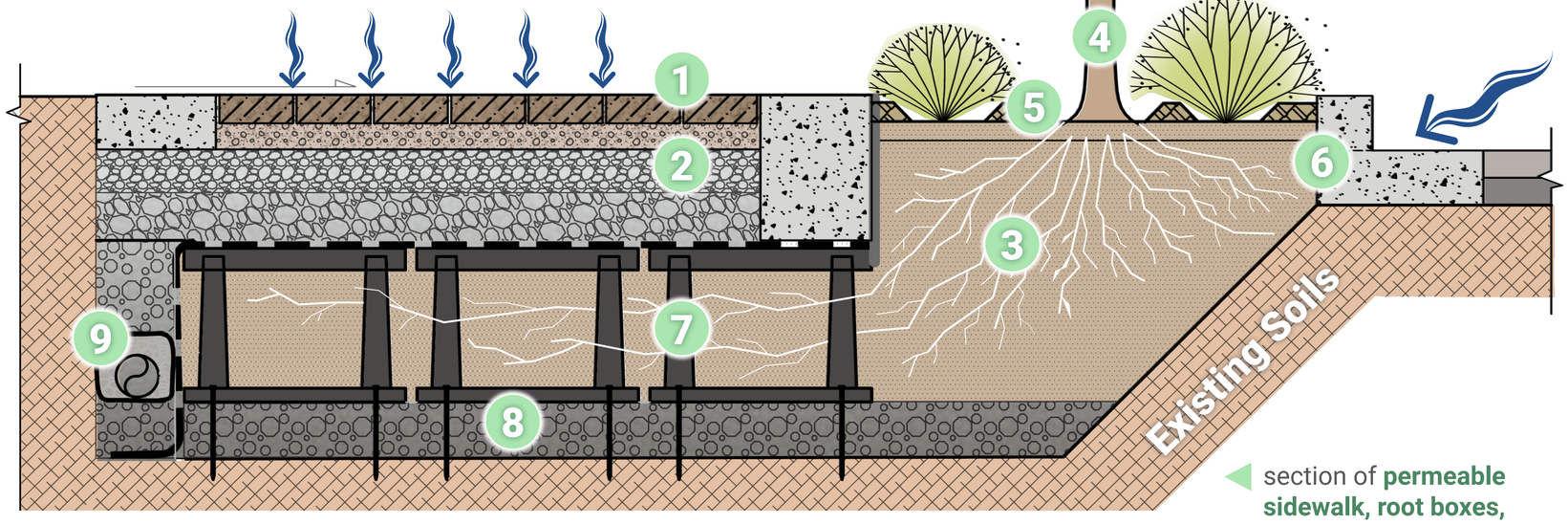
Soak it in by allowing the rain to soak through

Permeable pavement lets the rain that falls soak right through the pavement and into the ground. With permeable pavement, a street, driveway, or parking lot doesn't produce any stormwater runoff!

With LID, you might find permeable asphalt on a low-volume residential street, porous pavers on a downtown pedestrian plaza, or pervious concrete on the sidewalk in your neighborhood.

LID designs can include multiple BMPs as the example below illustrates

1. Stormwater enters between these **concrete paver** gaps
2. **Gravel layers** allow water to infiltrate
3. **Rain garden soil mix** (sand and compost) infiltrates stormwater, retains moisture, filters pollutants, and fertilizes plants
4. **Street trees and shrubs** take up the water, help remove pollutants, and shade urban corridors
5. **Compost/bark mulch** reduces soil moisture loss and suppresses weeds; adds nutrients and microorganisms
6. Stormwater enters from street via **curb cut**
7. **Root boxes** support the paving above loose soil in which tree roots can grow allowing for larger, healthier trees
8. **Layer of gravel** supports the root boxes
9. **Drain pipe** conducts excess water to the city storm drain pipes if needed



