

Gardening with Water Quality in Mind



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Drinking Water Protection Program
Oregon Dept. of Environmental Quality

Water Quality Topics

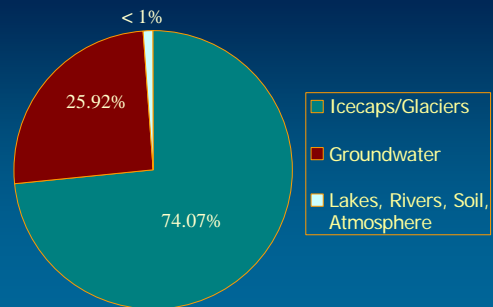
- Groundwater and Surface Water Concepts
- How Does Contamination Occur?
- What Can We Do to Protect Water Quality?
 - Soil Nutrient Retention
 - Fertilizer and Pesticide Use Practices
- Miscellaneous concerns:
 - Abandoned wells
 - Preventing backflow
 - Septic systems

Why is Protecting Water Quality So Important?

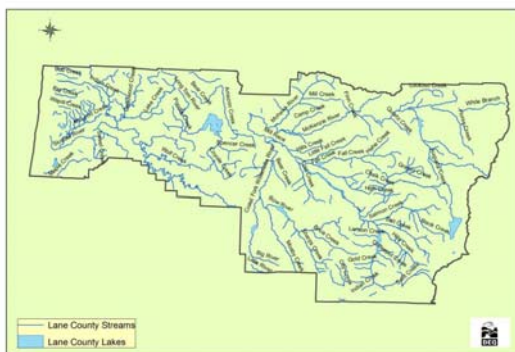
- Safety of drinking water
- Safety of irrigation water
- Wildlife habitat
- Recreational use of waterways
- Aesthetic value

And clean-up is time-consuming and costly...

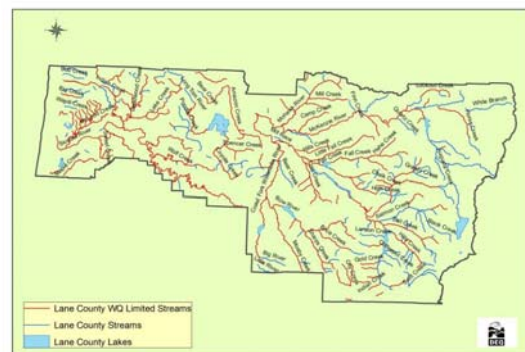
Global Freshwater Resources (< 3% of All Water on Planet!)

