

APPENDIX C

Pollution Prevention/Source Control Practices

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Appendix C: Pollution Prevention/Source Control Practices

Introduction

Residents and businesses engage in behaviors and activities that can negatively influence water quality, including over-fertilizing, using excessive amounts of pesticides, poor housekeeping practices, and dumping into storm drains. Alternatively, positive behaviors such as tree planting, disconnecting rooftops, and picking up pet waste can help improve water quality. Whether a pollution prevention program is designed to discourage negative behaviors or encourage positive ones, targeted education is needed to deliver a specific message that promotes behavior changes.

The following fact sheets provide information on how to craft targeted programs to address a variety of pollution prevention and source control practices, and can form the basis of a coordinated watershed education effort by groups including Howard County Department of Public Works, the Little Patuxent Watershed Group, and the Columbia Association

N-1	Neighborhood Source Area: Yard	
	REDUCED FERTILIZER USE	

Description

The ideal behavior is to not apply fertilizer to lawns. The next best thing for homeowners who feel they must fertilize is to practice natural lawn care: using low inputs of organic or slow release fertilizers that are based on actual needs as determined by a soil test. The obvious negative watershed behavior is improper fertilization, whether in terms of the timing, frequency or rate of fertilizer applications, or a combination of all three. The other important variable to define is who is applying fertilizer in the neighborhood. Nationally, about 75% of lawn fertilization is done by homeowners, with the remaining 25% applied by lawn care companies (Figure 1). This split, however, tends to be highly variable within individual neighborhoods, depending on its income and demographics.

How Fertilizer Influences Water Quality

Recent research has demonstrated that lawn over-fertilization produces nutrient runoff with the potential to cause downstream eutrophication in streams, lakes, and estuaries (Barth, 1995a and 1995b). Scientists have also discovered that nitrogen and phosphorus levels in lawn runoff are about two to 10 times higher than any other



Figure 1: Lawn Care Company Truck

part of the urban landscape such as streets, rooftops, driveways or parking lots (Bannerman *et al.*, 1993; Steuer *et al.*, 1997; Waschbusch *et al.*, 2000; Garn, 2002).

Percentage of People Engaging in Fertilizer Use

Lawn fertilization is among the most widespread watershed behaviors in which residents engage. A survey of lawn care practices in the Chesapeake Bay indicated that 89% of citizens owned a yard, and of these, 50% applied fertilizer every year (Swann, 1999). The average rate of fertilization in 10 other regional lawn care surveys was even higher (78%), although this may reflect the fact that these surveys were biased towards predominantly suburban neighborhoods and excluded non-lawn owners. Several studies have measured the frequency of lawn fertilization, and have found that lawns are fertilized about twice a year, with spring and fall being the most common season for applications (Swann, 1999).

A significant fraction of homeowners can be classified as “over-fertilizers” who apply fertilizers above recommended rates. Surveys indicate the number of over-fertilizers at 50% to 70% of all fertilizers (Morris and Traxler, 1996; Swann, 1999; Knox *et al.*, 1995). Clearly, many homeowners, in a quest for quick results or a bright green lawn, are applying more nutrients to their lawns than they actually need.

Variation in Fertilization Behavior

Many regional and neighborhood factors influence local fertilization behavior. From a regional standpoint, climate is a very important factor, as it determines the length of the growing season, type of grass, and the irrigation needed to maintain a lawn. A detailed discussion of the role these factors play in fertilization can be

found in Barth (1995a). A host of factors also comes into play at the individual neighborhood scale. Some of the more important variables include average income, market value of houses, soil quality, and the age of the development (Law *et al.*, 2004). Higher rates of fertilization appear to be very common in new suburban neighborhoods where residents seek to establish lawns and landscaping. Also, lawn irrigation systems and fertilization are strongly associated.

Difficulty in Changing Behavior

Changing fertilization behaviors can be hard since the desire for green lawns is deeply rooted in our culture (Jenkins, 1994; Teyssott, 1999). For example, the primary fertilizer is a man in the 45 to 54 year age group (BHI, 1997) who feels that “a green attractive lawn is an important asset in a neighborhood” (De Young, 1997). According to surveys, less than 10% of lawn owners take the trouble to take soil tests to determine whether fertilization is even needed (Swann, 1999; Law *et al.*, 2004). Most lawn owners are ignorant of the phosphorus or nitrogen content of the fertilizer they apply (Morris and Traxler, 1996), and are unaware that grass-cycling can sharply reduce fertilizer needs.

Most residents rely on commercial sources of information when making their fertilization decisions. The average consumer relies on product labels, store attendants, and lawn care companies as their primary, and often exclusive, sources of lawn care information. Consumers are also influenced by direct mail and word of mouth when they choose a lawn care company (Swann, 1999 and AMR, 1997).

Two approaches have shown promise in changing fertilization behaviors within a neighborhood, and both involve direct contact with individual homeowners. The first relies on using neighbors to spread the message to other residents, through master gardening programs. Individuals tend to be very receptive to advice from their peers, particularly if it relates to a

common interest in healthy lawns. The second approach is similar in that it involves direct assistance to individuals at their homes (e.g., soil tests and lawn advice) or at the point of sale.

Techniques to Change Behavior

Most communities have primarily relied on carrots to change fertilization behaviors, although sticks are occasionally used in phosphorus-sensitive areas. The following are some of the most common techniques for changing fertilization behaviors:

- Seasonal media awareness campaigns
- Distribution of lawn care outreach materials (brochures, newsletters, posters, etc.; Figure 2)
- Direct homeowner assistance and training
- Master gardener program
- Exhibits and demonstration at point-of-sale retail outlets
- Free or reduced cost for soil testing
- Training and/or certification of lawn care professionals
- Lawn and garden shows on radio
- Local restrictions on phosphorus content in fertilizer

Good Examples

King County, Washington- Northwest Natural Yard Days. This month-long program offers discounts on natural yard care products and educational information about natural yard care in local stores throughout King County and Tacoma. Education specialists came to Saturday and Sunday events at some stores and spent time with buyers to help them make good choices and learn about natural yard care, including the use of organic fertilizers that don't wash off into streams and lakes as easily as "quick release" chemical fertilizers. For more details, consult: <http://dnr.metrokc.gov/swd/ResRecy/events/naturalyard.shtml>

North Carolina Department of Agriculture Free Residential Lawn Soil Testing. Residents can get a free soil test to determine the exact fertilizer and lime needs for their lawn, as well as for the garden, landscape plants and fruit trees. Information sheets and soil boxes are available from various government agencies, or local garden shops and other businesses. For more information, consult:
<http://www.ncagr.com/agronomi/stfaqs.htm>

Minnesota Department of Agriculture Phosphorus Lawn Fertilizer Use Restrictions. Starting in 2004, these restrictions limit the concentration of phosphorus in lawn care products and restrict its application at higher rates to specific situations based on need.
<http://www.mda.state.mn.us/appd/ace/lawncwaterq.htm>

Top Resources

Cornell Cooperative Extension. The Homeowner's Lawn Care Water Quality Almanac.
<http://www.hort.cornell.edu/gardening/lawn/almanac/index.html>

University of Rhode Island Cooperative Extension Home*A*Syst Healthy Landscapes Program
<http://www.healthylandscapes.org/>

University of Maryland Cooperative Extension - Home and Garden Information Center.
<http://www.agnr.umd.edu/users/hgic/>

Turf and Landscape Best Management Practices. South Florida Water Management District and the Broward County Extension Education Division
<http://www.sfwmd.gov/org/exo/broward/c11bmp/fermtgt.html>

Florida Yards and Neighborhoods Handbook: A Guide to Environmentally Friendly Landscaping
<http://hort.ufl.edu/fyn/hand.htm>

University of Minnesota Extension Service Low-Input Lawn Care (LILaC)
<http://www.extension.umn.edu/distribution/horticulture/DG7552.html>

Austin TX, Stillhouse Spring Cleaning
<http://www.ci.austin.tx.us/growgreen/stillhouse.htm>

When you fertilize the lawn, Remember you're not just fertilizing the lawn.

It's hard to imagine that a green, flourishing lawn could pose a threat to the environment, but the fertilizers you apply to your lawn are potential pollutants! If applied improperly or in excess, fertilizer can be washed off your property and end up in lakes and streams. This causes algae to grow, which uses up oxygen that fish need to survive. So if you fertilize, please follow directions and use sparingly.

Clean water is important to all of us.
 It's up to all of us to make it happen. In recent years, sources of water pollution like industrial wastes from factories have been greatly reduced. Now, more than 60 percent of water pollution comes from things like cars leaking oil, fertilizers from farms and gardens, and failing septic tanks. All these sources add up to a big pollution problem. But each of us can do small things to help clean up our water too—and that adds up to a pollution solution!

Why do we need clean water?
 Having clean water is of primary importance for our health and economy. Clean water provides recreation, commercial opportunities, fish habitat, drinking water, and adds beauty to our landscape. All of us benefit from clean water—and all of us have a role in getting and keeping our lakes, rivers, streams, marine, and ground waters clean.

What's the problem with fertilizers?
 Fertilizer is a "growing" problem for lakes, rivers, and streams, especially if it's not used carefully. If you use too much fertilizer or apply it at the wrong time, it can easily wash off your lawn or garden into storm drains and then flow into lakes or streams. Just like in your garden, fertilizer in lakes and streams makes plants grow. In water bodies, extra fertilizer can mean extra algae and aquatic plant growth. Too much algae causes water quality problems and makes boating, fishing, and swimming unpleasant. As algae decay, it uses up oxygen in the water that fish and other wildlife need.

Clean Water Tips: How can you fertilize and help keep our waters clean?


- Use fertilizer sparingly. Many plants don't need as much fertilizer or need it as often as you might think.
- Don't fertilize before a rain storm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Have your soil tested before applying fertilizers to your lawn and gardens. A standard soil test costs \$8.00. You may not need to add any fertilizer. (Call the UMass Extension Soil Testing Lab at 413/545-2311 or download a soil test order form at www.umass.edu/plots/soiltest/.)

To find out more about the impacts of nonpoint source pollution and what you can do to prevent it, call the numbers listed below.

617/227-5114
 617/626-1250
 617/918-1111
 617/292-5500
 617/626-1700
 617/626-1395
 617/626-1000

This information on nonpoint source pollution is brought to you by the Department of Environmental Protection, the Executive Office of Environmental Affairs, Massachusetts Watershed Initiative, Coastal Zone Management, the Department of Environmental Management, the Department of Fisheries, Wildlife, and Law Enforcement, the Department of Food and Agriculture, and the Metropolitan District Commission working to reduce nonpoint source pollution through public education. This project was funded by the U.S. Environmental Protection Agency with a Federal Healthy Green grant.

Figure 2: Educational Brochure on Fertilizer
 Source: <http://www.state.ma.us/dep/brp/wm/files/fertiliz.pdf>

N-2	Neighborhood Source Area: Yard	
	REDUCED PESTICIDE USE	

Description

The ideal watershed behavior is to not apply any insecticides or herbicides to the lawn or garden. Many residents, however, still want to control pests and weeds, so the next best behavior is a natural approach that emphasizes limited use of safer chemicals, proper timing and targeted application methods. The negative residential behavior is over-use or improper application of insecticides and herbicides that are known to have an adverse impact on aquatic life.

How Pesticide Use Influences Subwatershed Quality

The leading source of pesticides to urban streams is homeowner applications in the lawn and garden to kill insects and weeds. The pesticides of greatest concern are insecticides, such as diazinon and chlorpyrifos, and a large group of herbicides (CWP, 2003; USGS, 2001; Schueler, 1995; Figure 1). Very low levels of these pesticides can be harmful to aquatic life. According to a national monitoring

study, one or more pesticides were detected in 99% of urban streams sampled (USGS, 2001). Pesticide levels in urban streams exceeded national water quality standards to protect aquatic life in one out of every five samples. Even more troubling was the finding that 100% of fish in urban streams had detectable levels of pesticide in their tissues, with 20% exceeding recommended guidelines for fish-eating wildlife (such as racoons, kingfishers, ospreys and eagles).

Percentage of People Engaging in Pesticide Use

About half of Chesapeake Bay residents reported that they had applied pesticides to their lawn or garden (Swann, 1999). Surveys on residential pesticide use for other regions of the country indicate that home pesticide use varies greatly, ranging from a low of 17% to a high of 87% of households (Swann, 1999). According to EPA, the average acre of maintained suburban lawn receives five to seven pounds of pesticides each year.

Variation in Pesticide Use

Many regional and neighborhood factors influence the degree of local pesticide use. From a regional standpoint, climate is an extremely important factor. For example, insecticides are applied more widely in warmer climates where insect control is a year round problem (e.g., 50 to 90% of warm-weather residents report using them). This can be compared to 20 to 50% of insecticide use reported for colder regions where hard winters help keep insects in check (Schueler, 2000b). By contrast, herbicide application rates tend to be higher in colder climates in order to kill weeds that arrive with the onset of spring (e.g., 60 to 75% of cold weather residents report use).

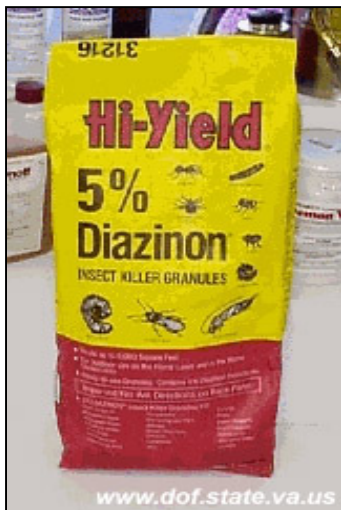


Figure 1: Bag of Pesticide Granules

Many neighborhood factors can play a strong role in the degree of pesticide use. These include lot or lawn size, presence of gardens, condition of turf, presence or absence of irrigation and neighborhood age. The average income and demographics within a neighborhood are also thought to play a strong role, particularly if residents rely on lawn care and landscaping companies to maintain their lawns.

Difficulty in Changing the Behavior

Pesticide use is a difficult behavior to change for several reasons. First, many residents want a quick and effective solution to their pest problems. Second, many residents lack awareness about the link between their pesticide use and stream quality. Lastly, many residents rely on commercial sources of information when choosing pesticides, and lack understanding of safer alternatives and practices. As with fertilizers, product labels are the primary source of information about pesticides. Nearly 90% of homeowners rely on them to guide their pesticide use (Swann, 1999). In addition, many residents are unaware of the pesticide application practices that their lawn care company applies to their yard and prefer to rely on professional know-how (Knox *et al.*, 1995).

