HB LANARC
PLANNING DESIGN SUSTAINABILITY
A Member of the Golder Group of Companies

Sustainable Sites

RDN Workshop June 25, 2011

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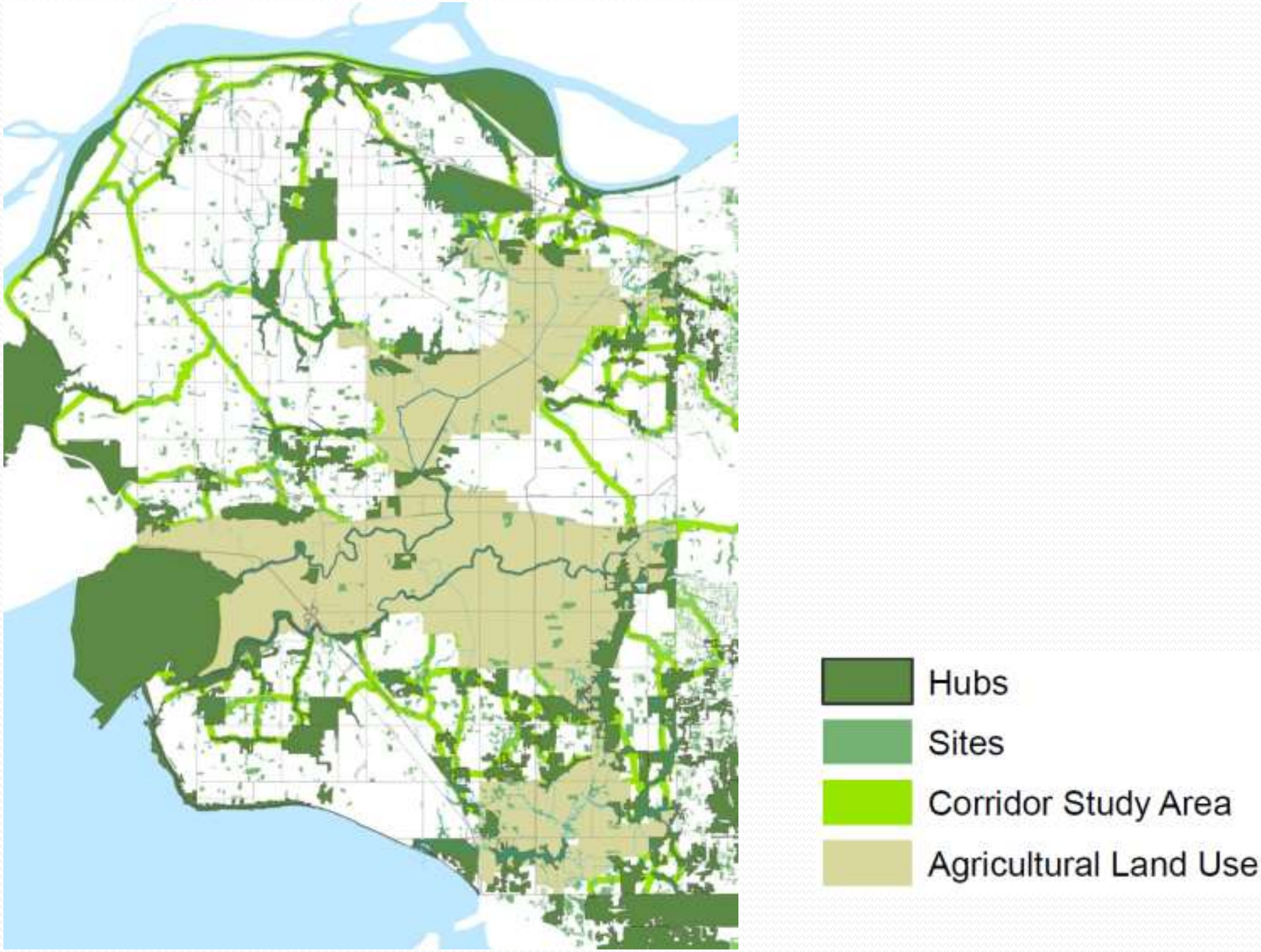
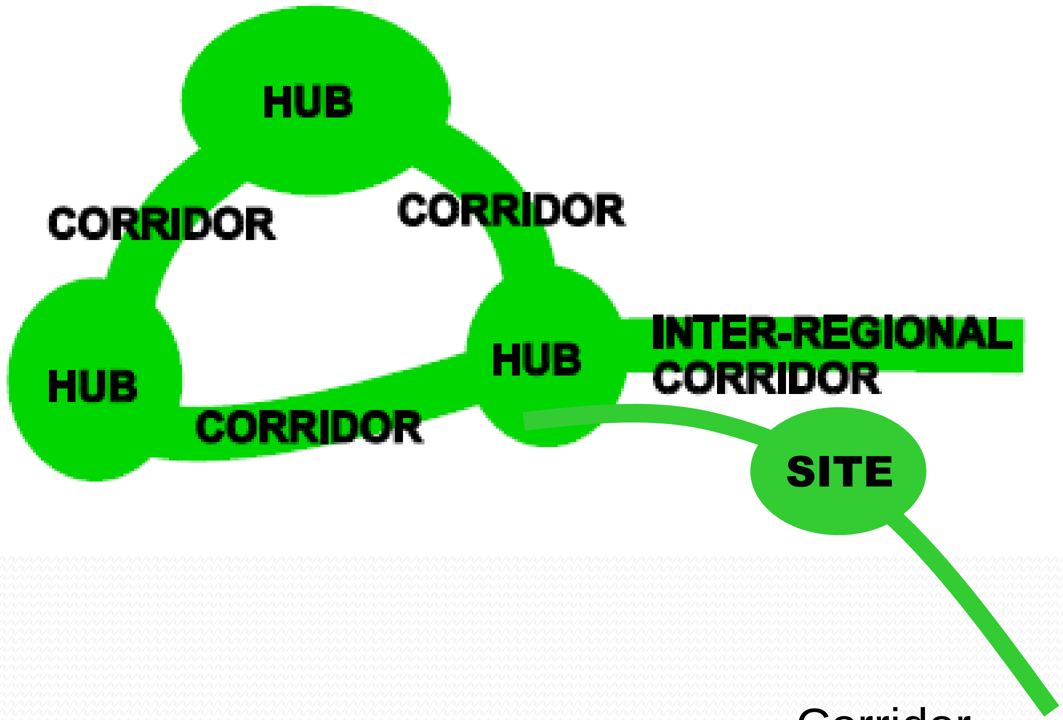
Environmental Designer