section of **permeable sidewalk, root boxes, and bioretention planter**

strategies for

SHORT PLATS, SUBDIVISIONS, & OTHER RESIDENTIAL DEVELOPMENT

- Address stormwater management early in your site planning process—this will be more efficient and cost effective than waiting until the engineering stage of work.
- Work with a geotechnical engineer to check your soil conditions and percolation rates to determine if and where infiltration facilities might be most feasible.
- As part of site planning, avoid compacting or paving over soils with high infiltration rates—plan ahead to make use of these areas in your development.
- Be efficient with land and get multiple uses by integrating code-required open space and stormwater facilities. Rain gardens with paths and interpretive elements can serve as recreation space for residents. Stormwater can disperse over lawn areas. Retention and infiltration vaults can be covered with lawn and picnic areas.
- Use bioretention, rain gardens, permeable pavements, and other features to reduce the amount of stormwater infrastructure and piping needed—this will reduce your development costs.
- Minimize the footprint of impervious surfaces—use permeable pavements and minimum allowable roadway and sidewalk cross sections, driveway lengths, and parking stall sizes. Use two-track/ribbon driveways and alleyways and/or shared driveways.
- Cluster homes and development to minimize the amount of land disturbance, preserve natural areas for stormwater absorption, and maximize pervious area.
- Maximize preservation of trees and natural areas and planting/restoration of native landscaping.
- Include landscape islands in streets, bulb-outs at intersections, and cul-de-sacs.
- Build neighborhood rain gardens. On sloping sites, look for opportunities to bench in a linear rain garden or bioretention swale.
- Work with a good landscape architect to choose the best Pacific Northwest native plants for your landscaping, rain gardens, and bioretention facilities.

TUKWILA LID CODE UPDATE

strategies for HOMES & YARDS

- Preserve trees, green belts, and natural areas as part of homesite development.
- Drain your roof downspouts to the rain garden or suitable area of the yard for letting the water soak in. Use splash blocks, chains, and runnels to manage and direct stormwater from roofs and surfaces to garden and yard areas.
- Use pervious pavement material for driveways, paths, patios, and other surfaces such as modular paving blocks, turf blocks, porous concrete and asphalt, brick, and gravel or cobble.
- Compost and use soil amendments and mulches to increase the moisture retention capacity of your yard and garden.
- Consider opportunities to harvest rainwater and reuse it for irrigation with cisterns and rain barrels.
- Use natural yard management (no pesticides or fertilizers).
- Don't wash your car in the driveway–take it to a car washing facility that safely cleans the water.

EMERGENTS

1. ***Juncus acuminatus, Taper-tipped rush,*** 6"- 18" height / 12"- 24" spreading
2. ***Juncus ensifolius, Dagger lead rush,*** 6"- 15" height, 6"- 9" spreading

GROUNDCOVERS, GRASSES, PERENNIALS, FERNS

3. ***Lupinus, Lupine,*** 18"- 24" height, 24" - 30" spread
4. ***Trillium ovatum, Western trillium,*** up to 18" height, 12" spread

SMALL TO MEDIUM SHRUBS

5. ***Cornus sericea, 'Flavimera,'*** *Yellow-twig dogwood,* 6'- 8' height, 5' spread
6. ***Cornus sericea 'Kelseyi',*** *Dwarf red-twig dogwood,* 1.5'-3' height, 3' spread
7. ***Ribes bracteosum, Stink currant,*** 5' - 7' height and spread
8. ***Spirea douglasii, Douglas spirea,*** 4' - 7' height, 6' - 10' spread

LARGE TREES AND SHRUBS

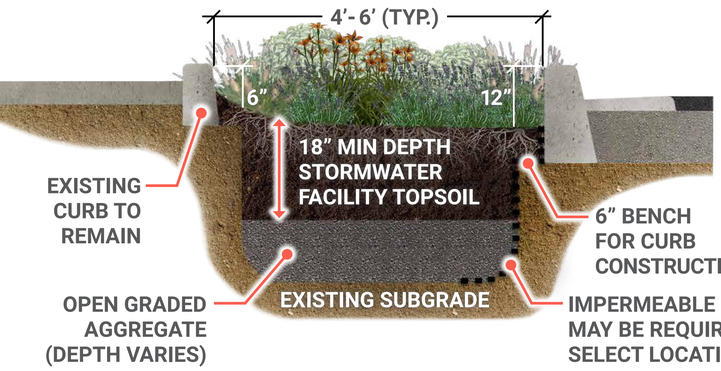
9. ***Acer circinatum, Vine maple,*** 15' - 20' height and spread
10. ***Betula papyrifera, Paper birch,*** 50' - 90' height, 25' - 50' spread