Confusion also stems from the recent growth of “weed and feed” lawn care products that combine weed control and fertilizer in a single bag. In one Minnesota study, 63% of residents reported that they used weed and feed lawn products, but only 24% understood that they were applying herbicides to their lawn (Morris and Traxler, 1996).

Techniques to Change the Behavior

Most communities rely on the same basic combination of carrots to change pesticide use as they do for fertilizer use, since they are so interrelated. The following are some of the most common techniques to change pesticide use:

- Seasonal media awareness campaigns
- Distribution of lawn care outreach materials (brochures, newsletters, posters, etc.)
- Direct homeowner assistance and training
- Master gardener program
- Exhibits and demonstration at point of sale at retail outlets
- Pest advice hotlines
- Training, certification and/or licensing of lawn care professionals and pesticide applicators
- Radio lawn and garden advice shows



Figure 2: Educational Pesticide Brochure
Source: <http://www.lacity.org/SAN/wpd/index.htm>

Good Examples

Perdue Pesticide Program - Web-based program to help comply with the State of Indiana regulations that help homeowners use pesticides effectively and safely. According to Indiana law and recently enacted regulations, all retail establishments in the state that sell gardening and pest control products and offer recommendations on their use must be licensed as consultants, while their sales associates must be trained to knowledgeably disseminate product information.

<http://www.btny.purdue.edu/PPP/>

Green Communities Association's Pesticide Free Naturally: A Campaign to Reduce the Cosmetic Use of Pesticides - The campaign includes an Action Kit that includes pesticide-free lawn signs, fact sheets on health impacts, tips on how to engage neighbors in discussions about pesticide use, a children's activity pack, and information on effective alternatives to pesticides, including home recipes.

<http://www.gca.ca/content.php?page=pfn>

Top Resources

Tips for Homeowners on Hiring a Pesticide Applicator

http://www.epa.gov/oppfead1/Publications/Cit_Guide/citguide.pdf

Try Pesticide Alternatives

http://www.mda.state.md.us/nutrient/1_p4.pdf

Washington State University - Pesticide Safety Programs

<http://pep.wsu.edu/psp/>

National Pesticide Information Center

Site - Provides objective, science-based information about a variety of pesticide-related subjects, including pesticide products, toxicology, and environmental chemistry.

<http://npic.orst.edu/>

IPM Practitioners Association IPM ACCESS Webpage


<http://www.efn.org/~ipmpa/>

Our Water, Our World

http://sfwater.org/detail.cfm/MC_ID/4/MSC_ID/78/MTO_ID/NULL/C_ID/1402

Grow Green: Landscaping for Clean Water

<http://www.ci.austin.tx.us/growgreen/default.htm>

N-4	Neighborhood Source Area: Yard	
	NATURAL LANDSCAPING	

Description

The ideal watershed behavior is to replace existing turf cover with native species of annuals, perennials, shrub and forest cover in mulched beds that produce less runoff and create backyard habitat. The negative watershed behavior is exclusive reliance on turf cover in the yard and/or use of non-native invasive species that can spread from the yard into adjacent stream corridors or natural area remnants.

How Natural Landscaping Influences Subwatershed Quality

The cumulative effect of natural landscaping practices on subwatershed quality are hard to quantify, but can provide some clear benefits. First, reduced turf area produces more natural hydrologic conditions in the yard, since mulched beds intercept and adsorb rainfall and can produce less runoff (Figure 1). Natural landscaping also creates native habitats, increases forest cover, and creates a natural seed bank of native plant species in subwatersheds. Natural landscaping can also prevent the spread of invasive non-native plant species into the stream corridor, which is an increasing problem in many urban subwatersheds. English ivy, bamboo, and other fast-spreading non-native species can quickly dominate the plant community of the urban stream corridor.

Percentage of Homeowners Engaging in Natural Landscaping

The proportion of homeowners that engage in natural landscaping is poorly understood at both the national and neighborhood level. About half of Americans report that home gardening and landscaping is one of their major hobbies (Figure 1), but the proportion using native plants or landscape for wildlife or watershed appears to constitute a much smaller niche market.

Variation in Landscaping Behavior

Native plant species are adapted to local differences in soil, rainfall and temperature conditions. Neighborhood factors such as neighborhood age, lot size, income level and watershed awareness appear to influence the promotion of natural landscaping.

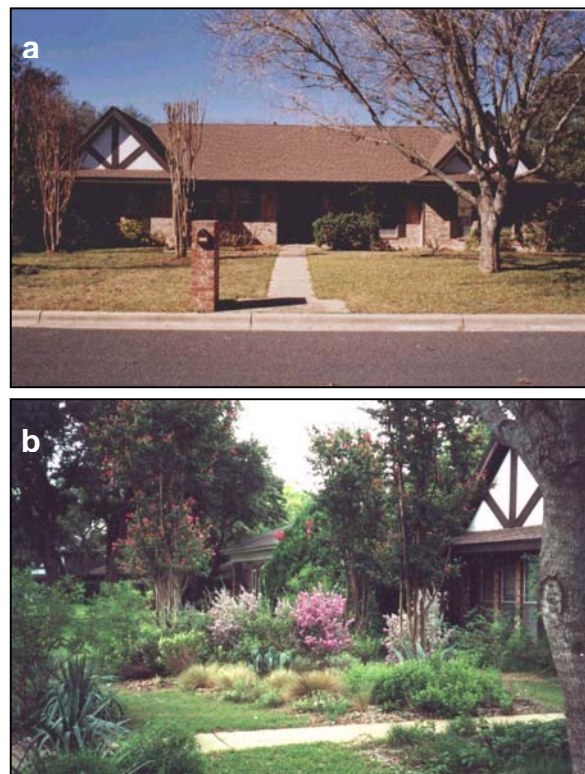


Figure 1: Before (a) and After (b) Natural Landscaping

Difficulty in Changing Landscaping Behavior

While natural landscaping practices have been growing in recent years, there are a number of barriers to more widespread implementation. The first barrier is that many homeowners are not aware of which plant species are native or non-native, and they do not know the benefits of natural landscaping. Second, native plant materials are not always widely available at garden centers and nurseries. Third, some communities still have weed and vegetation control ordinances that discourage natural landscaping.

Techniques to Promote Natural Landscaping

A range of carrots and sticks can help promote more widespread use of natural landscaping in a subwatershed, including:

- Conventional outreach on natural landscaping (brochures, newsletters, plant guides)
- Backyard habitat programs
- Free or reduced mulch
- Distribution of free or discounted native plant material
- Repeal of local weed ordinances with natural landscaping criteria
- Support of garden clubs and native plant societies
- Demonstration gardens (e.g. Bayscapes)
- Invasive species alerts
- Promotion of native plant nurseries
- Homeowner award/recognition programs
- Xeriscaping rebates

Good Examples

City of Austin, TX - WaterWise Program. Owners of new and existing homes may qualify for rebates up to \$500 for Water Wise plantings of trees and shrubs. The goal of this program is to install a quality, low water use, low maintenance native landscape. <http://www.ci.austin.tx.us/watercon/wwlandscape.htm>

Village of Long Grove, IL - Village Code. Natural landscaping is encouraged in the city code, which states “impervious surfaces, shall not exceed forty percent (40%) of the total lot area. The remaining minimum sixty percent (60%) of the lot area shall be maintained as a ‘green area’ and shall consist of native wild areas, grass, trees, ponds or other natural vegetation.” The code also does not limit residential vegetation height, which in other communities can limit use of natural plant species. <http://www.longgrove.net/>

Top Resources

National Wildlife Federation - Natural Back Yard Habitat Program. The Backyard Wildlife Habitat program educates people about the benefits and techniques of creating and restoring natural landscapes. Through a backyard wildlife “certification” process, guided efforts of homeowners and other community members to improve wildlife habitat where they live and work are formally acknowledged. <http://www.nwf.org/backyardwildlifehabitat/>

Alliance for the Chesapeake Bay - Bayscapes. This website provides practical guidance on how to design a “Bayscape,” which is a watershed friendly form of natural landscaping. <http://alliancechesbay.org/bayscapes.cfm>

Wild-Ones- Native Plants, Natural Landscaping Publications and Model Ordinances. Website contains a wealth of information on natural landscaping, including the *Wild Ones Handbook* - a compendium of useful information for the native plant landscaper and wildflower gardener, appropriate for all bioregions. The site also provides vegetation and weed control model municipal ordinances that encourage the use of native plant communities as an alternative in urban landscape design. <http://www.for-wild.org/>

<h1>N-5</h1>	Neighborhood Source Area: Yard	
	<h2>TREE PLANTING</h2>	

Description

The ideal watershed behavior is to ultimately achieve a mature tree canopy that covers more than 50% of residential lots within a neighborhood through tree planting and care (Figure 1a). The negative watershed behavior is tree clearing that reduces existing tree canopy on a residential lot and in neighborhoods (Figure 1b).

How Tree Planting Influences Subwatershed Quality

Forested neighborhoods have a distinctly different hydrological profile than non-forested neighborhoods. For operational purposes, American Forests defines forested neighborhoods as having at least 50% forest canopy covering the residential lot. The

branches and leaves of the forest canopy help intercept and slowdown rainfall. For example, a large oak tree can intercept and retain more than 500 to 1,000 gallons of rainfall in a given year, which is roughly equivalent to a rain barrel in terms of runoff reduction (Cappiella, 2004). According to American Forests (1999), a healthy forest canopy can reduce storm water runoff by as much as 7% in a neighborhood.

A healthy residential forest canopy provides many additional environmental and economic benefits within a neighborhood. These include savings on home heating and cooling costs, higher property values, shading, removal of air pollutants, and noise reduction (Cappiella, 2004).

Percentage of Homeowners Engaging in Tree Planting

Regional GIS analyses of urban areas conducted by American Forests (2001) reveal that about 60% of neighborhoods have less than 50% forest canopy cover. The actual rate of tree planting is a poorly understood residential behavior. The actual rate of tree planting is a poorly understood residential behavior. A survey in the Chesapeake Bay watershed indicated that 71% of residents had planted a tree within the last five years (CBP, 2002). Tree planting rates by homeowners of around 50% were reported in urban metropolitan areas such as Baltimore, MD and Washington, D.C.; however, more research is needed to determine the frequency and impact of tree planting in urban subwatersheds.

Variation in Tree Planting Behavior

Trees may not be part of the native plant community in some regions of the country, and specific tree or prairie species will be determined by local climate and soils. Also,



Figure 1: Lots with Extensive Tree Cover (a) and Less Tree Cover (b)

concerns about fire safety may make the 50% forest canopy goal impractical in regions that experience wildfires. At the neighborhood level, several factors influence the extent of forest canopy that can be attained. Probably the most important factor is the neighborhood age, as recently constructed neighborhoods generally lack established forest cover (Figure 2). Other factors include the existing forest canopy, lot subsidies or rebates for energy conservation plantings, size and soil depth.

Difficulty in Increasing Tree Planting Behavior

Generally, tree planting is a relatively easy behavior to encourage, although it may take decades to grow a mature canopy on a residential lot. Perhaps the biggest barrier to overcome is to find the best locations in the yard to plant trees that can grow to maturity (e.g., away from overhead powerlines, underground utilities, septic systems, etc.). The second concern is proper planting and care techniques to ensure that trees can survive and flourish in the critical first few years after they are planted. Third, some localities may discourage tree planting in the right-of-way due to maintenance concerns and pavement cracking.



Figure 2: Newly Planted Trees in a New Neighborhood

Techniques for Increasing Residential Forest Canopy Cover

A series of techniques can promote tree planting and discourage tree clearing:

- Distribution of outreach materials on tree planting (brochures, newsletters, plant guides)
- Tree clearing ordinances and permits
- Direct forestry assistance
- Free seedlings or other native tree stocks
- Native tree planting guidebooks

Good Examples

Slinger, WI -Residential Tree Power Incentive Program. The electric utility in this community offers cash incentives for planting deciduous trees that conserve energy by providing significant shading of an air conditioning unit or the south or west exposure of a home upon tree maturity.

<http://www.slinger-wi-usa.org/utilityprograms.htm>

Tucson Electric Power (TEP) Tree Planting Incentives for Residents. TEP, working with the Trees for Tucson program, offers residents up to two five-gallon size trees at \$3.00 per tree for planting on the west, east or south side of their homes. The program has distributed more than 22,000 trees since its inception, and also provides information to homeowners, neighborhood groups, and schools on low-water species appropriate to the local environment, and optimum placement of trees for energy and water conservation.

<http://swenergy.org/programs/arizona/utility.htm>

Banks and Buffers: A Guide to Selecting Native Plants for Streambanks and Shorelines.

Produced by the Tennessee Valley Authority, this guide includes a software application to assist in plant selection. It also contains selected characteristics and environmental tolerances of 117 native plants and over 400 color photographs illustrating habitat and growth form.

<http://www.tva.gov/river/landandshore/stabilization/index.htm>

National Arbor Day Foundation Awards

This award recognition program honors the achievements of citizens, communities, the media, and schools whose work in the cause of tree planting, care, and conservation have set an example of excellence. Applications are submitted through the Department of Natural Resources to the National Arbor Day Foundation. Contact: DNR - Forest Service regional office or The National Arbor Day Foundation, 100 Arbor Avenue, Nebraska City, NE 68410. <http://www.arborday.org/>

Top Resources

American Forests - CityGreen GIS software
<http://www.americanforests.org/>

Center for Urban Forest Research
<http://wcufre.ucdavis.edu/>

Guidelines for Developing and Evaluating Tree Ordinances
<http://www.isa-arbor.com/tree-ord/>

Treelink
<http://www.treelink.org/>

National Tree Trust
<http://www.nationaltreetrust.org/>

Treepeople
<http://www.treepeople.org/>

Society of Municipal Arborists
<http://www.urban-forestry.com/>

Urban Forest Ecosystems Institute
<http://www.ufe.calpoly.edu/>

USDA Forest Service, Northeastern Research Station
<http://www.fs.fed.us/ne/>

USDA Forest Service, Southern Region
<http://www.urbanforestrysouth.org/>

USDA Forest Service, Pacific Northwest Research Station
<http://www.fs.fed.us/pnw/>

USDA Forest Service, Pacific Southwest Research Station
<http://www.fs.fed.us/psw/>

N-6	Neighborhood Source Area: Yard	
	YARD WASTE COMPOSTING	

Description

The ideal watershed behavior is to recycle or compost yard waste entirely within the yard, so that it stays out of the solid waste stream and the storm drain system. The next best behavior is curbside yard waste collection that keeps organic matter from the storm drain system (Figure 1). The negative behavior is to blow or rake yard waste into the gutter and storm drain system or dump it into the stream corridor or natural areas.