hblanarc.ca

Surrey ESA Networks & linear corridors



ESA Network: Develop with Care

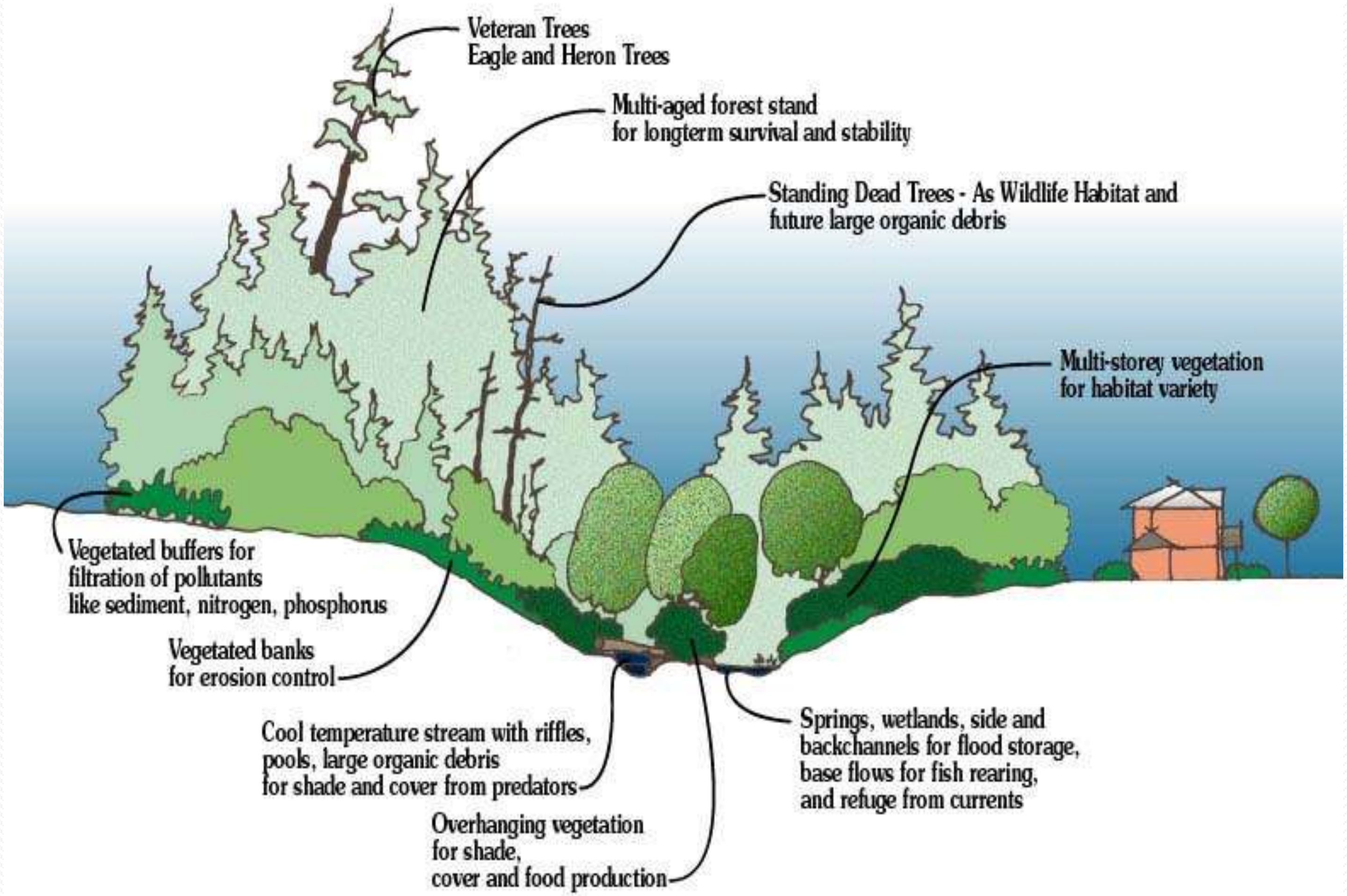


Hub
>10 ha
Semi-natural or
natural vegetation

Site
<10 ha
Semi-natural

Corridor
Most natural route between hubs; and ALR as a whole

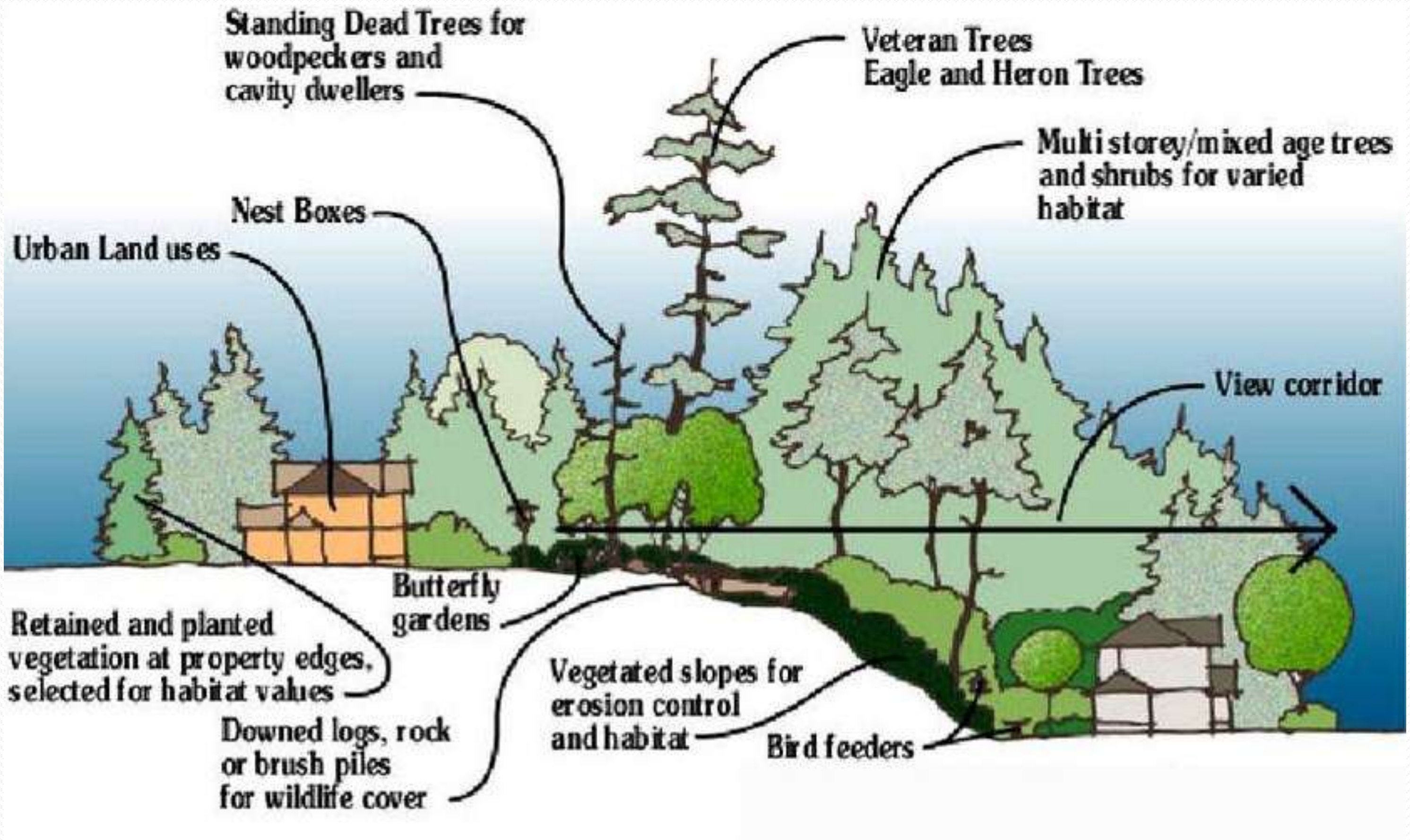
Aquatic Habitat Greenways



Connection Example – Stream corridor

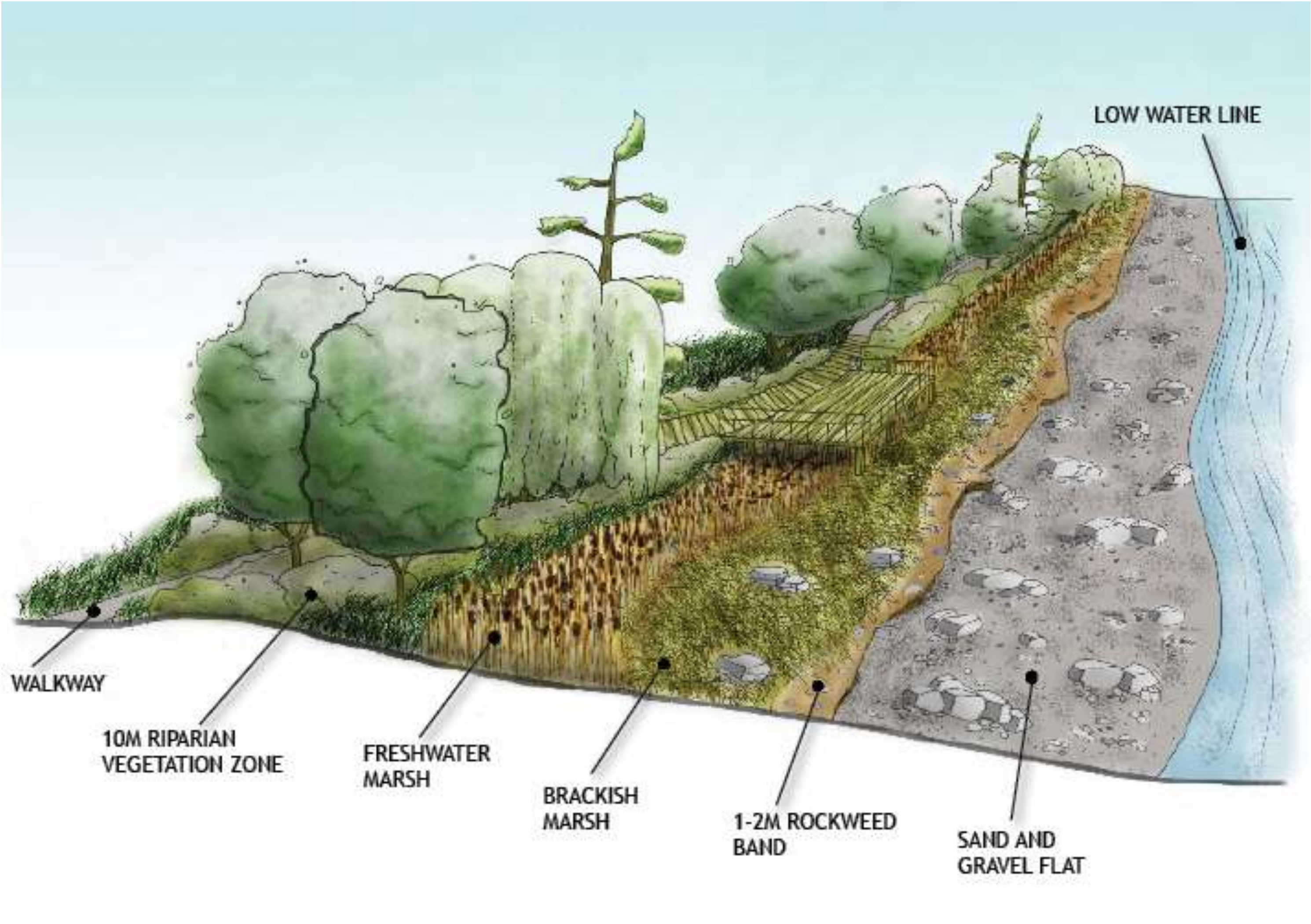
Upland Habitat Greenways

& Steep Slope Management



Connection Example – Upland corridor

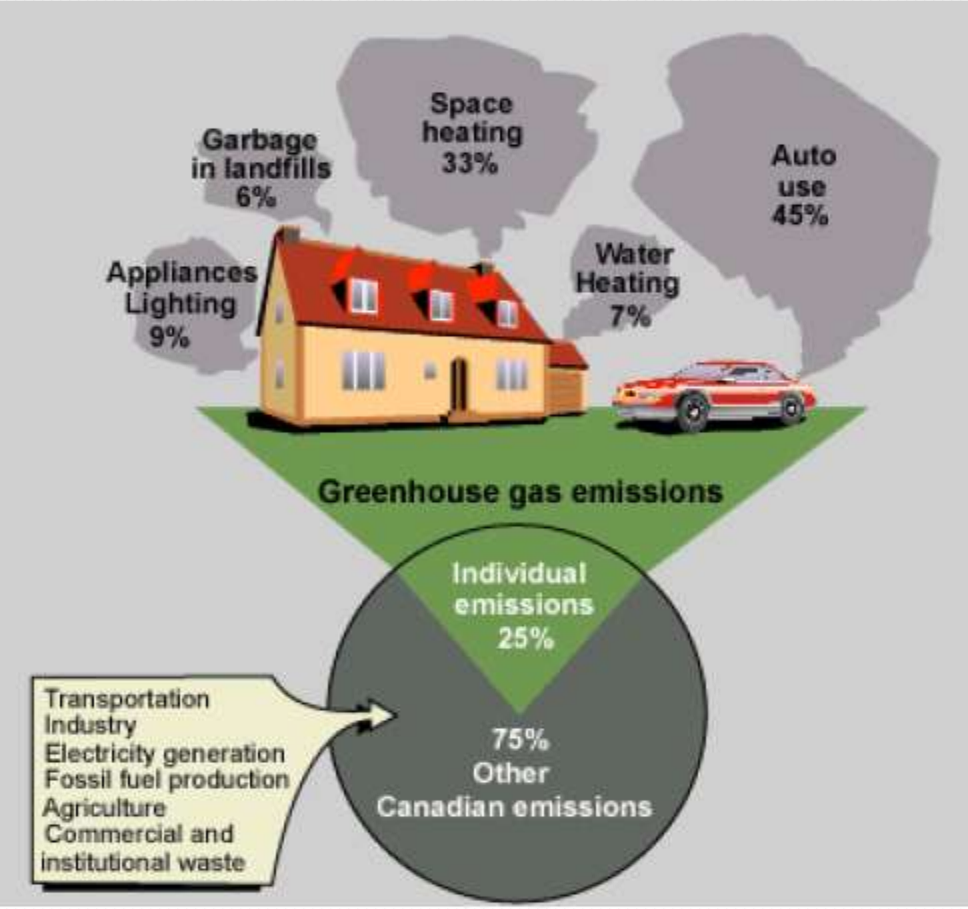