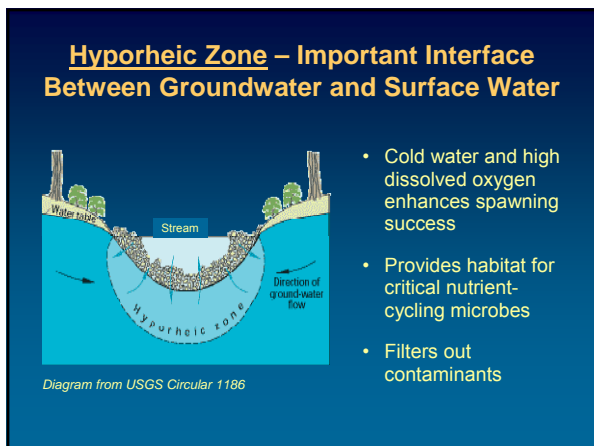
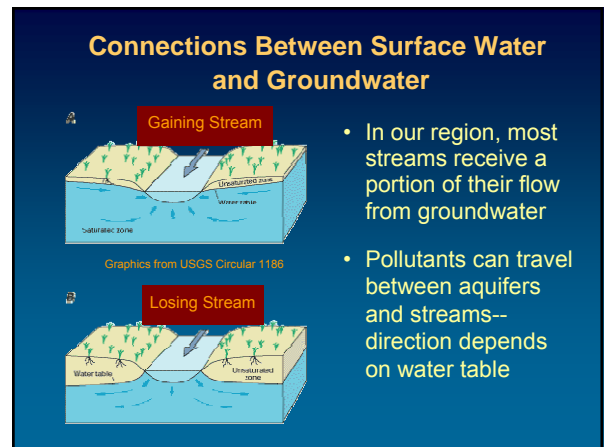
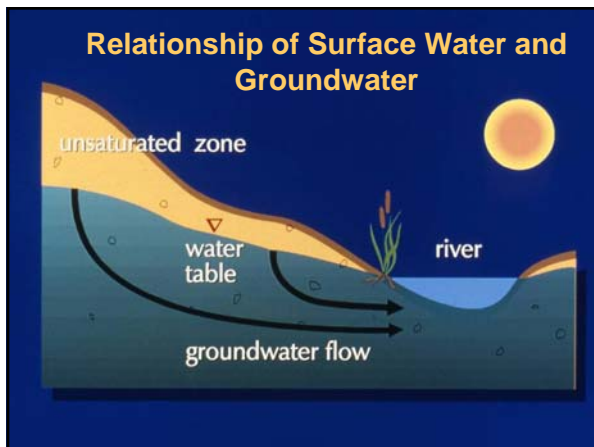
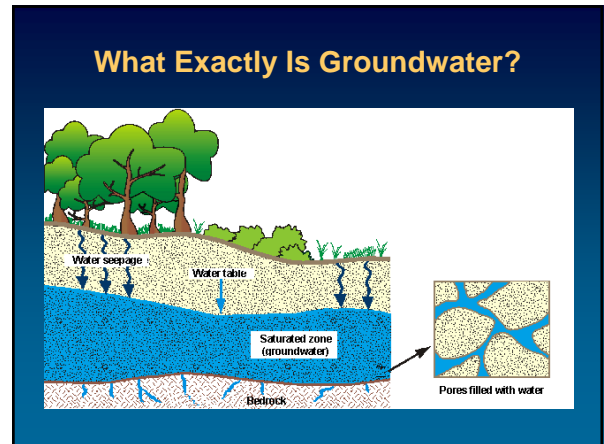
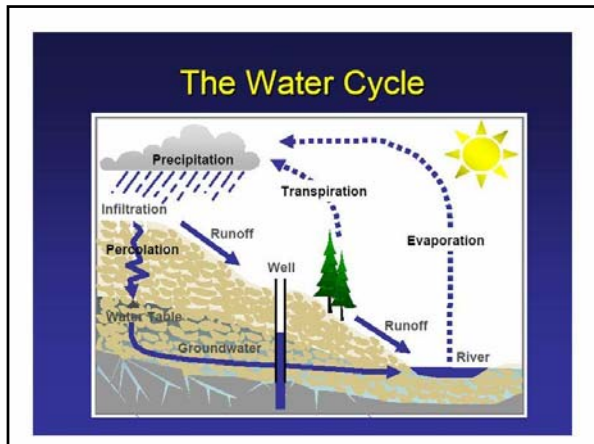


Lane County Waterways



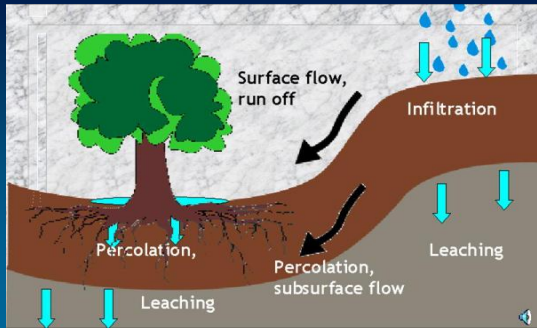
Lane County Impaired Waterways





- ### How Does Water Get Contaminated?
- ❖ Fertilizer Runoff and Leaching
 - ❖ Pesticide Runoff and Leaching
 - ❖ Erosion of soil
 - ❖ Human and other animal waste
 - ❖ Underground storage tanks
 - ❖ Illegal Dumping
 - ❖ Accidental Spills
- ← Related to Gardening!

Soil Water Movement



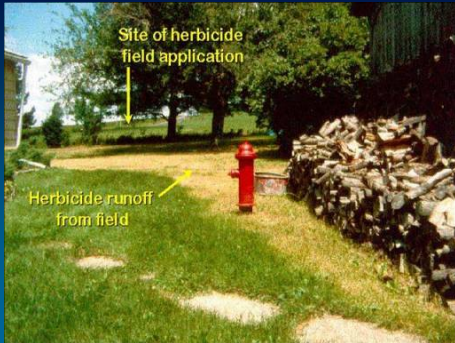
Courtesy University of Minnesota Extension

What Caused this Algae Bloom?



