

# Beaver Lake *LakeSmart*

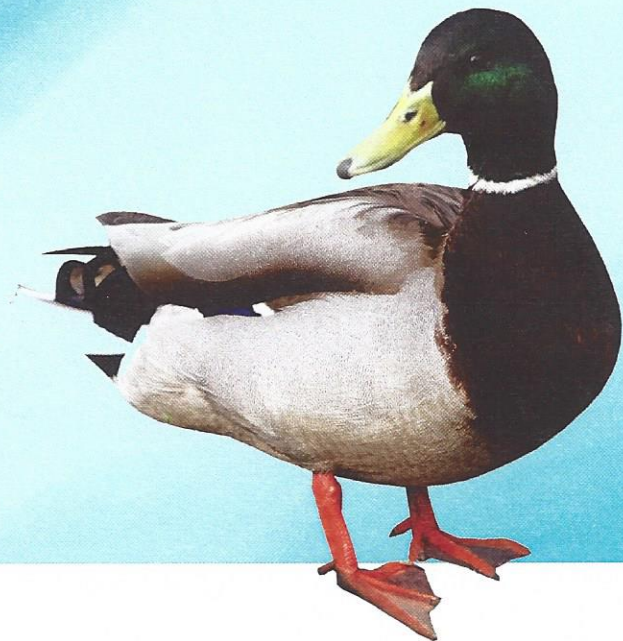
An environmental self-assessment guide for  
lakeshore property owners.





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# Chapter 1 INTRODUCTION

## Beaver Lake

Before we learn about protecting Beaver Lake water quality, we first ought to understand the multi-faceted value of this important Northwest Arkansas resource. Beaver Lake is the first in a series of three U.S. Army Corps of Engineers reservoirs on the White River in Arkansas and Missouri. The White River headwaters originate in the Boston Mountains south-southeast of Fayetteville, Arkansas, flow north-northeast into Beaver Lake and discharge from Beaver Dam into the backwaters of Table Rock Lake. Beaver Lake is the primary water source for the fastest growing region of Arkansas, providing hydropower generation and water for individuals and industry, as well as recreational opportunities.

Beaver Lake was authorized by Congress to provide storage for flood control, hydropower generation, and water supply. Beaver Lake is crucial to meeting the region's increasing demands for fresh, clean water. The quality of water in the lake is generally good, but a few areas of concern include eutrophication of upstream portions of the lake and sedimentation at the mouths of feeder streams. Regional growth has the potential to adversely impact the quality of water in tributaries of Beaver Lake and the lake itself. Expansion of the urban area and industrial activity within the Beaver Lake Watershed will increase nutrients and other pollutants delivered to the Lake.

## Drinking Water Supply

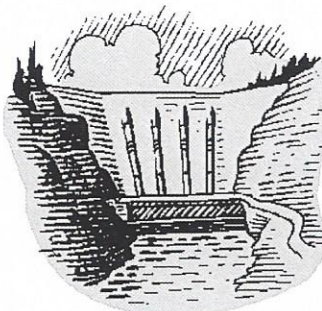
Beaver Water District provides water to more than 250,000 people and industries in Northwest Arkansas, or more than 9 percent of Arkansas' population. The District's plants can produce up to 140 million gallons per day (MGD) of drinking water. Currently average daily use is about 45 MGD. Three other water suppliers – Benton-Washington Regional Public Water Authority (a.k.a. Two-Ton), Carroll Boone Water District, and Madison County Regional Water District – also operate on the lake today. Combined, the four provide water to one in eight Arkansans. Water districts each have an allocation of space within Beaver's conservation pool for their water supply. In

return, each district makes an annual payment to the United States government for their pro-rata share of the costs operating and maintaining the reservoir and amortization of the capital investment in the dam and reservoir. Beaver Water District, one of four public water suppliers withdrawing water from the lake, works with stakeholders through outreach and education programs, such as this LakeSmart lakeshore property environmental self-assessment tool to preserve water quality and protect this resource.

## Flood Control

One primary reason for constructing Beaver Dam was to provide flood control. Roughly 287,000 acre feet of flood storage are provided in the reservoir's flood pool (between elevation 1120.43 and 1130). Rainfall is captured in the flood pool to prevent flooding downstream. During flood events, the lake may rise into the flood pool. Water in the flood pool is released over time, through hydropower generation or by opening the flood gates to return the lake level to the top of the conservation pool, the normal operating level. The release rate is balanced against the capacity of downstream reservoirs to receive the water. The U.S. Army Corps of Engineers is entirely responsible for flood control use of the reservoir.


## Hydroelectric Power Generation



Power generation from Beaver Dam is managed by the Southwestern Power Administration (SWPA) under the Department of Energy. Beaver Dam houses two generating units that produce 56,000 kilowatts of power each, with average

annual production of 172 gigawatt hours. Electricity is sold to rural electric cooperatives, municipal utilities and military installations and \$4.5 million in revenue are produced annually as a result of these sales. This is used to repay the cost of maintaining the generat-





ing and transmission facilities operated by SWPA, as well as repaying the Federal investment in the dam facilities.

### Recreation

Recreation and aquatic life are allowed uses of Beaver Lake under its congressional authorization. The Arkansas Department of Environmental Quality under authority of the Clean Water Act also designates waters of Beaver Lake as suitable for recreation and aquatic life uses. Recreational facilities include eight marinas, 11 recreation areas, and multiple hiking trails around the lake. Hobbs State Park and Pea Ridge National Military Park are nearby. Recreation activities, fishing, boating and swimming are dependent on both water quality and quantity. The lake and associated park areas also support other types of recreation including camping, pic-

nicking, scuba diving, hunting, hiking, bird watching, and sightseeing. The economic benefits of Beaver Lake include \$30.24 million in visitor spending within 30 miles of the lake in 2006 (Source: U.S. Army Corps of Engineers, Value to the Nation).

**'Beaver Lake** *can't protect itself. Our community must therefore act in ways that will ensure its long term health and viability."* -- John Lewis (1939-2007)

### Protecting Beaver Lake from Potential impacts

Recognizing the regional resource values Beaver Lake provides, it is essential to understand how lakeshore landuse practices can affect water quality. Because educated lakeshore landowners can make wise behavioral choices that protect the water quality of the lake, Beaver Water District, in collaboration with the University of Arkansas Division of Agriculture Cooperative Extension Service and the Association for Beaver Lake Environment (ABLE), initiated the development of this LakeSmart guide.

### Primary Water Quality Concerns

- **Algae:** A large and diverse group of simple plant-like organisms, ranging from unicellular to multicellular forms. Algae reduce the aesthetic value of a body of water; adds organic carbon; and depletes dissolved oxygen when it dies. Some algae release taste and odor causing compounds into the water.
- **Bacteria:** Microorganisms, typically single-celled, some of which have the potential to cause disease in humans.
- **Chlorides (Cl):** A chemical compound in which one or more chlorine atoms are bonded in the molecule. Chlorides can corrode metals and affect the taste of food products.
- **Dissolved Oxygen (DO):** The measure of free oxygen dissolved in water. Higher levels of DO indicate higher water quality.
- **Eutrophication:** A process by which an excess of plant nutrients (e.g. nitrogen and phosphorous) reduces the oxygen dissolved within a body of water.
- **Nutrients:** Elements essential for the growth of organisms. In aquatic systems, the primary nutrients are nitrogen and phosphorus. Surplus nutrients may lead to excessive algae growth and DO depletion of water bodies.
- **pH:** A measure of the acidity or alkalinity of water. For aquatic life the pH should be between 6 and 9.
- **Sediment:** Particulate matter that can be transported by water flow. Sediment increases turbidity, fills in habitat between gravel, and transports nutrients and other pollutants.
- **Sulfates (SO<sub>4</sub>):** A salt of sulfuric acid. The recommended limit of SO<sub>4</sub> in potable water is below 250 mg/L.
- **Total Organic Carbon (TOC):** The amount of carbon that originates from organic matter only.
- **Total Dissolved Solids (TDS):** The residue of solids left after water is passed through a very fine filter and all remaining moisture is evaporated. Water high in TDS may contain ions in concentrations exceeding Primary or Secondary Drinking Water Standards.
- **Turbidity:** A measure of the cloudiness of water caused by suspended particles.



## What is LakeSmart?

LakeSmart is a confidential, self-assessment guide that can help you evaluate your home and property for potential pollution risks. In every home – large or small, new or old, city or country – there are potential pollution sources that can affect the health of your family, community or the environment.

## Why LakeSmart?

LakeSmart is based on the national Home\*A\*Syst program tailored to help residents evaluate their homes and property for environmental impact. This LakeSmart program was designed as an assessment tool specifically for lake-

front property owners on Beaver Lake in Northwest Arkansas. It is similar to previous Home\*A\*Syst and Urban Home\*A\*Syst environmental self-assessment guides, but topics have been tailored to lakefront properties.

In Northwest Arkansas, Beaver Lake can be affected by many potential contaminant sources including fertilizers, pesticides and hazardous household products. The LakeSmart assessment guide is designed to help lakeside residents identify management techniques which reduce or prevent pollution and help reduce consumption of water, energy and other resources.

## Who Should Use the Book?

This easy-to-use assessment program can serve as a valuable reference for residents surrounding Beaver Lake. It is for those who care about natural resources and the environment and who are willing to take steps – no matter how small – to improve how they manage their homes and properties. Whether you rent a room or own a house, this tool can guide you in how to reduce your impact on natural systems and cut back on your use of the earth's resources. LakeSmart can also help you protect your investment by identifying pollution risks on your property before expensive problems occur.

The introduction was written by Barbara Avery Keen, Cornell Cooperative Extension, and David Eagan, Farm\*A\*Syst/Home\*A\*Syst. It was adapted for Beaver Lake LakeSmart by Katie Teague, University of Arkansas Division of Agriculture Cooperative Extension Service.

## What Is Inside?

The next chapters in LakeSmart cover essential topics that every resident or homeowner should understand. Each chapter contains key points, along with tables of assessment questions, to help you understand which risks may apply to your situation. For some topics, this guidebook offers all the information you need to minimize or eliminate a pollution risk. For others, it provides a starting point and helps you locate further information and/or assistance.

**“The main idea is to take the time to identify pollution threats to your local environment; then, where feasible, to take voluntary actions to reduce those risks ...”**

## Getting Started

You can complete the LakeSmart exercises one at a time or all together – it's

up to you. The main idea is to take the time to identify pollution threats to your local environment; then, where feasible, to take voluntary actions to reduce those risks and prevent problems. This guidebook should help you accomplish three important objectives:

1. Identify environmental risks, concerns or problems in and around your home.
2. Learn about better home and property management and find further information.
3. Take preventive actions to safeguard your health and the environment.

## Checklist for Pollution Risks in and Around Your Home Purpose

This checklist is a quick way to scan for potential problem areas in and around your home and property. It will help you identify possible risks and introduces you to many of the topics discussed in this book. The chapters cover many other assessment questions about situations and practices not included in the checklist. If you identify potential concerns using this checklist or think there may be risks or areas needing improvement, please turn to the chapter on the appropriate topic.



## Instructions

Using a pencil, answer the following yes/no questions. If you don't know the answer, try to find out by scanning the corresponding LakeSmart chapters. You may need to locate your home maintenance records, ask family members or neighbors or seek assistance or further information. The answers you give on this checklist – and on the assessment tables in each chapter – are confidential. They are for your eyes only and simply invite you to consider actions that can help reduce your impact on water quality in Northwest Arkansas.

| <b>Chapter 2 - Site Assessment</b>  | <b>Yes</b> | <b>No</b> |
|---|------------|-----------|
| Is your soil sandy or gravelly, allowing water to drain through it quickly?   |            |           |
| Is there a potential source of contamination – such as animal wastes, pesticides, fertilizers, automotive products or eroding soil – on your property within 100 feet of the lake or a drainage path to the lake? |            |           |
| Is the water table less than 10 feet below the surface?   |            |           |
| Do the downspouts from your roof gutters empty out onto paved surfaces instead of onto grass, mulch or gravel – keeping the rain from soaking into the ground?  |            |           |
| Are fertilizers, pesticides or salts stored where floodwaters might reach them?   |            |           |
| Are some parts of your property, particularly slopes, sparsely planted and without mulch, exposing the soil to erosion?   |            |           |
| <b>Chapter 3 - Landscape Management</b>   | <b>Yes</b> | <b>No</b> |
| If you use fertilizer, has it been longer than three years since you last had your lawn and garden soil tested for nutrients?   |            |           |
| Do you ever use fertilizers or pesticides without reading the label or following the recommended doses and application instructions?  |            |           |
| Do you have areas of bare soil on your property that are susceptible to erosion?  |            |           |
| <b>Chapter 4 - Water Management and Conservation</b>  | <b>Yes</b> | <b>No</b> |
| Has it been more than five years since you've had your well inspected?  |            |           |
| Do you have unused wells on your property?  |            |           |
| Do you have older water fixtures that might be inefficient?   |            |           |
| <b>Chapter 5 - Septic System Management</b>   | <b>Yes</b> | <b>No</b> |
| Is the location of your septic tank and or drain field unknown?   |            |           |
| Has it been more than 5 years since your septic tank has been pumped?   |            |           |
| Do you pour paints, stains, polishes, cleaners or solvents down a sink drain or a toilet as a way to dispose of leftover products   |            |           |
| <b>Chapter 6 - Managing Household Hazardous Products</b>  | <b>Yes</b> | <b>No</b> |
| Do you use products without knowing whether or not they are hazardous?  |            |           |
| Do you ever pour hazardous substances such as paints, stains, polishes or solvents down a sink drain, down a storm drain, in a ditch or on the ground?  |            |           |
| Do you have a vehicle that leaks automotive fluids?   |            |           |
| Do you use deicers on paved surfaces in the winter?   |            |           |
| <b>Chapter 7 - Boat &amp; Dock Maintenance</b>  | <b>Yes</b> | <b>No</b> |
| Do you wash your boat on the driveway or paved street?  |            |           |
| Do you use whatever cleaning agent is handy to wash you boat?   |            |           |
| Do you mix your oil to burn rich because you've been told that it will make your engine last longer?  |            |           |



# Chapter SITE ASSESSMENT 2

Is your soil sandy or gravelly? Does it drain quickly?  
Does stormwater runoff from your property flow into the lake or a tributary of the lake?  
Do you store hazardous chemicals on your property?

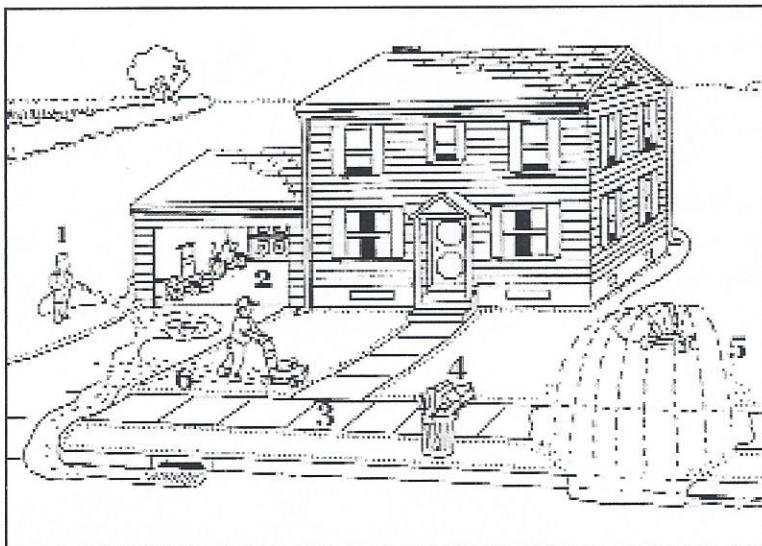
This chapter will help you become familiar with your lakeside property and how you manage it so you can identify potential risks to water resources. Completing this chapter will provide background information you can use throughout this guide. This chapter covers two areas:

1. Physical characteristics of your property  
Examples of characteristics include soil type; depth to bedrock; depth to the water table; and location of storm drains, creeks, streams or other pathways to surface water.
2. Making a map of your home and property. A map of your property showing buildings, roads and other constructed or natural features can help you identify potential sources of trouble.

## Why Should You Examine Your Property's Physical Characteristics and How You Manage Your Home?

What you do in and around your home can affect water quality both below the ground and in the lake. This chapter will help you identify some important characteristics of your property such as soil type, geology, depth to groundwater and proximity to the lake.

This chapter also invites you to draw a simple "aerial view" map of your home and property. Your completed map will show the locations of important features and help you identify activities in and around your home that may pose risks to your health and the environment. Remember – this assessment is a starting point. It is meant to encourage you to complete some, or all, of the other LakeSmart chapters. To begin thinking about how your activities and site conditions can harm water quality, consider some examples of typical home practices that can lead to health



Homeowner impacts

risks and water pollution:

1. Washing spilled motor oil and grass clippings into gulleys, creeks or the lake
2. Storing gasoline and other hazardous chemicals outside or near children's toys
3. Paving walkways instead of using porous materials, thus increasing runoff
4. Not separating garbage for recycling
5. Improperly adjusting sprinklers, wasting water
6. Plantings that require fertilizers and pesticides close to gutters and storm drains

## What Is a Watershed?

The water from city taps and in nearby lakes or streams is part of a much larger water system. While not everyone lives next to a lake or a stream, we all live in a watershed — the land area that contributes water to a specific surface water body, such as a pond, lake, wetland or river. The landscape's hills and valleys define the watershed, or "catchment" area.

A watershed is like a bathtub. The watershed outlet — the mouth of a pond, lake or river — is the tub's drain. The watershed boundary is the tub's rim. The watershed's drainage system consists of a network of



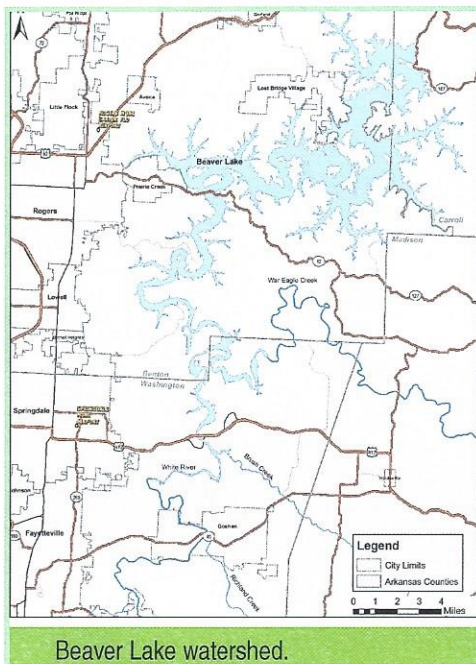
rivers, streams, constructed channels and storm drains, wetlands and the underlying groundwater.

Common activities like fertilizing your lawn and garden can affect water quality, even when you do these things far from any water bodies. By paying careful attention to how you manage activities in and around your home, you can protect your watershed and the water you drink.

### What Influences the Quality of My Water?

Understanding the site characteristics of your residence and the location of potential contamination sources are important first steps in safeguarding your water. Water is continuously moving through the air, over land and through the soil and land use activities across the watershed can affect groundwater, stream and lake quality at lower elevations in the watershed.

Physical characteristics, like soil type, depth to groundwater and distance to surface water, can hasten or limit a contaminant's effect on water quality. Water quality is also affected by many activities such as the use and storage of household chemicals, fertilizers, pesticides and automotive fluids, waste disposal methods, and soil erosion. Animal wastes can be another threat to water quality, particularly if large amounts from dogs or other animals are allowed to accumulate on your property. To protect your water, all of these factors need to be considered.



