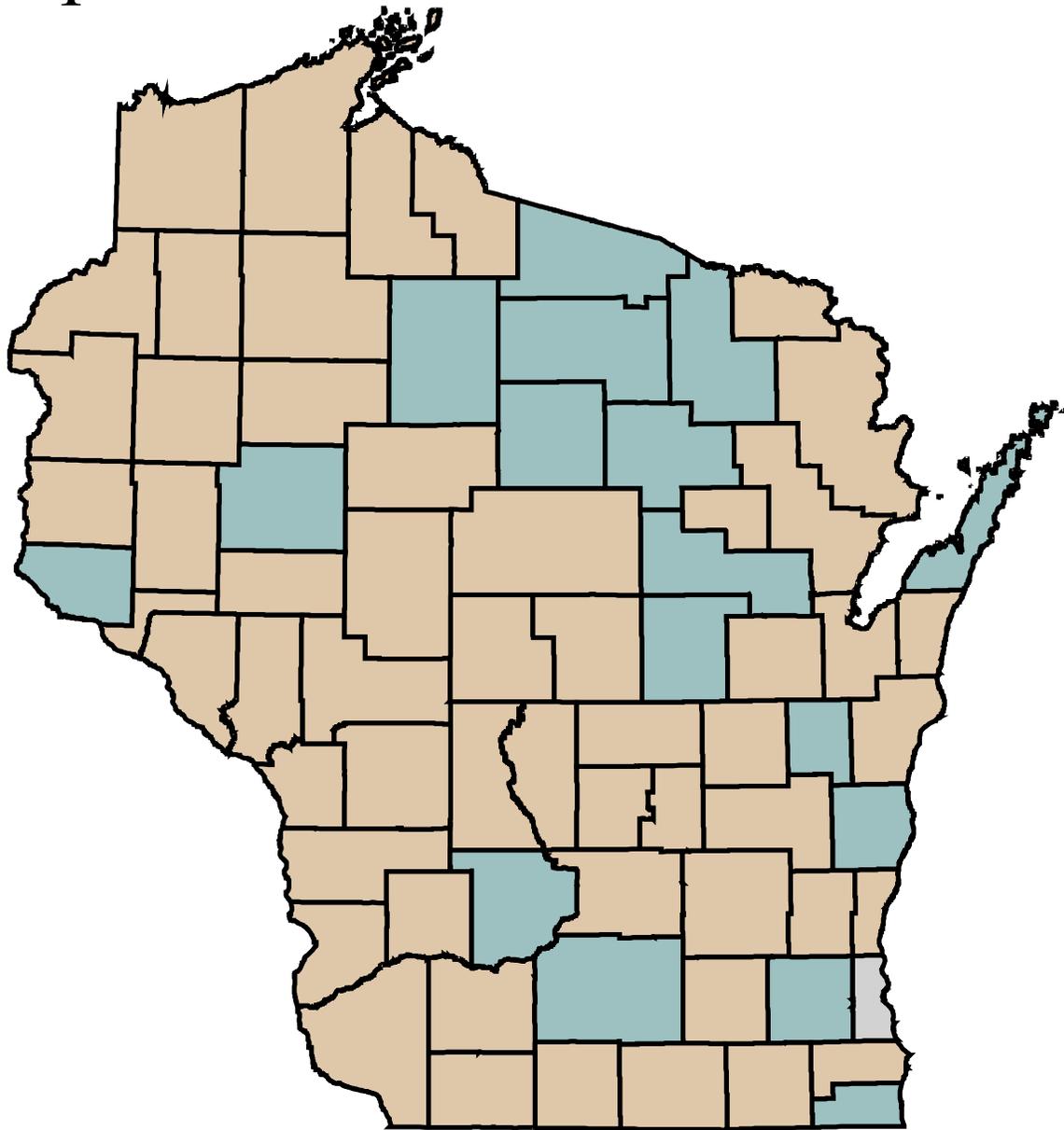


Impervious Surface Area Standards



County is not regulated under NR 115.



County does not place limitations on impervious surface area for shoreland lots.



County limits impervious surface area for shoreland lots.

For more information, contact Carmen Wagner,
WI DNR, Shoreland Zoning Specialist, 608-267-7694.