How Yard Waste Influences Watershed and Subwatershed Quality

The major benefit of managing yard waste is realized at the regional or watershed level, where it can preserve local landfill capacity by keeping organic waste out of the trash stream. Yard waste normally comprises about 10% of the annual waste stream during the year, but this rises to almost 70% during the fall. The impact of yard waste at the subwatershed level is poorly defined, but can be significant, at least on a seasonal basis. The major concern is the potential for nutrient and organic matter to wash off to the storm drain system, whether it consists of grass clippings, fallen leaves or organic debris accumulating on impervious surfaces and street gutters. The second concern is dumping yard wastes in the stream corridor itself.

Percentage of Residents Engaging in Yard Waste Composting

Based on municipal surveys, the average rate of backyard composting of yard waste ranges from one to 5% of households, although participation rates as high as 10% have been observed after intensive municipal education and subsidy programs. Much higher rates have been reported for recycling of grass clippings, whether by composting or use of grass-cycling mowers. Surveys indicate about 40 to 70% of households

currently recycle grass clippings, with higher rates reported in communities that prohibit grass-clippings in regular trash pickup (Smith, 1996; DeYoung, 1997; Morris and Traxler, 1996; and Knox *et al.*, 1995). The highest homeowner participation rates are noted for curbside leaf and yard waste collection (50 to 70%), which is not surprising given the convenient nature of this municipal service. It is worth noting that communities need to educate homeowners to keep leaves out of streets and gutters during seasonal curbside pick-up where they can easily reach the storm drain system.

Variation in Yard Waste Behavior

Regional factors influencing the generation and disposal of yard waste include the length of growing season, the presence of deciduous trees, and annual rainfall. Neighborhood factors contributing to the generation of yard waste are large lot size or turf area, high forest canopy, low usage of lawn care or landscaping companies, and older neighborhoods. The actual rate of participation in various yard waste programs depends largely on their ease and convenience, as well as the degree of outreach, notification and education employed by the municipality.



Figure 1: Curbside Yard Waste Pick-up

Techniques to Change the Behavior

To promote better management of yard wastes, communities can facilitate backyard composting and “grass-cycling” lawnmowers, arrange seasonal curbside yard waste collection, and/or prohibit yard waste from regularly scheduled trash pickup. Other techniques include:

- Conventional outreach methods (bill inserts, brochures, newsletters, neighborhood meetings)
- Regular yard waste collection
- Fall leaf collection
- Seasonal collection (e.g., Christmas trees)
- Distribution of free or discounted compost bins
- Ban on lawn clipping pickup
- Promotion of grass-cycling
- Notification about keeping leaves out of gutters during fall leaf pick-up

Good Examples

Fort Worth, TX. Division of Environmental Management - “Don’t Bag it” Program

The City of Fort Worth requires that, if grass clippings are put out for pick-up, they be contained in paper yard bags to be sent to a composting facility instead of the landfill. Under the “Don’t Bag It” program homeowners are encouraged to leave lawn clippings on the grass to allow them to work themselves back into the soil. Residents that have followed this lawn care plan report that they mow their lawns in 38% less time than when they bagged their grass clippings. They also found that their lawns are 30% better than they were before the “Don’t Bag It” campaign.

<http://www.fortworthgov.org/dem/dontbag.htm>

The Village of Niles, IL - Yard Waste Collection

The Village of Niles offers an optional yard waste collection service to help residents comply with an Illinois law that requires the separation of yard waste from regular garbage. To participate in the curbside yard waste collection homeowners need to purchase stickers for a nominal fee to place on yard waste bags.

Mulching is recommended as an alternative no-cost disposal method. Free leaf pick up is provided in the fall.

<http://www.vniles.com/Pages/yard%20waste%20collection.asp>

City of Gresham, OR Yard Debris Exemption Program - Residents can receive a \$3.65

reduction on their garbage bill when they agree to compost yard waste instead of having it picked up by the curbside yard-debris collection program. The approval process requires an application and a site inspection by a Master Gardener and composting expert who inspects the homeowner composting system before granting the exemption.

<http://www.ci.gresham.or.us/departments/des/solidwaste/yarddebris/>

Top Resources

USEPA- Composting Materials - *Waste Prevention, Recycling, and Composting Options: Lessons from 30 Communities; Composting, Yard Trimmings, and Municipal Solid Waste; and Innovative Uses of Compost: Erosion Control, Turf Remediation, and Landscaping*

<http://www.epa.gov/compost/>

Master Composter

<http://www.mastercomposter.com/>

Compost Guide Web Page

<http://www.compostguide.com/>

Recycle Your Grass Clippings


<http://ucce.ucdavis.edu/files/filelibrary/1808/3868.doc>

“Don’t Bag It” Lawn Care

<http://muextension.missouri.edu/xplor/agguides/hort/g06959.htm>

Washington County, Minnesota, Recycling & Yard Waste

http://www.co.washington.mn.us/info_for_residents/environment/recycling_yard_waste/

N-9	Neighborhood Source Area: Yard	
	SEPTIC SYSTEM MAINTENANCE	

Description

While most urban subwatersheds are served by sewers, some still rely on septic systems for sewage disposal, particularly in less developed subwatersheds that may lie outside of the sewer service envelope. The ideal watershed behavior is to regularly inspect and maintain septic systems, make repairs as needed, and prevent disposal of household chemicals through the leach field. The accepted practice is to inspect the tank and leach field once every two years to make sure it is working properly, and to pump out the tank (Ohrel, 1995; Figure 1). The negative watershed behavior is to ignore regular inspections and pumpouts to the point that the septic system becomes a subwatershed pollution source.

How Septic Systems Influence Subwatershed Quality

Failing septic systems can be a major source of bacteria, nitrogen, and phosphorus, depending on the overall density of systems present in a subwatershed (Swann, 2001). Failure results in surface or subsurface movement of nutrients and

bacteria into the stream. According to the U.S. EPA (2002), more than half of all existing septic systems are more than 30 years old, which is well past their design life. The same study estimates that about 10% of all septic systems are not functioning properly at any given time, with even higher failure rates in some regions and soil conditions. It is extremely important to understand resident behavior in regard to inspection, pump out and repair, particularly if septic system density in a subwatershed is high.

Percentage of Homeowners Engaging in Septic System Maintenance

Until recently, homeowner awareness about septic system maintenance was poorly understood. Swann (1999) conducted one of the first surveys to examine how frequently homeowners maintain their septic systems. Roughly half of the owners were classified as “septic slackers,” since they indicated that they had not inspected or cleaned out their systems in the past three years. A small, but significant, fraction (12%) of septic system owners had no idea where their septic system was located on their property. In addition, only 42% of septic system owners had ever requested advice on how to maintain their septic system, and they relied primarily on the private sector for advice (e.g., pumping service, contractors, and plumbers).



Figure 1: Septic System Inspection/Cleaning Truck

Variation in Septic System Maintenance

Septic system failure rates appear to vary regionally, ranging from five to 40% (Swann, 2001). In most regions, failure rates are tied to current or past design, construction and maintenance regulations, which are set by local or state public health authorities. Failing systems are often clustered together. At the neighborhood level, many factors can influence septic system problems. Key factors linked to failure include small lot size, aging systems, poor soil or water table conditions, and close proximity to streams, lake fronts or ditches. In other cases, failure rates are tied to experimental septic system technologies, and seasonal use of properties.

Difficulty in Improving Septic System Maintenance

Septic systems are a classic case of “out of sight, out of mind.” Many owners take their septic systems for granted, until they back up or break out on the surface of their lawn. Subsurface failures, which are the most common, go unnoticed. In addition, inspections, pump outs, and repair can be costly, so many homeowners tend to put off these expenditures until there is a real problem. Lastly, many septic system owners lack basic awareness about the link between septic systems and water quality at the subwatershed level.

Techniques to Increase Septic System Maintenance

Many carrots and sticks have been developed in recent years to improve resident behaviors in regard to septic system maintenance, including:

- Media campaigns to increase awareness about septic system and water quality (e.g., billboards, radio, newspaper)
- Conventional outreach materials on maintenance (e.g., brochures, bill inserts, newsletters)
- Free or mandatory inspections
- Discount coupons for septic system maintenance

- Low interest loans for septic system repairs
- Performance certification upon property transfer
- Creation of septic management districts
- Certification and training of operation/maintenance professionals
- Termination of public services for failing systems

Good Examples

Swann (2001) describes a series of case studies of effective local programs to improve septic system maintenance. Some additional examples are provided below:

Washtenaw County, Michigan Time-Of-Sale Program: The County's septic system regulation requires the inspection of all residential septic systems by private evaluators at the time of sale of a property. Evaluations must be done by a certified inspector who has received a license after training and an exam.

<http://www.rougeriver.com/pdfs/illicit/OSS-02.pdf>

Yarmouth, Maine Free Pumpouts (Septic Tank Pumping Ordinance) - The town offers free septic system pump-outs to residents once every three years.

<http://www.yarmouth.me.us/vertical/Sites/%7B13958773-A779-4444-B6CF-0925DFE46122%7D/uploads/%7B363C4270-0879-43BC-8639-55BFA419AC12%7D.PDF>

Cannon Township, MI Septic Inspections and Testing - The township used school children to conduct dye tests to identify failing septic systems. This program doubled as an education campaign to increase awareness of septic system owners.

http://peer.tamu.edu/curriculum_modules/Water_Quality/module_1/Kids%20Dye%20Project.htm

Top Resources

Many excellent resources are available to educate homeowners about septic systems and water quality. Some of the better reference websites are provided below, and many contain additional educational links.

On-site Wastewater Treatment Systems Manual
<http://www.epa.gov/ord/NRMRL/Pubs/625R00008/html/625R00008.htm>

A Homeowner's Guide to Septic Systems
http://www.epa.gov/npdes/pubs/homeowner_guide_1ong.pdf

National Small Flows Clearinghouse
http://www.nesc.wvu.edu/nsfc/nsfc_septicnews.htm

On-site Septic Systems: Educating the Homeowner
[http://www.nesc.wvu.edu/nsfc/Articles/SFQ/SFQw02_web/SFQw02_Onsite Education.html](http://www.nesc.wvu.edu/nsfc/Articles/SFQ/SFQw02_web/SFQw02_Onsite%20Education.html)

University of Minnesota Onsite Sewage Treatment Program
<http://septic.coafes.umn.edu/>

North Carolina Coast A* Syst*
<http://www.soil.ncsu.edu/assist/cas/septic/index.htm>

<h1>N-10</h1>	Neighborhood Source Area: Yard	
	<h2>SAFE POOL DISCHARGES</h2>	

Description

Routine and end-of-season pool maintenance can cause chlorinated water or filter back flush water to be discharged into the storm drain system or the stream. The ideal watershed behavior is to discharge chlorinated pool water to the sanitary sewer system, or hold it for a week or more before spreading over a suitable pervious surface. The negative watershed behavior is to drain pool water directly into the storm drain system or stream where it may be toxic to aquatic life (Figure 1). Public and community pools can also be a subwatershed hotspot; details on controlling these pollution sources can be found in Profile Sheet H-14.

How Swimming Pool Maintenance Influences Subwatershed Water Quality

Pool water typically contains two to four parts per million of chlorine, as well as other chemicals to reduce bacteria and algae, and control pH. Consequently, the direct discharge of pool water can be toxic to aquatic life in small streams. Not much research has been done to characterize the precise impact of pool

discharges on aquatic systems, but there is anecdotal evidence of fish kills and other problems. Part of the problem is the size of pool discharges: the average in-ground pool is estimated to have a capacity of nearly 20,000 gallons.

Percentage of Homeowners Engaging in Pool Maintenance

The density of swimming pools in a subwatershed is extremely variable, but can be determined through inspection of low-altitude aerial photographs or the USSR survey (Figure 2). The number of in-ground or above-ground swimming pools in the United States is estimated at 7.5 million (Pool and Spa Marketing, 2003), or about 7% of all households. The actual operational and discharge behaviors of pool owners remains poorly understood, so it is difficult to characterize the magnitude of the pool discharge problem.



Figure 1: Swimming Pool Discharging to Street and into Storm Drain



Figure 2: Aerial Photo Showing High Density of Swimming Pools (~30%) in a Neighborhood

Variation in Pool Discharge

While the greatest pool density is found in warmer regions, the actual discharge problem may be more acute in northern regions where pools must be drained before the onset of winter. Key neighborhood factors include local plumbing codes that govern how discharge water is handled, the overall density of pools in the subwatershed, and their age.

Techniques to Change the Behavior

Most pool owners understand that regular maintenance is essential to keep a pool safe and clean, and they probably conduct more water quality monitoring as a group than any other segment of society. Therefore, they may be more receptive to changing discharge behaviors with proper education. Some techniques include:

- Conventional outreach techniques on proper discharge (pamphlets, water bill inserts, posters)
- Educational kiosks at the retail outlets where they purchase pool chemicals
- Changes in local plumbing codes to require discharge to sanitary sewer systems
- Adoption of water quality ordinances that allow for fines/enforcement for unsafe pool discharges
- Inspections (done in conjunction with regular local health and safety inspections)

Good Examples

State of Maryland Pool Permit. The State has developed a general permit to govern pool discharges. The general discharge permit, developed by the Maryland Department of the Environment, addresses discharges from both swimming pools and spas. It can be found at: <http://www.mde.state.md.us/assets/document/permit/MDE-WMA-PER070-SI.pdf>


Top Resources

Guidelines for Swimming Pool and Spa Owners and Operators
<http://www.montgomerycountymd.gov/mc/services/dep/Enforcement/pools.htm>

Oregon Department of Environmental Quality (ODEQ). 1997. Water Quality Permit Program: Guidance for Swimming Pool and Hot Tub Discharges.
<http://www.deq.state.or.us/wq/wqpermit/swimpools.pdf>

US EPA National Menu of Best Management Practices for Storm Water Phase II: Alternative Discharge Options for Chlorinated Water. Office of Wastewater Management
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll_1.cfm

Sacramento County Stormwater Utility. Proper Disposal of Pool Water.
http://www.sactostormwater.org/documents/pool_brochure_03.pdf

N-11	Neighborhood Source Area: Driveway	
	SAFE CAR WASHING	

Description

The ideal watershed behavior is to wash cars less often, wash them on grassy areas, and use phosphorus-free detergents and non-toxic cleaning products. Alternatively, residents can use commercial car washes that treat or recycle wash water. The negative behavior is to wash cars in a manner where dirty wash water frequently flows into the street, storm drain system, or the stream. This behavior applies not only to individuals, but to community groups that organize outdoor car washes for charitable purposes (Figure 1).