## Part 1 - Physical Land Characteristics of Your Property

Every home comes with its own unique set of physical site conditions such as soil type, depth to the water table (groundwater) and depth to bedrock. While these physical conditions cannot be changed, once aware of them, homeowners can better understand risks that may result from their decisions and actions that can be changed.

### The Role of Soils in Water Quality

Soil plays an important role in determining where contaminants go and how water moves. Chemicals applied to a lawn, for example, can flow across the land and reach surface water supplies. On the other hand, the same lawn chemicals may soak into the ground and move down through the soil into groundwater supplies. It becomes easy to see how typical household activities can produce problems that go beyond property boundaries as pollutants can be transported through surface runoff and leaching.

It is also important to recognize that groundwater and surface water are interconnected. Groundwater generally flows downhill, following the same path as surface water, and eventually discharges into rivers, lakes, springs and wetlands. If you keep pollutants out of surface water, but do not protect groundwater – or vice versa – contamination may occur where you least expect.

To better understand how water contamination can occur, let's examine some physical site conditions which can affect the risk for ground and surface water quality.

### Soil Type

Soil is composed of mineral particles, organic matter (decomposed plants and animals), microorganisms



(bacteria, protozoans, fungi and worms), water and air. Typically, soils are classified by the relative amounts of the three mineral particle sizes – sand, silt and clay. Fine soils (clays, silty clays and sandy clays) have a high percentage of the tiniest mineral particles – clay. Medium soil types (loams, clay loams, silt loams and sandy loams) are composed of a mixture of small (clay), medium (silt) and large (sand) mineral particle sizes. A coarse soil type (loamy sands and sands) is predominantly composed of sand, the largest particles. Much of the information on soils and water table was included in the percolation (perc) test results when your property was assessed for a septic system. If you don't have a copy, you can get a good idea about your soil type by rubbing a moist sample between your fingers. Is it sticky like clay, gritty and crumbly like sand or somewhere in between like one of the loams?

### **How Does Soil Type Affect Groundwater?**

Nearly all soils are permeable – which means water and other fluids can percolate or seep through them. Soil particle size influences pollutants that are able to reach groundwater. Some soils are better at trapping pollutants than others. Clay soils, which are made of tiny particles, slow down the movement of water and in some cases can impede water movement completely. Sandy soils pose the greatest risk because water seeps downward through them readily without filtering out or decomposing pollutants. The ideal soil is a mix of large and mid-sized particles to allow infiltration and tiny particles, like clay or organic matter, to slow water movement and filter pollutants.

### **What Are the Risks to Surface Water?**

Soil type can also affect surface water contamination. Although runoff can occur on all soil types, clay soils (which are least permeable) are more likely to cause surface water runoff. During a storm or flood, or even when watering your lawn, this runoff can wash contaminants from the land's surface into nearby surface waters. Eroding soil is also considered a water pollutant. Bare soil, especially on sloping land, can be carried in runoff and be deposited in streams, rivers and lakes.

### **Depth to Bedrock**

Bedrock depth varies; it can be at the land's surface, just below the surface or hundreds of feet down. The type of bedrock influences pollution risks. Shale, granites and other impermeable types of rock make an effective barrier that blocks the downward movement of water contaminants. Limestone geology (karst) weathers easily and forms cracks, fractures, caves and sinkholes, allowing water to move freely into groundwater. When bedrock is split or fractures, water can move through it unpredictably, rapidly spreading pollutants over long distances.

### **Depth to Groundwater**

If you dig a hole, you will eventually reach soil saturated with water. This water table marks the boundary between the unsaturated soil (where pore spaces between soil or rock contain air, roots, soil organisms and some water) and the saturated soil (where water fills all the pore spaces). In a wetland, the water table is at or just below the soil surface.

Your local water table fluctuates throughout the year but is usually highest in the wet months of spring and in late fall. In general, the closer the water table is to the land's surface, the more the groundwater is susceptible to contamination. Deep soils offer a better chance of filtering or breaking down pollutants before they reach groundwater. Usually, a water table that is less than 10 feet from the surface presents a higher risk for groundwater contamination. Generally, soils that are less than 3 feet deep present the highest risk for groundwater.

Groundwater is the water below the surface of the earth that, from the water table down, saturates the spaces between soil particles or fills in the cracks in underlying bedrock.





The table “Assessment - Lake Impacts Based on Physical Site Conditions,” is similar to the assessment tables in the other LakeSmart chapters. For each question, three choices are given that describe your property’s physical site conditions that could lead to high, medium and low risks to human or environmental health. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Then look to the appropriate section for tips.

Do not depend solely on the physical characteristics of your soil, bedrock or other site features to protect water quality. You must take informed steps to prevent pollution. Although you cannot change your soil type or the depth to bedrock, you can account for these factors when choosing home management practices that are better for preventing environmental problems. Especially note the medium and high risks you identified. Keep them in mind as you complete your property map and work on other LakeSmart chapters.

## Part 2 – Pollutants in Runoff

Runoff starts as rain or melting snow that does not

readily soak into the ground. This water flows from rooftops, over paved areas, on saturated or compacted soil and across sloped lawns. The flowing runoff picks up and transports pollutants such as yard and pet waste, sediment, fertilizer, chemicals, oil, grease, and other possible contaminants becoming polluted stormwater. Polluted stormwater then enters lakes, streams, and rivers. But, keep in mind you don’t always need a heavy rainstorm to send pollutants rushing toward the lake - your hose can supply enough water.

Completing this section’s self-assessments helps you find out how runoff affects the environmental quality of your own property as well as the lake that is down-slope or “downstream” from your residence. This section also gives you tips on reducing stormwater runoff pollution risks.

### Why Should I Be Concerned?

Polluted runoff can degrade your lake and its tributaries. Soil particles cloud water and degrade the habitats and food supply of fish and water plants by filling in the lake bottom and stream beds. Muddy, murky water also makes the lake less aesthetically attractive.

## Assessment - Lake Impacts Based on Physical Site Conditions

|   | Low Risk                          | Medium Risk                       | High Risk                        | Your Risk  |
|---|-----------------------------------|-----------------------------------|----------------------------------|--|
| Soil type and risks to surface water (creeks, river, lakes) from runoff | Sand/gravel<br>(large particles)  | Silt/loam<br>(mid-size particles) | Clay<br>(very tiny particles)    | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Soil type and risks to groundwater from infiltration                    | Clay<br>(very tiny particles)     | Silt/loam<br>(mid-size particles) | Sand/gravel<br>(large/particles) | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Soil depth  | Deep<br>(over 12 feet)            | Moderately deep<br>(3 - 12 feet)  | Shallow<br>(less than 3 feet)    | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Bedrock   | Solid, not permeable or fractured | Solid limestone or sandstone      | Fractured bedrock (any kind)     | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Depth to water table  | More than 20 feet                 | 10 - 20 feet                      | Less than 10 feet                | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Proximity to surface water  | More than 100 feet                | 25 - 100 feet                     | Less than 25 feet                | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



Nutrients such as nitrogen and phosphorus promote the growth of algae, which crowds out other aquatic life. Nutrients in runoff can stem from overuse of fertilizers on lawns and gardens. It can also be a result of improper timing of fertilizer use. Many of our lawn care products are great for turf yards, vegetable gardens and landscaping beds, but can cause problems if they get into nearby waterways.

Toxic chemicals such as antifreeze and oil from leaking cars, carelessly applied pesticides and zinc from galvanized metal gutters and downspouts can threaten the health of fish and other aquatic life in the lake.

Bacteria and parasites from pet waste and improperly managed septic systems can make the lake unsafe for wading and swimming after storms. Recreational beaches have been temporarily closed due to high fecal coliform levels.

Stormwater also can flow down a poorly sealed well shaft and contaminate groundwater used as a drinking water source. These pollutants, often in minute concentrations such as parts per billion, are not detected by taste or odor, but can be a threat to human health. (continued on Pg. 12)

## Where Do Pollutants Come From?

| Pollutant   | Common Sources   |
|---|--|
| Silt, sand and clay particles and other debris (sediment) | Construction sites<br>Bare spots in lawns and gardens<br>Cars and trucks washed on driveways or parking lots |
| Nutrients (phosphorus, nitrates, etc.)                    | Fertilizers (overused or spilled)<br>Pet waste<br>Grass clippings and leaves                                 |
| Disease organisms   | Pet waste and garbage  |
| Hydrocarbons (toxic chemicals)                            | Car, truck and lawnmower exhaust<br>Leaks and spills of oil and gas<br>Open burning of leaves and garbage    |
| Pesticides and herbicides (toxic chemicals)               | Applications before rainstorms<br>Spills and leaks   |
| Metals (toxic chemicals)                                  | Cars and trucks (exhaust, brake and tire wear)<br>Galvanized metal gutters and downspouts                    |

Nonpoint source pollution such as runoff cannot be collected and treated centrally in the same way as pollution from point sources, such as wastewater treatment plants. Runoff pollution does not come from a few sources. Rather, runoff carries pollution from every street, parking lot, yard and garden. Solving the problem requires everyone's help.

Take a few minutes to go through the following assessment to determine your risk of contribution to runoff pollution from your property. Then read about the areas where you have the highest risk to learn more about things you can do to reduce the potential for runoff pollution from your property.



## Assessment – Reducing Pollutants in Runoff

Use the table below to rate your risks related to your potential stormwater runoff pollutants. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Then look to the appropriate section for tips.

The goals are to help make you more aware of the potential problems associated with nonpoint source pollution from runoff and to help you lower your risks of contributing to these problems. The following pages will help provide you with ways to improve on the areas identified as “high” or “medium” risks in the assessment above. Keep in mind that the keys to reducing pollution caused by runoff are:

1. Keep pollutants from being carried by the runoff, and
2. Reduce the amount of water that travels in the form of runoff.

## Assessment – Reducing Pollutants in Runoff

|  | Low Risk<br>Recommended  | Medium Risk<br>Potential Hazard   | High Risk<br>Unsafe Condition   | Your Risk  |
|--|--|---|---|--|
| Storage of pesticides, fertilizers and other potentially harmful chemicals | Stored in waterproof container in garage or shed out of reach of rainfall. Containers clearly labeled and out of the reach of children. Buy only what you need to reduce the need to store leftovers.          | Stored in waterproof containers but within reach of rain water. Containers not clearly labeled. Buy chemicals based on price instead of actual needs. | Stored in non-waterproof containers. Not clearly marked. Accessible to children. Storage area often wet.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Handling and use of pesticides, fertilizers and outdoor chemicals          | Keep absorbent material like cat litter on hand for spill clean-up. Apply only recommended amounts and control the watering-in of fertilizers immediately after application. Delay applications to avoid rain. | Don't delay applications to avoid rain. Sometimes increase the recommended rate based on my own judgment.   | Don't clean up spills. Rinse equipment out on my driveway. Generally try to over apply to be sure the product is doing some good. Try to wait until right before a rain to fertilize. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Car washing  | Cars and trucks taken to a commercial car wash or spray booth.   | Vehicles washed on lawn instead of driveway.  | Vehicles washed on driveway.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Automotive wastes  | Always clean up oil spills with absorbent material. Take used oil to collection center. Store anti-freeze in a safe place.   | Don't clean up oil spills. Anti-freeze stored in areas accessible to children or pets.  | Wash oil spills off the driveway and into the street. Pour old gasoline or used motor oil in ditch or on the grass.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



## Assessment – Reducing Pollutants in Runoff (cont.)

|   | Low Risk<br>Recommended  | Medium Risk<br>Potential Hazard  | High Risk<br>Unsafe Condition   | Your Risk  |
|---|--|--|---|--|
| Pet and animal wastes                         | Bury pet wastes away from garden, ditch or children's play area, dispose of in toilet or dispose of in trash.  | Pet wastes left to decompose on grass or soil. Wastes scattered over wide area.  | Animal wastes usually concentrated in grass area and not picked up. Any droppings on driveway are washed into the street.                                   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Grass clippings, leaves and other yard wastes | Sweep clippings, leaves and other yard wastes off paved surfaces and onto lawns or landscape planters away from water flow routes. Leaves and other yard wastes are composted or used for mulch. | Leaves and other yard wastes are sometimes removed or composted. Clippings are swept off of paved surfaces around the house only, but not areas like the street. | Leaves, clippings, and other yard wastes are left where they fall. -  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Paved surfaces                                | Paved surfaces are kept to a minimum, and alternatives, such as wood chips, stepping stones or paver blocks are used when possible.  | Some small areas are paved for patios, basketball, or tennis, but there are also some larger grassy areas.   | A large portion of the property is paved, and there are only small areas of lawn.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Exposed soil                                  | Bare spots in the lawn are promptly seeded and covered with a layer of straw and garden areas are mulched.   | Grass is spotty, especially on sloping ground. However, all areas of bare soil are surrounded by grass.  | Bare spots in the lawn or garden are without mulch or vegetation for long periods of time. Mounds of bare soil are present or bare spots are near pavement. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Landscaping to prevent erosion.               | Yard is landscaped to slow the flow of water and allow storm water to soak into ground.  | No areas allow water to soak into ground. Mowed grass or spotty vegetation near water.   | No erosion control landscaping. Erosion on banks and shores.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



**Question** - Are household products stored outside the reach of runoff?

**Answer** - Most households store lawn and garden products – weed and insect killers, fertilizers, etc. Rain, stormwater or floodwater reaching these products can transport them into surface water or local groundwater supplies.

- Choose plants which require less fertilizer for yards.
- Store chemicals in waterproof containers in a covered storage area.
- Choose the most environmentally friendly pesticide for the job if one must be used.
- Quickly clean up spills, especially on paved surfaces.
- Lightly water-in fertilizer so it will soak into the soil.
- Rinse pesticide spray equipment out on the yard, not the drive.
- Leave an untreated strip along the edges of your yard to act as a filter strip when fertilizing.
- Maintain a good cover of grass on the yard to minimize the water that runs off from it.

**Question** - Is stormwater carrying away any car or truck wastes?

**Answer** - A rainstorm can easily carry away oil stains on your driveway, and outdoor spills of antifreeze, brake fluid and other automotive liquids. Runoff from your driveway that has an oily sheen is a sure sign you need to be more careful.

- Use an absorbent material such as sawdust or cat litter to soak up spilled auto fluids. They can then be swept up to keep them from being washed down to the lake.
- Used oil is flammable and toxic. It contains hazardous ingredients such as hydrocarbons (like benzene) and heavy metals. When poured onto the ground, used oil tends to move through the soil, stressing soil microbes and other small organisms. Loss of these reduces nutrient cycles and can stress the plant foundation of the food chain. On water, oil spreads on the surface and eventually settles as a tar-like substance on the bottom. The oil stresses plants, microbes, aquatic insects, fish and other organisms by clogging their breathing mechanisms,

interfering with temperature regulation or it also may accumulate in their tissue such as muscle.

- Washing your car in the driveway creates runoff problems even without a rainstorm. Your hose provides the water. Try washing your car on the lawn. Or better yet, take it to a commercial car wash or spray booth that sends its dirty, soapy water to a wastewater treatment plant.

**Answer** - Droppings from dogs and cats, and from commonly-kept animals like rabbits, goats and chickens, can be troublesome in two ways. Pet wastes contain nutrients that can promote algae growth if the



**Question** - Do you keep animal wastes from becoming a pollution problem?

wastes enter streams and lakes.

- The chances of stormwater contamination increase if pet wastes are concentrated or left on slopes, sidewalks, streets or driveways where runoff occurs.
- Droppings should be buried if local laws allow, flushed along with human wastes down the toilet or put in a securely closed bag in the trash (especially used cat litter).



## Part 3 - Landscaping and Site Management to Control Runoff

Some stormwater risks can be controlled by changes to buildings, paved surfaces, landscape and soil surfaces. This section reviews some easily addressed problems, as well as major landscape alterations you might want to consider.

### Paved Surfaces

Concrete or asphalt roads, driveways, and walkways prevent rainwater from soaking into the ground. If possible, disconnect paved surfaces by draining them onto lawns or forested areas instead of into drainage ways or streams. If you have a choice, consider using alternative materials, such as gravel or wood chips for walkways to let water infiltrate the soil. Where you need a more solid surface, consider using a "porous pavement" made from interlocking cement blocks or rubber mats that allow space for rainwater to seep into the ground.

### Slow or Capture Runoff

Include vegetated areas at the base of downspouts and adjacent to paved surfaces to capture water and allow it to infiltrate and recharge groundwater. This can be as simple as including a grass swale or low area that holds stormwater, allowing it to slowly soak into the soil. Also consider designing curved paths and drives to prevent runoff water from being directed to the lake. This will also create a more attractive design.

### Dealing with Bare Soil

Areas of bare soil are common in garden areas, on newly seeded lawns, and around construction projects. Rainwater and melting snow can remove large amounts of soil and carry it into surface waters including rivers, lakes, and streams. Plant groundcovers or apply mulch to gardens or newly seeded areas to slow erosion and prevent soil from polluting surface water.

### Reducing Erosion with Landscaping

Gardens, lawns and construction sites with areas of bare soil, especially on sloped land, are prone to soil erosion. You can protect soil and reduce erosion by planting groundcover vegetation or using wood-chip mulch or landscape fabric. Many lawns are sloped to encourage water to run off onto neighboring property or into the lake. On steep slopes, plant a vigorous ground cover, build terraces, or use retaining walls on slopes to help prevent soil loss. Swales (small dips in the ground) and berms (raised earthen areas) can help divert runoff that rushes from your yard. By landscaping low areas with shrubs and flowers, you can instead encourage water to soak into the ground. To prevent concentrated erosion near your home, direct

drainage from your roof to your lawn or flower bed. If you have a large lot, consider naturalizing parts of it with prairie, woodland, or wetland plants. Since your property adjoins the lake and/or a stream, consider leaving a buffer strip of thick vegetation that includes trees and native grasses.

**Question** - *Do you keep yard and garden wastes out of stormwater?*

**Answer** - If left on sidewalks, driveways or roads, grass clippings and other yard wastes will wash away with the next storm.

Although leaves and other

plant debris accumulate naturally in streams and lakes, you and other residents can contribute excess amounts of plant matter. This can lead to water that is over-fertilized and unsuitable for recreation (like swimming, boating and fishing).

- Burning is not an environmentally friendly alternative. Hydrocarbons and nutrients (like phosphorus and nitrogen) released by burning leaves contribute to water and air pollution. Rain washes smoke particles out of the air and runoff picks up dust and ashes left on pavement or in ditches.





- Avoiding the problem is easy — mulch mow grass clippings back into your lawn, use leaves as landscape mulch and compost leaves on your property to recycle nutrients for later use. Never place grass clippings, yard wastes or trash in drainage ditches or alongside the lake.

**Question** - *Are there areas of bare soil around your home?*

**Answer** - You can find areas of bare soil in vegetable and flower gardens, newly-seeded lawns, steeper slopes and around construction projects. Even on gentle slopes, water from rain can remove large amounts of soil and deliver it to rivers and lakes.

- Planting grass or other ground covers is the best way to stop erosion. A good stand of thick grass is one of nature's best filter systems.
- Putting a straw or chip mulch over gardens or newly seeded areas will slow erosion.
- Diversion ditches and commercially available silt fences around construction sites can help slow runoff and trap sediment on-site.

**Question** - *Can you eliminate paved surfaces or install alternatives?*

**Answer** - Concrete and asphalt roads, driveways and walkways prevent rainwater from soaking naturally into the ground.

- When you have the choice, consider alternatives such as gravel, wood-chip or brick walk on driveways or patios.
- Where you need a more solid surface, consider using a "porous pavement" made from porous concrete, interlocking cement blocks, pavers, or gravel that allow spaces for rainwater to seep into the ground.
- If you do pour concrete, keep the paved area as short and narrow as possible.