May 22, 2000
Bureau of Watershed Management

Impervious Area Issue Summary

MANAGEMENT RATIONALE

Impervious areas are hard surfaces such as roofs, concrete, asphalt, and compacted soil which prevent the rain and snowmelt from soaking into the ground. Impervious areas increase the amount of runoff as well as its velocity and cause:

- greater fluctuations in water levels,
- increased erosion,
- more sediment and pollutants delivered to waterways,
- degraded stream habitat (e.g. gravel spawning areas filled with sediment),
- warmer water and loss of sensitive coldwater fish,
- decline in aquatic insect diversity,
- decline in fish diversity, and
- reduced spawning of fish.

In addition, impervious surfaces affect groundwater quality and quantity by:

- preventing the physical filtration and natural biological processes that remove nutrients and other pollutants when water is allowed to soak into the ground, and
- inhibiting groundwater recharge.

Limiting impervious areas addresses the commonly voiced concern of overbuilt lots. Many seasonal waterfront cottages are being replaced with very large year around dwellings (with three-car garages, patios, decks and other accessory construction) often on small substandard lots. A segment of the public and waterfront property owners find this “over development” environmentally and aesthetically objectionable. A percentage cap on impervious surfaces tends to scale the building area to the lot size and supports aesthetic, habitat and water quality goals.

An issue closely related to impervious areas is the identification and protection of natural runoff detention and infiltration areas such as ephemeral wetlands, lakeside ice push ridges and similar features. Unfortunately, most of these features are too small to be efficiently mapped and the risk remains that they may be obliterated during construction.

MINIMUM STATEWIDE STANDARDS

State law does not regulate the amount of impervious surface area on a shoreland lot; however several counties have begun regulating impervious area as a unique way to limit surface water runoff and increase infiltration.

RELATED RESEARCH

Development and the resulting impervious areas lead to increased quantities and velocities of runoff that may overwhelm infiltration capacity of the native soils. It also results in transport of sediment, nutrients and other pollutants directly to surface waters if proper management techniques are not employed (Bannerman 1993, Waters 1995). An illustration of increased runoff quantity, the total runoff volume from a one-acre parking lot is about sixteen times that produced by a one-acre undeveloped meadow (Schueler,

1994). Declines in water quality and benthic macroinvertebrate populations have been correlated with increases in impervious surface area in many watersheds (Arnold 1996, Hicks 1995). The literature generally shows that when more than 15% of a watershed is converted to impervious surfaces, water quality, aquatic habitat and aquatic species diversity decline rapidly (Schueler, 1994, see table below).

THE WATER QUALITY IMPACTS OF IMPERVIOUS AREAS LITERATURE REVIEW (<i>Watershed Protection Techniques</i> Vol. 1, No. 3, Fall 1994)			
Year	Location	Parameter	Study results
1991	Seattle	Fish habitat	Channel stability & fish habitat quality declined rapidly beyond 10% impervious
1994	Maryland	Brown trout	Abundance & recruitment of young declines rapidly at 10-15% impervious
1981	Atlanta	Aquatic insects	Abundance of insects & urbanization negatively correlated in 21 streams.
1987	Northern Virginia	Aquatic insects	Sharply lower species diversity beyond 15-25% impervious
1990	New York	Fish spawning	Resident & anadromous fish eggs & larvae decline sharply beyond 10% impervious
1994	Delaware	Aquatic insects	Species diversity declined sharply at 19 sites at 8-15% impervious
1994	Delaware	Habitat quality	Insect species diversity highly correlated with habitat quality; majority of urban streams had poor habitat.
1992	Maryland	Fish	Sharp decline in species diversity began at 10-12% impervious
1992	Maryland	Aquatic insects	Species diversity became poor at about 15% impervious
1994	Maryland	Fish & insects	Poor habitat in 5 watersheds over 30% impervious
1979	Maryland	Fish & insects	Species diversity for both declined rapidly beyond 10% impervious
1993	Seattle	Fish	Habitat sensitive species fall out beyond 10-15% impervious
1988	Ontario	Aquatic insects	Habitat degradation at 209 stream sites begins at about 10% impervious
1986	Seattle	Aquatic insects	Sensitive species drop out as impervious increases.
1983	Seattle	Salmon	Reduction in coho salmon at 9 sites beyond 10-15% impervious
1993	Seattle	Wetland plants & amphibians	Pop. density declined sharply above 10% impervious
1986	New Jersey	Aquatic insects	Sharply reduced species diversity in urban streams.
1991	Ohio	Aquatic insects & fish	100% of 40 urban sites had significantly reduced habitat values.