Hunter Creek Estuary, Curry County

Visible Effects of Herbicide Runoff



Courtesy of Cornell Extension

What Water Quality Problems Do You See?



Ahh...the perfect lawn....



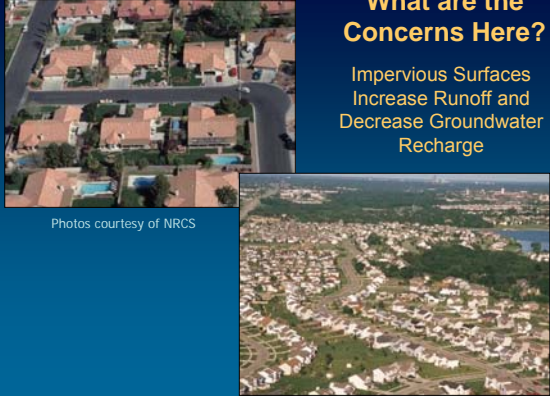
Or is it???

What's Wrong? Ways to Improve?



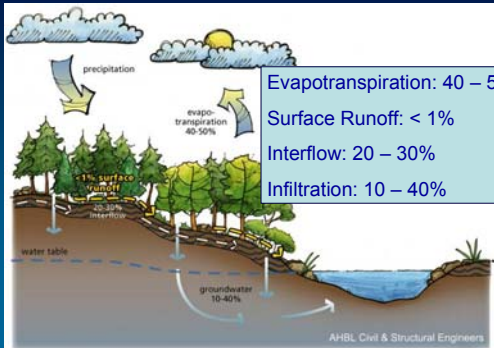
What are the Concerns Here?

Impervious Surfaces Increase Runoff and Decrease Groundwater Recharge



Photos courtesy of NRCS

Hydrology BEFORE Development

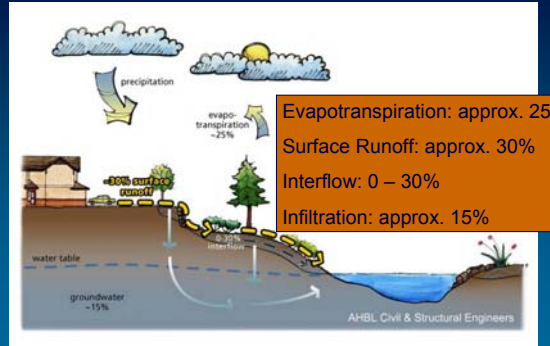


Evapotranspiration: 40 – 50%
 Surface Runoff: < 1%
 Interflow: 20 – 30%
 Infiltration: 10 – 40%

AHBL Civil & Structural Engineers

LID Technical Guidance Manual for Puget Sound 2005

Hydrology AFTER Development



Evapotranspiration: approx. 25%
 Surface Runoff: approx. 30%
 Interflow: 0 – 30%
 Infiltration: approx. 15%

AHBL Civil & Structural Engineers

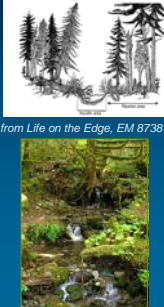
LID Technical Guidance Manual for Puget Sound 2005

Low Impact Development Plantings



City of Portland Stormwater Management Manual

Riparian Areas are Important Ecological Interfaces



from *Life on the Edge, EM 8738*

- Groundwater/surface water interchange
- Nutrient uptake and cycling
- Sediment retention
- Groundwater recharge/infiltration
- Wildlife and beneficial insect habitat
- Stream temperature regulation

Effective Riparian Buffer Widths

Function	Buffer Width
Shade	20 to 30 meters
Bank Stabilization	25 to 50 meters
Bacteria Removal	5 to 75 meters
Pesticide Removal	15 meters
Wood Input	45 meters



Courtesy OSU Yamhill Extension

Working with Nature

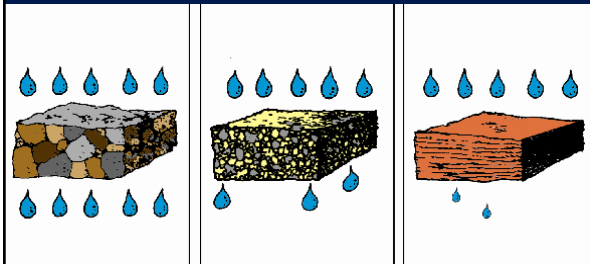


Photo Courtesy OSU Yamhill Extension

What Factors Affect Movement of Water and Contaminants through Soil?