**Question** - *Does water from roofs flow onto pavement or grass?*

**Answer** - Your house roof, like pavement, sheds water. If downspouts from roof gutters empty out on grassy areas, the water will have a better chance to soak naturally into the ground.

- Aim your roof downspouts away from foundations and paved surfaces. This will allow the water that runs off your roof to have a chance to soak into the ground and not simply run off.

- For roofs without gutters, you can plant grass, spread bark mulch or use gravel under the drip line to prevent soil erosion and increase the ground's capacity to absorb water.

**Question** - *Can you change the layout of your landscape to reduce runoff?*

**Answer** - An essential part of runoff management is keeping water from leaving your property or at least slowing its flow as much as possible.

- Many home lawns are sloped to encourage water to run off onto neighboring property, streets or the lake. Instead, you could provide low areas landscaped with shrubs and flowers, adapted to temporary wet conditions, where water is encouraged to soak into the ground.
- If your property adjoins a stream or ditch, or slopes strongly to the lake, one of the best ways to slow and filter runoff is to leave a buffer strip of thick natural vegetation along the lower areas. See the Resources Section to contact your local Natural Resource Conservation Service/Soil and Water Conservation District for ideas.

## Part 4 – Lakeshore Vegetation

### The Role of Vegetative Buffers

A vegetative buffer zone is an undeveloped area directly adjacent to a pond, stream, or lake. Buffers can be comprised of existing plants on the site and/or new plantings. Buffer zones include aquatic plants in shallow water, moisture-loving plants along the shore, and upland plants in dry soils.

The primary purposes of vegetative buffer zones are to:

- Reduce runoff by increasing stormwater infiltration into soil. Less runoff means less nutrients and other pollutants entering the water -- excess nutrients are the primary cause of algal blooms and increased aquatic plant growth:



- Stabilize soils with plant root systems
- Reduce shoreline erosion due to wave action
- Purify water with aquatic vegetation
- Improve wildlife and fish habitat by providing food, shelter, and shade

Some additional benefits of maintaining a more natural, vegetated shoreline include spending less time doing yard work and more time relaxing. In addition, a vegetated lakeside buffer zone can create a more aesthetically pleasing shoreline for you and your neighbors to enjoy.

Landscape design and management that creates sustainable shoreland landscapes is referred to as lakescaping. Incorporation of a native plant vegetative buffer zone is a key element in creating successful lakescaping plans that are good for water quality and wildlife as well as being beneficial to property owners. The wider the buffer zone the better it will function. A 25-foot native plant buffer from your lakeshore/U.S. Army Corps of Engineers property line would be a great start!

As you consider buffer designs for water quality protection, also consider the types of wildlife you would like to encourage and determine the type of habitat needed. For example, many birds are ground nesting and require thick vegetation for protection. Woody debris provides habitat for insects and amphibians on which other species depend. Logs in the water and along the shoreline provide attractive perching sites for birds and turtles. Replacing a natural shoreline with mowed grass creates habitat that is suitable for few species except geese -- lots of geese. Including a vegetative buffer zone in your design will discourage geese while providing food and shelter for more desirable species. A well-designed vegetative buffer zone should not block views. It is easy to maintain views between the shrub layer and the tree canopy with careful plant selection and a little pruning. Vegetation can actually be a means to frame desired views and restrict undesirable views.

The first step in creating any landscape design plan

is to do a property site survey that inventories the landscape features, plants, and structures. The materials you need to make your map are readily available: a measuring tape, a clipboard, a pencil and grid (at the end of this chapter). The map you create will be an aerial view—the way your property would look if you took a photo of it from the air. A sample map is provided on page 18 and grid on page 19. Draw a

base plan indicating where structures and plants are located along with drainage areas, attractive and unsightly views, topography, and accurate site measurements.



A site survey for shoreland property should include:

- Water depths along the shore
- Steepness of slope moving inland from the shore
- Soil type (sand, clay, gravel, muck)

for major areas

- Areas prone to erosion - both upland and along the shoreline
- Inventories of existing plants should indicate problem plants, invasive species, existing native plants, and dead trees (standing snags and downed logs are valuable for wildlife), and areas where wildlife is observed
- areas where runoff water flows into Beaver Lake or a tributary
- existing use areas such as beaches, boat dock, picnic area
- winter storage areas for boats and docks
- access roads/driveways/paths

In addition, note if water levels tend to fluctuate, signify where the ordinary low and high water marks are, which direction is north, and indicate the shoreline's exposure to wave action.

Using the information gathered with the site survey, evaluate the site's challenges and strengths such as undercut shore needing stabilization. Determine how much area is actually needed for lake access and



recreation and which areas can be left undeveloped or earmarked for restoration.

## Part 5 - Add Property and Homesite Details to Your Map

By adding detail to the map of your property, you will take another step toward more fully understanding your potential water quality impact risks. Although your property has physical features you cannot change, there are many things that you can do to minimize risks. Your map will identify areas where you can focus your efforts. It will also help you complete other LakeSmart chapters. And if you involve children as you make your map and conduct the assessment, you will help teach them the importance of having and protecting clean water.

Use the table below to rate your risks related to your lakefront vegetation. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Then look to the appropriate section for tips.

### Assessment – Lakefront Vegetation

|                                  | Low Risk<br>Recommended   | Medium Risk<br>Potential Hazard  | High Risk<br>Unsafe Condition                                      | Your Risk  |
|----------------------------------|---|--|--|--|
| Lakeshore plant types            | A combination of native plant, shrub and tree species.  | Some invasive plants mixed with native species and turf grass.                             | Mostly invasive species with limited native species or turf grass. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Vegetative buffer width          | There is >25 feet of additional vegetative buffer inland from the U.S. Army Corps of Engineers property line. | Vegetation is thriving within U.S. Army Corps of Engineers property line adjacent to lake. | There is limited vegetation adjacent to the lake.                  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Mowing/maintenance of vegetation | Vegetation is allowed to flourish without mowing.   | Vegetation is mowed 2-3 times a year.  | Vegetation is regularly mowed (every 1-2 weeks.)                   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



Several home management practices and home site characteristics can have major effects on water quality. As you survey your property to make your map, be especially watchful for the following:

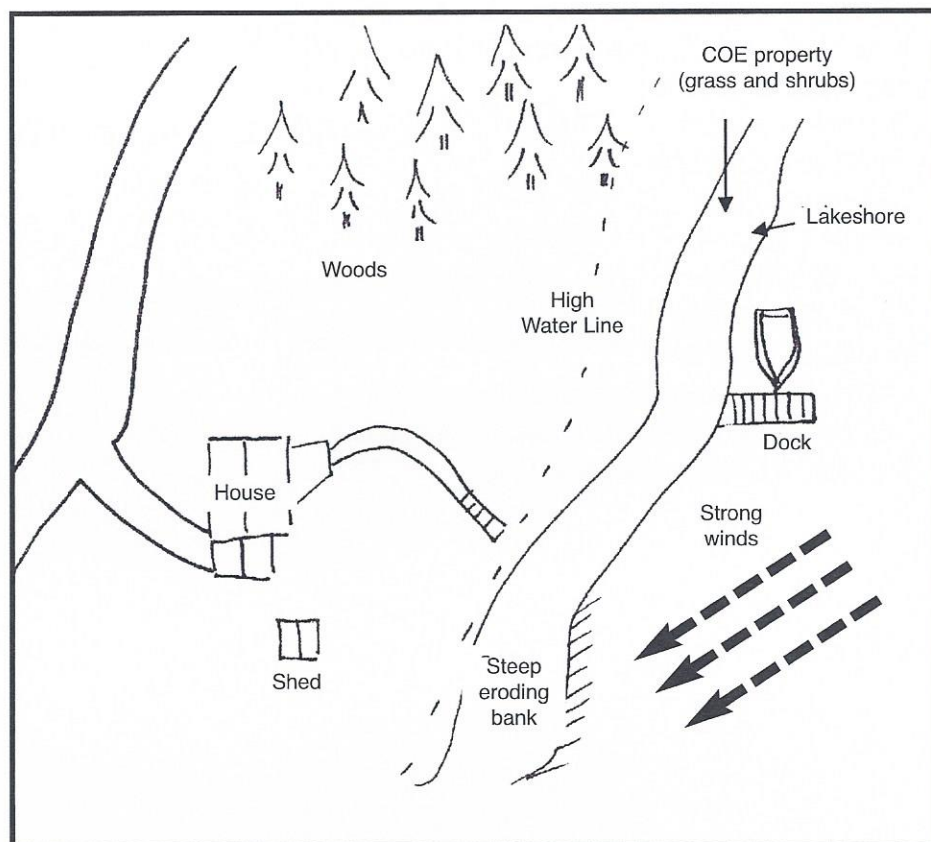
1. Improper storage, use or disposal of yard and garden chemicals and other hazardous products like paints and solvents
2. Stockpiled pet waste, animal pens or kennels close to a well, the lake, or a stream
3. Underground or above-ground storage tank containing fuel oil, gasoline or other petroleum products

On your map, note the areas where you store and use chemicals and other potential hazards by using letter codes. Make up your own code letters or symbols as needed. Examples might be:

- A – Automotive products like motor oil, gasoline and antifreeze
- P – Pesticides, herbicides
- H – Hazardous products like solvents, acids, paint and thinners
- W – Animal waste

For larger-view maps, add landscape features such as hills, ponds and human-built features such as docks and pathways down to the lake, runoff drainage ways, roads and bridges. You might also note potential sources of contamination beyond the boundaries of your property. Indicate seasonal changes at your homesite. One example might be high water levels experienced with spring flooding.

Inquire about previous or current industrial or agricultural activities in the area. Old landfills and buried fuel tanks are just a few examples of what you might find. Determine if any underground fuel tanks exist on



Sample site assessment diagram

neighboring or area properties.

The final step is to put both pieces of your assessment together – the assessment table results and map – so you can identify potential problem areas on your property. If you have rated any of the items in the table as medium or high risks and have identified potential contamination sources, then you should be concerned.

If you identify potentially hazardous or unsafe situations, what should you do? There are five other chapters in this *LakeSmart* handbook that address specific concerns. For example, Chapter 6 on Managing Household Hazardous Products contains information on the safe management of gasoline, heating oil, diesel and other fuels. This chapter and others will help you identify problems and develop an action plan for protecting your family's health and the local environment.

This *LakeSmart* handbook covers a variety of topics to help homeowners examine and address their most



important environmental concerns. See the complete list of chapters in the table of contents at the beginning of this handbook.

For more information about topics covered in LakeSmart, Urban Home\*A\*Syst, Home\*A\*Syst and Farm\*A\*Syst, or for information about laws

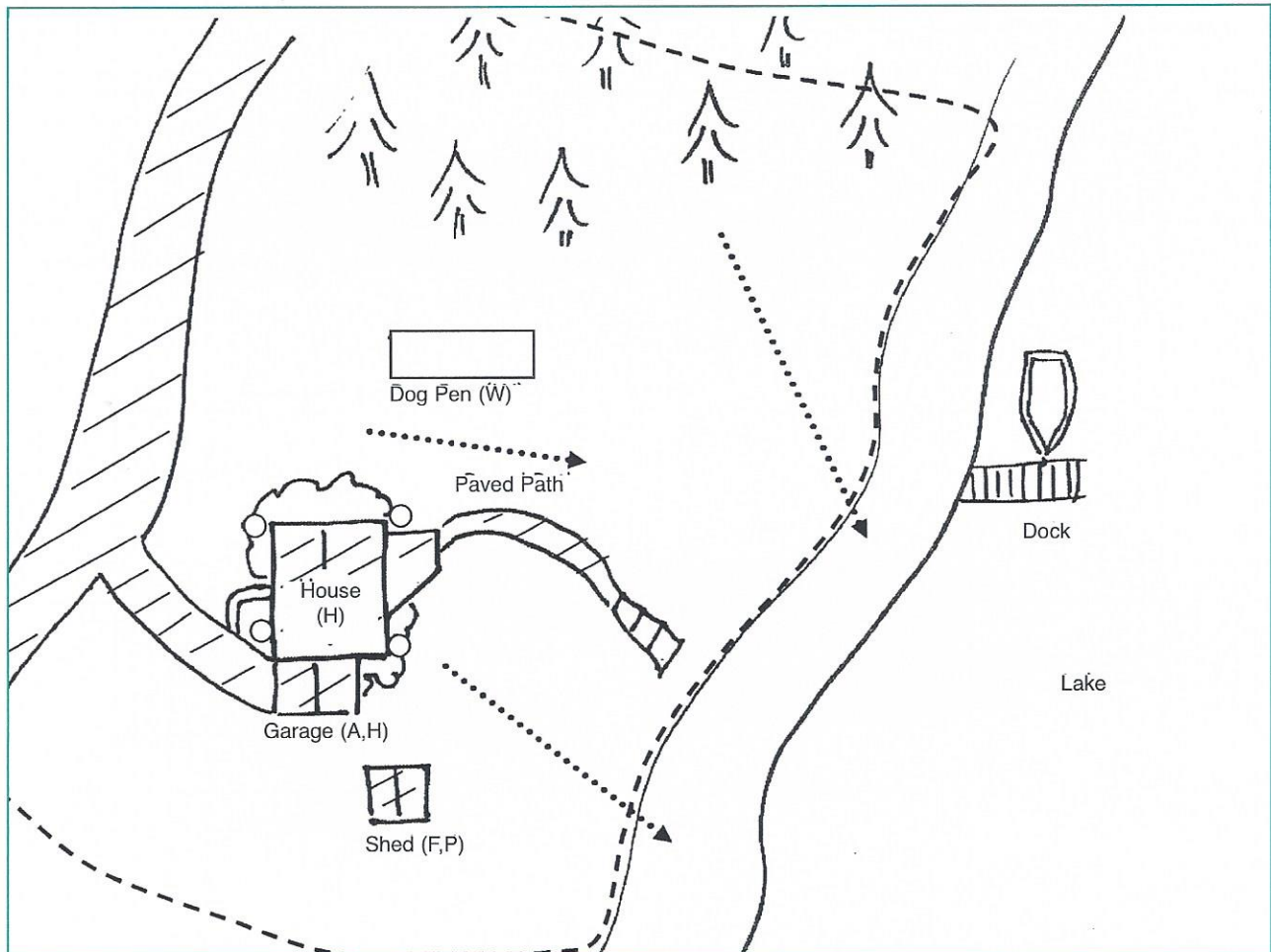
and regulations specific to your area, contact your local University of Arkansas Division of Agriculture Cooperative Extension Service office.

**Using the information** gathered with the site survey, evaluate the site's challenges and strengths such as undercut shore needing stabilization.





# Sample map



## Sample Map

Property boundaries

- House and garage
- Outbuildings, sheds
- Gutter down spouts
- Nearest surface water
- Roads, driveways
- Drainage ditches
- Impervious surfaces (such as patios or sidewalks)
- Lawn areas
- Vegetable and flower gardens
- Animal waste storage areas
- Nearest storm drain
- Slope/drainage direction

..... 30-foot property boundary

A = automotive products

P = pesticides, herbicides

H = hazardous products

F = liquid fuel

W = Animal waste

/// = impervious surface

→ = slope/drainage direction

O = downspout from gutters

This chapter was written by Alyson McCann, Water Quality Program Coordinator, University of Rhode Island Cooperative Extension, Kingston, Rhode Island. It was adapted for *Urban Home\*A\*Syst* by Katie Teague, University of Arkansas Division of Agriculture Cooperative Extension Service. Information on lakeshore vegetation management is from the University of Minnesota Sustainable Urban Landscape Information Series, <http://www.sustland.umn.edu/related/water2.html>.



## Sample grid

[illegible]



# LANDSCAPE MANAGEMENT

## Chapter 3

### Why Should I Be Concerned?

Landscaping, gardening and lawn care can improve the beauty and value of your home and be a part of a healthy lifestyle. Pesticides, fertilizers, and water play an important role in maintaining a successful lawn and garden. Pesticides control undesirable weeds, insects, diseases, and rodents; fertilizers increase the fertility of the soil to enhance the growth of plants; and of course water, is essential for the very life of the plants a homeowner is growing. However, over-application or misuse of fertilizers, pesticides, and even irrigation water can affect the quality of lake and groundwater supplies.

Most residents want to have well-kept homes with attractive landscape plants and a green lawn. These residents may spend a lot of time and money to achieve this ideal and the number of products and lawn care and landscaping services increases each year to meet the demand. Proper applications of lawn

and garden products generally pose few problems. In fact, a properly maintained home landscape can help reduce soil erosion, conserve water and improve soil fertility. Alternately, poor maintenance — either through neglect or excessive chemical applications — can lead to soil problems, polluted runoff and groundwater contamination. This chapter will help you identify, evaluate and reduce the pollution risks of yard and garden care practices on your health and the environment including:

- Fertilizer needs and application
- Pesticide use and Integrated Pest Management (IPM)
- Water conservation
- Composting

### Improving Lawn and Garden Management

Your lawn is something you can be proud of! For most homeowners, it is an attractive part of their land-

### Assessment – Reducing Pollutants from the Landscape

Use the table below to rate your risks related to your landscape management and maintenance. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Then look to the appropriate section for tips.

|                                  | Low Risk  | Medium Risk  | High Risk   | Your Risk  |
|----------------------------------|---|--|---|--|
| Fertilizers                      | Apply <1lb. of nitrogen per 1,000 square feet, two to three times per year. Have my soil tested at least every 3 years. Only apply phosphorus based on soil test recommendations. | Soil hasn't been tested within last 5 years. Apply >1lb. of nitrogen per 1,000 square feet, and phosphorus as part of a complete fertilizer containing nitrogen, phosphorus, and potassium, (e.g. 13-13-13). | Apply unknown amounts of nitrogen and phosphorus over lawn four or more times per year. Have never had my soil tested.    | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Pesticides                       | Nonchemical methods used to control pests   | Low chemical methods used to control pests only when needed (IPM)  | Chemicals used without regard to label instructions or conditions. Buy whatever is cheapest.                              | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Lawn (turf) type and maintenance | Turf grass suited to soil type, available sunlight and climate. Pest resistant grass preferred. Mowed to proper height.   | Native unimproved grasses exist. Mowed to proper height, but not proper frequency.   | Grass type not suited to available light, soil or climate. Grass type is pest-prone. Mowed to less than 1 inch in height. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



|                              |   |  |   |  |
|------------------------------|---|--|---|--|
| Groundcover and other plants | Groundcover, flowers, trees and shrubs planted to reduce soil erosion. Plants resist disease and insects.   | Yard has small areas with soil erosion. Plants require chemical pest control to maintain good appearance.                                  | Yard has large areas with soil erosion. Plants require insect and disease-fighting chemicals to survive.                                    | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Composting                   | Compost pile well-maintained, contains yard waste and vegetable food scraps.  | Compost pile poorly maintained (such as not aerated, or lacking the proper mix of materials). Dog, cat and other pet wastes added to pile. | Compost pile poorly maintained, contains excessive high-nitrogen material and located less than 50 feet from shallow well or surface water. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Water requirements of plants | Grass, flowers, trees and shrubs able to survive with normal rainfall.  | Landscape plants require light to moderate watering.   | Heavy watering required to keep lawn and other plants alive.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Watering methods             | Watering done in early morning only as needed. Low water-use device used (like soaker hoses or drip irrigation). Sprinkler systems on manual control. | Watering done in the evening with hose or hose sprinkler. Some water run down drive and property.  | Watering done during heat of the day. Sprinkler system used without regard to weather conditions or lawn appearance.                        | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |

scape. In fact, a healthy, dense turf lawn can add value to your property, help to tie together your home and other landscape plants, and improve your living environment. On a hot day, your lawn reduces the glare of the sun and keeps surrounding areas cooler. On windy days, your lawn protects the soil on your property from erosion and evaporation.