MANAGEMENT INITIATIVES

Impervious areas are regulated in a variety of ways by Wisconsin counties. Some counties set an impervious area cap on a per lot basis. For example, Forest County allows 20% lot coverage by impervious areas (e.g. on a 20,000 square foot lot, a maximum of 4,000 square feet can be impervious area). A few counties refined the standard to include separate limits for buildings and for other hard surfaces (e.g. maximum 15% lot coverage by buildings and total 20% coverage by all impervious areas). Instead of directly regulating the amount of impervious area Waupaca County requires at least 75% of a lot to remain in vegetative cover.

Another option is to regulate impervious areas at a threshold beyond a certain distance from the water. Shawano County limits impervious area to 8% of lot area within 300 feet of the OHWM for White Lake. Requiring impervious areas greater than a certain area to be located farther back from the water's edge provides an opportunity to attenuate the runoff from these areas via infiltration and filtering through vegetative buffers.

Chippewa County limits the total habitable living area within 75 feet of water to 1500 square feet. This approach is only partially effective since it does not address driveways or accessory buildings which often represent more impervious area than a house.

CONSIDERATIONS

- Develop a clear definition of what is and is not considered impervious area. Will gravel areas, decks, and compacted soils be considered impervious areas?
- Landowners or zoning staff will need to measure and record the dimensions of impervious areas to administer impervious area standards. This can be measured with a simple tape measure and calculator, but may take some time.
- Building expansions are commonly tracked through zoning permits but tracking the expansions of other impervious areas (driveways, patios, etc.) to calculate total impervious area will probably require new administrative mechanisms.
- Using percentage caps can allow for very large impervious areas on large lots (e.g. a 20% cap on a 5 acre lot would allow 1 acre of impervious surface). Language such as “impervious area shall be less than 20% or 6,000 sq. ft., whichever is less” limits the amount of impervious surface on a 5 acre lot to 6,000 sq. ft while allowing 4,000 sq. ft. on a 20,000 sq. ft. lot.
- In very sandy areas, runoff will soak into the ground readily and is seldom carried to a waterbody. In areas with heavy clay soils there is significant runoff from undeveloped areas and addition of impervious areas may not increase the amount of runoff significantly. These scenarios illustrate that the amount of runoff delivered to waterbodies from impervious areas is quite dependent on the local soil types. However, the effects of impervious areas on wildlife habitat and natural scenic beauty are independent of soil type.

- Research shows that when more than 15% of a watershed is converted to impervious surfaces, water quality, aquatic habitat and aquatic species diversity decline rapidly. Yet counties have typically chosen impervious area caps of 15-20% for individual lots, which results in impervious areas significantly greater than 15% when the impervious area from roads are added. None of the management approaches used to date address the impervious area from roads despite the fact that these areas are often very substantial. Decisions about building or expanding roads are typically decided by the elected town and county officials. Planned residential development can be used to minimize the impervious area from roads and driveways.

BIBLIOGRAPHY

Arnold, C. L. and C. J. Gibbons. 1996. Impervious surface coverage: the emergence of a key environmental indicator. *Journal of the American Planning Association* 62(2):243-58.

Bannerman, R. T., Owens, D. W. Dodds, R. B. and N. J. Hornewer. 1993. Sources of pollutants in Wisconsin stormwater. *Water Science and Technology* 28(3-5): 241-59.

Hicks, A. L. 1995. Impervious surface area and benthic macroinvertebrate response as an index of impact from urbanization on freshwater wetlands. University of Massachusetts, Amherst. M.S. Thesis.

Schueler, T .R. 1994. The importance of imperviousness. *Watershed Protection Techniques* 1:100-11, available at: [<http://www.cwp.org>], under articles.

Waters, T.F. 1995. Sediment in streams: sources, biological effects and control. *American Fisheries Society*. Bethesda, MD. Monograph 7. 251 pp.

Abbreviations used in the following table are:

AS = Accessory Structure
 Bldgs. = Buildings
 Dist. = District
 Expan. = Expansion
 Incr. = Increase
 Imperv. = Impervious
 Int. = Interior
 Max. = Maximum
 NC = Nonconforming
 NCS = Nonconforming structure
 OHWM = Ordinary high water mark
 Swrd = Sewered
 s.f. = Square feet
 Unswrd = Unsewered