Green Shores



City of Campbell River

Sustainable CAMPBELL RIVER

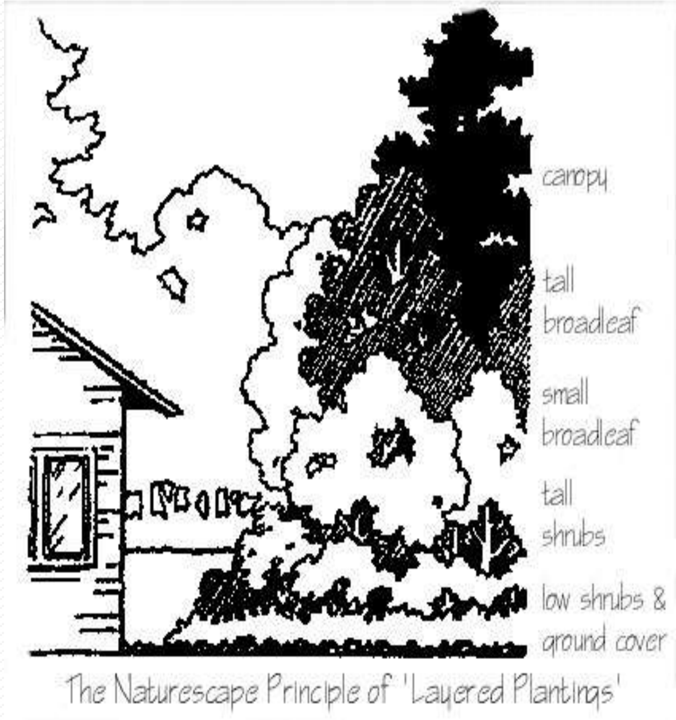
Greenhouse Gas Emission Calculator

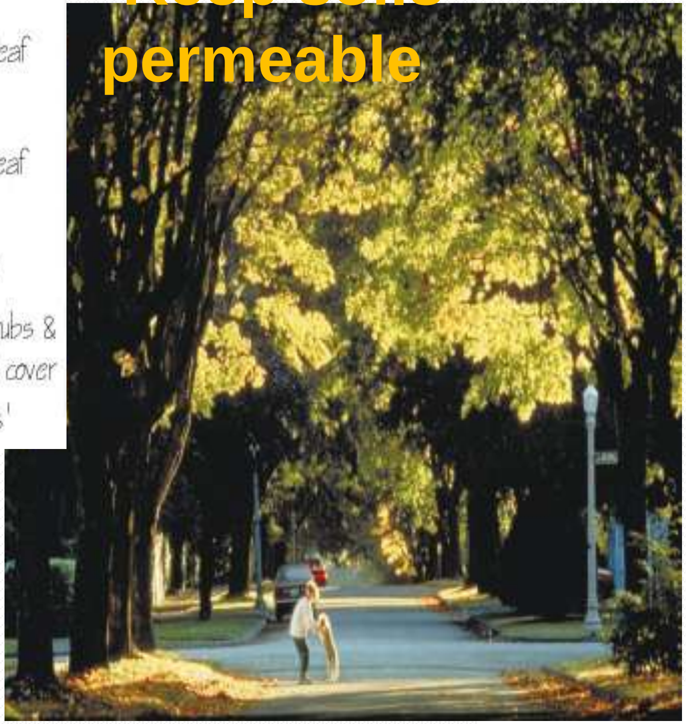


Alternative Transportation

Vegetation Planning

- Avoid heat gain
- Provide wind shelter
- Keep soils permeable





Geoexchange

Four basic types of geothermal energy sources:

Horizontal loops are often considered when adequate land surface is available. Pipes are placed in trenches, in lengths that range from 100 to 400 feet.