Some homeowners intensively manage their lawns and gardens by using large quantities of chemicals. But, when used incorrectly, pesticides, fertilizers, and irrigation water may adversely impact the quality of the lake. To protect the quality of water resources and the surrounding environment, you should use lawn care best management practices (BMPs) which are defined as strategies that are compatible with sound turf management and eliminate or minimize pollution.

## Part 1 – Fertilizer Needs and Application

Why should homeowners be concerned about fertilizer use on lawns and gardens?

Some homeowners use a larger quantity of fertilizer on their lawns and gardens than is really needed. Fertilizer over use or misapplication may cause:

- Nutrients to wash into the lake or nearby water ways
- Excessive algal growth
- Depleted dissolved oxygen
- Loss of sportfish populations
- Increased treatment costs for drinking water supplies
- Decrease in aesthetic value of the lake

So what fertilizer does your lawn or garden need? Nitrogen (N) is the key plant nutrient for building a thick green lawn. Nitrogen is one nutrient that is extremely difficult to measure; therefore, homeowners need to use products with nitrogen judiciously. Do not apply more than 1 pound of nitrogen per 1,000 square feet and never apply more than three times a year. When applied at the right time and in the right amount, fertilizers supply the nitrogen your lawn needs. A basic fertilizer containing slow-release nitrogen and other essential nutrients is the most environmentally safe and cost-effective. At least 30 percent of the nitrogen on the fertilizer package should be listed as slow release. This fertilizer usually costs more but you apply it less often. If you apply fertilizer at the wrong time or in the wrong amount, insect and disease problems can get worse. For instance, chinch bugs, sod webworms,



nematodes and brown patch may increase if you overstimulate your lawn with soluble nitrogen. Too much nitrogen also causes excessive growth that can increase maintenance costs. If you apply too much fertilizer it can also be washed away before the grass takes it up, carrying nutrients into nearby streams, lakes and rivers.

Phosphorus (P) is an important ingredient for the energy processes inside plants and grasses and for root growth during establishment, but it is needed at much lower levels than nitrogen. Based on data from the University of Arkansas Soil Test Laboratory, approximately 86 percent of lawn soils in Arkansas have enough phosphorus to sustain optimum turf growth. Therefore, fertilizers with low or no phosphorus should be used on these lawns. If excessive amounts of phosphorus are applied to lawns, excess can be carried in stormwater or irrigation runoff down to the lake. However, when applied according to soil test recommendations, there is little risk of phosphorus lawn applications contaminating surface or groundwater supplies except when fertilizer is incorrectly applied onto impervious surfaces (driveways, sidewalks, etc.) or in cases where soil erodes. Before rain washes away excess fertilizer, sweep it from walks, driveways and patios back onto the lawn and remember that a dense lawn is your best defense against runoff and erosion.

If you hire a lawn and garden care service, insist that fertilizers only be applied when the weather is favorable — preferably when rain is not expected for at least 24 hours. Rainfall, however, can be tricky to predict. Be sure to keep children and pets away from treated lawns for at least 24 hours following the application. Lightly water in fertilizer applications. Nonchemical fertilizers, such as compost and fish meal, and other soil amendments also should be applied based on the needs of your lawn according to your soil test recommendation.

### **Fertilizer Management for Lawns, Gardens and Landscaping Beds**

Fertilizer should be added only in the amounts needed, at the appropriate time, and in a form that makes the nutrients available to plants. BMPs for fer-

tilizer management should include the following:

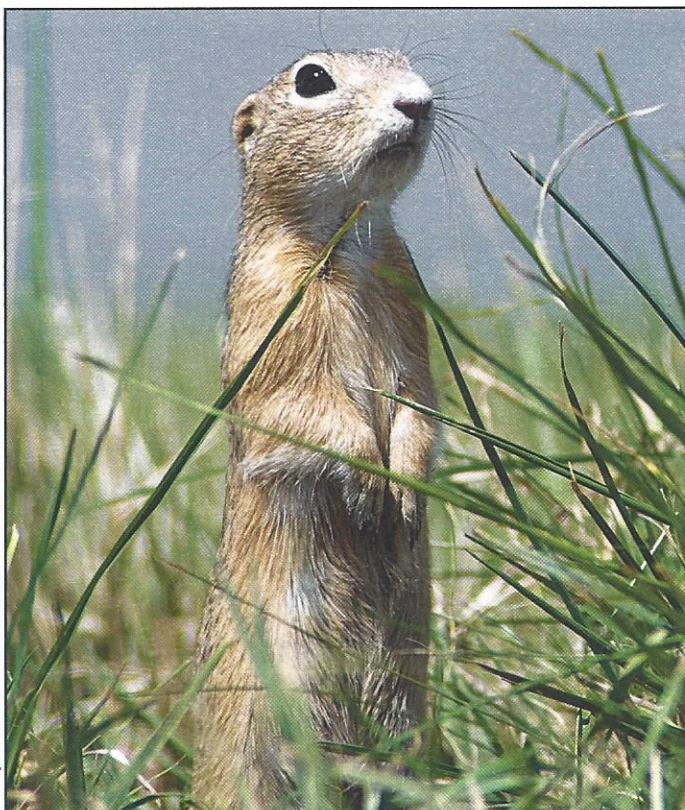
- Test your soil. The results of the test will help you determine what kind and how much fertilizer you need to apply to keep your lawn healthy. Soil testing is a free service offered through your county Cooperative Extension Service.

- Use fertilizers that slowly release the nutrients. By using slow release fertilizers, the lawn is fed slowly so there is no excess fertilizer to leach into groundwater that you pump for your drinking water. Also, using slow release fertilizer eliminates the risk of burning the grass.

- Most soils in Arkansas have adequate amounts of trace elements, such as copper, manganese, nickel, and zinc to meet lawn needs.

- Build a healthy soil. Add organic matter, such as compost to enhance the structure, aeration, and nutrient and water-holding capacity of the soil. Organic matter can also be added by growing winter cover crops. Also, try to supply needed nutrients using organic fertilizers, such as composted manure, cottonseed meal, bone meal, blood meal, and greensand. Most gardening shops have these types of fertilizers. If not, you can order from gardening retailers that specialize in providing organic fertilizers and pesticides.

- Apply fertilizers properly. Based on your soil test





and plant needs, apply the proper rate of nutrients and apply it at the correct growth stage of the plant. Overfeeding plants can be as detrimental as underfeeding, but this risk can be reduced if organic fertilizers are used, because the nutrients are released slowly. Synthetic fertilizers are also useful, as they can provide readily needed nutrients. Just be sure not to over-apply nutrients as they can be washed into the lake with the next rain storm event.

**Integrated Pest Management (IPM) is simply a systematic, holistic approach to controlling pests in your landscape.**

## Part 2 - Pesticide Use and Integrated Pest Management (IPM)

Some landowners use a large quantity of pesticides on their lawns and gardens. Pesticide over use or misapplication may cause the following:

- Harm or kill beneficial insect and earthworms associated with your landscape
- Harm wildlife and pets that come in contact with your lawn or garden
- Result in chemical runoff during rainfall or irrigation into the lake and nearby water resources
- Leach through the soil directly into ground water which is used for drinking water
- Accumulate in the soil and become toxic to the plants you are growing
- Create pest resistance to the applied chemicals so that they will be very difficult to control in the future.

Your garden is a complex ecosystem of plants, animals, insects, birds, fungi, worms, and microorganisms such as bacteria. All ecosystems have three basic interacting categories of organisms:

- Producers: which are green plants that convert sunlight, carbon dioxide, and water into energy for plant growth
- Consumers: which are organisms that feed on live plant or animal material
- Decomposers: which use dead plant and animal material for energy

A healthy garden ecosystem will have a balance

among producers, consumers, and decomposers. If there is an imbalance, symptoms such as plant disease or an increase of damaging pests may result. An imbalance in the ecosystem can be caused by improper applications of pesticides, fertilizers, and

water or by removing organic matter, such as leaves, from the garden. By using gardening BMPs, you will reduce the potential for gardening problems and thus the need for

chemical controls. By reducing the use of chemicals, the risk of contaminating your drinking water is also reduced.

Integrated Pest Management (IPM) is simply a systematic, holistic approach to controlling pests in your landscape. Although the use of nonchemical controls is preferred, chemicals may be used selectively if nothing else works. Weeds can be controlled by hand-pulling or hoeing, and bugs can be removed by picking them off vegetables and garden plants. Clean up dead leaves and debris before they become a home to pests. The lady beetle (ladybug), green lynx spider, praying mantis and green lacewing feed on other insects. Pesticides are often used on pests which, if left alone, would never have become a problem. Not killing all of the destructive insects helps maintain a food source for beneficial insects and organisms that provide natural, biological control. Planting a variety of flowering plants in the landscape may also increase the population of beneficial insects.

When you have no other choice, try to find nontoxic or low-toxic chemicals such as insecticidal soaps. Follow directions carefully and mix only the amount you need. Some pesticide labels give directions only for mixing 1 or more gallons of spray. Use the conversions in the table below for mixing smaller quantities:

### Handy Conversions for Small Amounts of Pesticides

|                            |                 |
|----------------------------|-----------------|
| 1 teaspoon (tsp)/gallon    | = 1/4 tsp/quart |
| 1 tablespoon (tbsp)/gallon | = 3/4 tsp/quart |
| 2 tablespoons              | = 1 ounce (oz.) |
| 3 teaspoons                | = 1 tablespoon  |



Be sure to treat just the affected plant(s). On lawns, spray the affected area and a 5-foot buffer area around it. Blanketing the lawn or landscape with pesticides is wasteful and could damage the environment. Pesticide overuse can kill beneficial organisms and insect predators. And the beneficial insects rebound slower than the pests! For IPM to work, you have to give more time and attention to your yard and garden. For instance, regular monitoring helps you detect pest problems early.

### **Pest Management for Lawns**

Many pests attack lawns. These pests fall under four broad categories: weeds, insects, diseases and other pests.

**Weeds:** Weeds simply are plants growing in the wrong place. In the case of your lawn, a weed is any plant that is not the variety of grass that you've seeded or sodded to produce your lawn. There are many weeds common to lawns. Most of these weeds can be easily eliminated from your lawn by using management options that discourage the competition from weeds. These options include mowing to the proper height, not over fertilizing or watering. Chemicals are also an option and the ones that kill weeds are called herbicides.

**Insects:** Several dozen different insects live in your lawn at any one time. Most of these insects are harmless and in fact, many insects are actually beneficial. These beneficial insects prey on insect pests that harm your lawn. Chemicals applied to lawns to kill insects are called insecticides.

**Diseases:** Lawns are susceptible to several different diseases. Many of the diseases that attack lawns are caused by improper management by the property owner. Some potential management problems include improper watering and fertilization, lack of thatch removal, and choosing the wrong grass type for the climate. Chemicals that are applied to lawns to control disease problems are usually called fungicides.

**Other pests:** Several categories of non-insect pests can also attack lawns. These include rodents (moles and gophers), nematodes, snails, slugs, and ants. Chemicals used to kill rodents are called rodenticides, while chemicals used to kill nematodes are

called nematocides.

### **The Principles of IPM for Lawns Include:**

- Know what is in your lawn – Properly identify weeds, insects, pests, disease problems, and your grass type (bluegrass, fescue, etc.) so you can choose the proper solution to your problem.
- Use the least toxic solution to your problem. For example, consider hand-pulling weeds, changing water management practices instead of using fungicides to control diseases, and live with a low level of plant damage.
- Use pesticides carefully! Be sure to match the pesticides with the problem, follow label directions, use the correct application rates, buy only what you need, and if possible spot treat rather than treat the entire lawn.
- Store and dispose of pesticides properly. Buy pesticides in small quantities, store it in a secured area away from your water well and dispose of the material safely through a licensed household hazardous waste collection service.
- Use water wisely on lawns. Over-watering may cause pesticides to leach and contaminate the groundwater you use for drinking water.

### **Pest Management for Gardens**

It is best to try to not use pesticides as beneficial insects may be killed along with the pests you are trying to control. The following pest management BMPs will help keep your garden ecosystem healthy:

- Create a garden with diversity. Plant a combination of different types of plants to create a balanced ecosystem and in general, rotate vegetable garden plants each year to outsmart potential pests and minimize the threat of soil borne diseases.
- Maximize conditions for healthy plant growth. Choose plants that are suited for your climate and are resistant to diseases in the area. Group plants according to water and light requirements and space them to allow ample root and top growth at maturity.
- Protect and use beneficial insects. Develop garden habitats to ensure a healthy environment for beneficial insects. Also, learn to recognize the eggs and larvae of beneficial insects so as to not harm them.
- Use the least toxic solution for your problems. Some low toxic methods to solve problems include biological controls, insect traps, or mechanical means to remove



pests. Also, learn to live with a low level of plant damage.

- If you do choose to use pesticides, use them carefully! Identify the insect and weed pests and select the appropriate chemical. Also, buy only what you need and be sure to follow label directions.

- Store and dispose of pesticides properly. Store any extra in a secured area, and if you need to dispose of these chemicals, take it to your locally organized household hazardous waste collection. Refer to Chapter 6 for more information on the proper storage and disposal of these household hazardous products.

## Part 3 – Additional Landscape Management Considerations

### Are You Taking Proper Care of Your Lawn?

It will be easier to keep your lawn healthy if your grass is suited to local growing conditions including rainfall, temperature, soil type and available light. Cutting the grass to the right height is important; lawns cut too short invite weeds. Mow often enough so that you remove no more than one-third of the grass blades per mowing. Keep your mower blades sharp. A dull mower blade makes a ripping cut, creating two or three large wounds on each grass blade. The larger the wounds, the greater chance of the grass becoming diseased.

Grass clippings should be left on the lawn – in many cases clippings supply enough natural fertilizer so that only minimal additional fertilizer is needed to keep your lawn green and healthy. You should collect clippings,

however, if you are trying to prevent the spread of lawn diseases. Switching to a human-powered mower can cut down air and noise pollution. If you reduce your lawn size and grow plants that require little maintenance, such a mower can be practical.

### Water Consumption

The average American uses around 100 gallons of water each day. About half of that water may be used for landscaping and gardening, depending on climate and time of year. This is an immense amount of clean water — and your plants need only a small portion. Consider using rain barrels or cisterns to capture and store roof runoff. Don't let that free, valuable rainwater escape as runoff. Instead store it and meter it out slowly through drip irrigation to water your landscape beds.

### Go Native!

If you convert your landscape plants to ones adapted to the local climate, you will take the biggest step in conserving water. Fortunately, Arkansas' climate supports countless plant varieties; local plant nurseries grow many of these. Once native and drought-tolerant plants are established in the right location, most require little, if any supplemental water, fertilizers and pesticides.

Perennial flowers conserve water because their roots grow deeper than annual plants and require little or no watering once established. A 2-inch layer of leaves, compost, wood or bark chip mulch over bare soil will reduce stormwater runoff and keep water from evaporating. (See the section on Landscaping and Site Management to Control Runoff in Chapter 2).





## Watering Wisely

Because most plants can tolerate at least short dry periods, watering should be timed to meet the biological needs of the plants. Watering slowly and deeply (1"-1 1/2") helps develop deep roots; in the long run your plants will need less frequent watering. The plants that seem to benefit most from shallow watering are the ones you don't want—weeds. Plants can absorb only so much water. Overwatering wastes water and can injure certain plants.

Drip irrigation systems and soaker hoses deliver their water to the intended plants efficiently. By choosing and operating a watering system correctly you can reduce water bills, fungal diseases and maintenance requirements. If you have an automatic sprinkler system, install a rain shut-off device or sensor that will override the system when adequate rain has fallen.

For best results, water in the early morning (4 a.m.-7 a.m.) when temperature and wind speeds are at their lowest and evaporation is reduced. Grasses will be less susceptible to fungus if you apply water at the time dew normally forms.

For grass watering, apply 1" to 1 1/2" of water when the grass shows signs of distress (bluish-gray color, folded leaf blades). Don't water anymore until the symptoms reappear. Gradually reduce watering to see if plants can tolerate less water. There is usually very little need for watering from fall through spring, and you should always turn off automatic systems if rainfall is consistent.

## Irrigation Water Management for Lawns

Water is a precious, limited resource and we need to not only watch how we water lawns to prevent the leaching of chemicals into groundwater, but we also need to be sure we do not waste it by over watering. Both your lawn and water bill can benefit by using the following BMPs for lawn watering:

- Apply water only when your lawn needs it. Turf needs water when it begins to wilt from dryness (color

dulls and footprints stay compressed for more than a few seconds) or about a couple times a week. When you do water, water slowly and apply about an inch of water, then let the lawn dry out before watering again. Be sure to water during times when evaporation is lowest, for example, in the early morning.

- Avoid over watering. Avoid this at all times, but especially after applying fertilizers and pesticides. Too much water will allow the chemicals and nutrients to leach past the grass root zone into groundwater or cause the applied products to runoff into the lake.

## Irrigation Water Management for Gardens

Excess water use may result in nutrients leaching below the root zones into the ground water that is used for drinking water. Excess watering can also leach pesticides into ground water. Some water management BMPs are:

- Reduce the need for watering by mulching. Mulches not only show the evaporation of water from the soil surface but also can improve a soil's water-holding capacity, keep the soil cooler on hot summer days, reduce weed growth, and help prevent soil erosion. Examples of organic mulches include grass clippings, leaves, and straw. Inorganic mulches may also be used and examples are permeable sheeting and/or rock. Keep in mind that rocks can form undesirable heat sinks.
- Reduce the need for watering by improving soil structure. Each year be sure to add organic matter such as compost, grass clippings, tilled in cover crops, and other dead plant materials.
- Irrigate only when the plants need water. Check whether the soil is dry several inches below the surface. If it is dry, then water, but water slow enough so that it soaks into the root zone and does not run off the soil surface. The depth of the root zone depends on the plant, but in general this is 6 to 18 inches deep. If possible, use a drip irrigation system to conserve water.

## Do You Make Compost?

From an environmental point of view, yard wastes account for up to 20 percent of the total municipal waste

**Plants can absorb only so much water. Overwatering wastes water and can injure certain plants.**



generated year-round. Composting is a cost-effective, natural way to handle leaves, clippings, vegetable scraps and other yard wastes resulting in a high-quality, soil-enhancing material.

Composting takes advantage of nature's recycling system for breaking down plant and other organic materials. You can simply put yard wastes in a pile, or install homemade or store-bought bins. In addition to yard waste, you can add vegetable trimmings and fruit peels from your kitchen. Your compost pile will remain relatively odor-free if you turn and water it regularly. Composting can take as little as 4 to 6 weeks or as long as 1 to 2 years, depending on the size and type of material in the pile and the amount of attention you give it.

Finished compost is valuable. It can be mixed into garden soil or spread on lawns and landscape plants as a slow-release source of nutrients. Adding compost 1) improves soil structure, texture and aeration and increases the soil's capacity to hold water; 2) helps loosen compacted soils; 3) promotes soil fertility and stimulates root development in plants; and 4) creates a favorable environment for microorganisms and larger creatures such as earthworms and insects that are nature's "soil builders."

One word of caution: Animal manures contain high levels of nitrogen, and different types of animals have different levels. If manure is left in piles exposed to the

weather, nitrogen-rich runoff may result. If you mix manure from horses, sheep, cows or other plant-eating animals with your compost, be sure to add plenty of leaves, straw, rotted sawdust or pulled weeds to keep concentrations of nitrogen and other nutrients low. This will help prevent contamination of groundwater.