- Soil type/texture (refer to soil surveys!)
- Permeability
- Porosity
- Topography
- Site conditions
- Irrigation practices
- Precipitation

Variations in Permeability & Adsorption



LARGE (SAND)
 - Rapid drainage
 - Does not hold water
 - Prone to leaching
 - Low adsorption

INTERMEDIATE
 - Moderate drainage
 - Moderate adsorption

FINE (CLAY)
 - Slow drainage
 - Holds lots of water
 - Prone to runoff
 - High adsorption

What Type of Soil Might This Be?



Lower Risk Soil

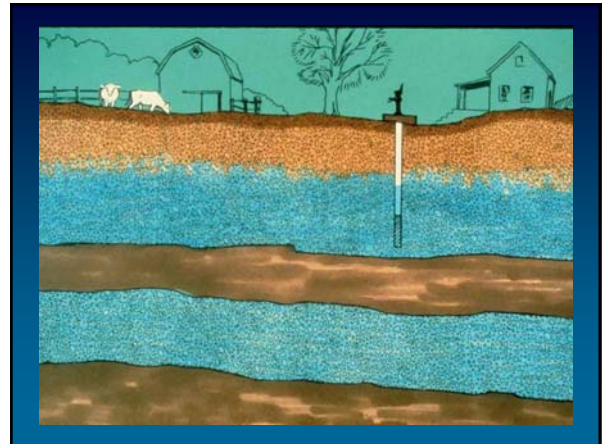
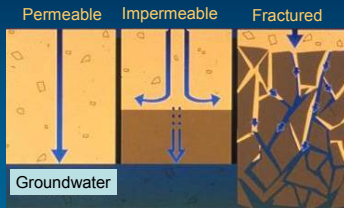
- Medium to fine texture
- Deep
- High organic matter
- Slow permeability



High Risk Soil

- Coarse Texture
- Shallow
- Fast draining
- High permeability
- Low organic matter

Subsurface Geology Affects Movement of Water and Contaminants to Aquifers



What's in a Well Log?

- ❖ Age and depth of well
- ❖ Whether your well is in a confined or unconfined aquifer
- ❖ Geology of subsurface
- ❖ and more!

Database of Well Logs is Maintained by Oregon Water Resources Department

Nutrients and Pesticides

- How they can become water quality contaminants
- An ounce of prevention!

Important Plant Nutrients Found in Soil Water

- Iron
- Manganese
- Copper
- Sulfur
- Nitrate
- Phosphorus
- Potassium
- Calcium
- Magnesium
- Molybdenum
- and others!

How are Nutrients Lost From Soil?

- Dissolved in water that runs off surface
- Dissolved in water that leaches through soil
- Carried away during soil erosion
- Removed when plants are harvested
- Removed by microorganisms

GOAL: Maximize Retention of Nutrients and Minimize Loss to Leaching and Runoff

Irrigation Practices Make a Difference!

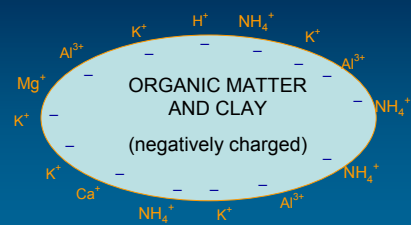


Tips to Maximize Retention of Water and Nutrients and Prevent Contamination

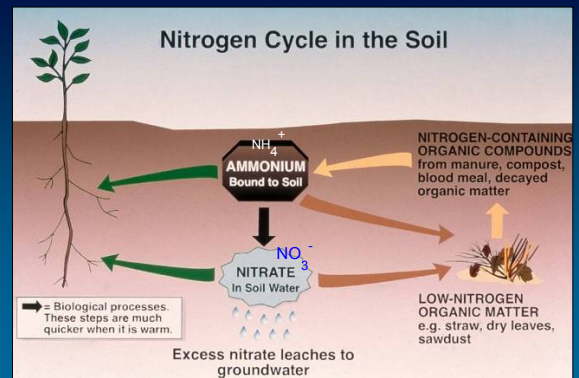
- Soil Management is KEY!
- Encourage infiltration:
 - Drip irrigation
 - Minimize compacted or paved surfaces



Organic Matter Holds and Releases Important Nutrients



Nitrogen Cycle in the Soil



Is Your Fertilizer Going Where You Want it to Go?