How Car Washing Influences Subwatershed Quality

Outdoor car washing has the potential to generate high nutrient, sediment, metal, and hydrocarbon loads in many subwatersheds. Detergent-rich water used to wash the grime off cars can flow down the driveway and into the storm drain, where it can be an episodic pollution source during dry weather. Not much is currently known about the quality of car wash water, but local water quality sampling can

easily characterize it. Car wash water can also be a significant flow source to streams during dry weather. As an example, a typical hose flowing at normal pressure produces between 630 and 1,020 gallons of water per hour, depending on its diameter. These flows can be sharply reduced if the hose is equipped with a shut-off nozzle.



Figure 1: Poor Practices at a Charity Car Wash Event at a Local Gas Station

Percentage of Residents Engaging in Car Washing

Car washing is one of the most common watershed behaviors in which residents engage. According to surveys, about 55 to 70% of homeowners wash their own cars, with the remainder utilizing commercial car washes (Schueler, 2000b). Of these, 60% of homeowners can be classified as “chronic car-washers,” in that they wash their car at least once a month (Smith, 1996; PRG, 1998; and Hardwick, 1997). Between 70 and 90% of residents reported that their car wash-water drained directly to the street, and presumably, to the nearest stream.

Variation in Car Washing

Regional and climatic factors play a strong role in determining the frequency of residential car washing. In colder climates, many residents utilize commercial car washes during the winter months, and then wash their cars themselves during the

summer. In warmer climates, residential car washing is often a year-round phenomenon. Neighborhood factors that influence car washing include the number of vehicles per household, lot size, driveway surfaces, income and demographics. Another key factor is the nature of the storm water conveyance system. If a neighborhood has open section roads with grass swales, the impact of car wash water will be less.

Difficulty in Changing Car Washing Behaviors

Residential car washing is a hard watershed behavior to change, since the alternative of using commercial car washes costs more money. In addition, many residents are not aware of the water quality consequences of car washing, nor do they understand the chemical content of the soaps and detergents they use. Lastly, many residents do not understand that their driveway is often directly connected to the storm drain system and the urban stream. Consequently, many communities will need to educate homeowners about the water quality implications of car washing.

Techniques to Change Car Washing Behavior

Several communities have developed effective techniques to promote safer car washing, including:

- Media campaigns to increase awareness about water quality impacts of car washing (billboards, posters, etc.)
- Conventional outreach materials (brochures, posters, water bill inserts)
- Promote use of nozzles with shut-off valves
- Provide information on environmentally safe car washing products at point of sale
- Provide storm drain plugs and wet vacs

for charity carwash events

- Provide discounted tickets for use at commercial car washes
- Modify sewer bylaws or plumbing codes to prevent storm drain discharges
- Storm drain marking (see N-21)

Good Examples

Puget Sound Car Wash Association - This charity car wash program allows qualifying nonprofit organizations to raise money for their group by selling tickets that can be redeemed at participating commercial car wash facilities.

<http://www.charitycarwash.com/>

Drain Plugs and Bubble Busters (Kitsap County) – This program provides drain plugs to contain car wash water from charitable car wash events, as well as “bubble busters” to pump out and safely dispose of wash water.

<http://www.kitsapgov.com/sswm/carwash.htm>

Top Resources

RiverSafe Carwash Campaign

<http://www.riversides.org/riversafe/>

The Dirty Secret of Washing Your Car at Home

http://www.forester.net/sw_0106_trenches.html

Best Management Practices for Controlling Runoff from Commercial Outdoor Car Washing


[http://environment.alachua-county.org/Natural_Resources/Water_Quality/Documents/Commercial Outdoor Car Wash.pdf](http://environment.alachua-county.org/Natural_Resources/Water_Quality/Documents/Commercial%20Outdoor%20Car%20Wash.pdf)

How to Run a Successful Carwash fundraiser

<http://www.carwashguys.com/fundraisers/ch2.html>

Make Your Next Car Wash “Environmentally Smart”

[http://www.ci.eugene.or.us/PW/storm/Publications/Carwash fundraiser.pdf](http://www.ci.eugene.or.us/PW/storm/Publications/Carwash_fundraiser.pdf)

N-15	Neighborhood Source Area: Driveway	
	CAR FLUID RECYCLING	

Description

The ideal watershed behavior is to have automotive fluids changed at a commercial operation where stringent pollution source controls and fluid recycling practices are in place. The next best alternative is to perform car maintenance under cover within the garage, and carefully dispose of all oil, antifreeze and other fluids at approved recycling facilities. The negative behavior is to improperly store, dump or otherwise dispose of car fluids into the storm drain system.

How Fluid Changing Influences Water Quality

Dumping automotive fluids down storm drains can be a major water quality problem, since only a few quarts of oil or a few gallons of antifreeze can have a major impact on small streams. Dumping can be a major source of hydrocarbons, oil/grease, metals, xylene and other pollutants to a stream, and are potentially toxic if dumped during dry-weather conditions when existing flow cannot dilute these discharges. The major culprit has been the backyard mechanic who changes his or her own



Figure 1: Fluid Changing on Driveway

automotive fluids (Figure 1). It has been estimated that do-it-yourself mechanics improperly dispose of 192 million gallons of used oil into the environment each year (University of Missouri, 1994). It remains unclear what fraction of the improper disposal of motor oil occurs within the storm drain system.

Percentage of People Engaging in Improper Disposal

The number of backyard mechanics who change their own oil and antifreeze has been dropping steadily in recent decades. With the advent of the \$20 oil change, only about 30% of car owners still change their own oil or antifreeze (Swann, 2001). Backyard mechanics have traditionally been the target of community oil recycling and storm drain marking programs. These programs appear to have been quite effective, since more than 80% of backyard mechanics claim to dispose of or recycle these fluids properly (Smith, 1996; PRG, 1998; Assing, 1994). Most backyard mechanics were more prone to recycle oil than antifreeze. Backyard mechanics that indicated they had improperly disposed of automotive fluids reported that they dumped it into trashcans rather than the storm drain system. Oil and antifreeze dumping is considered socially unacceptable in many communities, and, according to Swann (2001), less than 5% of backyard mechanics report that they illegally dump oil.

Variation in Car Fluid Disposal

Neighborhood demographic and income levels appear to be important factors governing the number of “do-it-yourselfers” in a given subwatershed. As with other residential behaviors, proper disposal of oil and anti-freeze

is primarily influenced by the ease, convenience and costs for accepting these fluids at local service stations or municipal collection stations.

Techniques to Change Car Fluid Disposal

While used oil collection has been a common municipal service for many years, some communities are continuously refining their programs to increase participation (Figure 2). These techniques include:

- Conventional outreach materials provided at point of sale (e.g., auto parts stores, service stations)
- Multilingual outreach materials
- Community oil recycling
- Directories of used oil collection stations
- Free or discounted oil disposal containers
- Storm drain marking



Figure 2: Frisbee Advertising Oil Recycling

Good Examples

King County Kiosks (Washington). Thirty interactive kiosks on oil recycling were placed in King County licensing offices, county buildings and other locations. In addition, a direct mail campaign to 6,000 households and three newspaper ads were used to distribute coupons good for product or service discounts that could be used when dropping off oil at participating sites.

California's Used Oil Recycling Program Incentive Program. Residents can receive incentives from certified centers that recycle used oil. Certified centers must accept used oil from the public at no charge during business hours and offer a \$0.16 per gallon recycling incentive. In turn, only certified used oil collection centers can file a claim for recovery of the \$0.16 per gallon it pays out. Certified centers can also claim the recycling incentive for all used oil generated on site from their business as an inducement to take oil from the public. <http://www.ciwmb.ca.gov/BoardInfo/ProgramResp/SpecialWaste/HHW.htm> - Public%20Info

Top Resources

Car Care for Do-It-Yourselfers
<http://www.monterey.org/publicworks/carcare.html>

Car Care for Cleaner Water
<http://www1.uwex.edu/ces/pubs/pdf/GWQ019.PDF>

Motor Vehicle Maintenance
<http://www2.ctahr.hawaii.edu/oc/freepubs/pdf/HH-15.pdf>

How To Set Up a Local Program to Recycle Used Oil - Explains the organization, design, implementation, and promotion of a used oil program, as well as administrative issues. Includes sample brochures and letters.
<http://www.epa.gov/epaoswer/non-hw/recycle/89039a.pdf>

<h1>N-16</h1>	Neighborhood Source Area: Rooftop	
	<h2>DOWNSPOUT DISCONNECTION</h2>	

Description

Downspout disconnection spreads rooftop runoff from individual downspouts across the lawn or yard where it filters or infiltrates into the ground. While some disconnections are simple, most require the installation of an on-site storm water retrofit practice. These simple practices capture, store and infiltrate storm water runoff from residential lots, and include rain barrels, rain gardens, French drains or dry wells. *Rain barrels* capture runoff from rooftops and are typically installed on individual roof leaders. Runoff captured in the barrel is stored for later use as supplemental irrigation. *Rain gardens* are shallow, landscaped depressions in the yard used to store and infiltrate runoff from rooftops and other impervious surfaces on the lot. *French drains and dry wells* are shallow small stone trenches used to infiltrate rooftop runoff into the ground, where soils are permeable. More details about on-site retrofit practices can be found in Profile Sheets OS-15 through OS-17 in Manual 3.

The ideal watershed behavior is to disconnect all downspouts so individual rooftops deliver no runoff to the storm drain system or stream. The negative watershed behavior is to pipe downspouts across the yard and into the curb or street in order to promote positive drainage (Figure 1).

How Downspout Disconnection Influences Subwatershed Quality

Downspout disconnection reduces the amount of impervious cover on a developed lot that can generate stormwater runoff. In addition to reducing the volume of runoff, downspout disconnection promotes groundwater recharge, reduces storm water runoff volumes, and filters out pollutants through the lawn soil. Since each individual retrofit for downspout disconnection treats only a few hundred or thousand square

feet of impervious cover, dozens or hundreds are needed to make a measurable difference at the subwatershed level. Consequently, an intensive campaign to target education, technical assistance, and financial resources within a neighborhood or subwatershed to encourage widespread adoption of disconnection is needed.

Percentage of Residents Engaging in Downspout Disconnection

Data is not currently available to estimate the rate at which homeowners voluntarily disconnect downspouts. The frequency of this behavior is thought to be extremely low in most neighborhoods unless a community aggressively promotes and subsidizes disconnections. If this occurs, homeowner participation rates of 20 to 30% have been reported in pilot projects (Environment Canada, 2001).



Figure 1: Downspout Intentionally Bypassing Landscaped Area and Draining onto Driveway

Variation in Downspout Disconnection

The potential to disconnect downspouts is normally evaluated as part of the Neighborhood Source Assessment component of the USSR survey (see Manual 11). The most important neighborhood factor is the proportion of existing homes directly connected to the storm drain system. Negative neighborhood factors include the presence of basements, compacted soils, and poor neighborhood awareness or involvement. Positive factors are large rooftop areas that are directly connected to the storm drain system, lots with extensive tree canopy, and good neighborhood housekeeping. In general, large residential lots are most suitable for most disconnection retrofits (1/4 acre lots and larger), although rain barrels can be used on lots as small as 4,000 square feet (Figure 2).

To date, the impetus for most disconnection retrofit programs has been to separate residential storm water from sewer flows in older neighborhoods in order to minimize basement sewer backups or combined sewer overflows.



Figure 2: Rain Barrel Used on a Back, Second Floor Balcony

Techniques to Promote Downspout Disconnection

Communities are experimenting with many different carrots to promote disconnection retrofits, including:

- Conventional outreach materials (flyers, brochures, posters)
- Free or discounted rain barrel distribution
- Municipal or schoolyard demonstration projects
- Credits or subsidies for disconnection retrofits
- Direct technical assistance
- Provision of discounted mulch, piping or plant materials
- Modification of sewer and storm water ordinances to promote disconnection
- Mandatory disconnection for targeted subwatersheds

Good Examples

Downspout Disconnection Program (Portland, OR). The City offers residents a credit of \$53 per disconnection in the form of a check or a one-time lump sum credit toward their sewer bill after inspection and approval of the work. In addition, neighborhood associations and other civic groups (churches, schools, etc.) can earn \$13 for every downspout they disconnect.

http://www.cleanrivers-pdx.org/get_involved/downspout_disconnection.htm

Rain Blocker Program (City of Chicago). The Rain Blocker pilot program is specifically designed to eliminate or greatly reduce the amount of basement flooding caused by sewer surcharge. The program works by restricting the rate of storm water flow into the city sewer system, via installing vortex restrictors within the catch basins of city streets and through downspout disconnection from buildings.