Do not put pet wastes (from cats and dogs) in compost piles because of potential parasite and disease problems. Also, never place meat, animal fat or dairy products in the compost pile. Try to locate piles at least 50 feet from surface water, drainage ditches, creeks and storm drains.

In Arkansas, you can receive more information and training on composting from the Master Gardener program through Cooperative Extension Service offices. These horticulture-trained volunteers are available to consult with you on how to set up a compost bin and get you started.



# WATER MANAGEMENT & CONSERVATION

## Chapter

# 4

### How Will This Chapter Help You Protect Your Drinking Water and Home Environment?

This chapter is a guide to help you better understand the condition of your well and how to take care of it. Easy-to-understand assessments tables help identify

situations and practices that are safe as well as ones that may require prompt attention. Additional information on how to safeguard all water sources may be obtained from your local health department, your county Extension office, and your county conservation district staff.

Use the table below to rate your risks related to your well usage and maintenance. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Then look to the appropriate section for tips.

### Assessment - Water Management

|   | Low Risk   | Medium Risk  | High Risk   | Your Risk  |
|---|--|--|---|--|
| Well Location                           | My well is uphill from all potential pollution sources. Surface water does not reach the well or is diverted.        | My well is level with or uphill from most potential pollution sources. Some surface water runoff may reach the well. | My well is downhill from potential pollution sources or is in a pit or depression. Surface water runoff reaches the well. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Subsurface Conditions                   | The water table or fractured bedrock is deeper than 20 ft.   | The water table or fractured bedrock is 15 – 20 ft. deep   | The water table or fractured bedrock is shallower than 15 ft.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Age of Well                             | My well is less than 20 years old.   | My well is 20 – 50 years old.  | My well is more than 50 years old.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Height of Well Casing                   | The casing is 12 or more inches above the surface and 1-2 feet above the highest recorded flood level.               | The casing is at the surface or up to 12 inches above the surface.   | The casing is below the surface, in a pit or depression, or the well has no casing.                                       | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Backflow Prevention                     | Measures are taken to prevent backflow, and where necessary, air gaps or back-flow prevention devices are installed. | Measures are sometimes taken to prevent backflow. No backflow prevention devices are installed.                      | No measures are taken to prevent backflow. No backflow prevention devices are installed.                                  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Last Inspection                         | My well has been inspected within the last 10 years.   | My well was inspected 10 – 20 years ago.   | My well was inspected more than 20 years ago, or I do not know when the well was last inspected.                          | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Records from Inspections or Maintenance | I have copies of all inspection and maintenance reports.   | I have some records on inspections and maintenance.  | I do not have any inspection or maintenance records.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



## Assessment - Water Management (con't.)

|  | Low Risk  | Medium Risk   | High Risk   | Your Risk  |
|--|---|---|---|--|
| Type of Water Testing Schedule and Results | My water is tested at least once a year. Test results are consistent and indicate good water quality. Results meet standards for bacteria, nitrate, and other contaminants. | I have tested my water before, but it has been a few years.   | My water is not tested. Water is discolored after a rainstorm, and it changes noticeably in color, odor, and taste.     | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Unused Wells                               | There are no known unused wells on my property, or unused wells have been properly sealed   | Unused wells are not sealed, but they are capped and isolated from potential contaminants.  | Unused, unsealed wells are located on my property. They are in poor condition, near pollution sources, and/or uncapped. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Water Conservation                         | Water-conserving fixtures and practices are always used. Drips and leaks are fixed immediately.   | Some water-conserving steps are taken (such as using low-flow shower heads or fully loading the washing machine and/or dishwasher). | Standard high-volume bathroom fixtures are used. No effort is made to conserve water. Leaks are not repaired.           | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |

### Why Should You Be Concerned?

Wells are a source of drinking water for many rural residents and are intended to provide clean, safe drinking water from groundwater sources. However, improperly installed or poorly maintained wells can create a direct pathway for contaminants to enter the water supply. Contaminants such as fertilizers, pesticides, and bacteria often have no odor or color and are therefore hard to detect. In addition to problems that can be caused by the wells themselves. Limestone regions known as karst, are easily contaminated by impurities in runoff that directly enters groundwater supplies. This contaminated water then can enter your well water supply. By

managing your well and activities on or near your property, you can greatly reduce the risk of a contaminated water supply.

A good understanding of your well is a step toward a protected water supply. This chapter has been designed to help you better understand the factors that affect the condition of your well and how to take care of it. Your answers will help you identify any potential problems. If you would like more help in assessing your management of your well for drinking water, contact your local Health Department office.



### Well Location

Your well's location in relation to other components of your property or those near your property can determine some pollution risks. Where your well is located on the land surface is important, but the critical factor is where it is located in relation to potential sources of pollution. Wells located downhill from a septic system, animal feeding lot, over-fertilized farm field, or leaking fuel storage tank have a greater risk of contamination than does a well located uphill from these pollution sources. Changing the location or depth of your well may protect your water supply, but any condition likely to cause groundwater contamination also should be addressed.

### Subsurface Conditions

Contamination of groundwater is more likely if soils are shallow (a few feet above bedrock) or if they are highly porous (sandy or gravelly). Generally, the more time it takes for surface water to reach the aquifer, or groundwater, the better and more complete filtration will be. Shallow soil increases risk of pollution because contaminants do not have far to travel before reaching groundwater. If bedrock below the soil is fractured so that water can seep down rapidly, the chance of groundwater contamination increases.

Shallow wells that draw from groundwater nearest the land surface, are most likely to be affected by local sources of contamination.

### Age of Your Well

The age of your well also affects the likelihood of contamination. Wells built more than 50 years ago are more likely to be shallow and poorly constructed than those built recently. Older wells also are more likely to have thinner casings that may be cracked and likely to leak lubricating oils that can pollute the water. If your well is several years old, you may want to have it inspected for any possible defects by a qualified person such as a Health Department sanitarian or a licensed well driller. If you do not know how old your well is, assume it needs an inspection.

### Well Casing and Cap

Well drillers install a steel or plastic pipe casing to prevent the collapse of the well hole during drilling. The space between the casing and sides of the hole is a direct pathway for contaminants and surface water to reach the water table. The driller seals this channel by filling it with grout. Visually inspect the portion of your well casing that extends above the ground by removing the cap and inspecting the inside with a flashlight. If the casing moves with light pressure, you may have a problem with the ability of the well casing to keep out pollutants. Sometimes damaged casings can be detected by listening for water falling into the well when the pump is not running. If you hear water, there might be a crack in the casing, or the casing may not reach the water table. Either situation is risky.

**Shallow wells that draw from groundwater nearest the land surface, are most likely to be affected by local sources of contamination.**

The well casing should extend at least 12 inches above the ground surface. If there are occasional floods in your area, the casing should extend 1 to 2

feet above the highest flood level recorded for the site. Also, the well cap should be attached firmly to the casing with a vent that allows only air to enter. If your well has a vent, make sure it is connected tightly to the well cap or seal, faces the ground, and is properly screened to keep out insects.

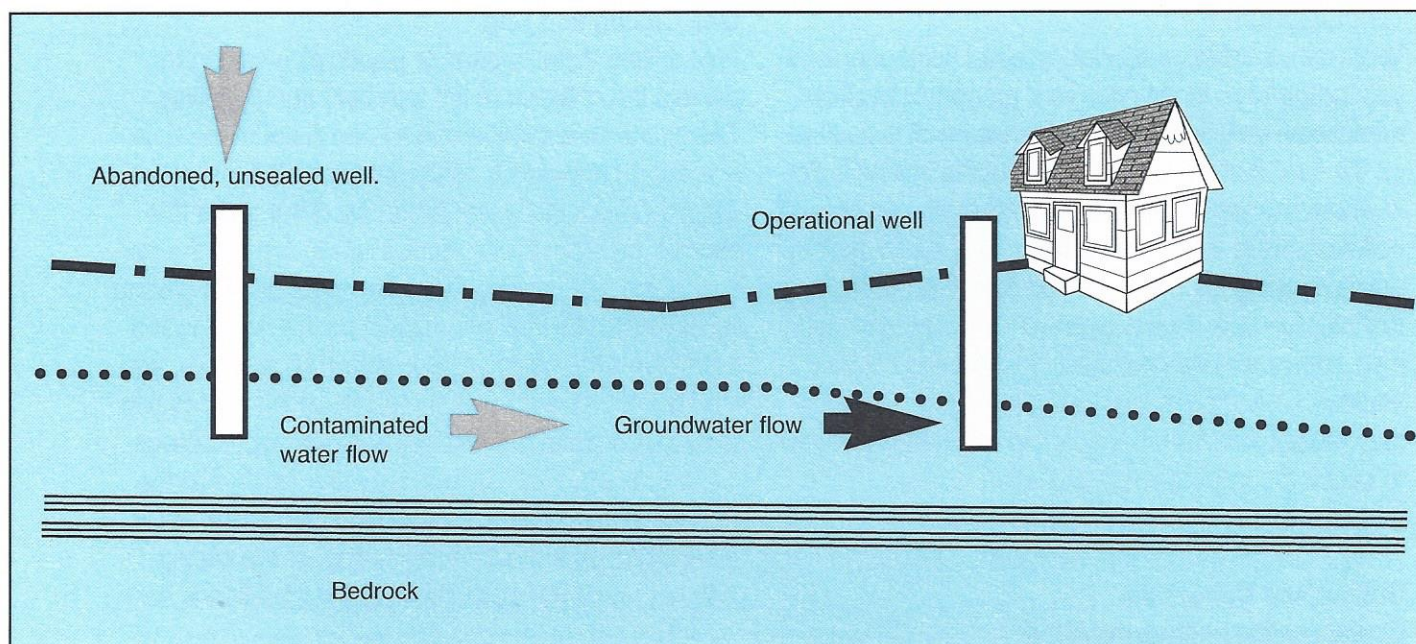
### Backflow Prevention

Backflow is defined as the movement of water opposite to the normal pressurized flow. When the backflow occurs between a chemical or water source of poor quality and the drinking water source, pollutants are carried into the potable water, contaminating it. Backflow of contaminated water into your water supply can occur if your system undergoes sudden pressure loss. Pressure loss can occur if the well pump fails or, if you are on a public water system, if there is a line break in the system.

The simplest way to guard against backflow is to leave an air gap between the water supply line and any reservoir of "dirty" water. For example, if you are filling a swimming pool with a hose, make sure that



## Wells and Groundwater Flow



you leave an air gap between the hose and the water in the pool. Toilet tanks should be equipped with a fill valve labeled with the words “anti-siphon”; when the fill valve is replaced be sure to use the anti-siphon type. Washing machines have built-in air gaps. Where an air gap cannot be maintained, a backflow prevention device such a check valve or vacuum breaker should be installed on the water supply line. For example, if you are using a pesticide sprayer that attaches directly to a hose, a hose bib vacuum breaker or check valve should be installed on the faucet to which the hose is connected.

Inexpensive backflow prevention devices can be purchased from plumbing suppliers. It must be recognized that waters which are hard or contain dissolved lime will leave deposits that in time render the devices useless, and they will need to be replaced. If water must be provided to a chemical reservoir, always use an air gap. Whenever a hose is used, think about whether or not you would like to drink the liquid in which the hose is submerged.

### Well Inspections and Record Keeping

You would not let a car go too long without a tune-up or oil change. Your well deserves the same attention. Well equipment does not last forever. Visually inspect your well often, and have it inspected by a qualified

well driller or pump installer every 10 to 15 years. Regular well inspections can help you ensure that your water supply is safe. You should keep well construction details, as well as the dates and results of maintenance visits for the well and pump. It is important to keep good records so you and future owners can follow a good maintenance schedule.

### Water Testing

Water testing helps you monitor water quality and identify potential risks to your health. Contaminants enter drinking water from many sources. Many contaminants can only be detected through a water test. Your water should be tested at least once a year for the four most common indicators of trouble: bacteria, nitrates, pH, and total dissolved solids.

A more complete water analysis for a private well will tell you about its hardness; corrosivity; and iron, sodium, and chloride content. In addition, you may choose to obtain additional tests targeted to specific contaminants such as chemicals or pesticides, if pesticides are used on or near your property, especially in the vicinity of the well. A good source of information to determine further testing can be obtained by contacting your local Health Department office.



### Unused Wells

Many properties have wells that are no longer used, including older homes or sites where homes have stood previously. Unsealed wells not only provide a direct channel for waterborne pollutants to reach groundwater, they also pose a hazard to small children who may be playing nearby. A state licensed well driller should be hired to close these wells. Effective well plugging calls for experience with well construction materials and methods, as well as knowledge of the geology of the site and the regulations of the state. The cost to close a well varies because of well depth, well diameter, and soil/rock type, but the money spent sealing a well will be a bargain compared to the potential cost of cleanup and potential hazards to your family and others. For more information, call the Arkansas Water Well Construction Commission at (501) 682-3900.

### Conserving Water

If you reduce the amount of water being used from your well, you will also reduce the flow of wastewater through the septic tank. This will allow more time for solids to settle out, providing less chance of solid particles being carried into the drain field. Less water in the drain field means better aeration for the soil microbes at work in your system. Here are a few ways to reduce the volume of water you use:

- Install low-flow toilets
- Take shorter showers
- Repair leaks immediately
- Run the washing machine or dishwasher only when full
- Turn off water when brushing your teeth or shaving
- Spread out laundry and other major water-using activities over a day or week

Using less water is better at reducing pollution all the way around. It will also save energy!



This chapter was written by Trish Ouei University of Arkansas Division of Agriculture Cooperative Extension Service.



### Why Should You Be Concerned?

Household wastewater carries dirt, soap, food, grease, and bodily wastes down the drain and out of your house. This wastewater, which starts in sinks, toilets, showers, and washing machines, also can carry nutrients and pathogens. Nutrients can impair water quality, and pathogens can cause disease. Wastewater treatment systems are designed to remove and break down these contaminants before they enter groundwater or nearby lakes, streams, or wetlands. Because wastewater treatment is often out of sight and mind until problems occur, you should know the basics of your household wastewater system and take simple precautions to help prevent future problems and costly repairs.

This chapter can help you make choices to protect your watershed and reduce risks to your family's health. After you have read it, walk around your home and property and answer the questions in the boxes, circling the answers that best apply. Your answers will help you identify potential problems. If you would like further help in assessing your household's wastewater treatment, contact your local Health Department office.

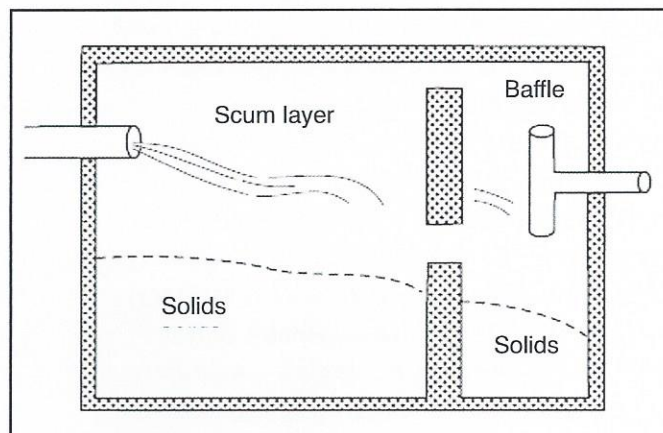
### On-Site Wastewater Treatment

The simplest septic system consists of a septic tank and drain field (also known as a soil absorption field, leach field, or drain field). Other kinds of systems also may be used for on-site wastewater treatment, including sand filters, drip irrigation, low pressure distribution, and aerobic treatment units. This chapter, however, will focus on the more traditional septic tank and drain field system.

Here is how the septic tank system works:

1. Wastewater from your home enters the septic tank.
2. In the tank, solids settle to the bottom, where bacteria feed on the solids and break them down.

### Septic Tank



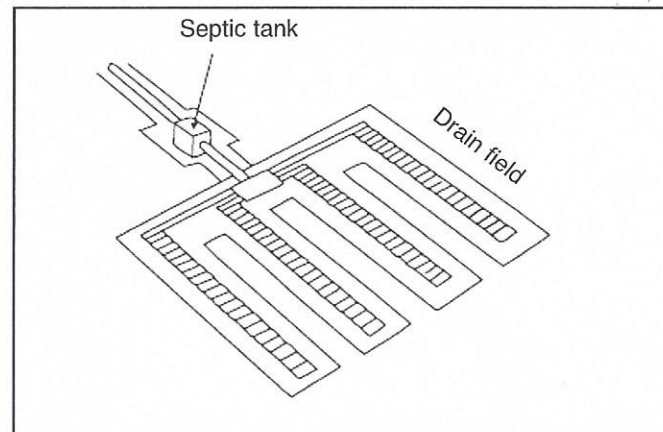
Scum rises to the top. The baffle prevents solids and scum from leaving the tank until they are broken down.

3. The liquid then flows through a pipe into a distribution box.

4. The distribution device directs the flow out into the drain field, which consists of underground pipes in shallow beds of gravel or soil.

5. The liquid flows through small holes in the drain field pipes and seeps into the gravel or soil, which filters more waste from the water and reduces harmful pathogens.

### Drain Field





## Septic System Risk Assessment

Use the table below to rate your risks related to your septic system usage and maintenance. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Then look to the appropriate section for tips.

### Assessment - Septic System Management

|                              | Low Risk  | Medium Risk   | High Risk  | Your Risk  |
|------------------------------|---|---|--|--|
| Septic tank location         | I keep a map with the exact location documented.  | I know the location of my septic tank, but it is not recorded.  | I do not know where my septic tank is located.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Drain field location         | The drain field is at least 100 feet from any well or surface water.  | The drain field is between 50 and 100 feet from a well or surface water.  | The drain field is less than 50 feet from a well or surface water.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Capacity                     | The tank is designed to handle more wastewater than is required based on the size of the home.  | Capacity just meets load requirements, but factors that would indicate the system is overloaded are watched for. Conservation measures are taken. | Bathrooms, bedrooms, or water-using appliances have been added without re-examining the system's capacity.                                 | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Age of septic system         | It is five years old or less.   | It is between six and 20 years old.   | It is more than 20 years old.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Tank pumping and maintenance | The septic tank is pumped regularly; it is pumped about every three to five years. Records are kept on all inspections and pumpings.      | The septic tank is pumped, but not regularly. Inspections are not done regularly, and record keeping is not consistent.                           | The septic tank has not been pumped. There is no record of the last inspection.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Drain field protection       | Vehicles and other heavy objects or activities are kept from the drain field area.  | Occasionally, the drain field is compacted by heavy objects or activities.  | Vehicles, livestock, heavy objects, or other disturbances are permitted in the drain field area.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Solid waste                  | There is no garbage disposal in the kitchen. No grease or coffee grounds are put down the drain. Only toilet tissue is put in the toilet. | There is moderate use of a garbage disposal, and some solids are disposed of down the drain.  | There is heavy use of a garbage disposal, and many solids are disposed of down the drain. Many paper products are flushed down the toilet. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Household chemicals          | No solvents, fuels, medications, or other hazardous chemicals are poured down the drain.  | Hazardous chemicals are poured down the drain.  | Strong cleaning chemicals and medications end up in wastewater.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



### Locating Your Septic System

Taking proper care of your septic system starts with knowing where it is. If your septic system's location is not in your home records, check with a previous homeowner or the local Health Department. Once you have located the septic tank, sketch a map of your house and yard. Make note of the distance from the septic tank opening to at least two permanent points (such as the corner of the house foundation or survey stakes on the property line). Keep this map on file along with other maintenance records, and if you sell the house, pass the map on to the new owners.