Desired Pathways

- Taken up by PLANTS
- Bound by ORGANIC MATTER

Contaminating Pathways

- Leached into Groundwater (especially nitrate!)
- Runoff into Streams and Lakes

Area in Southern Willamette Valley with High Nitrate in Drinking Water Wells

Contributing Sources:

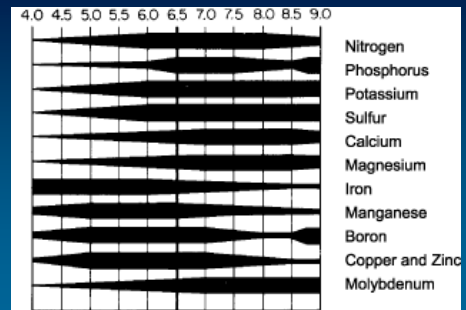
- Fertilizer
- Animal waste
- Septic systems



Water Quality Friendly Fertilizer Application

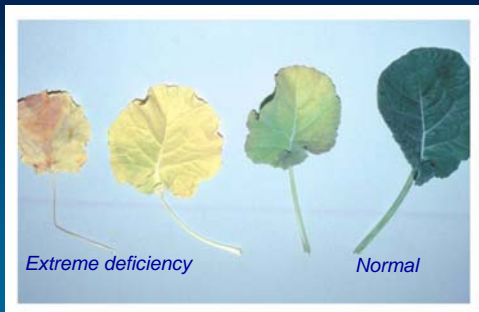
- Slow-release types are best
- Don't apply fertilizer in fall/winter!
- Don't overapply
- Think about seasonal needs of plants and plan ahead (Nitrogen-fixing cover crops, leaf cover)

pH Can Affect Availability of Plant Nutrients



Courtesy of University of Colorado

Nitrogen Deficiency



The Benefits of Organic Matter

- ❖ Enhances percolation and infiltration
- ❖ Improves soil aggregate development
- ❖ Holds and releases important nutrients
- ❖ Makes soil easier to cultivate
- ❖ Provides habitat for beneficial organisms



Before Using Pesticides...

Identify problem...



Photos courtesy of University of Nebraska



Is it REALLY a pest?



Field Scouting can provide valuable insights!

Pesticides in U.S. Waterways

More than half of streams sampled by USGS contained pesticides at concentrations that exceeded aquatic life criteria.



Concentrations detected in groundwater have been low, however, little is known about synergistic effects.

Pesticides Commonly Found in U.S. Streams and Groundwater

(summarized from USGS Circular 1291)

Streams

- Atrazine
- Deethylatrazine
- Metolachlor
- Simazine
- Prometon
- Diazinon*
- Carbaryl*

Groundwater

- Atrazine
- Deethylatrazine
- Simazine
- Prometon
- Metolachlor
- Tebuthiuron

Buffer Requirements to Protect Salmon Bearing Waterways

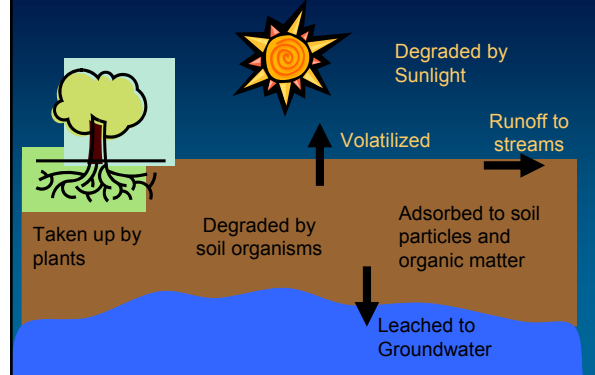


- Washington Toxics Coalition vs. EPA (2002)
- Restrictions placed on 26 active ingredients found in pesticides
- For ground equipment: ≥ 20 yards
- For aerial equipment: ≥ 100 yards

Examples of common active ingredients with buffer zone requirements in Lane County