<http://www.cityofchicago.org/WaterManagement/sewers.html>

Pilot Disconnection Program (Toronto)

http://www.ene.gov.on.ca/envision/gp/4224e_3.htm

Neighborhood Rain Gardens (Minneapolis, MN).
This program works with neighborhood associations to encourage landscaping for rainwater management. The Fulton Neighborhood Association has worked with eight homeowners to install rain gardens, rain barrels, gutter downspout redirection, and infiltration systems that reduce runoff delivered from individual properties to streets, alleys and sidewalks.
<http://www.fultonneighborhood.org/lfrwm.htm>

Top Resources

How to Disconnect Your Downspouts (Portland Oregon)
http://www.cleanrivers-pdx.org/get_involved/downspout_disconnection.htm

Milwaukee Downspout Disconnection Program
<http://www.mmsd.com/projects/downspout.cfm>

Boston Water and Sewer Commission's Downspout Disconnection Program
http://www.bwsc.org/Customer_Service/Programs/downspout.htm

RainGardens.org
<http://www.raingardens.org/>

Rain Gardens: A how-to manual for homeowners
<http://www.dnr.state.wi.us/org/water/wm/dsfm/shore/documents/rgmanual.pdf>

Rain Garden Applications and Simple Calculations
http://www.cwp.org/Community_Watersheds/Rain_Garden.htm

How to Build and Install a Rain Barrel
http://www.cwp.org/Community_Watersheds/brochure.pdf

Transitions Landscape and Design: Constructing a French Drain
http://www.transitionslandscape.com/grading_drainage.html

Skills for Protecting Your Stream: Retrofitting Your Own Backyard
http://www.cwp.org/Community_Watersheds/Retrofitting_Backyard.pdf

<h1>N-18</h1>	Neighborhood Source Area: Common Areas	
	<h2>PET WASTE PICKUP</h2>	

Description

The ideal watershed behavior is to pick up and properly dispose of pet waste (Figure 1). The negative watershed behavior is to leave pet waste in common areas and the yard, where it can be washed off in storm water runoff.

How Pet Waste Influences Subwatershed Quality

Pet waste has been found to be a major source of fecal coliform bacteria and pathogens in many urban subwatersheds (Schueler, 1999). A typical dog poop contains more than three billion fecal coliform bacteria and as many as 10% of dogs are also infected with either *giardia* or salmonella, which is not surprising considering they drink urban creek water. Fecal coliform bacteria are frequently detected in urban streams and rivers after storms, with levels as high 5,000 fecal coliform per tablespoon. Thus, it is not uncommon for urban and suburban creeks to frequently violate bacteria standards for swimming and water contact recreation after larger rainstorms.

Percentage of Residents that Pick Up After Pets

Surveys indicate that about 40% of all households own one or more dogs (Swann, 1999). Not all dog owners, however, are dog walkers. Only about half of dogs are walked regularly. About 60% of dog walkers claim to pick up after their dog some or all of the time (Swann, 1999; HGIC, 1998; and Hardwick, 1997). The primary disposal method reported by

residents for pet waste is the trash can, with toilets coming in distant second. Dog walkers that do not pick up after their dogs are highly resistant to change; nearly half would not pick up even if confronted with fines or complaints from neighbors (Swann, 1999). Men are also prone to pick up after their dogs less often than women (Swann, 1999).



Figure 1: Pet Waste Pickup Station

Techniques to Promote Pet Waste Pickup

The key technique is to educate residents on sanitary and convenient options for retrieving and disposing of pet waste. Several communities have used both carrots and sticks to get more owners to pick up after their pets, including:

- Mass media campaigns of the water quality impacts of pet waste
- Conventional outreach materials (brochures, flyers, posters)
- Pooper bag stations in parks, greenways and common areas
- Educational signs in same areas
- “Pooper scooper” ordinances and enforcement
- Banning dogs from beaches and waterfront areas
- Providing designated “dog parks”

Good Examples

Water Quality Consortium Nonpoint Source Education Materials

The Water Quality Consortium implemented an ad campaign focused on four themes: a man pushing a fertilizer spreader, a car driving on water leaking oil, a man washing his car, and man walking his dog. Each ad explains how the behavior leads to water pollution and provides specific tips outlining what residents can do to protect water quality.

http://www.psat.wa.gov/Programs/Pie_Ed/Water_Ed_Materials.htm

Pick It Up - It's Your Doodie Campaign (Gwinnett County Parks & Recreation Department) - The county park agency provides plastic grocery bags for pet owners to use to clean up after their pets as part of a pilot program. The baggies are attached to a wooden post at a local park. Underneath a sign explains their purpose. Pet owners are also encouraged to bring replacement bags when they visit the park. <http://www.gwinnettcitizen.com/0203/doodie.html>

Top Resources

Public Open Space and Dogs: A Design and Management Guide for Open Space Professionals and Government

<http://www.petnet.com.au/openspace/frontis.html>

Considerations for the Selection and Use of Pet Waste Collection Systems in Public Areas

http://www.ecy.wa.gov/programs/wq/nonpoint/pet_waste/petwaste_station.pdf


Properly Disposing of Pet Waste

http://www.cleanwatercampaign.com/what_can_i_do/pet_waste_home.html

Managing Pet and Wildlife Waste to Prevent Contamination of Drinking Water

U.S. EPA Source Water Protection Practices Bulletin.

<http://www.epa.gov/safewater/protect/pdfs/petwaste.pdf>

N-20	Neighborhood Source Area: Common Areas	
	BUFFERSCAPING	

Description

Many neighborhoods built in the last few decades still have a decent stream corridor protected by buffers, flood plain setbacks or wetland protection requirements. The stream corridor that remains is often in common or private ownership. The ideal watershed behavior is to respect the boundaries of the stream corridor and expand it where possible through “bufferscaping” and backyard planting of native plants and trees. The negative watershed behavior is stream corridor encroachment, through clearing, dumping, allowing invasive plant species to spread from private yards, and erecting structures (Figure 1).

How Bufferscaping Influences Subwatershed Quality

A forested stream corridor is an essential ingredient of a healthy stream, except in certain arid and semi-arid regions. Bufferscaping can add to the total area of the stream corridor, provide wildlife habitat and enhance the structure and function of the buffer. By contrast,



Figure 1: A New Subdivision Encroaching on the Stream Buffer

encroachment activities diminish the quality, function and attractiveness of the stream buffer.

Percentage of People Encroaching on/Expanding the Stream Corridor

Data is not currently available to estimate the rate at which homeowners add to the stream corridor, but several troubling studies have examined the degree of residential buffer encroachment. Many residents perceive buffers as an extension of their backyard, and think little of removing trees, dumping yard wastes or erecting structures on their land. A major reason is that nearly 60% of residents are ignorant of the boundaries and intended purpose of stream

buffers (Heraty, 1993). Studies of wetland buffer encroachment in Washington residential areas found that 95% of buffers were visibly altered, 40% to such a degree that their functional value was eliminated (Cooke, 1991). Other studies of Maryland buffers indicate encroachment rates of as much as 1% of area buffer per year. Clearly, residential awareness and behaviors in regard to the stream corridor need to be improved in many subwatersheds.

Neighborhood Factors that Contribute to Buffer Stewardship

Several factors play a role in how buffers are managed within a neighborhood: the age of the development, lot size, activism of homeowner association, boundary signs, and the prior existence of stream buffer or flood plain regulations.

Techniques to Encourage Buffer Stewardship

Protecting or expanding stream buffers requires direct education and interaction with individual

property owners that back up to the buffer. Some useful techniques include:

- Bufferscaping assistance and guides
- Community buffer walks
- Buffer boundary inspections
- Boundary signs (Figure 2)
- Defining unallowed uses in local stream buffer ordinances
- Presentations to community associations
- Adopt-a-stream program
- Financial incentives for bufferscaping



http://sites.state.pa.us/PA_Exec/Fish_Boat/

Figure 2: Sign Identifying a Buffer Boundary
Good Examples

Burnett County, WI Natural Shoreline Incentives. The county pays homeowners to enroll in a program to maintain shorelines in their natural state. The program asks for a voluntary commitment by placing a covenant on a homeowner's property stating that the shoreline will remain natural. Program members receive a payment of \$250 after an initial inspection that certifies the property meets program standards, and the shoreline covenant is recorded. Participants also receive an annual deduction from their tax statement as a thank you.

<http://www.burnettcounty.com/burnett/lwcd/preserve.html>

Tennessee Valley Authority Banks and Buffers Software: A Guide to Selecting Native Plants for Streambanks and Shorelines includes software application to help homeowners select plants for bufferscaping. It also contains selected

characteristics and environmental tolerances of 117 plants and more than 400 color photographs illustrating habitat and growth form.

<http://www.tva.gov/river/landandshore/stabilization/websites.htm>

Top Resources

The Architecture of Urban Stream Buffers

<http://www.stormwatercenter.net/Library/Practice/39.pdf>

Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers

<http://www.chesapeakebay.net/pubs/subcommittee/nsc/forest/riphbk.pdf>

Riparian Forest Buffer Design, Establishment, and Maintenance

<http://www.agnr.umd.edu/MCE/Publications/Publication.cfm?ID=13>

Riparian Area Management: A Citizen's Guide

<http://www.co.lake.il.us/elibrary/publications/smc/riparian.pdf>

Backyard Buffers for the South Carolina Lowcountry

<http://www.scdhec.net/ocrm/pubs/backyard.pdf>

Alliance for the Chesapeake Bay – Backyard Buffers


<http://www.acb-online.org/pubs/projects/deliverables-158-1-2003.pdf>

Cayuga County, NY – Green Thumbs for Blue Water Workshops

<http://www.co.cayuga.ny.us/wqma/greenthumbs>

Tree-mendous Maryland

<http://www.dnr.state.md.us/forests/treemendous/>

N-21	Neighborhood Source Area: Common Areas	
	STORM DRAIN MARKING	

Description

The ideal watershed behavior is to get residents to fully understand the connection between storm drains and downstream waters and avoid any activity that discharges pollutants. This awareness is most often created by marking or stenciling storm drain inlets with a “Don’t dump, drains to...” message (Figure 1). The negative watershed behavior is to use storm drains as a means of disposal for trash, yard waste and household products.

How Storm Drain Marking Influences Water Quality

Storm drain marking sends a clear message to keep trash and debris, leaf litter and organic matter out of the storm drain system. Stencils may also reduce residential spills and illicit discharges. Marking is also a direct and local way to increase watershed awareness and practice neighborhood stewardship. The actual water quality benefits of storm drain marking have yet to be demonstrated through field research or monitoring. Still, marking is always a sign of good neighborhood housekeeping. Santa Monica, CA also marks the hotline phone number on storm drains to report water quality problems and illegal dumping.

Percentage of Residents Engaging in Storm Drain Marking

This behavior does not require extensive resident participation; only a few trained volunteers are needed to thoroughly mark storm drains within a neighborhood. Volunteers can include scouts, service groups, high school students, neighborhood associations, and other volunteers. Normally, marking is “sanctioned” by the local public works authority or environmental agency, so it is important to coordinate closely with them (Figure 2). Table 1 provides guidance for marking storm drains.

Factors to Consider in Storm Drain Marking

The only significant impediment to storm drain marking is when a neighborhood is primarily served by open channels or grassed channels, rather than enclosed storm drains.



Figure 1: Storm Drain Marking

Table 1: Storm Drain Marking Guidance

- Enlist one person to serve as the team leader, and make sure he/she knows all marking rules and safety procedures.
- Review all safety procedures before marking.
- Marking should be performed by at least two people, so one can be on the lookout for oncoming vehicles. Safety vests and traffic cones can be used to alert vehicles.
- Remember to wear old cloths and shoes.
- Bring paper towels or a rag to wipe up and two trash bags – one for the wet stencil (when necessary), which is not garbage, and one to pick-up garbage along the way.
- Keep track of all storm drain stencils and turn this information over to the team leader or the appropriate local government agency.
- Do not mark any storm drains with vehicles parked nearby.
- Record the locations of any storm drains that have leaves, grass clippings, oil, or other pollutants.
- Properly dispose of all trash at the end of the day, and return all empty paint cans and supplies to the team leader.

Information adapted from the following websites:
<http://www.deq.state.la.us/assistance/litter/stormdrain.htm>
<http://www.tnrcc.state.tx.us/admin/topdoc/gi/212.pdf>

STORMWATER POLLUTION —WHAT IS IT?
 Runoff from rainstorms is called stormwater. Stormwater becomes polluted by flowing over dirty surfaces, like parking lots, or when someone dumps materials, like oil or paint, directly into the storm drain. Polluted stormwater flows without treatment directly to creeks and rivers, where it can be harmful to aquatic life.

IT'S ILLEGAL TO DISCHARGE POLLUTANTS
 Intentionally or unintentionally causing materials to enter the storm drain system is illegal and can result in corrective penalties. The following is a partial list of materials that are prohibited for discharge into the storm drain:

Paint	Concrete mix
Motor oil	Antifreeze
Yard waste	Chlorinated pool water
Rinse water from clothes washers	

HOW TO GET A FREE STENCILING KIT
 To obtain a stenciling kit, or for more information about controlling stormwater pollution, contact your local stormwater agency or check out their website:

County of Sacramento	(916) 874-6851
www.sactostormwater.org	
City of Sacramento	(916) 433-6369
www.sactostormwater.org	
City of Elk Grove	(916) 478-2232
City of Citrus Heights	(916) 727-4769
City of Folsom	(916) 355-7272
City of Elk Grove	(916) 478-2232
City of Galt	(209) 366-7260

To report illegal discharge to the storm drain or creeks in your area, call:

NON-EMERGENCY	
County of Sacramento	(916) 875-RAIN (7246)
City of Sacramento	(916) 264-5011
City of Citrus Heights	(916) 875-RAIN (7246)
City of Elk Grove	(916) 875-RAIN (7246)
City of Folsom	(916) 355-7250
City of Galt	(209) 366-7260
EMERGENCY ONLY	
	911

PROTECT the ENVIRONMENT

PAINT-A-DRAIN CAMPAIGN

Storm drain stenciling sends a clear "No Dumping" message

SACRAMENTO STORMWATER MANAGEMENT PROGRAM

Figure 2: Educational Brochure on Storm Drain Marking/Stenciling

Source: http://www.sactostormwater.org/documents/stencil_brochure_03.pdf

Top Resources

Texas Natural Resource Conservation Commission's Storm Drain Stenciling: A Guide for Communities. This extensive guide includes information on how to get volunteers involved, guidelines and materials for marking, reviews of five marking programs, and sample recognition certificates, press releases, door hangers, and public service announcements.
<http://www.tnrcc.state.tx.us/exec/sbea/education.html>

The Urban Dweller's Guide To Watersheds
<http://www.museumca.org/creeks/umbrella.html>

University of Wisconsin-Extension Water Resources Program Storm Drain Stenciling Web Page
<http://clean-water.uwex.edu/wav/stormdrain/index.htm>

Earthwater Stencils Home Page
<http://www.earthwater-stencils.com/>

Storm Drain Stenciling Project Guidelines
<http://www.epa.gov/adopt/patch/html/guidelines.html>
The Ocean Conservancy's Storm Drain Sentries
<http://www.oceanconservancy.org/dynamic/learn/programs/sentries/sentries.htm>

South Carolina Department of Health and Environmental Control's Water Watch Campaign: Conducting a Storm Drain Tagging Project
<http://www.scdhec.net/water/pubs/wwtag2.pdf>

Multilingual Storm Drain Stenciling GreenSpace Partners worked with local watershed groups and volunteers to stencil storm drains with messages in English, Somali and Spanish.
<http://www.greeninstitute.org/GSP/programs/stormwater/stencils/stencils.html>

North Carolina's Storm Drain Stenciling Project This project was piloted in 1994 along coastal NC watersheds and has received support from many state and national organizations and has received the "Take Pride in North Carolina" Award.
<http://www.bae.ncsu.edu/bae/programs/extension/wqg/smp-18/stormdrain/>

<h1>H-1</h1>	Hotspot Source Area: Vehicles	
	VEHICLE MAINTENANCE AND REPAIR	

Description

Vehicle maintenance and repair operations can exert a significant impact on water quality by generating toxins such as solvents, waste oil, antifreeze, and other fluids. Often, vehicles that are wrecked or awaiting repair can be a storm water hotspot if leaking fluids are exposed to storm water runoff (Figure 1). Vehicle maintenance and repair can generate oil and grease, trace metals, hydrocarbons, and other



Figure 1: Junkyard and Potential Source of Storm Water Pollution

toxic organic compounds. Table 1 summarizes a series of simple pollution prevention techniques for vehicle maintenance and repair operations that can prevent storm water contamination. You are encouraged to consult the Resources section of this sheet to get a more comprehensive review of pollution prevention practices for vehicle maintenance and repair operations.