Impervious Area Standards

<i>County</i>	<i>Impervious Area</i>
Adams	Not addressed in county's shoreland zoning ordinance.
Ashland	Not addressed in county's shoreland zoning ordinance.
Barron	Not addressed in county's shoreland zoning ordinance.
Bayfield	Not addressed in county's shoreland zoning ordinance.
Brown	Not addressed in county's shoreland zoning ordinance.
Buffalo	Not addressed in county's shoreland zoning ordinance.
Burnett	Not addressed in county's shoreland zoning ordinance.
Calumet	Total buildable lot area=max. 20% (swrd) or 15% (unswrd) of lot.
Chippewa	W/i 75' of water, total habitable living area not >1800 s.f.
Clark	Not addressed in county's shoreland zoning ordinance.
Columbia	Not addressed in county's shoreland zoning ordinance.
Crawford	Not addressed in county's shoreland zoning ordinance.
Dane	Bldgs. & AS shall occupy max. 30% on int. lot or 35% corner lot.
Dodge	Not addressed in county's shoreland zoning ordinance.
Door	Varies w/ zoning dist. of 7.5% to 75% max. imperv. surface ratio.
Douglas	Not addressed in county's shoreland zoning ordinance.
Dunn	Not addressed in county's shoreland zoning ordinance.
Eau Claire	Not addressed in county's shoreland zoning ordinance.
Florence	Not addressed in county's shoreland zoning ordinance.
Fond du Lac	Not addressed in county's shoreland zoning ordinance.
Forest	Max. 20% lot coverage (impervious surface area)
Grant	Not addressed in county's shoreland zoning ordinance.
Green	Not addressed in county's shoreland zoning ordinance.
Green Lake	Not addressed in county's shoreland zoning ordinance.
Iowa	Not addressed in county's shoreland zoning ordinance.
Iron	Not addressed in county's shoreland zoning ordinance.
Jackson	Not addressed in county's shoreland zoning ordinance.
Jefferson	Not addressed in county's shoreland zoning ordinance.
Juneau	Not addressed in county's shoreland zoning ordinance.
Kenosha	Varies with zoning district.
Kewaunee	Not addressed in county's shoreland zoning ordinance.

<i>County</i>	<i>Impervious Area</i>
La Crosse	Not addressed in county's shoreland zoning ordinance.
Lafayette	Not addressed in county's shoreland zoning ordinance.
Langlade	Lot area < or =15% bldgs. & < or =5% impervious surfaces
Lincoln	Expansion of NC at 40' from OHWM limited to max. 1500 s.f.
Manitowoc	Not addressed in county's shoreland zoning ordinance.
Marathon	Not addressed in county's shoreland zoning ordinance.
Marinette	Not addressed in county's shoreland zoning ordinance.
Marquette	Not addressed in county's shoreland zoning ordinance.
Menominee	Not addressed in county's shoreland zoning ordinance.
Monroe	Not addressed in county's shoreland zoning ordinance.
Oconto	Not addressed in county's shoreland zoning ordinance.
Oneida	Max. 25% impervious surfaces w/i 200' of OHWM.
Outagamie	Not addressed in county's shoreland zoning ordinance.
Ozaukee	Not addressed in county's shoreland zoning ordinance.
Pepin	Not addressed in county's shoreland zoning ordinance.
Pierce	Rural Residential 20 = max. 40%.
Polk	Not addressed in county's shoreland zoning ordinance.
Portage	Not addressed in county's shoreland zoning ordinance.
Price	Lesser of 25% of lot or 10,000 s.f., may be impervious.
Racine	Not addressed in county's shoreland zoning ordinance.
Richland	Not addressed in county's shoreland zoning ordinance.
Rock	Not addressed in county's shoreland zoning ordinance.
Rusk	Not addressed in county's shoreland zoning ordinance.
St. Croix	Not addressed in county's shoreland zoning ordinance.
Sauk	Limit NCS expan. to max. s.f. & % incr. by distance to OHWM.
Sawyer	Not addressed in county's shoreland zoning ordinance.
Shawano	WL=max. 8% of lot w/i 300' of OHWM covered by imperv. surfaces.
Sheboygan	Total ground floor s.f of all struct. max. 20% of total lot area.
Taylor	Not addressed in county's shoreland zoning ordinance.
Trempealea	Not addressed in county's shoreland zoning ordinance.
Vernon	Not addressed in county's shoreland zoning ordinance.
Vilas	Limited to greater of 4000 s.f. or 30% lot area w/i 300' of OHWM.