Vertical loops are the ideal choice when available land surface is limited. Drilling equipment is used to bore small-diameter holes from 75 to 300 feet deep.

Pond (lake) loops are very economical to install when a body of water is available, because excavation costs are virtually eliminated. Coils of pipe are simply placed on the bottom of the pond or lake.

Open loop systems are the fourth type and utilize ground water as a direct energy source. In ideal conditions, an open loop application can be the most economical type of geothermal system.

Boiler/Tower Systems
For efficiency upgrades where large geothermal systems are not viable, existing boiler/tower jobs are frequently retrofitted. Hybrid systems incorporate both geothermal loop coupled with down-sized conventional heat rejection or addition equipment (boiler or tower).

Surface Water Heat Exchange

- Submerged heat exchange loop in water connected to heat pumps
- E.g. Brentwood College School ocean loop
  - Loop sunk 70 m offshore, 6 m deep (low tide)
  - DFO granted permission
  - 35 % reduction in heating & cooling energy compared to conventional system

Courtesy Lockhart Industries

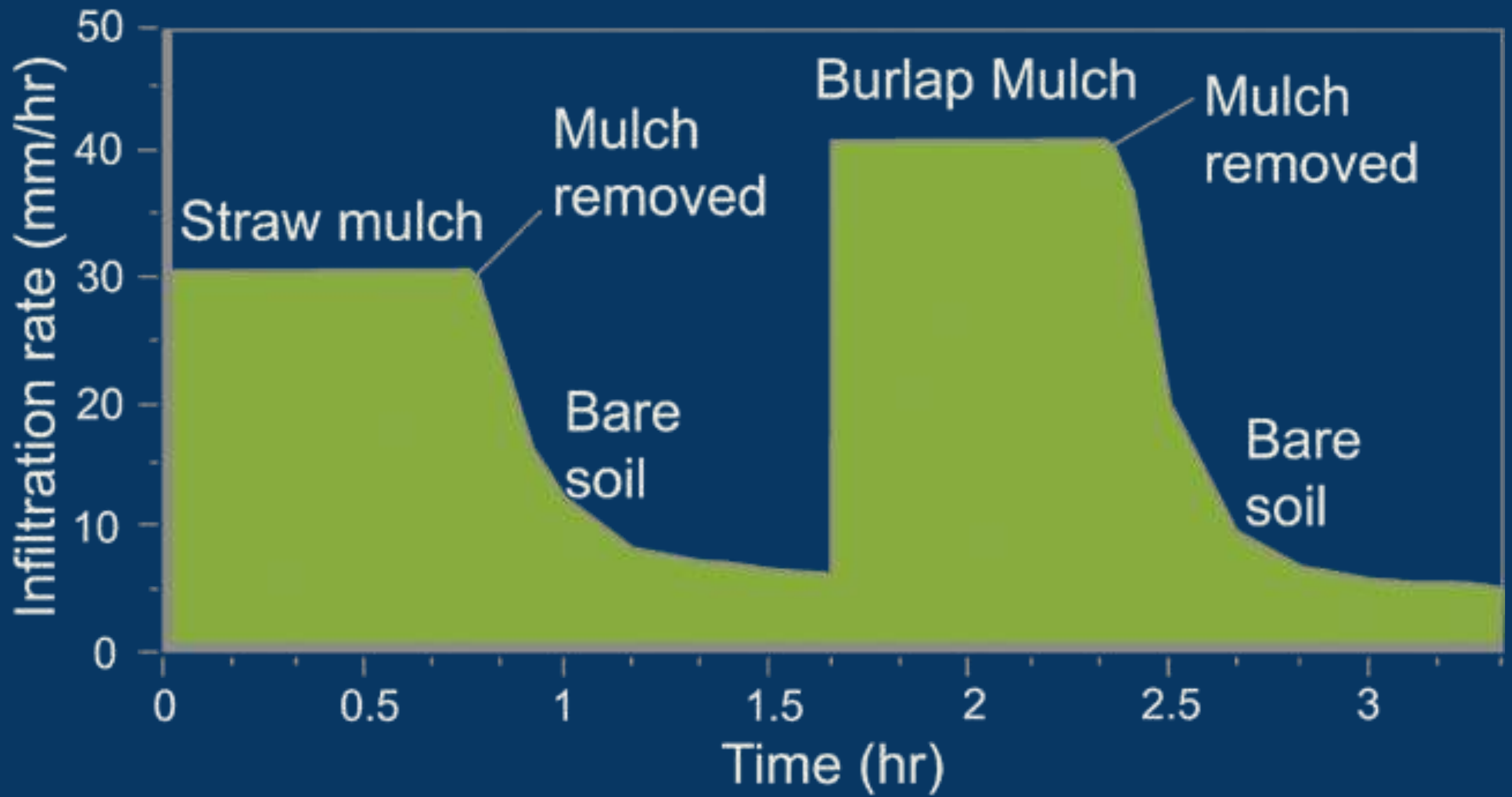
Preparation of heat exchange mats

Solar Collectors
for Domestic Water Pre-Heating

- Can significantly reduce hot water heating energy (30 – 60%)
- Need significant roof area
- Consider solar access

Contractor Training - Source Erosion Control

Contractor Training - Source Erosion Control



Rainfall Storage in Soil is 7% to 18% of Soil Volume

Infiltration rate of a sandy loam under continuous water sprinkling at a rate in excess of intake with a series of 4 surface conditions (Ferguson, 1994: 191).

Stormwater Strategy includes Soils

1. Crown Interception
2. Throughfall and Stemflow
3. Evapotranspiration
4. Soil Water Storage
5. Soil Infiltration
6. Surface Vegetation
7. Organics and Compost
8. Soil Life
9. Interflow
10. Deep Groundwater
11. Water Quality Improvement
12. Impermeable Surfaces and Surface Runoff

Stormwater Variables of Absorbent Landscape

A schematic representation of the 12 stormwater variables of absorbent landscape. Keeping these variables in balance is the key to successful stormwater source control using absorbent landscape.