- 2,4-D (aquatic uses only)
- Azinphos-methyl (Guthion)
- Carbaryl (Sevin)
- Chlorpyrifos (Dursban, Lorsban)
- Chlorothalonil (Bravo)
- Malathion
- Triclopyr BEE (Garlon 4)

Fate of Pesticides in Environment

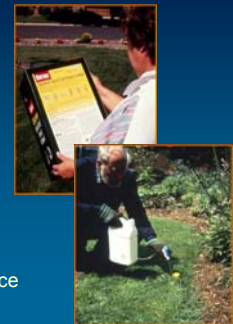


Water Quality Considerations for Pesticide Products

- Is it water soluble?
- How easily will it adsorb to soil particles?
- On what type of soil and terrain will it be applied?
- How toxic is it to humans and wildlife?
- How persistent is it? (half-life)

If You Decide to Use Pesticides...

- Choose least toxic alternative
 - HOE & HOSE Method
 - Biological controls
 - Soaps
- Don't over-buy or over-apply
- Spot applications work!
- Storage: secondary containment for liquids; dry above wet
- Always prepare on impervious surface



Sample of Pesticide Info from University of California Riverside

http://www.pw.ucr.edu/WQ_Homep.asp

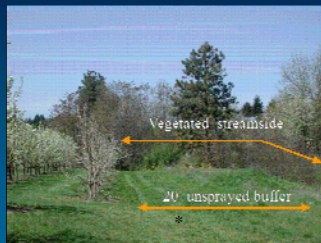
Pesticide Name:	Atrazine (ANSI)
Solubility (ppm):	33
Adsorption (KOC):	100
Half-Life (days):	60
Human Toxicity:	HIGH
Fish Toxicity:	INTERMEDIATE
Leaching:	HIGH
Runoff:	INTERMEDIATE

Pesticide Reduction Case Study Lower Neal Creek (Hood River Basin)

Hood River Grower-Shipper Association
OSU Extension
Department of Environmental Quality

Unsprayed Vegetated Buffers

- Reduces water pollution by filtering
- Reduces potential for drift
- Provides habitat for beneficial insects



Hood River Grower-Shipper Association – Best Management Practices Project

Planting and Maintaining Cover Crops

- Increases water infiltration / decreases runoff
- Slows water movement



Hood River Grower-Shipper Association – Best Management Practices Project

Avoiding Spray Drift

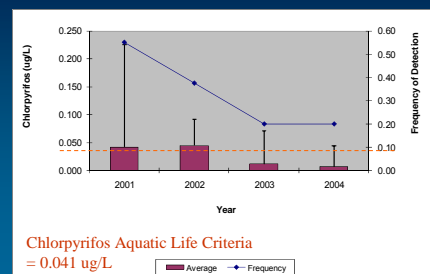
Potential for spray drift is LOW



Potential for spray drift is HIGH

Recommendations from:
Hood River Grower-Shipper Association – Best Management Practices Project

Lower Neal Creek (Hood River Basin) Sampling of Chlorpyrifos



Pesticide Free Landscapes

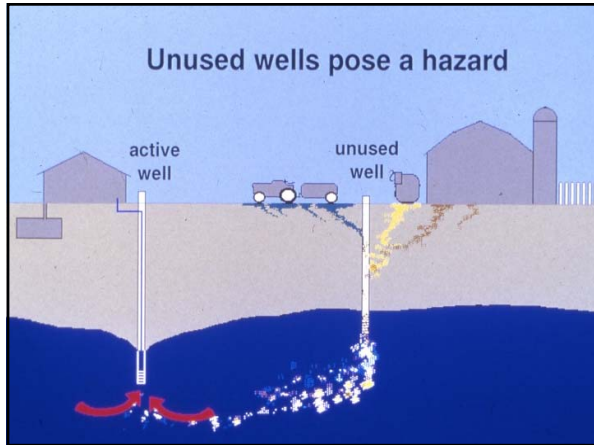


Photos Courtesy of Washington Toxics Coalition

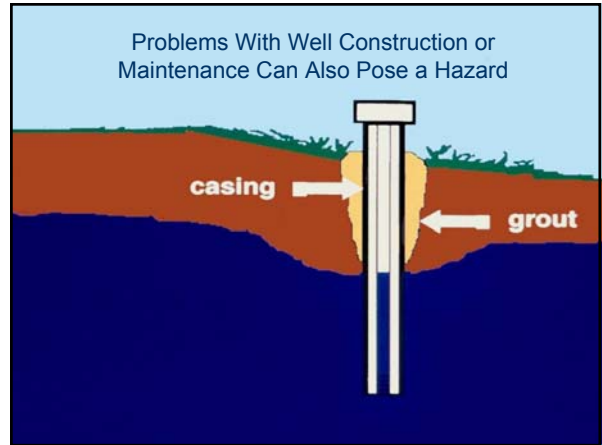
Special Issues:

- ❖ Water Quality and Abandoned Wells
- ❖ Preventing Backflow Incidents
- ❖ Landscaping With Septic Drainfields

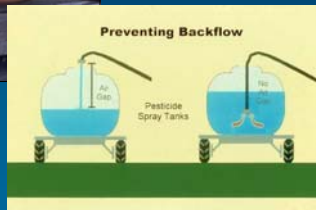
Unused wells pose a hazard



Problems With Well Construction or Maintenance Can Also Pose a Hazard



Prevent Pesticide Contamination Events with Backflow Protection

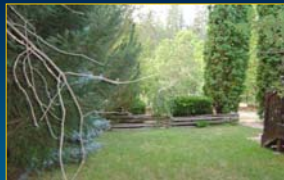


Why is the Grass so Green?

Are Trees OK Near Septic System Drainfields?

- Not recommended, especially:

- Willow
- Cottonwood
- Cedar



- *How far away?*

- Depends if it is a water seeking tree or not
- Consider size and root spread of mature tree
- Consider value of tree vs. value of drainfield

Septic System Management for Gardeners

- Avoid planting trees within 25' of drainfield
- Grass is preferred vegetation above drainfield
- Avoid compacting or disturbing soil above drainfield
- Avoid irrigating above drainfield
- Soggy, marshy conditions? Don't buy wetland plants!!
- Dark green or brown lines? Sounds normal!
- Avoid toxic chemicals (leaching potential)

And Now....Let's Ask the Master Gardeners!

Caller: "I've got these awful weeds in my yard...I've already sprayed Roundup and it didn't seem to work. My neighbor said to try something called CrossBow...will it work on these?"

What kinds of weeds? Is physical removal possible?

Use pesticide info resources to learn about product characteristics; spot applications if possible

"Crossbow" Key Ingredient Characteristics

Pesticide Name:	Butoxyethyl triclopyr
Solubility (ppm):	23
Adsorption (KOC):	780
Half-Life (day):	46
Human Toxicity:	LOW
Fish Toxicity:	INTERMEDIATE
Leaching:	INTERMEDIATE
Runoff:	INTERMEDIATE

Caller: "I'm putting in brand new landscaping...what would you recommend?"

Drought-tolerant varieties

Resistant cultivars

Design to reduce/manage stormwater runoff

Caller: "I have funny lines in my grass. Is there something wrong?"

Drainfield "Striping" is Normal *IF* Growth is Not Excessive



Caller: "What kind of fertilizer should I use for my lawn?"

Do they **need** to fertilize?...If so, slow release is best; don't overwater!

"Weed and feed" types contain herbicide and may pose threat to nearby plants and water resources

Caller: "I've got these bugs all over my roses. What can I do?"

Identify first...is it really a pest?

Is physical removal an option? If not, emphasize lowest toxicity, lowest leachability, lowest runoff options first

Caller: "My backyard has become really lush in one area...Can you tell me what I can plant there?"

Wait! Don't reach for your wetlands plant list! First ask if they have a septic system...it could be a failing drainfield.

Caller: "What are some plants that will not need to be watered very often?"

Refer to *Xeriscaping and Drought-Tolerant Plant Guides*, but make sure not to recommend invasives!

Contact information:

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Web Resources

- OSU Integrated Plant Protection Center
<http://ipmnet.org>
- *Field Guide to Water Quality Friendly Development*
<http://www.lcrep.org/fieldguide/techniques.htm>
- DEQ Water Quality
<http://www.oregon.gov/DEQ/WQ/>
- Oregon Department of Agriculture
(*pesticide restrictions to protect salmon*)
<http://www.oregon.gov/ODA/PEST/buffers.shtml>
- USGS Report on Pesticides in Nation's Streams and Groundwater
<http://pubs.usgs.gov/circ/2005/1291/>