Application

Pollution prevention practices should be applied to any facility that maintains or repairs vehicles in a subwatershed. Examples include car dealerships, body shops, service stations, quick lubes, school bus depots, trucking companies, and fleet maintenance operations at larger industrial, institutional, municipal or transport-related operations. Repair facilities are often clustered together, and are a major priority for subwatershed pollution prevention.

Table 1: Pollution Prevention Practices for Vehicle Maintenance and Repair Activities
<ul style="list-style-type: none"> • Avoid hosing down work or fueling areas • Clean all spills immediately using dry cleaning techniques • Collect used antifreeze, oil, grease, oil filters, cleaning solutions, solvents, batteries, hydraulic and transmission fluids and recycle with appropriate agencies • Conduct all vehicle and equipment repairs indoors or under a cover (if done outdoors) • Connect outdoor vehicle storage areas to a separate storm water collection system with an oil/grit separator that discharges to a dead holding tank, the sanitary sewer or a storm water treatment practice • Designate a specific location for outdoor maintenance activities that is designed to prevent storm water pollution (paved, away from storm drains, and with storm water containment measures) • Inspect the condition of all vehicles and equipment stored outdoors frequently • Use a tarp, ground cloth, or drip pans beneath vehicles or equipment being repaired outdoors to capture all spills and drips • Seal service bay concrete floors with an impervious material so cleanup can be done without using solvents. Do not wash service bays to outdoor storm drains • Store cracked batteries in a covered secondary containment area until they can be disposed of properly • Wash parts in a self-contained solvent sink rather than outdoors

Primary Training Targets

Owners, fleet operation managers, service managers, maintenance supervisors, mechanics and other employees are key targets for training.

Feasibility

Pollution prevention techniques for vehicle repair facilities broadly apply to all regions and climates. These techniques generally rely on changes to basic operating procedures, after an initial inspection of facility operations. The inspection relies on a standard operations checklist that can be completed in a few hours.

Implementation Considerations

Employee training is essential to successfully implement vehicle repair pollution prevention practices. The connection between the storm drain system and local streams should be emphasized so that employees understand why any fluids need to be properly disposed of. It is also important to understand the demographics of the work force; in some communities, it may require a multilingual education program.

Cost - Employee training is generally inexpensive, since training can be done using posters, pamphlets, or videos. Structural practices can vary based on what equipment is required. For instance, solvent sinks to clean parts can cost from \$1,500 to \$15,000, while spray cabinets may cost more than \$50,000. In addition, proper recycling/disposal of used or spilled fluids usually requires outside contractors that may increase costs.

Resources

Stormwater Management Manual for Western Washington: Volume IV -- Source Control BMPs.

<http://www.ecy.wa.gov/biblio/9914.html>

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial.
<http://www.cabmphandbooks.com/>

Coordinating Committee For Automotive Repair (CCAR) Source: US EPA CCAR-GreenLink®, the National Automotive Environmental Compliance Assistance Center CCAR-GreenLink® Virtual Shop <http://www.ccar-greenlink.org/>

Auto Body Shops Pollution Prevention Guide. Peaks to Prairies Pollution Prevention Information Center.
<http://peakstoprairies.org/p2bande/autobody/abguide/index.cfm>


Massachusetts Office of Technical Assistance for Toxics Use Reduction (OTA). Crash Course for Compliance and Pollution Prevention Toolbox
<http://www.state.ma.us/ota/pubs/toolfull.pdf>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities.
<http://www.swrcb.ca.gov/stormwtr/murp.html>

US EPA. Virtual Facility Regulatory Tour: Vehicle Maintenance. FedSite Federal Facilities Compliance Assistance Center.
<http://www.epa.gov/fedsite/virtual.html>

City of Santa Cruz. Best Management Practices for Vehicle Service Facilities (in English and Spanish).
<http://www.ci.santa-cruz.ca.us/pw/pdf/vehiclebmp.pdf>

City of Los Angeles Bilingual Poster of BMPs for Auto Repair Industry
<http://www.lastormwater.org/downloads/PDFs/autopstr.pdf>

<h1>H-2</h1>	Hotspot Source Area: Vehicles	
	<h2>VEHICLE FUELING</h2>	

Description

Spills at vehicle fueling operations have the potential to directly contribute oil, grease, and gasoline to storm water, and can be a significant source of lead, copper and zinc, and petroleum hydrocarbons. Delivery of pollutants to the storm drain can be sharply reduced by well-designed fueling areas and improved operational procedures. The risk of spills depends on whether the fueling area is covered and has secondary containment. The type, condition, and exposure of the fueling surface can also be important. Table 1 describes common pollution prevention practices for fueling operations.

Application

These practices can be applied to any facility that dispenses fuel. Examples include retail gas

stations, bus depots, marinas, and fleet maintenance operations (Figure 1). In addition, these practices also apply to temporary above-ground fueling areas for construction and earthmoving equipment. Many fueling areas are usually present in urban subwatersheds, and they tend to be clustered along commercial and highway corridors. These hotspots are often a priority for subwatershed source control.



Figure 1: Covered Retail Gas Operation Without Containment for Potential Spills

Table 1: Pollution Prevention Practices For Fueling Operation Areas
<ul style="list-style-type: none"> • Maintain an updated spill prevention and response plan on premises of all fueling facilities (see Profile Sheet H-7) • Cover fueling stations with a canopy or roof to prevent direct contact with rainfall • Design fueling pads for large mobile equipment to prevent the run-on of storm water and collect any runoff in a dead-end sump • Retrofit underground storage tanks with spill containment and overfill prevention systems • Keep suitable cleanup materials on the premises to promptly clean up spills • Install slotted inlets along the perimeter of the “downhill” side of fueling stations to collect fluids and connect the drain to a waste tank or storm water treatment practice. The collection system should have a shutoff valve to contain a large fuel spill event • Locate storm drain inlets away from the immediate vicinity of the fueling area • Clean fuel-dispensing areas with dry cleanup methods. Never wash down areas before dry clean up has been done. Ensure that wash water is collected and disposed of in the sanitary sewer system or approved storm water treatment practice • Pave fueling stations with concrete rather than asphalt • Protect above ground fuel tanks using a containment berm with an impervious floor of Portland cement. The containment berm should have enough capacity to contain 110% of the total tank volume • Use fuel-dispensing nozzles with automatic shutoffs, if allowed • Consider installing a perimeter sand filter to capture and treat any runoff produced by the station

Primary Training Targets

Training efforts should be targeted to owners, operators, attendants, and petroleum wholesalers.

Feasibility

Vehicle fueling pollution prevention practices apply to all geographic and climatic regions. The practices are relatively low-cost, except for structural measures that are installed during new construction or station remodeling.

Implementation Considerations

Fueling Area Covers - Fueling areas can be covered by installing an overhanging roof or canopy. Covers prevent exposure to rainfall and are a desirable amenity for retail fueling station customers. The area of the fueling cover should exceed the area where fuel is dispensed. All downspouts draining the cover or roof should be routed to prevent discharge across the fueling area. If large equipment makes it difficult to install covers or roofs, fueling islands should be designed to prevent storm water run-on through grading, and any runoff from the fueling area should be directed to a dead-end sump.

Surfaces - Fuel dispensing areas should be paved with concrete; the use of asphalt should be avoided, unless the surface is sealed with an impervious sealant. Concrete pads used in fuel dispensing areas should extend to the full length that the hose and nozzle assembly can be pulled, plus an additional foot.

Grading - Fuel dispensing areas should be graded with a slope that prevents ponding, and separated from the rest of the site by berms, dikes or other grade breaks that prevent run-on of urban runoff. The recommended grade for fuel dispensing areas is 2 - 4% (CSWQTF, 1997).

Cost - Costs to implement pollution prevention practices at fueling stations will vary, with many of the costs coming upfront during the design of a new fueling facility. Once a facility has

implemented the recommended source control measures, ongoing maintenance costs should be low.

Resources

Best Management Practice Guide – Retail Gasoline Outlets. Prepared by Retail Gasoline Outlet Work Group.
http://www.swrcb.ca.gov/rwqcb4/html/programs/stormwater/la_ms4_tentative/RGO_BMP_Guide_03-97_.pdf

Stormwater Management Manual for Western Washington: Volume IV -- Source Control BMPs.
<http://www.ecy.wa.gov/biblio/9914.html>

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: New Development and Redevelopment.
<http://www.cabmphandbooks.com/>

City of Los Angeles, CA Best Management Practices for Gas Stations
<http://www.lacity.org/SAN/wpd/downloads/PDFs/gasstation.pdf>

City of Dana Point Stormwater Best Management Practices (BMPs) For Automotive Maintenance And Car Care
<http://www.danapoint.org/water/WC-AUTOMOTIVE.pdf>


Alachua County, FL Best Management Practices for Controlling Runoff from Gas Stations
http://environment.alachua-county.org/Natural_Resources/Water_Quality/Documents/Gas%20Stations.pdf

California Stormwater Regional Control Board Retail Gasoline Outlets: New Development Design Standards For Mitigation Of Storm Water Impacts
http://www.swrcb.ca.gov/rwqcb4/html/programs/stormwater/la_ms4_tentative/RGOpaper.pdf
http://www.swrcb.ca.gov/rwqcb4/html/programs/stormwater/la_ms4_tentative/RGOPaperSupplement_12-01_.pdf

Canadian Petroleum Products Institute Best Management Practices Stormwater Runoff from Petroleum Facilities
<http://www.cppei.ca/tech/BMPstormwater.pdf>

City of Monterey (CA). Posters of Gas Station BMPs.
<http://www.monterey.org/publicworks/stormeduc.html>

Pinole County, CA Typical Stormwater Violations Observed in Auto Facilities and Recommended Best Management Practices (BMPs)
<http://www.ci.pinole.ca.us/publicworks/downloads/AutoStormwater.pdf>

<h1>H-3</h1>	Hotspot Source Area: Vehicles	
	<h2>VEHICLE WASHING</h2>	

Description

Vehicle washing pollution prevention practices apply to many commercial, industrial, institutional, municipal and transport-related operations. Vehicle wash water may contain sediments, phosphorus, metals, oil and grease, and other pollutants that can degrade water quality. When vehicles are washed on impervious surfaces such as parking lots or industrial areas, dirty wash water can contaminate storm water that ends up in streams.

Application

Improved washing practices can be used at any facility that routinely washes vehicles. Examples include commercial car washes, bus depots, car dealerships, rental car companies, trucking companies, and fleet operations. In addition, washing dump trucks and other construction equipment can be a problem. Washing operations tend to be unevenly distributed within urban subwatersheds. Vehicle washing also occurs in neighborhoods, and techniques to keep wash water out of the storm drain system are discussed in the car washing profile sheet (N-11). Table 1 reviews some of the pollution prevention techniques available for hotspot vehicle washing operations.

Primary Training Targets

Owners, fleet managers, and employees of operations that include car washes are the primary training target.

Feasibility

Vehicle washing practices can be applied to all regions and climates. Vehicle washing tends to occur more frequently in summer months and in drier regions of the country. Sound vehicle washing practices are not always used at many sites because operators are reluctant to change traditional cleaning methods. In addition, the cost of specialized equipment to manage high volumes of wash water can be too expensive for small businesses.

Improved vehicle washing practices are relatively simple to implement and are very effective at preventing storm water contamination. Training is essential to get owners and employees to adopt these practices, and should be designed to overcome cultural and social barriers to improved washing practices.