USDA Soil Class	Saturated hydraulic conductivity (mm/hr)
Sand	210
Loamy sand	61*
Sandy loam	26*
Loam	13
Silt loam	6.8
Sandy clay loam	4.3
lay loam	2.3
Silty clay loam	1.5
Sandy clay	1.2
Silty clay	0.9
Clay	0.6

Typical Infiltration Rates

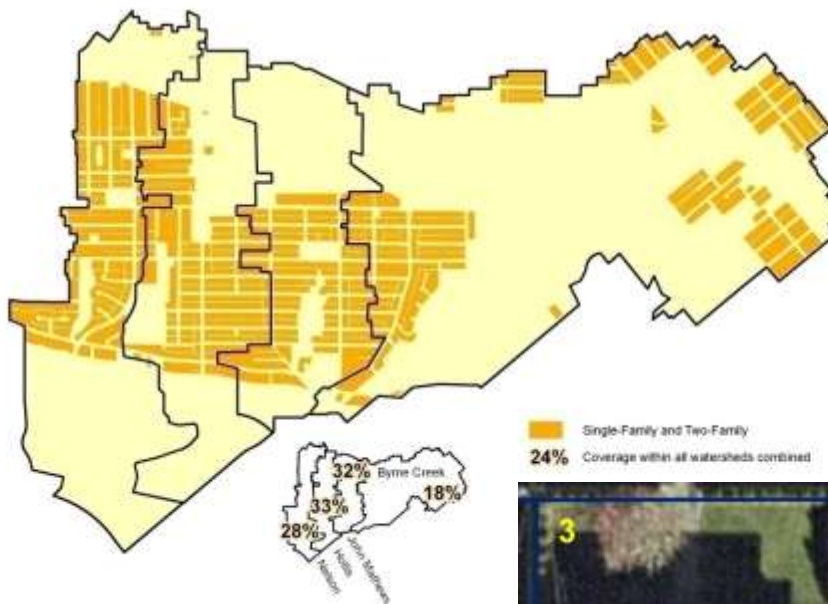
*Target soil texture for growing medium Level 2 “Groomed” and Level 3 “Moderate” landscape areas in B.C. Landscape Standard, which represent a good balance between infiltration performance and water retention capabilities.

At 13mm (1/2”)/ hour interflow, water moves at 321mm (1’) a day. At that rate, it would take +/- 3 months for water to flow as interflow through a 30m (100’) riparian buffer.

At 1mm / hour infiltration (till), a total of 24mm of rainfall is accepted over a 24 hour period.

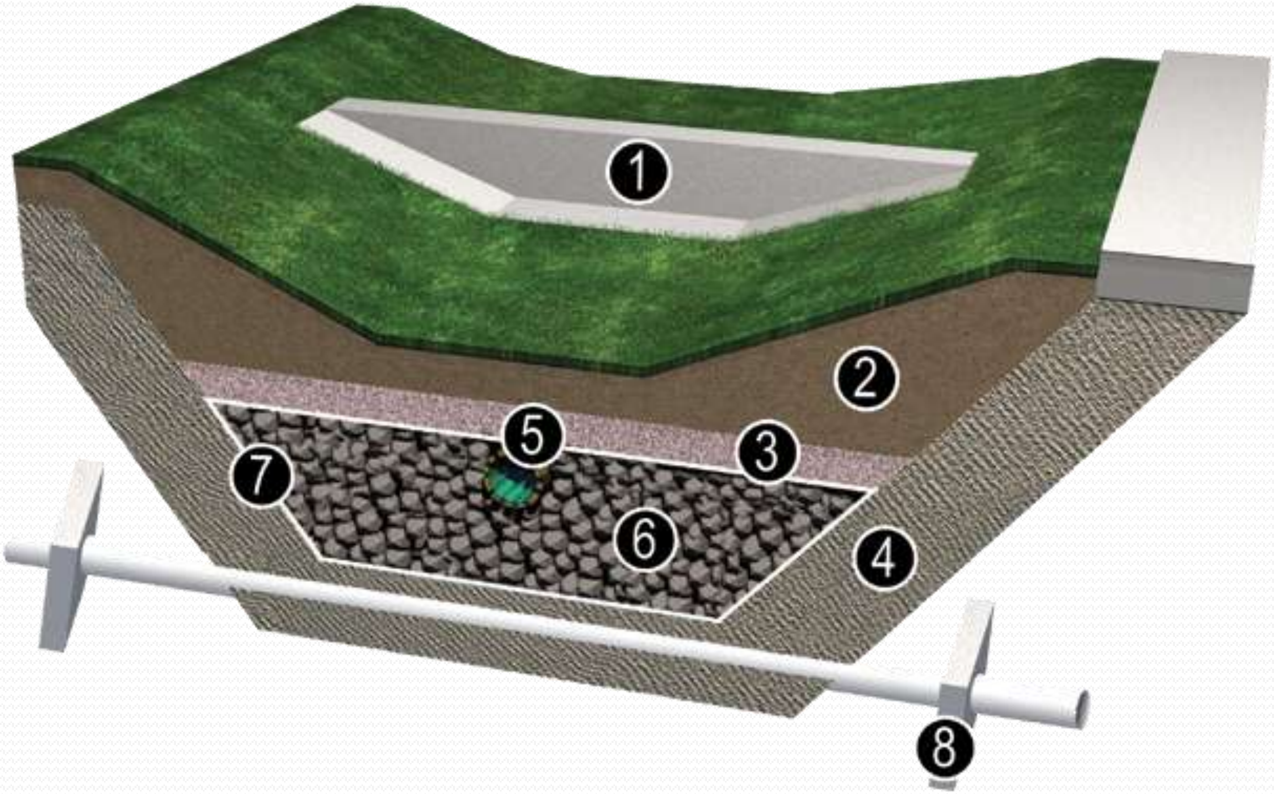
Infiltration also occurs in fractured bedrock.

Impervious Area

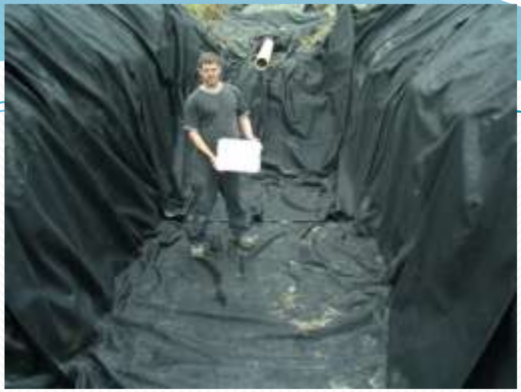


Infiltration Swale System

Partial Infiltration Swale with Reservoir and Subdrain



1. Weir Keyed into Swale Side Slope
2. Growing Medium (300mm Min.)
3. Sand
4. Existing Scarified Subsoil
5. Perforated Underdrain (150mm Dia. Min.)
6. Drain Rock Reservoir (300mm Min.)
7. Geotextile Along All Sides of Reservoir
8. Trench Dams at All Utility Crossing



Scarified, soils and plants installed after homes are built.

Drain Reservoir and filter cloth, sand reservoir and overflow used as minor sediment trap for road wash while homes under construction.

City of Campbell River

Sustainable CAMPBELL RIVER

Newly planted

Establishment maintenance includes temporary watering, and normal landscape maintenance.