<i>County</i>	<i>Impervious Area</i>
Walworth	Not addressed in county's shoreland zoning ordinance.
Washburn	Not addressed in county's shoreland zoning ordinance.
Washington	Not addressed in county's shoreland zoning ordinance.
Waukesha	Floor Area Ratio varies w/ zoning dist. from 15% (R3) to 10% (A2)
Waupaca	At least 75% of lot must be maintained in vegetative cover.
Waushara	Not addressed in county's shoreland zoning ordinance.
Winnebago	Not addressed in county's shoreland zoning ordinance.
Wood	Not addressed in county's shoreland zoning ordinance.

Impervious Area Ordinance Language

LANGLADE COUNTY

17.30 (8) (e) Shoreland Lot Coverage by Buildings and Impervious Surfaces:

- 1) Lot coverage by buildings. Buildings may not occupy more than 15% of total lot area within the shoreland zone. An applicant for a zoning permit shall provide a diagram describing lot dimensions and area and the location, dimensions and area of all buildings together with computations that demonstrate compliance with this section and Section 17.30 (8) (e) (3).
- 2) Building Height. Buildings shall not exceed 35 feet in height measured from the natural ground contour at the lowest exposed level to the peak of the roof.
- 3) Lot coverage by impervious surfaces. No more than 5% of total lot area may be covered by impervious surfaces unless a stormwater management plan approved by the Land Records and Regulation Department is implemented. Buildings and areas which do not drain to surface waters are excluded from the 5% limit. A plan may be approved if it provides that erosion will be controlled and that all runoff from the lot will be infiltrated on the lot or detained to prevent pollutants from reaching nearby waters.

VILAS COUNTY

9.6 Impervious Surface Limitations

A. Activities Requiring a Shoreland Alteration Permit and Stormwater Management Plan.

A stormwater management plan is required in conjunction with a Shoreland Alteration Permit for land disturbance activities on any waterfront lot which results in a maximum cumulative amount of impervious surfaces exceeding either 4,000 square feet or fifteen percent (15%) of the surface area of the lot within 300 feet of the OHWM, whichever is greater. In any case, the total maximum amount of impervious surfaces shall not exceed the standards in ¶9.6.B.

B. Maximum Limits

The maximum cumulative amount of impervious surfaces on a lot shall not exceed the following standards:

1. For all single-family-residential waterfront lots, the maximum total area of impervious surfaces shall not exceed 4,000 square feet or thirty percent

percent (30%) of the total lot area located within 300 feet from the OHWM, whichever is greater.

2. For all non-single-family residential lots, the maximum total area of impervious surfaces shall not exceed 4,000 square feet or fifty percent (50%) of the total lot area located within 300 feet of the OHWM, whichever is greater.
 3. For all Community Business District parcels which utilize community storm sewer systems, the maximum total area of impervious surfaces shall not in any case exceed 80% of the total lot area within 300 feet of the OHWM.
- C. Existing impervious surfaces exceeding these limitations may be maintained and improved, but not expanded.

WAUPACA COUNTY

6.16 Impervious surface standards.

- (1) At least 75% of each shoreland lot shall be maintained in vegetative cover inclusive of standard landscape practices such as mulch treatments, but excluding areas covered by structures such as decks and similar structures.
- (2) However, on parcels zoned industrial, commercial or multi-family, an approved stormwater management plan may be implemented as an option to (1) above. Such plan shall provide that there will be no increase in stormwater discharge from the parcel as a result of the proposed construction for storms up to and including the 10 year, 24 hour storm event. The plan shall be certified by a registered professional engineer or, at the county's option, the applicant shall provide funds to defray the costs of the county preparation of a plan.

Impervious Surfaces Resources

PRESENTATIONS

The Impacts of Urbanization. (72 slides, no date). PowerPoint presentation documenting the impact of the land development process on the quality of our watersheds. This presentation outlines 22 model principles for land development and focuses on streets, parking lots, lot design, and conservation of natural areas in new developments to mitigate water quality impacts. Through better site design, local governments can review their zoning and ordinance codes to minimize impervious cover and promote conservation of natural areas. Available on a CD for \$25 from Center for Watershed Protection, 8391 Main Street, Ellicott City, MD, 21043 or on-line at: [<http://www.cwp.org/>].

Impervious Areas. (unknown, 2000). This presentation illustrates the many effects of impervious areas including erosion, greater fluctuations in water levels, warmer water and loss of sensitive coldwater fish, and the decline in fish and aquatic insect diversity. Available from the Land Use Education Center, College of Natural Resources, University of Wisconsin – Stevens Point, 1900 Franklin Street, Stevens Point, WI, 54481 or by phoning (715) 346-3879.