Table 1: Pollution Prevention Practices for Vehicle Washing

- Wash vehicles at indoor car washes that recycle, treat or convey wash water to the sanitary sewer system
- Use biodegradable, phosphate-free, water-based soaps
- Use flow-restricted hose nozzles that automatically turn off when left unattended
- Wash vehicles on a permeable surface or a washpad that has a containment system
- Prohibit discharge of wash water into the storm drain system or ground by using temporary berms, storm drain covers, drain plugs or other containment system
- Label storm drains with “No Dumping” signs to deter disposal of wash water in the storm drain system
- Pressure and steam clean off-site to avoid runoff with high pollutant concentrations
- Obtain permission from sewage treatment facilities to discharge to the sanitary sewer

Implementation Considerations

The ideal practice is to wash all vehicles at commercial car washes or indoor facilities that are specially designed for washing operations. Table 2 offers some tips for indoor car wash sites. When washing operations are conducted outside, a designated wash area should have the following characteristics:

- Paved with an impervious surface, such as Portland cement concrete
- Bermed to contain wash water
- Sloped so that wash water is collected and discharged to the sanitary sewer system, holding tank or dead-end sump
- Operated by trained workers to confine washing operations to the designated wash area

Outdoor vehicle washing facilities should use pressurized hoses without detergents to remove most dirt and grime. If detergents are used, they should be phosphate-free to reduce nutrient loading. If acids, bases, metal brighteners, or degreasing agents are used, wash water should be discharged to a treatment facility, sanitary sewer, or a sump. In addition, waters from the

Table 2: Tips for Indoor Car Wash Sites

(Adapted from U.S. EPA, 2003)

- Facilities should have designated areas for indoor vehicle washing where no other activities are performed (e.g. fluid changes or repair services)
- Indoor vehicle wash areas should have floor drains that receive only vehicle washing wastewater (not floor washdown or spill removal wash waters) and be connected to a holding tank with a gravity discharge pipe, to a sump that pumps to a holding tank, or to an oil/grit separator that discharges to a municipal sanitary sewer
- The floor of indoor vehicle wash bays should be completely bermed to collect wash water
- Aromatic and chlorinated hydrocarbon solvents should be eliminated from vehicle-washing operations
- Vehicle-washing operations should use vehicle rinsewater to create new wash water through the use of recycling systems that filter and remove grit.

pressure washing of engines and vehicle undercarriages must be disposed of using the same options.

Discharge to pervious areas may be an option for washing operations that generate small amounts of relatively clean wash water (water only - no soaps, no steam cleaning). The clean wash water should be directed as sheet flow across a vegetated area to infiltrate or evaporate before it enters the storm drain system. This option should be exercised with caution, especially in environmentally sensitive areas or protected groundwater recharge areas.

The best way to avoid stormwater contamination during washing operations is to drain the wash water to the sanitary sewer system. Operations that produce high volumes of wash water should consider installing systems that connect to the sewer. Other options for large and small operations include containment units to capture the wash water prior to transport away for proper disposal (Figure 1). If vehicles must be washed on an impervious surface, a storm drain filter should be used to capture solid contaminants.

Cost - The cost of using vehicle-washing practices can vary greatly and depends on the size of the operation (Table 3). The cost of constructing a commercial grade system connected to the sanitary sewer can exceed \$100,000. Disposal fees and frequency of washing can also influence the cost. Training costs can be minimized by using educational



Figure 1: Containment System Preventing Wash Water from Entering the Storm Drain

materials available from local governments, professional associations or EPA's National Compliance Assistance Centers (<http://www.assistancecenters.net/>). Temporary, portable containment systems can be shared by several companies that cannot afford specialized equipment independently.

Table 3: Sample Equipment Costs for Vehicle Washing Practices	
Item	Cost
Bubble Buster	\$2,000 –2,500*
Catch basin insert	\$65*
Containment mat	\$480-5,840**
Storm drain cover (24" drain)	\$120.00 **
Water dike/ berm (20 ft)	\$100.00 **
Pump	\$75-3,000**
Wastewater storage container	\$50-1,000+**
Source: *U.S. EPA, 1992 **Robinson, 2003	

Resources

EPA FedSite Virtual Facility Regulatory Tour, Vehicle Maintenance Facility Tour. Vehicle Washing - P2 Opportunities
<http://www.epa.gov/fedsite/vmf/p2vehwash.html>


Alachua County Pollution Prevention Fact Sheet: Best Management Practices for Controlling Runoff from Commercial Outdoor Car Washing. http://environment.alachua-county.org/Natural_Resources/Water_Quality/Documents/Commercial_Outdoor_Car_Wash.pdf.

Kitsap County Sound Car Wash Program.
<http://www.kitsapgov.com/sswm/carwash.htm>.

Washington Department of Ecology. 1995. Vehicle and Equipment Wash Water Discharges: Best Management Practices Manual. Olympia, Washington.
<http://www.ecy.wa.gov/pubs/95056.pdf>

U.S. Environmental Protection Agency. Pollution Prevention/Good Housekeeping for Municipal Operations.
http://cfpub2.epa.gov/npdes/stormwater/menuofbmps/poll_18.cfm. Website Accessed 2004.

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial.
<http://www.cabmphandbooks.com/>

H-5	Hotspot Source Area: Outdoor Materials	
	LOADING AND UNLOADING	

Description

Outdoor loading and unloading normally takes place on docks or terminals at many commercial, industrial, institutional, and municipal operations. Materials spilled or leaked during this process can either be carried away in storm water runoff or washed off when the area is cleaned. As a result, many different pollutants can be introduced into the storm drain system, including sediment, nutrients, trash, organic material, trace metals, and an assortment of other pollutants. A number of simple and effective pollution prevention practices can be used at loading/unloading areas to prevent runoff contamination, as shown in Table 1.

Application

While nearly every commercial, industrial, institutional, municipal and transport-related site has a location where materials or products are shipped or received, the risk of storm water pollution is greatest for operations that transfer high volumes of material or liquids, or unload potentially hazardous materials. Some notable examples to look for in a subwatershed include distribution centers, grocery stores, building supply outlets, lawn and garden centers, petroleum wholesalers, warehouses, landfills, ports, solid waste facilities, and maintenance depots (Figure 1). Attention should also be paid to industrial operations that process bulk materials, and any operations regulated under industrial storm water NPDES permits.

Primary Training Targets

Owners, site managers, facility engineers, supervisors, and employees of operations with loading/unloading facilities are the primary training target.

Feasibility

Loading/unloading pollution prevention practices can be applied in all geographic and climatic regions, and work most effectively at preventing sediment, nutrients, toxic materials, and oil from coming into contact with storm water runoff or runoff. Few impediments exist to using this practice, except for the cost to retrofit existing loading and unloading areas with covers or secondary containment.



Figure 1: Loading/Unloading Area of Warehouse

Table 1: Pollution Prevention Practices for Loading and Unloading Areas

- Avoid loading/unloading materials in the rain
- Close adjacent storm drains during loading/unloading operations
- Surround the loading/unloading area with berms or grading to prevent run-on or pooling of storm water. If possible, cover the area with a canopy or roof
- Ensure that a trained employee is always present to handle and cleanup spills
- Inspect the integrity of all containers before loading/unloading
- Inspect equipment such as valves, pumps, flanges, and connections regularly for leaks, and repair as needed
- Install an automatic shutoff valve to interrupt flow in the event of a catastrophic liquid spill
- Install a high-level alarm on storage tanks to prevent overfilling
- Pave the loading/unloading area with concrete rather than asphalt
- Place drip pans or other temporary containment devices at locations where leaks or spills may occur, and always use pans when making and breaking connections
- Position roof downspouts to direct storm water away from loading/unloading areas and into bioretention areas
- Prepare and implement an Emergency Spill Cleanup Plan for the facility (see Profile Sheet H-7)
- Sweep loading/unloading area surfaces frequently to remove material that could otherwise be washed off by storm water
- Train all employees, especially fork lift operators, on basic pollution prevention practices and post signs
- Use seals, overhangs, or door skirts on docks and terminals to prevent contact with rainwater

Implementation Considerations

Loading/unloading pollution prevention practices should be integrated into the overall storm water pollution prevention plan for a facility. Employee training should focus on proper techniques to transfer materials, using informational signs at loading docks and material handling sites and during routine safety meetings.

Cost - Costs to implement loading/unloading pollution prevention practices consist of one-time construction costs to retrofit new or existing loading areas, but annual maintenance costs are relatively low thereafter. Exceptions include industries that elect to use expensive air pressure or vacuum systems for loading/unloading facilities, which can also be expensive to maintain (U.S. EPA, 1992). Ongoing costs include employee training and periodic monitoring of loading/unloading activities.

Resources


California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial.
<http://www.cabmphandbooks.com/>

Stormwater Management Manual for Western Washington: Volume IV -- Source Control BMPs. WA Dept. of Ecology 99-14
<http://www.ecy.wa.gov/biblio/9914.html>

Ventura County Flood Control District Clean Business Program Fact Sheet
<http://www.vcstormwater.org/sheet-materials.htm>

Business Best Management Practices Stormwater Bmp #3 - Shipping/Receiving/Loading Docks
http://www.cleancharles.org/stormwater_bmp3.shtml

City of Los Angeles, CA Reference Guide For Stormwater Best Management Practices
http://www.lastormwater.org/downloads/PDFs/bmp_refguide.pdf

H-6	Hotspot Source Area: Outdoor Materials	
	OUTDOOR STORAGE	

Description

Protecting outdoor storage areas is a simple and effective pollution prevention practice for many commercial, industrial, institutional, municipal, and transport-related operations. The underlying concept is to prevent runoff contamination by avoiding contact between outdoor materials and rainfall (or runoff). Unprotected outdoor storage areas can generate a wide range of storm water pollutants, such as sediment, nutrients, toxic materials, and oil and grease (Figure 1).

Materials can be protected by installing covers, secondary containment, and other structures to prevent accidental release. Outdoor storage areas can be protected on a temporary basis (tarps or plastic sheeting) or permanently through structural containment measures (such as roofs, buildings, or concrete berms). Table 1 summarizes pollution prevention practices available for outdoor storage areas.



Figure 1: Mulch Stored Outdoors at a Garden Center

Application

Many businesses store materials or products outdoors. The risk of storm water pollution is greatest for operations that store large quantities of liquids or bulk materials at sites that are connected to the storm drain system. Several notable operations include nurseries and garden centers, boat building/repair, auto recyclers/body shops, building supply outlets, landfills, ports, recycling centers, solid waste and composting facilities, highway maintenance depots, and power plants. Attention should also be paid to industrial operations that process bulk materials, which are often regulated under industrial storm water NPDES permits.

Primary Training Targets

Owners, site managers, facility engineers, supervisors, and employees of operations with loading/unloading facilities are the primary training target.

Feasibility

Outdoor storage protection can be widely applied in all regions and climate zones, and requires routine monitoring by employees. Most operations have used covering as the major practice to handle outdoor storage protection (U.S. EPA, 1999). The strategy is to design and maintain outdoor material storage areas so that they:

- Reduce exposure to storm water and prevent runoff
- Use secondary containment to capture spills
- Can be regularly inspected
- Have an adequate spill response plan and cleanup equipment

Table 1: Pollution Prevention Practices for Protecting Outdoor Storage Areas

- Emphasize employee education regarding storage area maintenance
- Keep an up-to-date inventory of materials stored outdoors, and try to minimize them
- Store liquids in designated areas on an impervious surface with secondary containment
- Inspect outdoor storage containers regularly to ensure that they are in good condition
- Minimize storm water run-on by enclosing storage areas or building a berm around them
- Slope containment areas to a drain with a positive control (lock, valve, or plug) that leads to the sanitary sewer (if permitted) or to a holding tank
- Schedule regular pumping of holding tanks containing storm water collected from secondary containment areas

Implementation Considerations

Covers - The use of impermeable covers is an effective pollution prevention practice for non-hazardous materials. Covers can be as simple as plastic sheeting or tarps, or more elaborate roofs and canopies. Site layout, available space, affordability, and compatibility with the covered material all dictate the type of cover needed for a site. In addition, the cover should be compatible with local fire and building codes and OSHA workplace safety standards. Care should be taken to ensure that the cover fully protects the storage site and is firmly anchored into place.

Secondary Containment - Secondary containment is designed to contain possible spills of liquids and prevent storm water run-on from entering outdoor storage areas. Secondary containment structures vary in design, ranging from berms and drum holding areas to specially-designed solvent storage rooms (Figure 2).

Secondary containment can be constructed from a variety of materials, such as concrete curbs,



Figure 2: Secondary Containment of Storage Drums Behind a Car Repair Shop

earthen berms, plastic tubs, or fiberglass or metal containers. The type of material used depends on the substance contained and its resistance to weathering. In general, secondary containment areas should be sized to hold 110% of the volume of the storage tank or container unless other containment sizing regulations apply (e.g., fire codes).

If secondary containment areas are uncovered, any water that accumulates must be collected in a sanitary sewer, a storm water treatment system, or a licensed disposal facility. Water quality monitoring may be needed to determine whether the water is contaminated and dictate the method of disposal. If the storm water is clean, or an on-site storm water treatment practice is used, a valve should be installed in the containment dike so that excess storm water can be drained out of the storage area and directed either to the storm drain (if clean) or into the storm water treatment system (if contaminated). The valve should always be kept closed except when storm water is drained, so that any spills that occur can be effectively contained. Local sewer authorities may not allow discharges from a large containment area into the sewer system, and permission must be obtained prior to discharge. If discharges to the sanitary sewer system are prohibited, containment should be provided, such as a holding tank that is regularly pumped out.

Employee training on outdoor storage pollution prevention should focus on the activities and site areas with the potential to pollute storm water and the proper techniques to manage material storage areas to prevent runoff contamination. Training can be conducted through safety meetings and the posting of on-site informational signs. Employees should also

know the on-site person who is trained in spill response.

Cost - Many storage protection practices are relatively inexpensive to install (Table 2). Actual costs depend on the size of the storage area and the nature of the pollution prevention practices. Other factors are whether practices are temporary or permanent and the type of materials used for covers and containment. Employee training can be done in connection with other safety training to reduce program costs. Training costs can also be reduced by using existing educational materials from local governments, professional associations or from EPA's National Compliance Assistance Centers (<http://www.assistancecenters.net>).

Table 2: Sample Equipment Costs for Outdoor Storage Protection	
Storage Protection Device	Cost
Concrete Slab (6")	\$3.50 to \$5.00 per ft ²
Containment Pallets	\$50 to \$350 based on size and # of barrels to be stored
Storage buildings	\$6 to \$11 per ft ²
Tarps & Canopies	\$25 to \$500 depending on size of area to cover
<i>Sources: Costs were derived from a review of Ferguson et al., 1997 and numerous websites that handle proprietary spill control or hazardous material control products</i>	

Resources

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial.
<http://www.cabmphandbooks.com/>

Rouge River National Wet Weather Demonstration Project. Wayne County, MI.
<http://www.rougeriver.com/geninfo/rougeproj.html>

Storm Water Management Fact Sheet: Coverings. USEPA, Office of Water,
<http://www.epa.gov/owm/mtb/covs.pdf>.