### Drain Field Location

To prevent contamination of water supplies, the drain field must be at least 100 feet from any source of domestic water supply, and at least 100 feet from the high water mark of any stream or lake. The greater the distance, the less the chance of contaminating the water supply. If your system is downhill from a well, the well will be better protected than if it is uphill. If your system is closer to your well than is recommended, you should test your well water for nitrates and bacteria more often than you would otherwise. For information on testing of well water, contact your county Health Department.

### Septic System Capacity

Both the septic tank and drain field should have enough capacity to treat all the wastewater generated in your house, even at times of peak use. Each state has procedures for calculating wastewater flow and the sizing of on-site treatment systems. In Arkansas, gallons per day are based on bedrooms - 1 bedroom 150 gallons; 2 bedrooms 270 gallons; 3 bedroom homes are assumed to consume 370 gallons; 4 bedroom is 450 gallons. Septic tanks are required to have a capacity of at least 1,000 gallons for a single family dwelling. Your system should be designed to handle your home's maximum occupancy. If you use more water than the system is designed for, wastewater will not be treated adequately, or the system will break down. You can reduce the size of the system you need by

installing low-flow toilets, low-flow shower heads, and water-saving faucets. You may need to expand the system if you add a bathroom, bedroom, or water-using appliance to your home.

### Age of Your System

Septic systems should last 15 to 40 years or longer, depending on how well they are designed for the site and how well they are maintained. The older your system, the more likely it is that it does not meet the latest standards. Even a relatively new system can fail if it is located in poor soil, is undersized, or is not properly installed or maintained.

### Tank Maintenance

Regular pumping is the most important thing you can do to maintain your septic system. As solids accumulate in the tank, particles are more likely to flow out of the tank and into the drain field. The best way to determine when to pump the tank is to have it inspected annually. A general rule is to have a septic tank pumped by a licensed pumper every three to five years, but how often a tank needs to be pumped depends on the:

Table 1. Recommended years between septic tank pumpings.

| Number of People in Your Household |      |      |     |     |     |     |
|------------------------------------|------|------|-----|-----|-----|-----|
| Tank size (gallons)                | 1    | 2    | 3   | 4   | 5   | 6   |
| 500                                | 5.8  | 2.6  | 1.5 | 1.0 | 0.7 | 0.4 |
| 1,000                              | 12.4 | 5.9  | 3.7 | 2.6 | 2.0 | 1.5 |
| 1,500                              | 18.9 | 9.1  | 5.9 | 4.2 | 3.3 | 2.6 |
| 2,000                              | 25.4 | 12.4 | 8.0 | 5.9 | 4.5 | 3.7 |

Source: Karen Mancl, *Septic Tank Maintenance* (AEX-740), Ohio Cooperative Extension Service, 1988.

- Size of the tank
- Amount of wastewater generated by your household
- Amount of solids carried in the wastewater.
- Age of the system

See Table 1 to help you gauge when your septic tank needs to be pumped.



### **Protecting Your Drain Field**

A septic system depends on good soil conditions for treatment and disposal of effluent, because water must be able to percolate through the soil at a reasonable rate. Compacted soil does not have enough oxygen for soil microbes to digest wastes efficiently. Another threat to the drain field and system is grease, especially if there is a break. To prevent soil compaction and damage to sewage system pipes, avoid:

- putting grease down the sink
- driving vehicles on the drain field
- construction over the drain field
- planting trees and shrubs with deep roots over or near the drain field.

### **Noticing Signs of Trouble**

If you have noticed foul odors in your home or in your yard, you may be having problems with your septic system. Other signs of septic system problems are:

- a slow or backed-up drain
- spongy ground
- lush plant growth near a drain field
- repeated intestinal illnesses in your family

You should respond quickly to any problems you observe, and you may need to modify your system to help avoid future problems. Remember, what may seem to be the least expensive option now may not be economical in the long run. Try to make your decisions based on lowering risks to your health and the environment.

### **Solid Wastes in Your System**

Your wastewater treatment system is not a substitute for the trash can or compost pile. You should dispose of tissues, diapers, baby wipes, sanitary napkins, tam-

pons, cigarette butts, dental floss, hair, and other solid waste along with regular garbage, not down the toilet. Since these materials do not break down easily, they will cause your septic tank or the settling tanks in a municipal treatment plant to fill up faster. Using a food grinder (garbage disposal) in the kitchen sink adds solids to your wastewater treatment system. Excess grease, fats, and coffee grounds can clog your system. Consider composting food waste and even some paper waste. Information from your local office of the Cooperative Extension Service can start you on your way to successful composting.

### **Household Chemicals and Septic Systems**

Wastewater treatment systems are not designed to neutralize a wide variety of household chemicals. Paints, solvents, acids, drain cleaners, oils, and pesticides can pass through your system and contaminate the groundwater. Pharmaceuticals and medications are not removed from the waste water and may contaminate groundwater. In addition, large volumes of water-soluble cleaners, bleach, and solvents that are designed to unclog your septic system can harm the septic tank microbes that break down solids and possibly contaminate your drinking water supply.

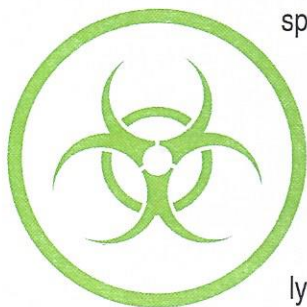
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Many of the products we use for housework or home improvements contain hazardous materials that can be harmful to the user or children in the house or may pollute the environment if not handled and stored properly.

These products give us more time to spend with our families and make our lives easier. We want to make sure these products are helpful to us and not harmful. To do this it is important to make sure they are used safely, stored properly and disposed of correctly.



Examine your activities that involve the use of hazardous products and make sure that you really need all the products you are purchasing. Carefully consider how to use the products safely, recycle or reuse them when possible. Dispose of used or remaining products in a way that will not pose a risk to surface water or groundwater. A few simple management principles apply in every situation.

### How Do You Know If a Product is Hazardous?

Read the label. If a product contains a hazardous substance, the front label must include a warning and a description of the hazard. The label will also include instructions for safe handling and use, the common or chemical name and first aid instructions.

### Remember T.R.I.C

A product is considered hazardous if it exhibits one or more of these properties:

- **Toxic** – capable of causing injury or death when swallowed, inhaled or absorbed through the skin. (Examples: insecticides, antifreeze, medicines)
- **Reactive** – is unstable and readily undergoes violent change; can react with air, water or other substances to explode or produce heat or toxic

gases. (Examples: ammunition, peroxide, chlorine bleach)

- **Ignitable** – easily set on fire; capable of burning rapidly or a product with a flash point of less than 140° F. (Examples: paint, solvents, gasoline, nail polish remover)
- **Corrosive** – burns skin on contact and is capable of dissolving or breaking down other substances, particularly metals; has a pH below 2 or above 12.5. (Examples: some cleaners, lye, car battery) Try to avoid products that contain these words if at all possible.

### Household Hazardous Waste Risk Assessment

Use the table below to rate your risks related to your management of household hazardous waste. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best. Then look to the appropriate section for tips. (See assessment table, next page)

When buying household products:

- Read labels. Make sure the product will do what you want and that you feel safe using it.
- Select the least hazardous product.
- Buy only what you need if the product is not safe to store.
- Use products with pumps, not aerosols.
- Select water-based products rather than solvent-based products.
- Use products in containers made from recycled materials and/or that can be recycled.
- Look for those with the fewest warnings and cautions. A warning that advises washing hands after using a product probably indicates the product is potentially less harmful than one that warns users to wear goggles while using. Although a disinfectant cannot be labeled green, a consumer can pick one without fragrance or one with a trigger spray rather than an aerosol.



## Assessment - Household Hazardous Products

|                                     | Low Risk   | Medium Risk  | High Risk  | Your Risk  |
|-------------------------------------|--|--|--|--|
| Household cleaners                  | Pay attention to warnings on labels before purchase and buy only what is needed. Try to dispose of these at a hazardous waste collection point.                    | Try to buy only what is needed. Dispose of these along with the regular trash. Stored in the most convenient place.  | Buy in larger quantities to save money. Pour out what is not used in yard or storm drain. Stored within reach of children.           | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Drain openers                       | Most often try to handle plugged drains with hot water, a plunger or a mechanical snake.   | Usually use drain cleaners. Purchase only what is needed. Always stored in original container.   | Try to keep a good supply of drain cleaner on hand. Purchase on the basis of the most powerful.                                      | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Paints and solvents                 | Only buy what is needed for the job. If there is any leftover, try to share it with a friend or take to be recycled.   | Try to use up the paint that is bought. If there is extra, store it in a safe area. Try to keep some solvents on hand, but they should be stored in a safe area. | Buy whatever size is cheapest. Store extra paint in the shed out back. Dispose of used solvents in the back yard or the storm drain. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Automotive waste                    | Oil drips and fluid spills are cleaned up. Stormwater runoff does not come in contact with dirty car parts and vehicle wastes                                      | Drips and spills are not cleaned up. Vehicle waste is left outside on paved areas.   | Used oil, antifreeze, and other wastes are dumped in a ditch or on the ground. Vehicle leaks are not repaired or cleaned up.         | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Handling pesticides and fertilizers | Spills are cleaned up immediately. Minimum amounts of chemicals are applied and in accordance with the label instructions. Applications are delayed to avoid rain. | Applications are not delayed to avoid rain.  | Spills are not cleaned up. Products are used in greater amounts than recommended.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Automotive washing                  | Cars and trucks are taken to a commercial car wash or spray booth.   | Cars and trucks are washed on a lawn or gravel drive.  | Cars and trucks are washed on a driveway, or other paved area.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| De-icing                            | Sand, road salts, and de-icers are not used to facilitate ice melt.  | Sand is used to de-ice driveways and sidewalks. Salts and fertilizers are not used.  | Fertilizers, salts, and sand are used to remove ice from driveways and sidewalks.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



- Seek those with third-party certification. Green Seal certified products and services can be found at [greenseal.org/findaproduct/index.cfm](http://greenseal.org/findaproduct/index.cfm). Products recognized by the Environmental Protection Agency's Design for the Environment Program are at [www.epa.gov/opptintr/dfe/pubs/projects/formulat/formpartc.htm](http://www.epa.gov/opptintr/dfe/pubs/projects/formulat/formpartc.htm). Consumers also can look for independently verified products at Consumer Reports' [www.GreenerChoices.org](http://www.GreenerChoices.org) under "Eco-labels center."

**Select less hazardous products whenever possible.**

- Never burn, dump or bury hazardous waste.
- Do not pour hazardous household waste into ditches, storm drains or gutters.
- DO RECYCLE products and containers whenever possible.

#### **While Using Hazardous Household Products:**

- Read and follow the directions.
- Wear protective clothing, if necessary.
- Make sure your work area is well ventilated.
- Seal products tightly before storage.
- Do not smoke, eat or drink when using these products.
- Be sure to warn children about the dangers of these products.

#### **If Products Must Be Stored:**

- Follow the directions for storage on the label.
- Protect the original label.
- Store hazardous household products in the original container.
- Keep metal containers dry to prevent corrosion.
- Store similar products together to reduce any danger from reactions if containers should leak or contents should spill.
- Store products away from children and pets.
- Store products away from any flammable materials or sources.

#### **When Disposing of Hazardous Household Products:**

- Do not mix products unless you are sure it is safe.
- Do not flush wastes down your sink or toilet.



#### **Keys to Reducing the Hazards of Household Products**

- Pay attention to warning labels when purchasing products. Select less hazardous products whenever possible.
- Use alternative products that are safer. Some of these may require a little more work than more hazardous products; however, they do not pose a disposal or storage problem like their more hazardous counterparts. A list of safer alternatives is included at the end of this section.
- Purchase only what you need or reasonably expect to use. It may not really be saving money to purchase the large quantity if it ends up just sitting around the house for long time periods.
- Be aware of the dangers of the products you purchase and store these products safely.
- Products should be stored in their original container.
- Try to use up the entire hazardous product purchased or give it to someone else who can use it. This eliminates the disposal problem altogether.
- If a product must be disposed of, do so according to label directions.

#### **Paints and Solvents**

The best method for managing paint, solvents and cleaning products is to use them up. To avoid wasting any of these products, buy only the quantity that you need. Store them in well-ventilated areas, away from children and pets.

#### **How Do You Store and Dispose of Your Paints and Solvents?**

The best way to use up old paint is to find a painting project or give it to someone who will use it. Store paint in



a dry place where it won't freeze. Paint generally is usable if it mixes well when stirred and hasn't been frozen and thawed repeatedly. Paint can be recycled or put on the reuse shelf at your local household hazardous waste collection center. Any paint that needs to be disposed of should first be dried out in a well-ventilated area away from children, pets, flames or anything that might spark. For small quantities of paint, remove the lid and let it dry in the can. For larger quantities, find other uses for the paint by contacting service agencies, such as Habitat for Humanity, or your original paint dealer. After the paint has dried, it may be put out with your household trash.

Disposing of solvents by dumping them on the ground or in a storm drain can allow the solvents to move into the groundwater. Always use solvents in a ventilated area. Store them in the original containers and out of the reach of children.

### **How Do You Dispose of Your Hazardous Household Products?**

Materials or products containing toxic or harmful substances should not be burned. It is illegal in the state of Arkansas to burn household garbage because of the potential air pollution. Burning can also contaminate the soil and water.

Household Hazardous Waste (HHW) collection centers and round ups provide a safe and environmentally sound means of disposal for certain unneeded household products. See [www.adeq.state.ar.us/solwaste/branch\\_recycling/hhwcc](http://www.adeq.state.ar.us/solwaste/branch_recycling/hhwcc) for a list of Arkansas household hazardous waste collection centers. Some facilities may require a fee.

The following items may be accepted:

- Automotive products (motor oils, oil filters, brake and transmission fluids and batteries)
- Paints, thinners, strippers
- Non-chlorinated solvents
- Household pesticides and herbicides (over-the-counter-products only)
- Fluorescent bulbs and ballasts
- Dry cell batteries
- Electronics

### **Automotive**

Following a rainstorm, oil stains on your driveway and outdoor spills of antifreeze, brake fluid, and other automotive fluids are easily carried away by water runoff. If you see an oily sheen on runoff from your driveway, it is a sure sign that you need to be more careful. Routine maintenance can prevent your car from leaking and help identify potential leaks. If you change your own oil, be careful to avoid spills and collect the waste oil for recycling. Used oil or other automotive fluid, if dumped down a storm drain or on the ground, may end up in your drinking water or the lake.

### **Safe Handling of Chemicals**

Safe storage of chemicals is very important, but so is safe handling. When mixing chemicals, try to do it in a confined area such as a washtub; this way any spills are contained. Be sure to read labels carefully before mixing chemicals together. If you spill chemicals, act quickly to contain them and clean up the spill.

### **Lawn and Garden**

The timing of the application of chemicals in yards, gardens, and landscapes is very important. Do not apply pesticides and chemicals if rain is expected within 24 hours. Besides being uneconomical, application just before rain almost guarantees pollutant runoff. Also, follow application rates for your soil, which should be listed on the product label. If you exceed recommended rates, the excess chemicals may run off. Contact your local office of the Cooperative Extension Service to learn about soil testing procedures and tests that are available.

### **De-icing**

While snow in Arkansas can be sporadic, some people will use road salt and other de-icers on their driveways and sidewalks. Road salt and de-icers eventually wash off paved surfaces and end up in the soil or water. Stormwater readily carries salt and chemicals into nearby estuaries and rivers. Salt harms wildlife and plants in high concentrations, so use as little salt as possible. Refrain from using fertilizers as de-icers; sand is a less toxic alternative. Chipping ice off pavement is an even better choice, although care must be taken not to damage the pavement surface.



## Cleaning Product Alternatives

Several types of cleaning jobs can be accomplished using safe products commonly found around the house. These include:

### **Linoleum Floor Cleaner** - vinegar and water

Mop with a mixture of ½ cup vinegar in a bucket of warm water. The vinegar odor will go away shortly after the floor dries.

**All-Purpose Cleaner** - ammonia and liquid detergent, water. Mix 2 tablespoons ammonia, 2 tablespoons liquid detergent, 1 quart water (Do not use liquid detergent with bleach added!)

**Drain Cleaner** - baking soda, vinegar, boiling water. This recipe will free minor clogs and helps prevent future clogs. Pour ½ cup of baking soda down the drain first, then ½ cup vinegar. Let it fizz for a few minutes. Then pour down a tea kettle full of boiling water. Repeat if needed. If the clog is stubborn, use a plunger. If very stubborn, use a mechanical snake.

**Oven Cleaner** - baking soda and water. Mix 1 cup of baking soda with just enough water to make a paste. Apply to oven surfaces, and let stand for a little while. Use the scouring pad for scrubbing most surfaces. A spatula or bread knife is effective to get under large food deposits. This recipe will require a little elbow grease, but it is not toxic to you or a child. Try spot cleaning your oven regularly. A dirty oven is less energy-efficient. Do not use this cleaner on self-cleaning ovens.

**Tub and Sink Cleaner** - baking soda, liquid castile soap. You can use baking soda in place of your scouring powder. Sprinkle it on porcelain fixtures and rub with a wet rag. Add a little soap to the rag for more cleaning power. Rinse well to avoid leaving a hazy film.

**Toilet Bowl Cleaner** - baking soda, liquid castile soap. Sprinkle baking soda inside the bowl as you would any scouring powder. Squeeze a couple of drops of soap in also. Scrub with a toilet bowl brush and finish outside surfaces with a rag sprinkled with baking soda.

**Window and Mirror Cleaner** - Vinegar and water, or lemon juice and water. Put ¼ cup vinegar in a spray bottle and fill to top with water. Spray on surface. Rub with a cloth diaper, other lint-free rag or sheets of newspaper. For outdoor windows use a sponge and wash with warm water with a few drops of liquid castile soap in it. Rinse well and squeegee dry.

### **Stain Removers**

- Perspiration stains from cloth. White vinegar, lemon juice and water.
- Cola and chocolate stains from cloth. Soak in club soda.
- Blood stains from clothes – hydrogen peroxide.
- Pet stains, non-oily stains from carpet. White vinegar.
- Soot stains, black heel marks - baking soda
- Rust stains - cover spot with salt or baking soda, then rub with peeled potato.

### **Other Alternatives**

- Club soda - Use as wax remover, chrome and floor polish remover.
- Toothpaste - Use to remove crayon marks or to remove discoloration around tub and sink fixtures.
- White vinegar - Removes adhesives (decals in tubs, stick-on hooks, price tags, wall hangers) from glass, wood, china and windshields. Use as final laundry rinse and fluff. Use as lime and mineral remover.

This chapter was written by Elaine Andrews, University of Wisconsin Cooperative Extension Service; Wilma S. Hammett, Deana L. Osmond and Janet Young, North Carolina Cooperative Extension Service. It was adapted for Urban Home\*A\*Syst by John Gunsaulis, University of Arkansas Division of Agriculture Cooperative Extension Service. Materials updated by Trish Ouei, University of Arkansas Division of Agriculture Cooperative Extension Service.



Recreational boating provides relaxation and enjoyment for thousands of local residents. With so many enthusiasts enjoying our shoreline, rivers and lakes, boat and personal watercraft owners play a major role in water quality along the coast. By understanding the potential impacts of boating practices, you can ensure that the waters we all depend on will not be damaged.