Linking Land Use to Water Quality. (80 slides, June 2000). PowerPoint presentation covering how land use impacts water quality and what can be done about it. Available from NEMO Project, University of Connecticut CES, 1066 Saybrook Road, Haddam, CT, 06438-0070 or by phoning (860) 345-4511. It can be viewed on-line at: [<http://www.canr.uconn.edu/ces/nemo/nsmodule/nsstatus.html>].

Luck Isn't Enough . . . The Fight for Clean Water. (12 minutes, no date). Video for the general public on nonpoint source (NPS) pollution -- its causes, effects, and what individuals and communities can do to combat it. Available for \$10 from NEMO Project, University of Connecticut CES, 1066 Saybrook Road, Haddam, CT, 06438-0070 or by phoning (860) 345-4511.

A Storm on the Horizon: An Educational Video on the Effects of Stormwater on Our Rivers. (18 minutes, no date). Video demonstrates the impact of storm water and outlines what can be done to allow development to occur with protection of water resources in mind. Available from Trout Unlimited at (715) 386-7568.

EDUCATIONAL MATERIALS

Impacts of Development on Waterways. (4 pp., no date). Fact Sheet describes how development impacts waterways and offers some options for limiting those impacts. Available from NEMO Project, University of Connecticut CES, 1066 Saybrook Road, Haddam, CT, 06438-0070 or by phoning (860) 345-4511. Ask for NEMO Project Fact Sheet #3.

Land Disturbance Management and Impervious Surface Area Standards. (2 pp., February 1999). Fact sheet explains how land disturbance and impervious surfaces impact shoreland buffer functions and water quality. Available from Wisconsin Association of Lakes, (800) 542-5253 or UWEX, Stevens Point at (715) 346-2116. Ask for fact sheet #7 of the Shoreland Management and Lake Classification Series.

Minimizing Runoff from Shoreland Property: Shoreland Best Management Practices. (4 pp., March 1996). Fact sheet describes Best Management Practices (BMPs) that can be used on shoreland properties to protect and preserve surface water quality as well as preserve the natural characteristics of a property. Available from Minnesota Extension Service at 109 Washburn Hall, 2305 East 5th Street, Duluth, MN, 55812-7512 or phoning (218) 726-7512.

Nonpoint Source Water Pollution. (2 pp., no date). Fact sheet explains what nonpoint source pollution and what causes it. Available from NEMO Project, University of Connecticut CES, 1066 Saybrook Road, Haddam, CT, 06438-0070 or by phoning (860) 345-4511. Ask for NEMO Project Fact Sheet #2.

Strategies for Coping with Polluted Runoff. (2 pp., no date). Fact sheet provides some strategies for communities to limit the impacts of polluted runoff. Available from NEMO Project, University of Connecticut CES, 1066 Saybrook Road, Haddam, CT, 06438-0070 or by phoning (860) 345-4511. Ask for NEMO Project Fact Sheet #4.

TECHNICAL REFERENCES

Impervious Surface Coverage: The Emergence of a Key Environmental Indicator. (14 pp., Spring 1996). Article summarizes the issues facing planners concerned with water resource protection in urbanizing areas. Article proposes that impervious surface area coverage is a quantifiable land-use indicator that correlates closely with the adverse impacts of polluted runoff. Available in *Journal of the American Planning Association*, Vol. 62, No. 2, Spring 1996 and authored by Chester Arnold and C. James Gibbons.

Nutrient Loading Impacts: Phosphorus Export from a Low-density Residential Watershed and an Adjacent Forested Watershed. (7 pages, 1986). This study shows that a watershed with low density residential subdivisions (~30,000 square foot lots) and 40% remaining forest cover delivered 7.2 times more phosphorus to the water than a similar undeveloped watershed (more phosphorus = more algae in lake). Article by J. Dennis in *Lake and Reservoir Management: Vol. II* (1986).

Urban Runoff: How Polluted Is It? (6 pp., 1992). Paper provides information on the quantity of runoff measured from residential and agricultural lands in Wisconsin as well as the concentrations of pollutants in each. Available from Wisconsin Environmental Resource Center at (608) 262-1369.

The Wisconsin Stormwater Manual. (172 pp., 1994) Provides information on ways to reduce pollution from urban stormwater runoff and technical design guidelines for best

management practices. Available for \$15 + s/h from Extension Publications, 630 W. Mifflin Street, Madison, WI, (608) 262-3346 and ask for publication number G3691-P.