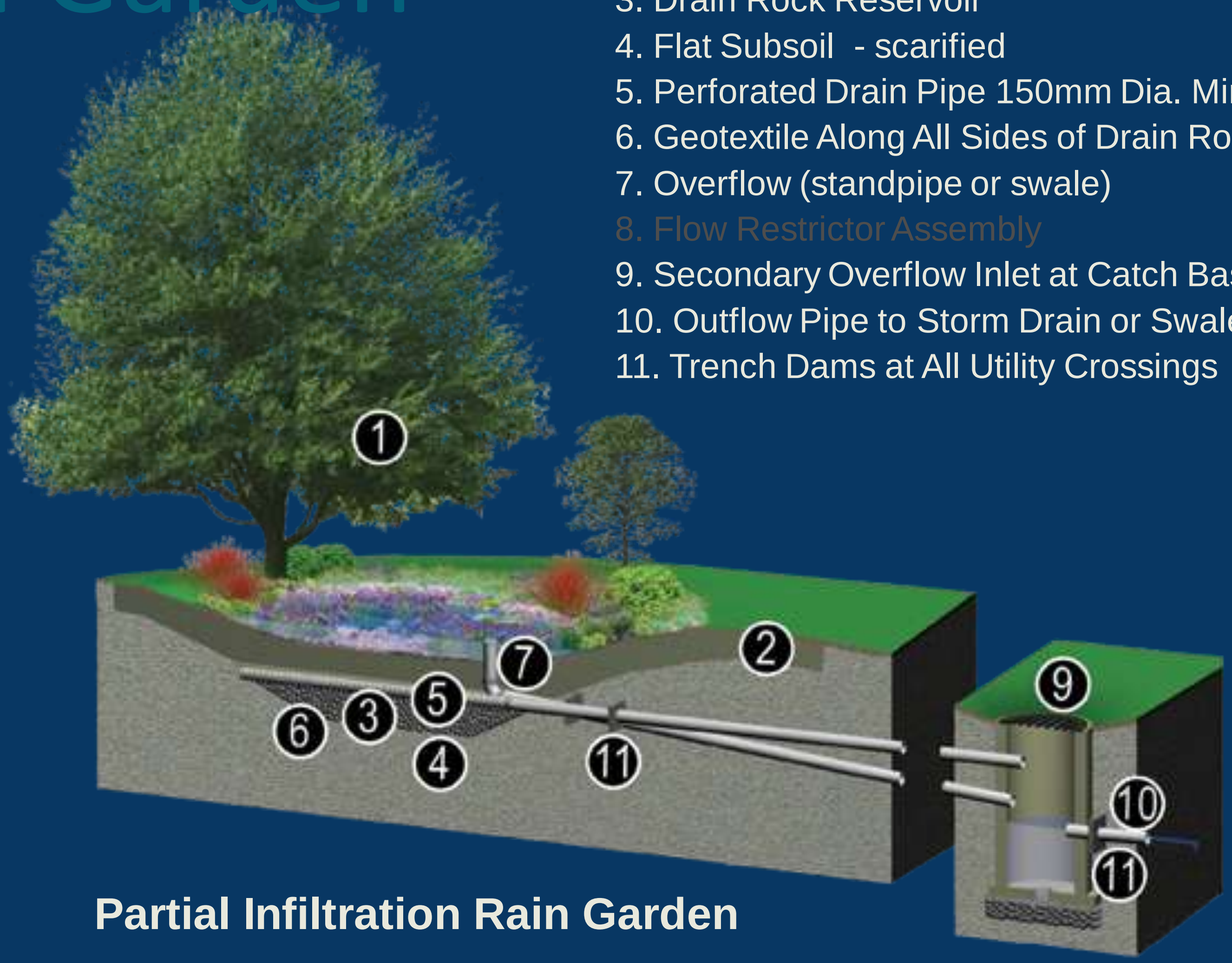
If surface crust develops remove by light cultivation of mulch areas, aeration of lawn areas.

City of Campbell River

Sustainable Campbell River

Rain Garden

1. Tree, Shrub and Groundcover Plantings
2. Growing Medium Minimum 450mm Depth
3. Drain Rock Reservoir
4. Flat Subsoil - scarified
5. Perforated Drain Pipe 150mm Dia. Min.
6. Geotextile Along All Sides of Drain Rock Reservoir
7. Overflow (standpipe or swale)
8. Flow Restrictor Assembly
9. Secondary Overflow Inlet at Catch Basin
10. Outflow Pipe to Storm Drain or Swale System
11. Trench Dams at All Utility Crossings



Partial Infiltration Rain Garden


LANARC

Rain Garden in Winter Flood

Rain Garden

Formal rain garden, Buckman Terrace, Portland, Oregon.

Informal rain garden, Water Pollution Control Laboratroy, Portland, Oregon.

Rain Garden

- Portland Urban Stormwater Planters

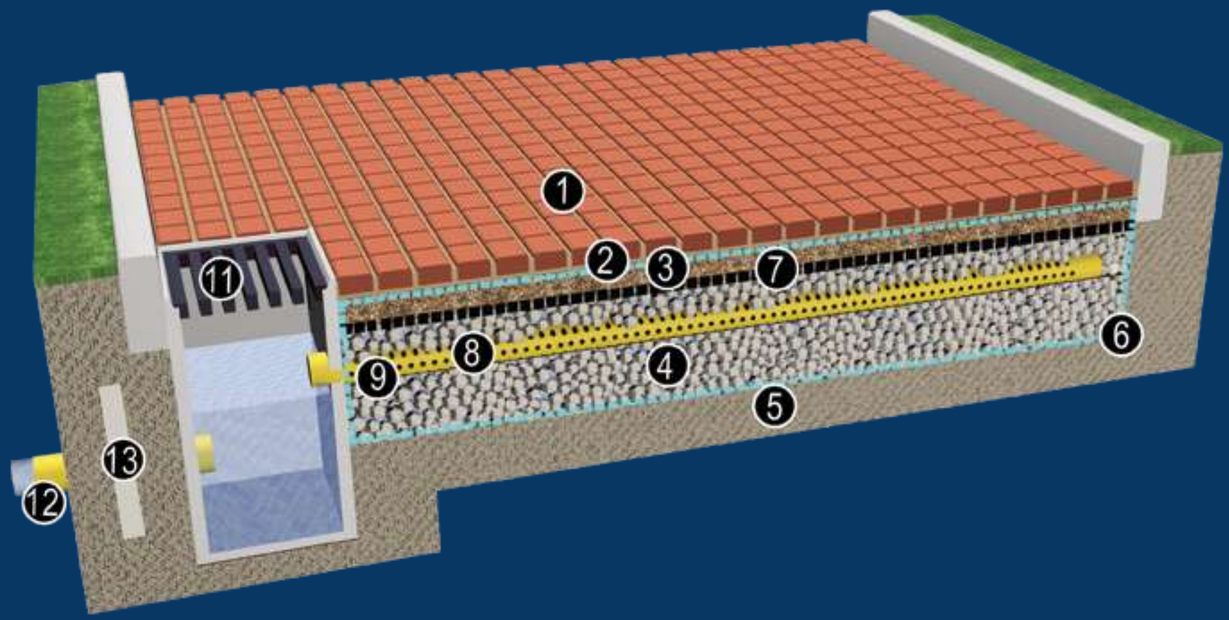
Pervious paving reservoir base.

Pervious Paving

Pervious unit paving with aggregate joints at bike rack.

Pervious Paving

Partial Infiltration Pervious Paving



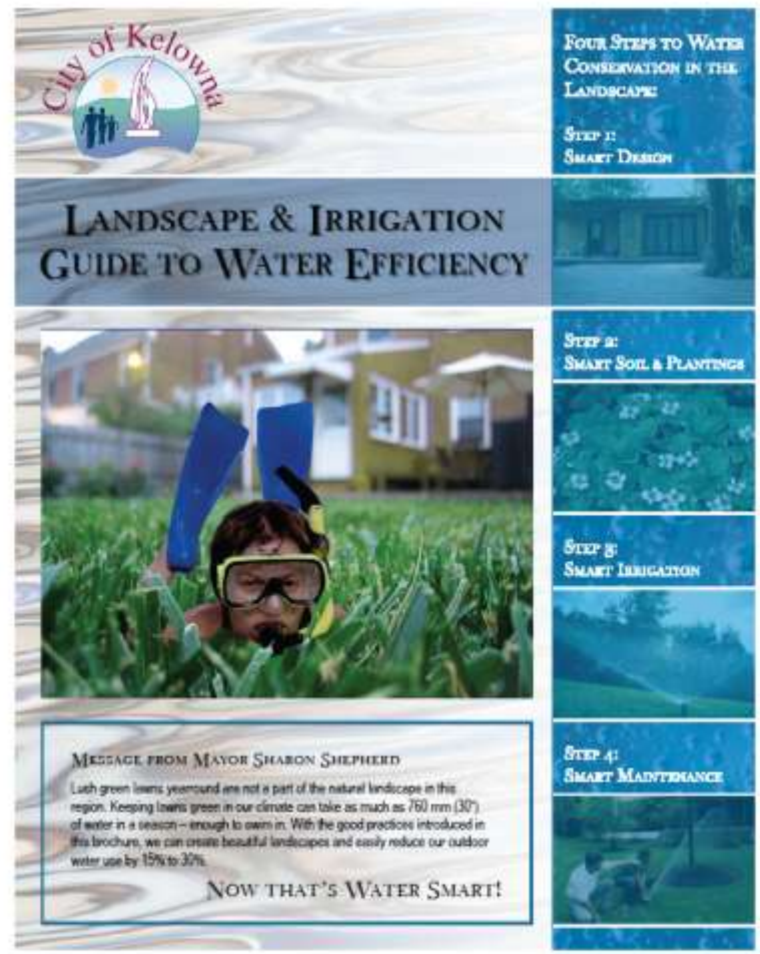
1. Permeable Pavers (Min. 80mm thickness)
2. Aggregate Bedding Course - not sand (50mm depth)
3. Open Graded Base (depth varies by design application)
4. Open Graded Sub-base (depth varies by design application)
5. Subsoil - flat and scarified in infiltration designs
6. Geotextile on All Sides of Reservoir
7. Optional Reinforcing Grid for Heavy Loads
8. Perforated Drain Pipe 150mm Dia. Min.
9. Geotextile Adhered to Drain at Opening
10. Flow Restrictor Assembly
11. Secondary Overflow Inlet at Catch Basin
12. Outlet Pipe to Storm Drain or Swale System. Locate Crown of Pipe Below Open Graded Base (no. 3) to Prevent Heaving During Freeze/Thaw Cycle
13. Trench Dams at All Utility Crossings