This chapter examines boating-related activities and what you can do to minimize possible harm to the environment. The following topics will be covered:

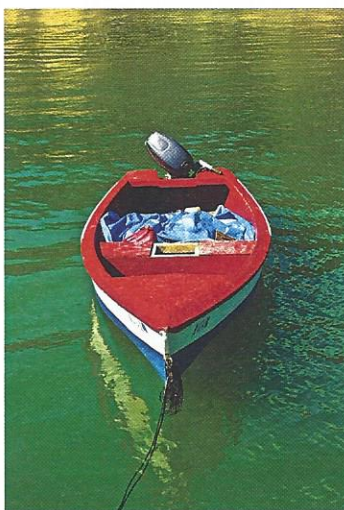
- Boat cleaning and maintenance.
- Spill prevention and waste disposal.
- Dock construction and maintenance.

By completing this chapter, you'll learn to identify, evaluate and reduce the pollution risks your boating practices may cause.

### What are the Environmental Concerns?

Boating- and marine-related activities can have a profound effect on local environmental quality. While individual boats usually release only small amounts of pollutants, when multiplied by thousands of boaters, docks and marinas, these pollutants can cause measurable water quality problems in lakes, rivers and coastal waters.

Products used to wash boat hulls and decks often contain toxic ingredients such as chlorine, phosphates and ammonia. Likewise, wood preservatives, stains, antifouling paints and strippers are used regularly without regard to potential environmental hazards. Individuals often



Good boating practices safeguard water resources for all citizens

clean or repair their boats in driveways, streets and parking lots where there is no drainage control and contaminated discharge typically lead directly to local surface water bodies.

Discarded trash in the water is not only unsightly; it can kill and injure aquatic life. Federal law prohibits boats from discharging plastics, or garbage that contains plastics, into any waters. Nevertheless, this type of debris commonly finds its way into our coastal waters at alarming levels.

The physical alteration of shoreline, wetlands and aquatic habitat during the construction of a private dock can be considerable. If docks are improperly sited or built, there can be significant erosion problems as a result of lost or destroyed vegetation. In addition, the pilings and decking are often made of lumber that is treated with pesticides and other preservatives. While this wood material is largely safe if treated properly, it should still be handled and disposed of with caution.



## Risk Assessment: Boat Cleaning & Maintenance

Use the table below to rate your risks related to the boat cleaning and maintenance practices you use. For each question, check your risk level in the right-hand column. Some choices may not be exactly like your situation, so choose the response that fits best.

### Assessment - Boat & Dock Maintenance

|                         | Low Risk   | Medium Risk   | High Risk  | Your Risk  |
|-------------------------|--|---|--|--|
| Cleaning products       | I use only water to clean my hull and deck. I rinse the boat after every trip and use a lot of elbow grease instead of harsh cleansers.          | I use only marine detergents or alternative cleaners to clean my hull and deck.   | I use whatever cleaning agent is handy, regardless of whether it is meant for use in the marine environment. I never rinse my boat.                                  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Cleaning location       | I take my boat to a self-service car wash after each trip so my runoff will be collected and treated or recycled.                                | I pull my boat trailer into the yard when I wash it off so most of the runoff will percolate into the soil.   | I wash my boat in the street or in my driveway where my runoff will likely find its way into a nearby surface water body.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Hull maintenance        | I take my boat to a licensed boatyard when the hull needs painting or scraping.  | I take on small or moderate painting and scraping jobs at my house. I use a tarp under the boat to catch debris and wear protective clothing. I use a containment bag and properly dispose of or recycle waste. | I never follow label instructions and take no precautions — even when recommended. I don't use drip pans or recycle left-over products.                              | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Wood & trim maintenance | I use covers for my exposed wooden components. I enjoy the look of weathered wood and use only salt water to rinse away the dirt and grime.      | I use wood cleaners and soaps sparingly, avoiding solvents and varnishes. If I must use a cleaner I apply with a sponge or soft cloth.  | I frequently use harsh wood cleaners and varnishes. I also use steel wool to prepare the wood surface for application. I rinse my tools in the water after I finish. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Engine maintenance      | I always keep my engine finely tuned. I use only cleaner-burning TC-W3 oil mixed to the correct ratio. I always capture and recycle my used oil. | I tune up my engine every couple of years. I use whatever oil is on sale, recycling when it's convenient.   | I never tune up my engine. I use the cheapest oil available. I mix my oil to burn rich because I've been told that will make my engine last longer.                  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |

Your goal is to lower your boat cleaning and maintenance risks and reduce potential harm to the environment. Review the sections below for the medium-and high-risk practices you identified. Use the recommendations to help you plan actions to reduce your risks.



## Boat Cleaning and Maintenance

Most boat owners want a clean and healthy environment in which to enjoy the full recreational potential of our lake waters. Preventing pollution can be as simple as using good maintenance practices and less caustic or toxic products. Look over the topics below, and read those that will help you better understand your boating practices and habits.

| Boat cleaning alternatives |  |
|----------------------------|--|
| Instead of ...             | Try this ...   |
| Bleach                     | Borax or hydrogen peroxide   |
| Detergent and soap         | Vegetable- or citrus-based soaps, plenty of elbow grease   |
| Scouring powder            | Baking soda  |
| Floor cleaner              | 1 cup white vinegar in 2 gallons water   |
| Window cleaner             | 1 cup white vinegar in 1 quart warm water, rinse and squeegee  |
| General cleanser           | Baking soda and vinegar; lemon juice combined with borax paste   |
| Head cleaner               | Pour in baking soda and brush  |
| Shower cleaner             | Wet surface, sprinkle on baking soda. Scrub with scouring brush  |
| Aluminum cleaner           | 2 tablespoons cream of tartar in 1 quart water   |
| Brass cleaner              | Worcestershire sauce or paste made with equal parts salt, vinegar and water; rinse thoroughly                  |
| Copper cleaner             | Lemon juice and salt   |
| Chrome cleaner/polish      | Apple cider vinegar to clean, bay oil to polish  |
| Fiberglass stain remover   | Baking soda toothpaste   |
| Drain opener               | Use boiling water or plumber's snake or disassemble; toxic substances should not be used in through-hull drain |
| Mildew remover             | Paste using equal parts of either lemon juice and salt or vinegar and salt.                                    |
| Wood Polish                | Almond or olive oil. (Interior wood only)  |

### Washing the Hull and Deck

Many of the products that we use every day in our homes are perfectly safe in that environment. On our boats however, where cleaners can be discharged directly into the water without any treatment, the same products can be lethal to marine life.

Grease-cutting detergents, scouring powders and bleaches clean very well, but these products are toxic to marine organisms and threaten water quality.

Fortunately, there are many alternative products and practices designed specifically for boaters that are less harmful.

To lessen the impact of cleaning your boat, scrub and rinse the deck and hull with fresh water after every trip. Remember, the safest cleaning product available is good, old-fashioned elbow grease!

If fresh water won't do the job, then take advantage of alternative cleansers. Don't use products that contain ammonia, sodium, chlorinated solvents, petroleum distillates or lye.

Use these cleaning agents conservatively rather than dousing the deck with soap. Apply small amounts with a cloth and wipe it up rather than hosing it off after each application. When you need a hose, use a



squeeze nozzle that shuts off when released to conserve water and minimize runoff.

If you must clean your boat at home, park the boat in the yard so excess water will seep into the ground instead of running off your property into a stormdrain. Always think about where you are going to clean your boat. Is it wise to clean it off beside the boat ramp? How about in your driveway or the street? Don't forget that runoff in both cases will find its way directly into a nearby surface water body. If possible, park your trailer in the grass or other permeable area where excess water will have a chance to seep into the ground and be filtered by the soil.

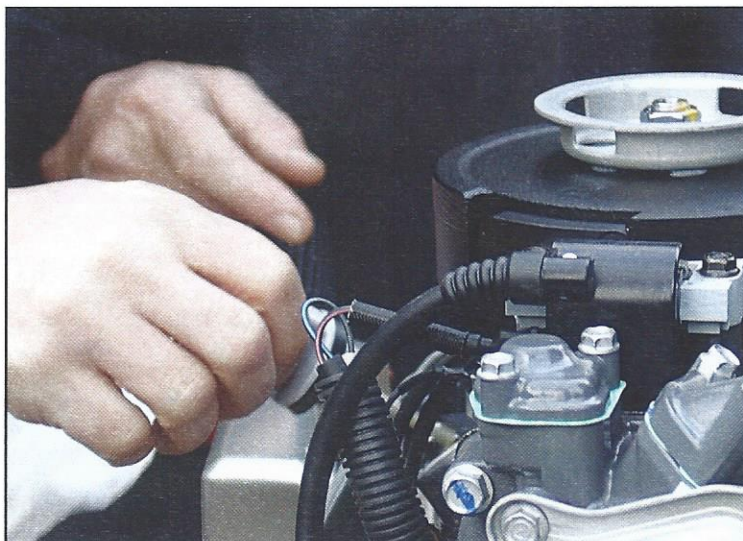
### **Sensible Boat Sanding and Painting**

Sanding and painting can be messy tasks, and if certain precautions are not taken, these chores can also create an environmental mess. You may want to consider using a licensed boatyard or contractor to under-

take the types of repair that include paints, varnishes and epoxies. These commercial facilities are equipped to control air emissions while painting, collect and treat debris from hull cleaning, and recycle or properly dispose of all types of haz-

ardous wastes. In other words, they take the headache of repair away from you! If you are a die-hard do-it-yourselfer, or for small to moderate projects, there are several precautions you should take to keep toxics and debris out of coastal waters.

First, always plan for maintenance so that it's done all at once when your boat is out of the water. Save difficult jobs until the winter, when most of us haul boats out for at least a month or two.



Before you start sanding or painting, cover the area between the boat and the ground with a plastic sheet or tarp to catch debris. This simple practice will collect much or all of the fine particles that result from your maintenance practices. In addition, if you are painting your boat yourself, wear appropriate protective clothing such as a hat, gloves and safety glasses. Invest in a high-quality respirator, not a dust mask. If you can smell and taste a solvent, stop what you're doing and take a break.

Never sand in a heavy breeze when the particles could become airborne and inhaled or deposited directly into water. Use sanding equipment with a dust containment bag, sweeping up residual sanding dust and disposing of it in the trash.

Marine paints come in two basic forms: water-based and oil-based. Water-based paints are generally considered less dangerous than oil-based paints, which

contain cancer-causing solvents that, if inhaled, ingested, or absorbed through the skin, can affect your health.

### **When Painting Your Deck or Hull**

- Buy only enough paint for the job. Mix your paint on land, avoiding spills and drips.
- Use pans or containment trays to catch drips and spills.
- Seal containers tightly when not in use and store

in a cool, dry location that is not accessible to children.

- Reuse paints, varnishes and solvents whenever possible. Toxic products should be disposed at a hazardous waste collection facility.
- Donate leftover paints to fellow boaters.

### **Exterior Wood and Trim**

Wooden parts and gear have been part of boating for years. Even though many boats are now manufactured using aluminum or fiberglass, there are still companies



that routinely construct boats with wooden components.

To minimize the use and harmful impacts of varnishes, consider having covers made for exposed wooden parts such as teak railings or hatches. While the initial investment may seem costly, you will save money on routine wood refinishing. You can also feel good about supporting a local marine business and protecting the environment!

Many people love the look of bleached teak decks and trim. However, wood cleaners used to restore the bleached look are mostly acid-based products that are very hazardous to the aquatic environment. In addition, regular application of wood cleaners can wear away the grain and damage seam compounds. Here are some alternatives to bleaching wood:

- Allow wood to fade to gray. Rinse with fresh water occasionally to remove excess dirt and grime.
- Use teak cleaners and soaps sparingly, avoiding solvents or varnishes.
- If you oil your teak trim, minimize or eliminate caustic cleaners before applying the oil.
- If you must use cleaners or solvents, apply with a cloth or sponge rather than more abrasive steel or copper wool.

### Engine Maintenance

Always keep your engine tuned up. Using only cleaner-burning TC-W3 oil. Capture and recycle any used oil.

Maintaining your outboard or inboard engine can pose some special problems, mostly due to the materials involved, such as oil, grease, transmission fluid and antifreeze. Oil can be a particular problem, since a single quart, when spilled, can pollute an area of up to 2 acres, equivalent to nearly three football fields of water surface.

Performing routine maintenance will improve boat and engine operation while protecting the environment. The basic rule to follow is keep your engine well-tuned. It will use fuel more efficiently, reduce fuel consumption and last longer. It will also discharge fewer pollutants into the water.

### Tips for Routine Engine Maintenance – from “Your Boat and Your Bay” Chesapeake Bay Foundation 1999

- Follow the manufacturer’s recommended maintenance schedule.
- When changing your oil, wipe up spills immediately and be extremely careful to catch all used oil in a container for onshore recycling.
- For inboard engines, place a bilge “pillow” (an oil-absorbing sponge available at many marine stores) in your bilge to remove oil from your bilge water. Then the oil won’t be pumped over-board by your bilge pump.
- For outboards, use the premium TC-W3 oil recommended by your engine’s manufacturer. Premium TC-W3 oils contain more detergents and burn cleaner than the older Type TC-W2 oils.
- If your engine does not have oil injection of any sort, carefully measure the oil you mix with your gasoline. Remember that too much oil in the gasoline means inefficient burning. Too little oil can cause significant engine damage.
- Prepare engines properly for winter storage. Good care at the end of the season can keep your outboard running well. Consider using a good professional service to winterize your engine or learn to do the job yourself.
- Inspect your rubber fuel lines regularly. The alcohol content of unleaded fuels has a tendency to deteriorate fuel line hoses, sometimes in a matter of months. Should signs of deterioration be evident (dry, cracked, or soft and mushy spots) replace them immediately with any hose marked “USCHG type A.”
- Use enzyme-based bilge cleaners, which are nonpolluting and also very effective. Drain old antifreeze into a container for onshore recycling. When you recycle, be sure you don’t mix propylene glycol and ethylene glycol types of antifreeze. Where possible, use less toxic propylene glycol, rather than traditional ethylene glycol antifreeze. Make sure you check the manufacturer’s specifications to see if propylene glycol can be used in your engine. Consider installing an in-line fuel/air separator on each tank. These devices prevent fuel from escaping out the vent holes but let air in.



## Assessment - Spill Prevention & Waste Disposal

Your goal is to lower your spill and waste risks and reduce potential harm to the environment. Review the sections below for the medium-and high-risk practices you identified. Use the recommendations to help you plan actions to reduce your risks.

### Assessment - Spill Prevention & Waste Disposal

|             | Low Risk   | Medium Risk  | High Risk  | Your Risk  |
|-------------|--|--|--|--|
| Fueling     | I always fill my gas tank at the local filling station, never refueling while on the water. I have a "whistle" installed in the line to warn me when my tank is getting full. I never leave the nozzle unattended. | I try not to overfill the gas tank, but when I do, I clean up spills using absorbent pads. I seldom use marina gas stations.                                   | I always try to get as much gas in my boat as possible, whether I am at a marina or at my local station. When the gas comes shooting out my vent, I know I've got enough.                    | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Bilge water | I maintain my engine very carefully, always checking hoses and connections for any sign of a leak. If I see an oil sheen in my bilge, I use a commercial pumpout service to clean it out.                          | When I see oil in my bilge, I stop the pump and use the absorbent pads I keep on board to soak it up. I dispose of these used pads at a local recycling center | If I notice an oily sheen in my bilge, I use the pump to get it overboard. I don't keep absorbent pads on board, but I do use a liquid detergent to eliminate oil in the bilge if I see any. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Head sewage | I never discharge any sewage into the water. I always use pumpout facilities, which are provided at many local marinas. I ensure that my MSD is functioning properly before each outing.                           | I only discharge treated sewage into coastal waters, and only when my holding tank is full. I use a pumpout station when it's convenient.                      | I discharge my sewage at the end of each outing before returning to the dock or ramp. I don't like using pumpout stations because they are costly and dirty.                                 | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Fish waste  | I only clean fish at designated fish-cleaning stations, with trash cans and wastewater treatment. If a station is not around, I bag the waste and throw it away at home.   |  | I always clean my fish at the boat ramp, disposing of the waste in the water.  | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



Large oil spills, such as the wreck of the Exxon Valdez in Alaska and the deep sea drilling rig explosion in the Gulf of Mexico, receive most of the public's attention. However, according to recent studies, these large spills account for only 10 percent of all the oil that ends up in the water each year. The other 90 percent comes from polluted urban runoff and other nonpoint sources, such as improperly disposed used oil, bilge water, outboard motors and careless fueling habits.

Likewise, disposal of waste is a serious issue. Human sewage discharged from boats can contain disease-causing organisms that harm marine animals and plants. Plastics and trash are often mistaken for food by marine life resulting in starvation or poisoning.

### Fueling Your Boat

Most recreational boaters fuel their boats on the back of their trailers at a local gas station. Since there is no surface water under the boat and there are safeguards in place to minimize the impacts of small spills, the risk of environmental damage is minor.

In the water however, filling the fuel tank often means waiting for the gas to spurt out the overflow vent. It doesn't take a genius to figure out where that extra fuel is going.

Following a few simple steps will go a long way toward eliminating this common problem:

- Never leave the fuel nozzle unattended. While fueling your boat, never leave the hose unattended.
- Don't overfill your tank. Know your tank's capacity and learn to gauge the amount of fuel you need.
- Fill slowly. Many marine filling stations are not equipped with nozzles that automatically shut off with backpressure. By slowing down, you can prevent that

accidental spill and still top off your tanks.

- Keep absorbent pads handy when fueling. Wipe up any accidental spills immediately, whether they occur at the vent outlet or the nozzle. Dispose of the soiled rags properly by giving them to the marina operator or placing them in a sealed container.
- Consider installing an in-line fuel/air separator. The devices are cheap — about \$75 — and they prevent the fuel from escaping out the vent hole, while letting the air in.

### Bilge Water

Nearly all boaters have encountered an oily sheen in their bilge water. Oil leaks from numerous lubricated parts of an engine and mixes with water entering the bilge.

How do we dispose of this polluted water?

The best advice involves prevention. As covered in the previous maintenance section, fix those small leaks that allow oil to drip into the bilge. Take a few minutes before you change the oil to ensure the proper capture and cleanup of all the fluids. Always keep an aluminum or plastic tray in the bilge as a containment device.

Once oil has seeped into the bilge, use oil-absorbent pads to capture the surface oil before pumping the water over. If too much is leaking to be contained by absorbent pads, consider the use of a bilge pumpout service. Check the phone book or contact a local marina for the service nearest you.





Under no circumstances should you ever add liquid detergents to bilge water. These chemicals only disperse the oil and can foul bilge pumps and absorbent pads.

Disposal of waste is a serious issue. Human sewage discharged from boats can contain disease-causing organisms that harm marine animals and plants.

### Head Sewage

Probably no issue draws the attention of regulatory agencies and environmental groups to boaters more quickly than the illegal dumping of raw sewage. The untreated sewage discharge from a single weekend



boater can put the same amount of bacterial pollution into the water as does sewage from 10,000 people whose waste has passed through a municipal treatment facility.

Boaters should attempt to achieve zero discharge of all sewage into recreational waters. While on the boat, human waste should be contained in a U.S. Coast Guard-approved marine sanitation device (MSD). Upon returning to shore, portable toilets should be emptied into approved shoreside waste handling facilities, and MSDs should be discharged into approved pumpout stations.

Whether you know it or not, each of us is already helping to promote proper sewage discharge. Every time you purchase motorboat fuel and fishing equipment, part of the money is contributed to a fund set aside by the Sportfish Restoration Act and the United States Clean Vessel Act. This fund provides states money for the construction, renovation, operation and maintenance of pump-out stations and waste reception facilities for boaters. Be proud of your role!