EPA Office of Wastewater Management Storm Water Management Fact Sheet: Coverings
<http://www.epa.gov/owm/mtb/covs.pdf>

California Stormwater Quality Association Factsheet: Outdoor Storage of Raw Materials
<http://www.cabmphandbooks.com/Documents/Municipal/SC-33.pdf>

Alameda Countywide Clean Water Program Outdoor Storage of Liquid Materials
http://www.cleanwaterprogram.com/outdoor_stor_liquid_fact_sht.pdf

Washtenaw County, MI Community Partners for Clean Streams Fact Sheet Series #1: Housekeeping Practices
http://www.ewashtenaw.org/content/dc_drnbmp1.pdf

H-7	Hotspot Source Area: Spills and Accidents	ATTENTION
	SPILL PREVENTION AND RESPONSE	Spill Clean-up Kit Located Here

Description

Spill prevention and response plans describe operational procedures to reduce spill risks and ensure that proper controls are in place when they do occur. Spill prevention plans standardize everyday procedures and rely heavily on employee training and education. The investment is a good one for most operations, since spill prevention plans reduce potential liability, fines and costs associated with spill cleanup. Table 1 provides some simple tips to prevent and respond to spills.

Application

A spill prevention and response plan is useful at any storm water hotspot operation, and is mandatory for any operation that uses, generates, produces, or transports hazardous materials, petroleum products or fertilizers. These operations are known as SARA 312 sites and are regulated by state environmental

agencies. A list of SARA 312 sites within a subwatershed helps locate these potential storm water hotspots. In addition, all industrial sites regulated by individual or group NPDES storm water permits must have an updated spill prevention and response plan on-site. Lastly, spill containment and response plans should be prepared for major highways that cross the subwatershed, since truck and tanker accidents often represent the greatest potential spill risk in many communities (Figure 1).



Figure 1: Overturned, Leaking Tractor Trailer

Table 1: Pollution Prevention Practices for Spill Prevention and Response
<ul style="list-style-type: none"> • Develop a Spill Prevention Plan and ensure that employees are familiar with it and proper spill cleanup procedures • Store and contain liquid materials to prevent the contents from entering the storm drain system, surface waters, or groundwater (see Profile Sheet H-7 on outdoor material storage) • Store and maintain appropriate spill cleanup materials in a readily accessible location and strategically deploy them based on the type and quantities of chemicals present • Schedule regular inspections for leaks and spills and replace storage containers as needed • Label all containers according to their contents and potential hazards (e.g., solvent, gasoline) • Clean up spills promptly and with as little water as possible; dispose of used cleanup materials properly • Always treat cleanup materials used for hazardous substances as a hazardous waste • Use absorbents, gels, and foams to cleanup chemical materials • Report spills that pose an immediate threat to human health or the environment to the appropriate local agencies, such as the fire department

Primary Training Targets

The owner or operator, facility engineer, safety supervisor, and employees should receive annual training on spill prevention and response.

Feasibility

Spill prevention and response plans are recommended for storm water hotspots in every region and climate zone.

Implementation Considerations

Cleanup costs for a single 55-gallon drum that spills and reaches the storm drain have been estimated at 10 to 100 times its raw material value. A spill response and prevention plan is used to assess how pollutants are handled at the site and the pattern of storm water movement. The plan seeks to minimize the chance of accidental spills and ensure that proper safety and response measures are understood and applied (U.S. EPA, 1992). A good spill prevention and response plan includes five major components:

1. A Site Map and Evaluation of Past Spills and Leaks

A site map should provide the following information:

- A general description of the facility
- Owner's name and address
- Nature of the activities at the facility
- Types of chemicals used
- Location of chemical storage areas
- Location of the storm drains and water bodies
- Direction of the drainage from the site
- Location of any structures or devices used to prevent spills leaving the site

2. An Inventory of Materials at the Site

A material inventory list should be created including the type of material, the location where it is stored, the type of container, its estimated volume, and whether a material safety data sheet is required. The inventory should also

indicate what safeguards are currently in place to reduce the exposure of chemicals to storm water, provide insight as to spill risks, and help local authorities in the event of an emergency response (such as a fire).

3. Locations of Possible Spill Areas

It is important to identify potential spill areas, project potential spill volume, and determine the drainage paths in order to choose the most appropriate prevention, containment, and spill response practices. Areas at the site that can be most vulnerable to spills include the following:

- Areas for outdoor processing (Profile Sheet H-4)
- Loading and unloading sites (H-5)
- Outdoor storage locations (H-6)
- Waste storage disposal (H-8)

Also, the spill potential should be assessed for stationary facilities, including manufacturing operations, warehouses, and service stations.

4. A List of Required Spill Response Equipment

The plan should document what kind of spill response equipment will be stored at the site, and contain clear and concise step-by-step instructions for their use.

5. Employee Training Needs

Effective and repeated employee training is essential to effectively implement this practice. Lack of employee motivation or training is considered the biggest weakness of most spill prevention plans. Employee training programs should be held annually to educate all personnel on the spill prevention plan. Spill prevention messages can be reinforced through signage and periodic inspections. The spill response training program should include detailed information on the following:

- The specific individuals responsible for implementing the plan
- Safety procedures for handling each kind of waste

- Current emergency contact numbers to notify appropriate authorities
- Step-by-step procedures to contain, divert, isolate, and clean up a spill
- Training in the use of spill response equipment, including safety procedures

Cost - Spill prevention and response plans are a good investment since they reduce the liability, cleanup costs and penalties. The costs to implement plans depend on the amount of employee training and cleanup equipment needed (which vary depending on the size of the facility); the containment needed; and the types of materials handled at the facility. The costs to inspect the site and write a plan range from \$5,000 to as high as \$20,000 for petroleum industries (IPAA, 2001). Costs to prepare plans at most other hotspots are much lower – about \$4,000 to \$7,000 (SWRCB, 1999). Annual costs to implement the plan are estimated to be less than \$2,500, mostly for on-going training and spill response equipment. Table 2 shows some of the equipment costs related to spill response.

Table 2: Sample Equipment Costs for Spill Prevention and Response	
Storage Protection Device	Cost
Absorbents	\$2 to \$35 for 25 lb. bag
Containment Pallets	\$50 to \$350, based on size and number of barrels to be stored
Industrial Spill Kits	\$280 to \$450, based on # of pads, booms, goggles, gloves, etc.
<i>Sources: Costs were derived from a review of numerous websites that handle proprietary spill control or hazardous material control products</i>	

Resources

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial.
www.cabmphandbooks.com

Setting Administrative Civil Liability. State Of California Regional Water Quality Control Board, San Francisco Bay Region.
www.swrcb.ca.gov/rwqcb2/OrderNum/99-038.doc

Pollution Prevention Fact Sheet Sector: Printers/Lithographer: Spill Prevention.
<http://dep.state.ct.us/wst/p2/p2printer/spillpre.htm>

EPA Office of Wastewater Management Storm Water Management Fact Sheet: Spill Prevention Planning
<http://www.epa.gov/owm/mtb/spillprv.pdf>


Developing A Spill Prevention Response Plan
<http://www.dep.state.pa.us/dep/subject/pubs/water/wc/FS1471.doc>

City of Rancho Santa Margarita Spill Prevention and Cleanup
<http://www.cityofrsm.org/civica/filebank/blobdownload.asp?BlobID=1697>

Land of Sky Regional Council Municipal Pollution Prevention Planning
http://h2o.enr.state.nc.us/su/PDF_Files/Land_of_Sky_factsheets/FactSheet_5.pdf

Environmentally Responsible Best Management Practices Emergency Response and Spill Cleanup Plans
<http://www.cleanrivers-pdx.org/pdf/bmp04.pdf>

City of Mitcham, Australia Emergency Spill Response Factsheet
http://www.mitchamcouncil.sa.gov.au/content/heritage/env_proj/Emergency%20Spill%20Response%20Plan.pdf

H-8	Hotspot Source Area: Waste Management	
	DUMPSTER MANAGEMENT	

Description

Dumpsters provide temporary storage of solid wastes at many businesses. Most dumpsters are unregulated hotspots that can be a significant pollution source in many subwatersheds. Many dumpsters are open, which allows rainfall to mix with the wastes, creating a potent brew affectionately known as “dumpster juice.” When combined with the inevitable spillage, dumpsters can be a source of trash, oil and grease, metals, bacteria, organic material, nutrients, and sediments. Poor dumpster management can make a site unsightly, create unpleasant odors, and attract rodents (Figure 1). Table 1 lists some common pollution prevention practices for dumpsters.

Application

Every business generates waste as a part of its daily operations and temporarily stores it pending disposal by an independent contractor. Nearly every hotspot site has a ubiquitous dumpster located somewhere behind the building. Several factors should be evaluated to determine whether an individual dumpster could be a pollution source. The first is whether the dumpster pad is directly connected to the storm drain system. The

second factor is how frequently the dumpster is emptied. Frequently emptied dumpsters usually have more spillage and are open more often and exposed to rainfall. The last factor is the type and moisture content of wastes thrown in the dumpster, which can include trash, yard waste, building rubble, food, or other waste products.

Good dumpster management is particularly important to reduce trash loadings to a stream. Several kinds of hotspots deserve scrutiny if they exist in a subwatershed, including dumpsters serving convenience stores, fast food restaurants, shopping centers, recycling centers, solid waste collection areas and hospitals. It may useful to target waste haulers as well, since the placement of temporary open dumpsters for demolition, remodeling and other construction purposes can be a problem in some subwatersheds.

Primary Training Targets

Key education targets are the managers and employees that use the dumpster.

Feasibility

Dumpster pollution prevention practices can be applied in all regions and climate zones.



Figure 1: Dumpster Site with Typical Signs of Poor Management (trash accumulation, dumpster without lid, dumpster near storm drain)

Table 1: Pollution Prevention Practices for Dumpsters

- Locate dumpsters on a flat concrete surface that does not slope or drain to the storm drain system
- Install a secondary containment system such as a berm or curb around the dumpster if it is connected to the storm drain
- Install protective covers or lids to keep rainfall from accumulating in the dumpster or secondary containment area
- Close lids at dumpsters located at vehicle service areas, fast food restaurants, and convenience stores
- Install an oil and grease separator or sump pit for dumpsters that receive waste with a high moisture content
- Place clear and visible signs on dumpsters indicating what kind of waste can be accepted
- Never throw oil and grease or other liquids into a dumpster - provide alternative disposal locations for impermissible substances
- Close and secure lids properly when the dumpster is not being loaded or unloaded
- Empty dumpsters on a frequent basis to prevent overflowing or storage outside the dumpster
- Repair leaking or damaged dumpsters immediately
- Never use bleach and soap to clean the container unless the wash water is sent to the sanitary sewer system
- Pick up and sweep trash and litter from around the dumpster regularly

Implementation Considerations

Dumpster pollution prevention practices can be hard to implement. Perhaps the greatest challenge is changing the mindset of employees about proper disposal techniques. Since dumpster practices require additional effort, owners need to train staff and inspect dumpsters more frequently. Lastly, dumpster practices that require liquids/oil and grease separation or secondary containment may be costly for many small businesses.

Target Areas for Education and Enforcement- Education and enforcement should be targeted to specific types of dumpsters that are known hotspots and/or have high potential for environmental contamination. These include:

- Foodservice dumpsters that produce waste with high moisture content and oil and grease that can be easily carried by storm water runoff (Figure 2)
- Automobile service dumpsters that can potentially produce a high volume of wastes, such as oil and grease, cleaning fluids, used parts, filters, and rags

- Industrial dumpsters that produce a high volume and variety of wastes
- Dumpsters with multiple contributors, such as multi-family units, and institutional facilities
- Temporary dumpster locations at small construction sites, demolition projects, and redevelopment projects



Figure 2: Restaurant Waste Barrels Without Secondary Containment

Routine Inspection - Dumpsters should be routinely inspected for the following problems:

- Cracks or dents in the dumpster that may permit storm water run-on
- Poorly functioning lids that cannot be closed or secured
- Hydraulic hoses with cracks or leaks (if applicable)
- Presence of impermissible substances in the container
- Liquid leaking from the container and/or signs of previous leakage, which are often indicated by stains or deposits on ground or storm drain inlets

Working with Solid Waste Disposal Contractor - Choosing a reliable and environmentally-conscious waste disposal contractor is important to prevent storm water contamination. Routine maintenance and emptying of the dumpster by the solid waste disposal contractor should be performed on a regular basis. If concerns about the condition of the dumpster or collection process arise (e.g. dumpster put in wrong location, dented corners, infrequent dumping, etc.), the service should be contacted immediately.

Cost - Proper dumpster management is a relatively inexpensive storm water pollution prevention practice and avoids the liability for spills and/or containment. Operational costs depend on the volume and type of waste, frequency of maintenance (e.g., replacing damaged containers), and whether additional protective measures need to be installed, such as secondary containment systems, canopies, and signs.

Operational costs are primarily related to training workers on proper dumpster management. Frequent training is needed to maintain compliance by workers, particularly in high turnover businesses.

Resources

California Stormwater BMP Handbook: Industrial and Commercial
<http://www.cabmphandbooks.com/>

Storm Water BMP #4. Solid Waste Containers (Dumpsters/Compactors)
http://www.cleancharles.org/stormwater_bmp4.shtml

North Central Texas Council of Governments (NCTCOG) Building Maintenance BMP Fact Sheet
http://www.dfwstormwater.com/P2/PDF/p2_bldg_bmps.pdf

San Mateo Countywide Storm Water Pollution Prevention Program: Storm Water Best Management Practices for Supermarkets and Grocery Stores
<http://www.flowstobay.org/pdfs/bmp/grocery.pdf>

Harvard University Stormwater Bmp: Solid Waste Container
http://www.uos.harvard.edu/ehs/env_sbmp4.shtml

California Stormwater Quality Association Factsheet: Waste Handling and Disposal
<http://www.cabmphandbooks.com/Documents/Municipal/SC-75.pdf>

City of Rancho Santa Margarita Waste Handling and Disposal
<http://www.cityofrsm.org/civica/filebank/blobload.asp?BlobID=1772>

Stanford University SLAC Stormwater BMP Factsheet: Waste Handling and Disposal
<http://www.slac.stanford.edu/esh/epr/Stormwater/BMP9.html>