Reid Residence, Lantzville

Water Conservation

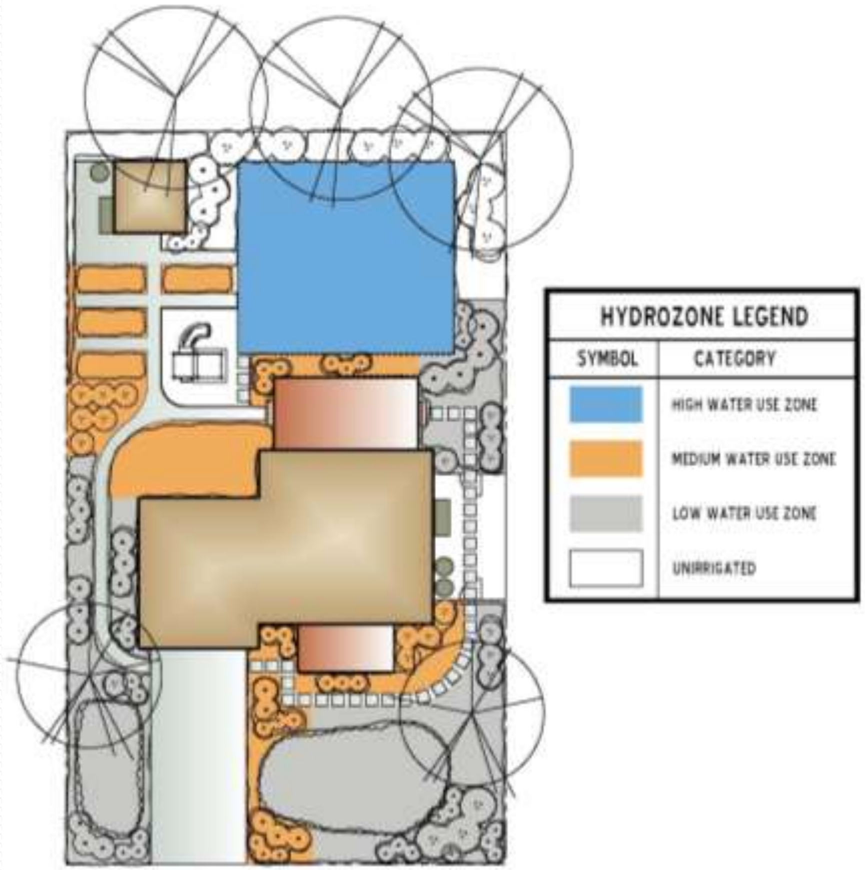
- Landscape & Irrigation Guide to Water Efficiency

- Four Steps to Water Conservation:
  - Smart Design
  - Smart Soil & Plantings
  - Smart Irrigation
  - Smart Maintenance



Guidelines

- Smart Design
- Hydrozones
  - High Water Use
    - Lawns - for active use only
    - Ornamentals-reserve for high-impact planting
  - Medium Water Use
    - Less water to look great all year round
    - Use drip or low volume irrigation
  - Low Water Use/ Unirrigated
    - Little or no water once established-native plants
    - Use permeable surfacing for unplanted areas



Guidelines

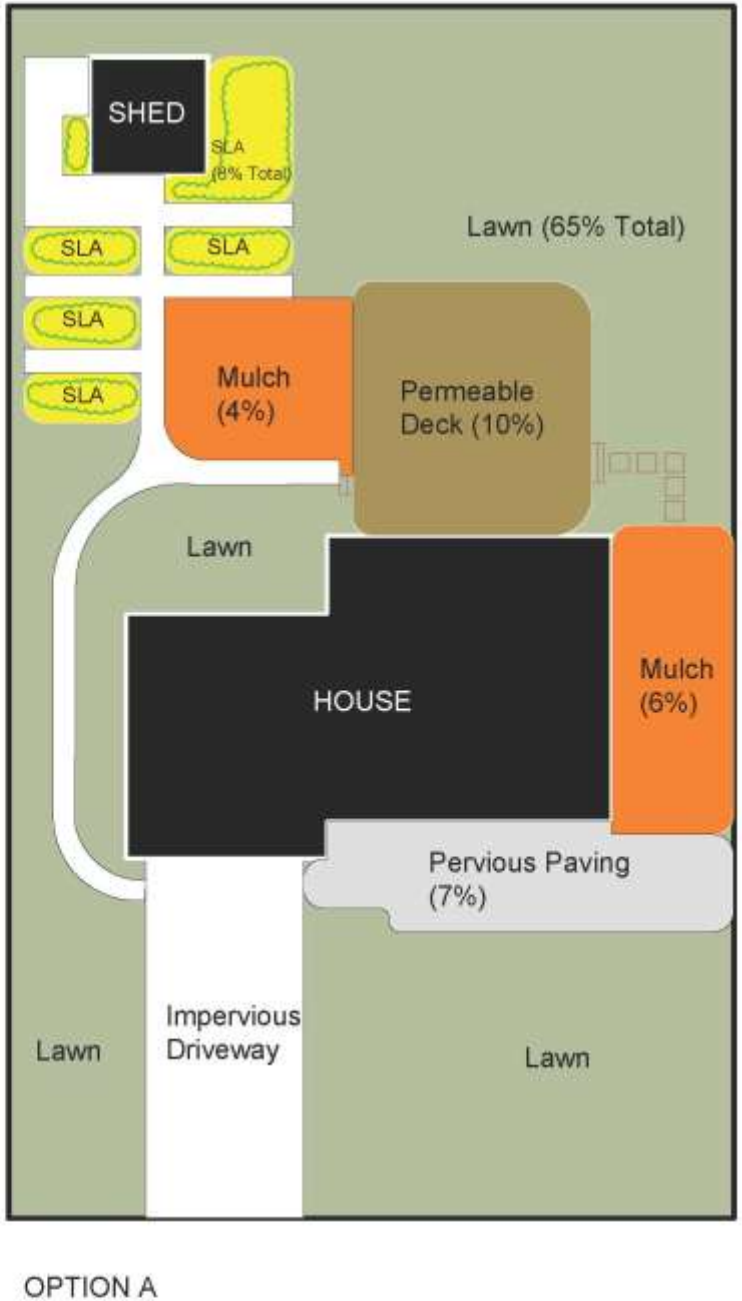
- Meeting a Water Conservation Target (15% - 30%)
  - Design 15% - 30% of site to not require watering
  - Limit turf to 25-50% of landscape
  - Lawn alternatives: ground cover, meadowgrass/ flowers, cobble, mulch, stone/ gravel, interlocking brick, permeable unit paving, decking, etc..
  - Use large areas of low water use plants
  - Ensure growing medium depth and quality and provide mulch
  - Use high efficiency irrigation and weather or sensor-based controllers