### Plastics and Trash

Today, most folks would not consider throwing their trash — plastic, nets, fishing line, six-pack rings, styrofoam and so forth — overboard. Yet every year, tons of debris makes its way into our waters.

Often unintentionally, boaters contribute to the problem. Empty ice bags and six-pack rings are blown out of the boat. Fishing line is too tangled to save so it gets tossed into the water. Cigarette butts are often not even considered trash, and casually flicked overboard.

The following recommendations are pretty straightforward:

- Be careful. Accidents and spills happen even when you have the best of intentions.
- Leave as much plastic ashore as is reasonably possible. That way there is no chance of it falling overboard.
- Carry a trash bag. If you put all of your trash in one place, it's easy to contain and dispose of when you get back to shore.
- Recycle where possible. Deposit your glass,

aluminum, plastic and newspapers in appropriately marked containers at marinas or other recycling centers.

### What Else Can I Do to Help?

- Equip your boat with a long-handled net and a trash bag, and put them to use — every time.
- Organize a one-day cleanup of your local waters. Encourage participation from your fishing group, civic group or even local boy/girl scout troops or 4-H clubs.



## Fish Wastes

When you've had a great day out catching fish, do you ever give any thought to where and how you clean them? You should!

The amount of fish waste (heads, scales and guts) disposed close to a marina or shore, can exceed what would exist naturally in the water. In small quantities, this fish waste is fed upon by such scavenging organisms such as catfish.

However, in large amounts where water circulation is restricted, decomposition of this fish waste can sig-

nificantly affect the water quality by lowering the dissolved oxygen levels and even spreading disease among native fish populations. This can be a problem in marinas or near boat landings where fish are cleaned and water is not flushed adequately.

Cleaning and gutting fish at a fish-cleaning station with trash receptacles and wastewater hookups easily solves any potential problems. If one of these stations is not convenient, bag your fish waste and throw it away with your other household garbage.

## Dock Construction and Maintenance

One of the many advantages to living on the lake is

### Assessment - Dock Construction & Maintenance

|                   | Low Risk   | Medium Risk  | High Risk   | Your Risk  |
|-------------------|--|--|---|--|
| Deck construction | I will use a licensed marine contractor to construct my dock. I will examine the plans, specs and permits for their compliance with state regulations.             | I will apply for the dock permit myself. I will construct the dock in a location that minimizes erosion.   | I will not apply for a dock permit. I will build the dock without regard for localized erosion.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Material          | I will insist on the use of recycled plastic lumber.   | I will use pressure-treated lumber that has been properly labeled and is free of visible residue.  | I will use whatever lumber is the cheapest and most readily available, giving no thought to the chemicals used.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Product selection | I will use whatever lumber is the cheapest and most readily available, giving no thought to the chemicals used.  | When I clean or seal my dock, I use commercially available products. I always read the label for warnings about potential harm when used around water and purchase only environmentally safe alternatives. | I always use whatever is on sale to clean my dock. I never pay attention to the chemicals inside.   | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |
| Application       | When applying sealer to my dock, I always work on a sunny day with no wind. I use a tarp under my bucket to catch drips and only use a small amount of the sealer. | When I apply sealer, I try to avoid spills and drips. I rinse my equipment out in the lawn, away from the dock.  | I always use a sprayer when I apply sealer to my dock, giving little consideration to how windy it is. I use a large amount of sealer. When I finish, I rinse the sprayer out in the creek. | <input type="checkbox"/> Low<br><input type="checkbox"/> Medium<br><input type="checkbox"/> High |



quick and easy access to water. Those who enjoy boating and other water related recreational opportunities, and also own waterfront property, often want a dock or boat slip to improve this access.

If you plan to repair the one you already own, there are choices you will make that affect the environment.



Are you going to use a marine contractor or do the work yourself? What kind of wood will be used for the pilings and decking? Have you made considerations for potential erosion problems?

### **Getting the Proper Permits**

Before any dock construction can begin by either you or a contractor, a permit must be acquired from the Corps of Engineers.

The permit application is a straightforward document explaining the requirements and information that must be submitted to Corps of Engineers. In most cases an administrative fee is required as part of the permitting process. The fee is \$30 for five years for private docks.

### **Choosing a Marine Contractor**

Choosing your marine contractor and or dock builder can be more important than any other contractor you may need. Why? Because the marine construction industry is largely unregulated. Blue prints, stamped by a professional engineer, must be submitted and

requirements must be met.

Nobody checks the work of the contractor during the building process, but final approval to make sure that standards have been met must be done by the Corps of Engineers.

Go look at the work of any marine contractor/dock builder you consider for your project and "ask around" about their reputation. Call the Better Business Bureau to see if there are any complaints registered against the company.

Also, make sure the contractor specifies what type of wood will be used for each of the dock components. Are they going to use regular or marine-grade pressure treated lumber? What is the pile length and how will they be seated? What are the dimensions of the decking lumber? Will they use galvanized nails or lag screws? The contractor

you select should spell out all of this detail and more.

### **What Type of Material Will You Use?**

To ensure structural soundness and long service life for docks, wood should be protected from attack by insects or microorganisms and by decay from fungi. Pressure treatment offers a long-lasting and generally environmentally safe alternative.

In pressure treatment, chemical preservatives are forced deep into the cellular structure of the wood in a closed cylinder under pressure. This process enables the preserved wood to maintain a chemical barrier against insects and decay for long periods of time. The fact that preservatives are bound so effectively into the lumber means less is available to seep or leach into water.

There are three basic types of wood preservatives: waterborne, oilborne and creosote. Only the waterborne chemicals are generally used in pressure-treated wood products intended for residential uses. These products are generally available at your neighborhood



home improvement centers.

Oilborne preservatives, such as creosote, are now used primarily for commercial applications, such as timbers for railroad ties, bridges and wood used in marine structures such as bulkheads and seawalls.

Pressure-treated wood has not been listed as hazardous waste. In many cases, the wood can be reused in its original form or used in secondary applications such as fence posts, landscaping or other projects. Treated wood should not be burned in fireplaces, stoves or other nonpermitted units because toxic residue may be produced as part of the smoke or ashes.

Board dimensions are also very important. 2" x 8" boards are much stronger than 2" x 6" boards when used for stringers. Make sure you know the dimensions and treatment levels for the boards to be used on your project.

#### **Pressure-treated Wood Application and Retention Table for CCA Alternatives to Wood**

| Retention (lbs/ft <sup>3</sup> ) | Product Application       |
|----------------------------------|---------------------------|
| 0.25                             | Above Ground              |
| 0.40                             | Ground Contact            |
| 0.60                             | Permanent Wood Foundation |

Recycled plastic lumber is gaining popularity among marine contractors and environmentally conscious homeowners. Plastic lumber is more expensive than regular or marine grade pressure-treated lumber, but it is virtually maintenance-free and many companies provide a lifetime warranty on the materials.

Plastic lumber means you'll never have to worry about the effects of water or moisture damage. It is impervious to marine borer worms, insects, water and chemicals. It is solid, nonporous, and will not leach any chemicals into the water. Another positive point is that most of this type of lumber is made from 100-percent recycled plastic material. Your purchase and use of these products closes the recycling loop!

Working with plastic lumber is the same as regular lumber and requires only standard wood-working tools and fasteners. Several floating even fixed docks can be shipped completely or in kit form with all the hardware you need. Talk with your dock builder or do some research yourself to find the best deals.

#### **Repairing and Maintaining Your Dock**

For too many people who own or take care of docks, it seems like repair and maintenance is an annual chore. Although pressure-treated wood resists insects and decay, it's still vulnerable to moisture and the sun's rays.

While nailing loose deck boards, replacing rusted or worn framing bolts and fasteners, and inspecting electrical or water lines are all necessary practices, we are going to focus on the maintenance of the wood itself.

Before you go out and purchase any cleaning products, remember that a hard bristle brush with a long handle (to save your back), a bucket of water and an afternoon of elbow grease will often clean your dock as well or better than commercial products. In addition, you have the added benefit of knowing that if you tipped your bucket over, no harmful chemicals would spill into the water around your dock!

Proper care and maintenance of your dock will ensure long years of enjoyment and clean water quality.

There are a wide variety of products available to help you maintain the structural integrity and look of your dock's wood. New wood treatment protects brand new lumber from sun and rain, deck cleaner can help with dirty and graying docks, and a clear wood preservative will revive the beauty of your weathered dock while protecting against the elements. Before you use any of these products, ALWAYS read the label before you begin. Many oil-based wood maintenance products are very harmful to water quality if they are spilled or applied improperly.



The following tips will help you properly apply wood-care products to your dock:

- Remove all loose dirt and debris before you apply wood-care products.
- Try to work on a day with light or no wind.
- Always use a tarp or ground cloth under your project to help prevent drips and spills.
- Use a brush or roller when applying the sealer to minimize dripping. Don't use a sprayer because the

excess will find its way into the water around your dock.

- Use as little of the product as it takes to completely cover the decking, avoiding drips.
- Rinse and clean tools in the yard, well away from any surface water.



# LakeSmart Regional Resources

## Agencies and Services

### Arkansas Department of Environmental Quality

[www.adeq.state.ar.us](http://www.adeq.state.ar.us)  
5301 Northshore Drive  
North Little Rock, AR  
72118-5317  
(501) 682-0744

### Arkansas Department of Health

[www.healthy.arkansas.gov](http://www.healthy.arkansas.gov)  
Benton County  
1200 W. Walnut, Suite 2200  
(479) 986-1358

Rogers, AR 72756  
(479) 271-1055

Benton County (Siloam Springs)  
221 North Maxwell  
Siloam Springs, AR 72761  
(479) 549-3794

Carroll County  
402 Hailey Road  
Berryville, AR 72616  
(870) 423-2923

Madison County  
709 North College  
Huntsville, AR 72740  
(479) 738-2612

Washington County  
3270 Wimberly Drive  
Fayetteville, AR 72703  
(479) 521-8181

### Arkansas Forestry Commission (District 7)

[www.forestry.state.ar.us](http://www.forestry.state.ar.us)  
Benton County  
11600 Short Road  
Bentonville, AR 72712

(479) 789-2266

Carroll County  
1105 CR 207  
Eureka Springs, AR 72632  
(479) 253-5005

Madison County  
911 Crossbow Road  
Huntsville, AR 72740  
(479) 738-2037

Washington County  
2752 N. Garland Ave.  
Fayetteville, AR 72704  
(479) 587-1442

### Arkansas Game & Fish Commission

[www.agfc.com](http://www.agfc.com)  
2 Natural Resources Drive  
Little Rock, AR 72205  
(501) 223-6300 or (800) 364-4263

Northwest Office  
455 Dam Site Road  
Eureka Springs, AR 72631  
(479) 253-2506

### Arkansas Poison Hotline

University of Arkansas for Medical  
Sciences Poison Control Center  
(800) 222-1222

### Arkansas Water Well Drilling Commission

[www.accessarkansas.org/awwcc](http://www.accessarkansas.org/awwcc)  
101 East Capitol, Suite 350  
Little Rock, Arkansas 72201  
(501) 682-3900

### Benton County Solid Waste District

[www.bcswd.com](http://www.bcswd.com)  
5702 Brookside Rd

Bentonville AR 72712  
(479) 795-0751

### Boston Mountain Solid Waste District

[www.bmswd.com](http://www.bmswd.com)  
11398 Bond Rd.  
Prairie Grove, AR 72753  
(479) 846-3005 or (888) 426-9278

### Madison County Solid Waste and Recycling Center

[www.madisoncounty.net/~recycle](http://www.madisoncounty.net/~recycle)  
173 Madison 6553  
Huntsville, AR 72740  
479-738-6351

### Natural Resources Conservation Service

[www.nrcs.usda.gov](http://www.nrcs.usda.gov)  
Benton County  
1401 NE McClain Rd  
Bentonville, AR 72712  
(479) 273-2622

Carroll County  
909A Freeman Switch Rd  
Berryville, AR 72616-4608  
(870) 423-2638

Madison County  
479 N. Parrott  
Huntsville, AR 72740  
(479) 738-6321

Washington County  
2898 N Point Cir #2  
Fayetteville, AR 72704-6809  
(479) 521-4520



**University of Arkansas System  
Division of Agriculture  
Cooperative Extension Service**  
www.uaex.edu  
Benton County  
1204 SW 14th Street  
Bentonville, AR 72712  
(479) 271-1060

Carroll County  
909-B Freeman Switch Road  
Berryville AR 72616  
(870) 423-2958

Madison County  
222 North Gaskill, Box 370  
Huntsville, AR 72740  
(479) 738-6826

Washington County  
2536 N McConnell Ave  
Fayetteville, AR 72704  
(479) 444-1755

**Washington County  
Environmental Affairs**  
www.co.washington.ar.us/EnvironmentalAffairs  
2615 Brink Drive  
Fayetteville, AR 72701  
(479) 444-1725

**US Army Corps of Engineers  
Beaver Lake Project**  
2260 N. 2nd Street  
Rogers, AR 72756  
(479) 636-1210

## **Organizations and Businesses**

**American Society of Landscape  
Architects  
Arkansas Chapter**  
www.arasla.org  
P.O. Box 3343  
Fayetteville, AR 72702  
(479) 575-4907

**Arkansas Irrigation Association**  
Mary Beth Rogers  
PO Box 185  
Bryant, AR 72089  
(501) 847-9534  
golfsecretary@att.net

**Association for Beaver Lake  
Environment (ABLE)**  
http://able-ark.org  
P.O. Box 1375,  
Rogers, AR 72757

**Beaver Water District**  
www.bwdh2o.org  
301 North Primrose Road  
Lowell, AR 72745  
(479) 756-3651

Hickory Creek Marina  
Lowell, AR  
(479) 751-7366

Holiday Island Marina  
Eureka Springs, AR.  
(479) 253-8300

Horseshoe Bend Marina  
Rogers, AR. 72756  
(479) 925-1545

Lost Bridge Marina  
Garfield, AR  
(479) 359-3222

Prairie Creek Marina  
#1 Prairie Creek Marina Dr.  
Rogers, AR. 72756  
(479) 925-1623

Rocky Branch Marina  
P.O. Box 1459  
Rogers, AR 72756  
(479) 925-1300

Starkey Boat Dock & Marina  
Eureka Springs, AR  
(479) 253-8194

War Eagle Marina  
Springdale, AR  
(479) 751-2050

## **Additional Resources** Websites, Factsheets and Books

To access any of the factsheets (FSA, MP, FSPPC, or FSFCS) listed below, visit <http://division.uaex.edu/publications.htm> or contact your local Extension office.

**Chapter 1 – Introduction**  
Source Water Protection  
www.bwd.h2o.org

FSA 9513 Water Resources of  
Beaver Lake

FSA 9521 Arkansas Watersheds  
  
FSA 9526 Using the Watershed  
Approach to Maintain and  
Enhance Water Quality

**Chapter 2 – Site Assessment**  
Lakeshore Vegetation  
Management  
www.sustland.umn.edu/related/water2.html



Rain Barrel Construction  
[www.bwdh2o.org/files/45/How\\_to\\_Build\\_a\\_Rain\\_Barrel\\_2010\\_Update.pdf](http://www.bwdh2o.org/files/45/How_to_Build_a_Rain_Barrel_2010_Update.pdf)

Rain Gardens - Capture the Flow and Watch it Grow  
[http://ppc.uaex.edu/storm\\_water/NWAR/NWA\\_raingardens.pdf](http://ppc.uaex.edu/storm_water/NWAR/NWA_raingardens.pdf)

Potential Rain Garden Native Plant Selections  
[http://ppc.uaex.edu/storm\\_water/NWAR/NWA\\_native\\_plants.pdf](http://ppc.uaex.edu/storm_water/NWAR/NWA_native_plants.pdf)

*Rain Gardening In The South* by Helen Kraus and Anne Spafford, Eno Publishers

### **Chapter 3 – Landscape Management**

[www.arhomeandgarden.org](http://www.arhomeandgarden.org)  
[www.turf.uark.edu](http://www.turf.uark.edu)  
[www.arkansas.forestry.org](http://www.arkansas.forestry.org)  
[www.urbanforestry.org](http://www.urbanforestry.org)  
[www.treesaregood.com](http://www.treesaregood.com)

FSA 2087 Composting

FSA 2109 Home Lawn Weed Control

FSA 2114 Fertilizing Your Lawn

FSA 2118 Understanding the Numbers of Soil Test

FSA 2121 Test your Soil for Plant Food and Lime Needs

FSA 2153 The Soil Test Report

FSA5011 Ten Easy Ways to Kill a Tree (And How to Avoid Them)

FSA 6023 Mowing Your Lawn

FSA 6029 Easy Compost

FSA 6047 Timely Tips Series: Common Landscape Plants

FSA 6118 Lawn Care Calendar: Tall Fescue

FSA 6119 Lawn Care Calendar: St. Augustinegrass

FSA 6120 Lawn Care Calendar: Centipedegrass

FSA 6121 Lawn Care Calendar: Bermudagrass

FSA 6122 Lawn Care Calendar: Zoysiagrass

FSA 6126 Landscape Trees for Specific Uses

FSA 6128 Landscape Series: Planting a Tree or Shrub

MP 167 Pruning Ornamental Plants

*The American Woodland Garden: Capturing The Spirit Of The Deciduous Forest* By Rick Drake, Timber Press (Ahs Book Award)

*Arkansas Gardener* Published By State-By-State Gardening

*Bringing Nature Home* By Doug Tallamy, Timber Press

*Deer-Proofing Your Yard & Garden* By Rhonda Massingham Hart, Storey Publishing

*Gardening With Native Plants Of The South* By Sally Wasowski With Andy Wasowski, Taylor Publishing Company

*Go Native* By Carolyn Harstad, Indiana University Press

*The Natural Garden* By Ken Druse, Clarkson Potter Publishers

*The Natural Shade Garden* By Ken Druse, Clarkson Potter Publishers

*The Southern Gardener's Book Of Lists* By Lois Trigg Chaplin, Taylor Trade Publishing

*Trees of Arkansas* By Dr. Dwight M. Moore, Arkansas Forestry Commission

*Trees, Shrubs & Vines Of Arkansas* By Carl G. Hunter, Ozark Society Foundation

*Wildflowers Of Arkansas* By Carl G. Hunter, Ozark Society Foundation

### **Chapter 4 - Water Management and Conservation**

FSA 9517 Nutrients and Water Quality Concerns

FSA 9520 Home Water Conversation

FSA 9528 What is Water Quality

FSPPC 100 Arkansas Water Primer Series: Water Basics

FSPPC 103 Arkansas Water Primer Series: Partners in Protecting Arkansas' Waterbodies

FSPPC 109 Arkansas Water Primer Series: Glossary of Water - Related Terms



FSFCS 01 Keep Food and Water  
Safe During Power Outages and  
Floods

[www.GreenerChoices.org](http://www.GreenerChoices.org) under  
"Eco-labels center"  
FSA 9524 Hazardous Household  
Products

MP 292 Improving Home Water  
Quality

### **Chapter 6 - HHW**

Household Hazardous Waste  
Collection Centers in Arkansas  
[www.adeg.state.ar.us/solwaste/branch\\_recycling/hhwcc.htm](http://www.adeg.state.ar.us/solwaste/branch_recycling/hhwcc.htm)

3rd Party Green Product  
Certification  
[www.greenseal.org/findaproduct/index.cfm](http://www.greenseal.org/findaproduct/index.cfm)  
[www.epa.gov/ootintr/dfe/pubs/projects/formulat/formpartc.htm](http://www.epa.gov/ootintr/dfe/pubs/projects/formulat/formpartc.htm)