1. RAIN GARDENS
2. PRESERVATION OF EXISTING TREES AND VEGETATION
3. NATURAL YARD MANAGEMENT (NO PESTICIDES OR FERTILIZERS)
4. RETAIN/RESTORE NATIVE PLANTINGS AS LAWN ALTERNATIVES
5. RAINWATER HARVESTING/ CISTERNS

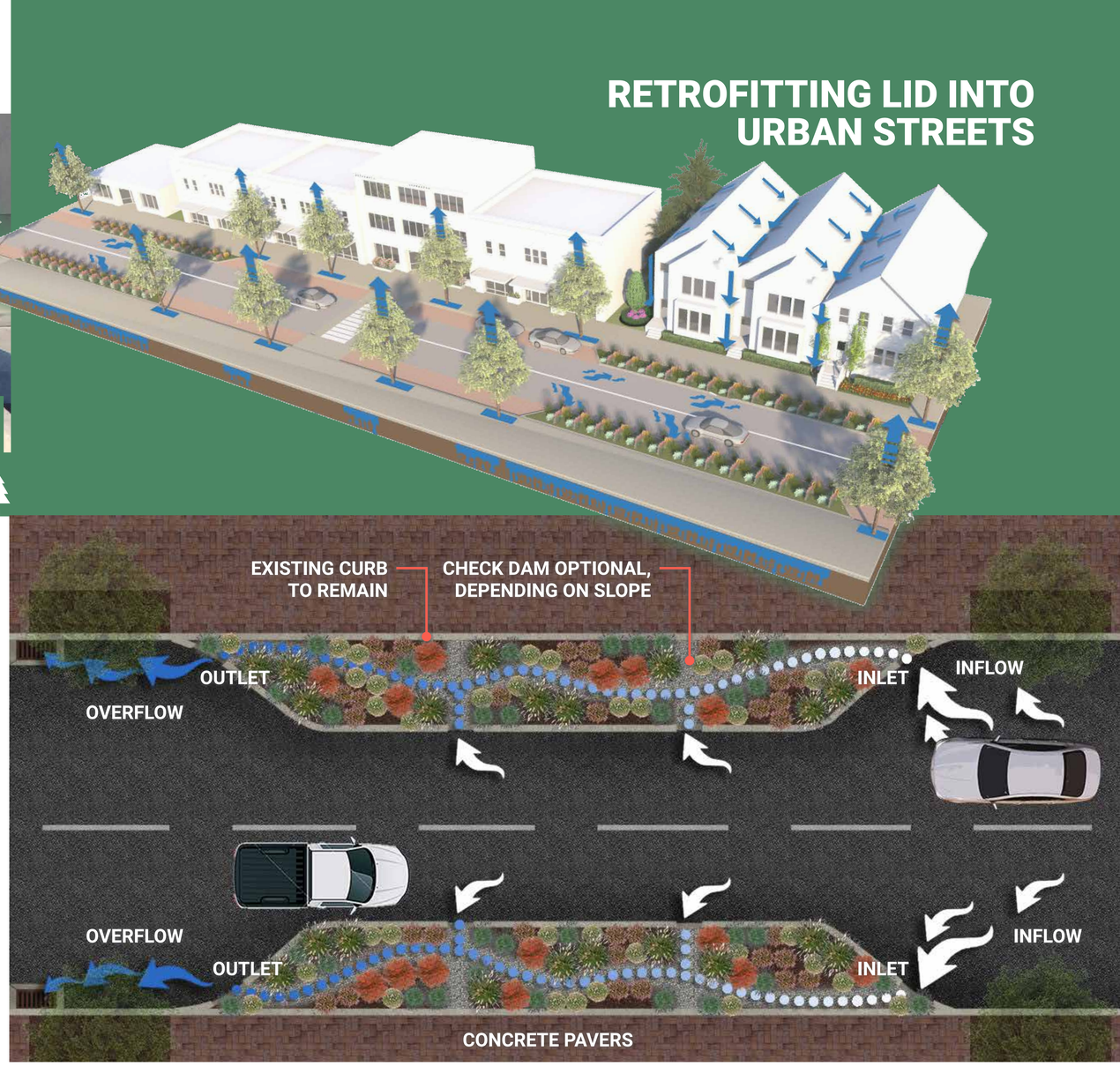
6 PERMEABLE PAVEMENT

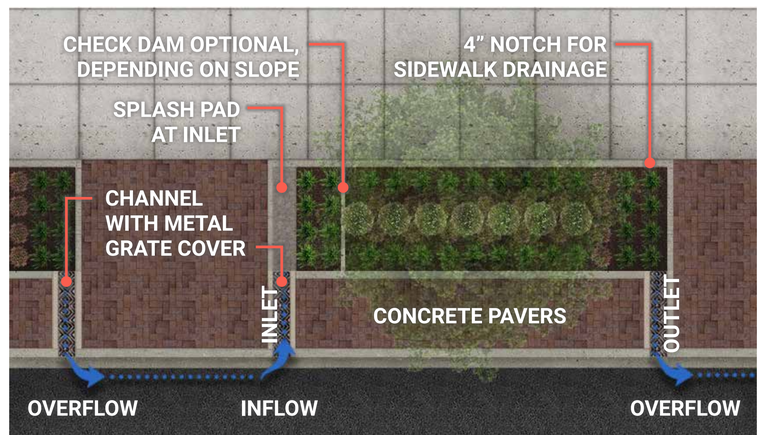
7. SPLASH BLOCKS FOR ROOF DOWNSPOUTS
8. SOIL AMENDMENTS

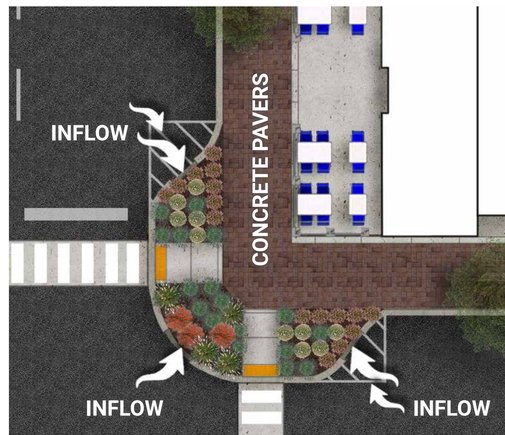
strategies for STREETS & RIGHTS-OF-WAY

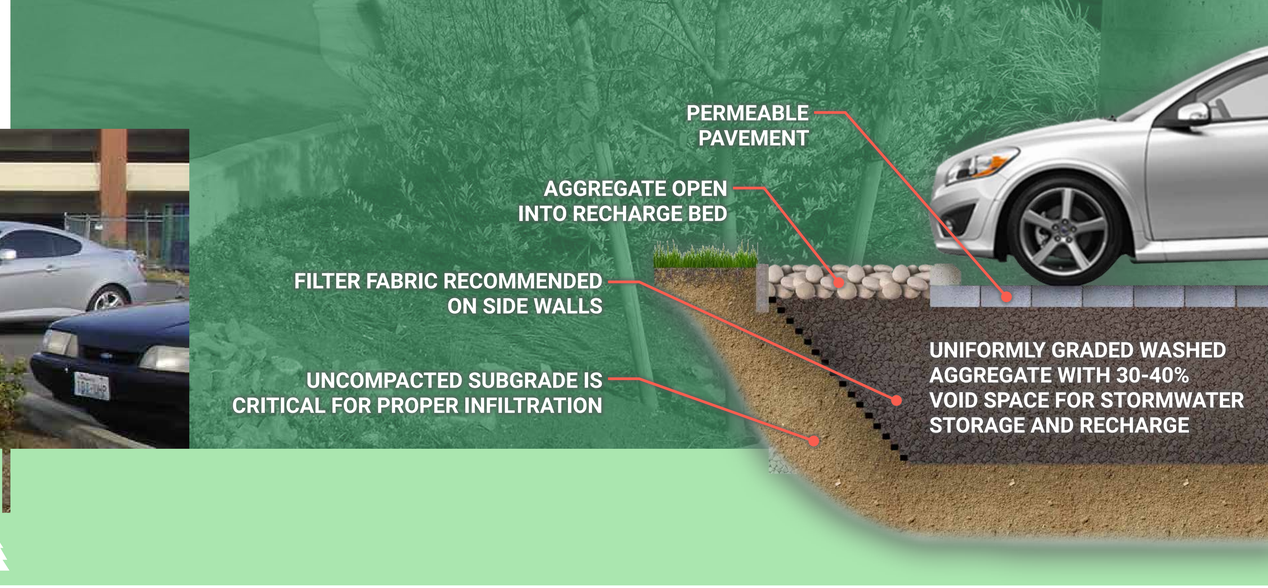


- Use minimum widths allowable for travel lanes, shoulders, paths, and sidewalks. By encouraging more multi-modal travel, fewer travel lanes may be needed.
- Infiltrate and slowly convey storm flows in roadside bioretention cells and swales.
- Make use of median islands, traffic circle islands, space at intersection bulb-outs, and planting strips along roadways for bioretention facilities and rain gardens.