Simple Spreadsheet Inputs

Landscape Type	Area (sq.m.)	Calculated Estimated Water Use (cu.m./yr)
Unwatered pervious	82	0
High water use lawn	275	393
High water use plants	55	55
Mod water use plants	138	99
Low water use plants	0	0

Calculated Results	
Maximum Landscape Water Budget	550
Estimated Landscape Water Use	547
	Budget Exceeds Estimate, therefore OK

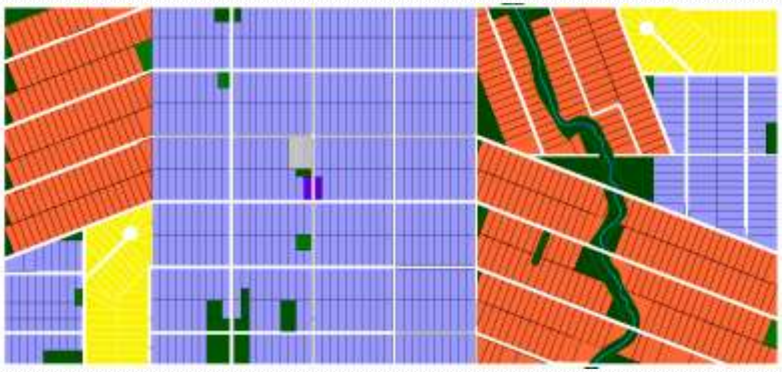
Landscape Solutions That Meet Targets

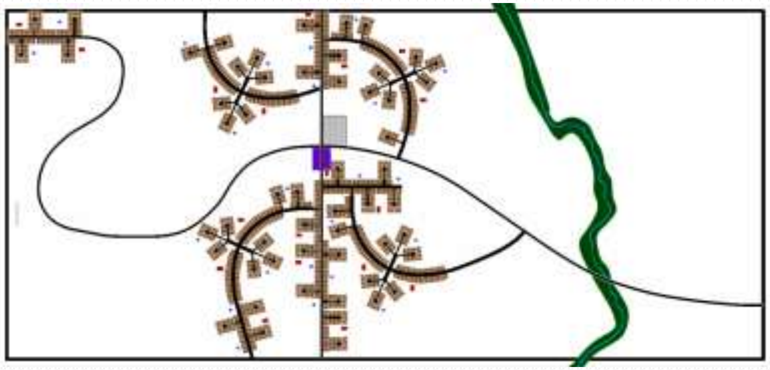


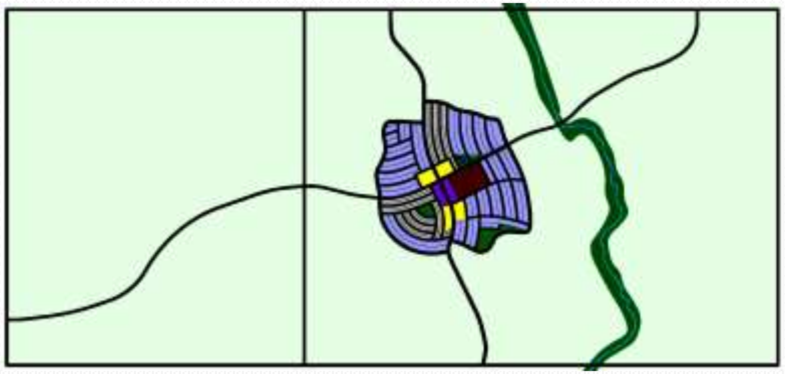
Land Use and Density Planning

- How should regions and communities grow?

- 1000 units in three different land use densities:
  - ❑ 1 Ha lots
  - ❑ Rural by Design
  - ❑ Compact Community







Water conservation performance

	1. 1 Ha lot	2. Rural by Design	3. Compact Community
Water Use (lpd average per household)	2,363	392	340
% reduction from RDN Water Service Area average use	0%	54%	60%
Annual cost over 25 yrs, no rainwater treatment	?	?	?
Annual cost over 25 yrs, with rainwater treatment		?	?

Land Use and Density Planning

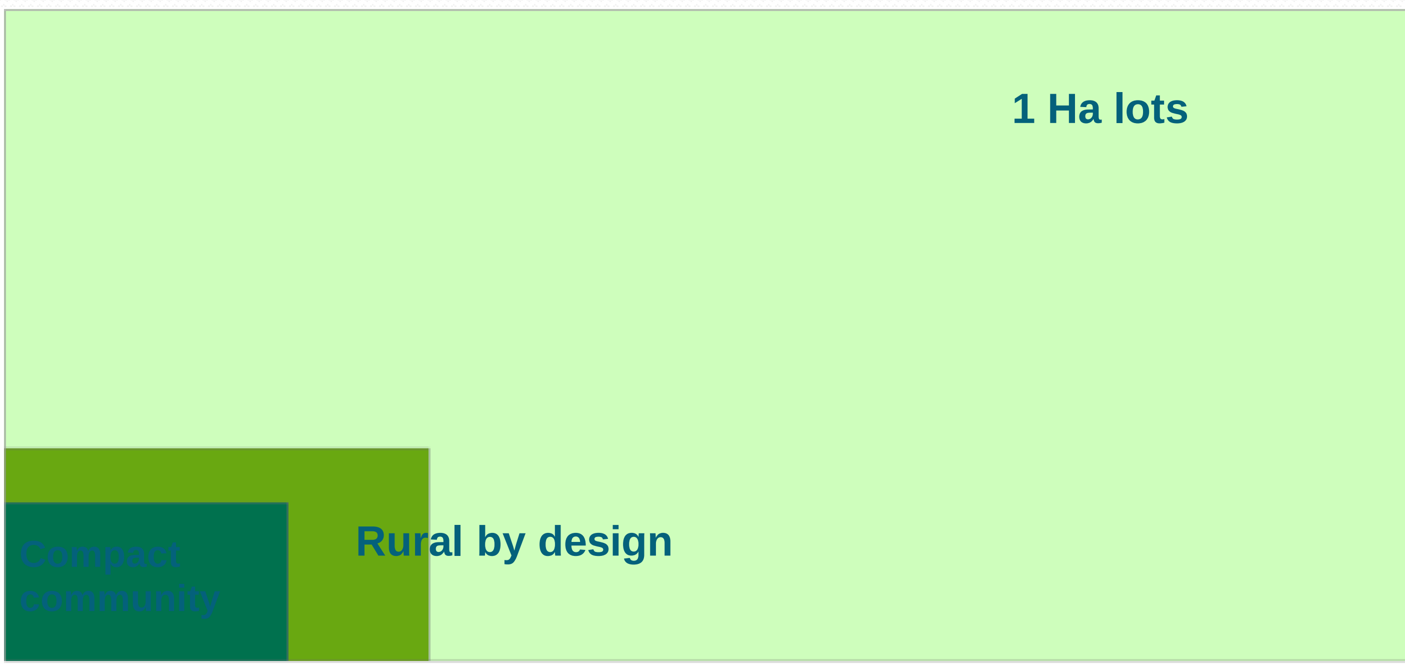
- Alternatives to sprawl?

Total Land Area = 1150 Ha

1 Ha lots - developed area = 1150 Ha

Rural by design - developed area = 112.5 Ha

Compact community developed area = 56 Ha



Video: Case Study

Case Study Wrap-up

Case Study Wrap-up

Case Study Wrap-up

Case Study Wrap-up

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Exercise:

5 minutes

1. Think of a project you are interested in (your residence, a client's residence)

2. Sketch a site plan to locate building and driveway related to environmentally sensitive areas or trees (think of solar orientation.

3. Identify watering 'hydrozones' of high, medium, low or no plant watering.

Questions and Discussion

I shall be telling this with a sigh
Somewhere ages and ages hence;
Two roads diverged in a wood, and I --
I took the one less traveled by,
And that has made all the difference.
Robert Frost