- Use permeable pavements (pavers, pervious concrete, porous asphalt, etc.); even if it isn’t feasible to make all paved surfaces permeable, do as much as possible, such as making all sidewalks, paths, driveways, and parking areas permeable.
- Create a connected grid of streets, alleyways, and sidewalks to promote more walking, bicycling, and access to transit services as well as efficient fire and safety vehicle access. Avoid dead-end cul-de-sacs.
- Layout streets and roadways in configurations that minimize stream crossings and protect critical natural areas. Design the roadway network to minimize site disturbance and reduce fragmentation of the landscape.
- Retrofit LID features into existing urban and suburban streets to reduce impervious surface area, better manage stormwater runoff, and enhance the environment.

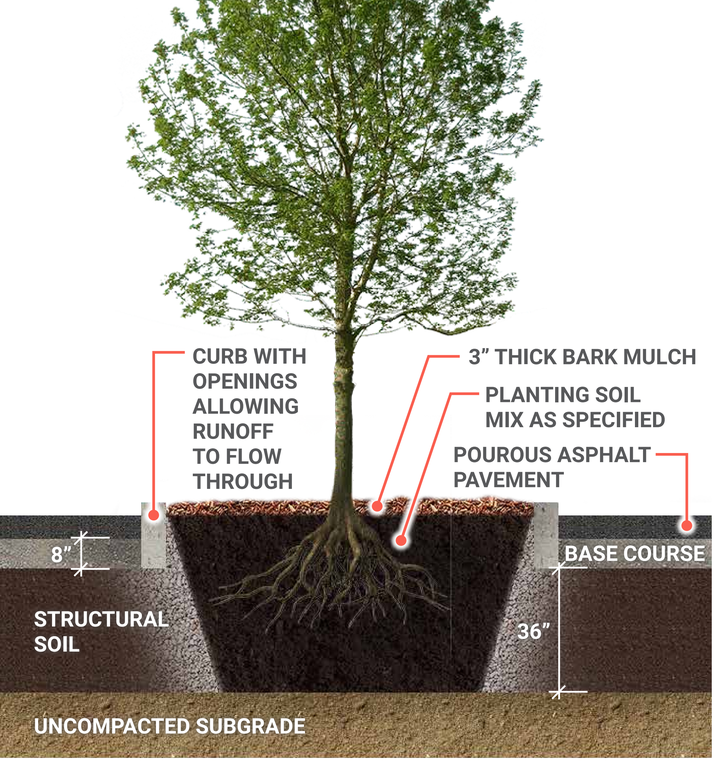








strategies for PARKING AREAS



- Use minimum allowable dimensions for parking spaces, access aisles, and driveways to reduce the overall footprint of the paved area.
- Use permeable paving as much as possible in parking areas, adjacent sidewalks, and paths.
- Build as many compact spaces as allowed. Tukwila allows up to 30% of stalls to be compact.
- Limit excess parking and use permeable surfaces (such as turfblock or pavers) for overflow parking areas.
- Infiltrate and slowly convey storm flows in bioretention cells and swales and through permeable paving and aggregate storage systems under the pavement.
- Make use of median islands and planting strips along parking areas for bioretention facilities and rain gardens.
- Retrofit LID features into existing urban and suburban parking areas to reduce impervious surface area, better manage stormwater runoff, and enhance the environment.