

Appendix G. Land Use Planning and Design Techniques

Reducing Road Widths

In many instances, road widths are required to be wider than needed to safely convey traffic through residential and commercial areas. Although these wide widths are often adopted to increase safety for automobiles, they often increase speeds through residential areas and, in so doing, may decrease safety for pedestrians and cyclists. Also, some jurisdictions require curb and gutter for aesthetic reasons where it is not actually necessary to control stormwater runoff. This can result in increased flooding and also eliminates the potential for stormwater runoff control and treatment that can occur in properly designed and maintained roadside swales.

Most local governments model their residential street design standards after state and/or federal highway criteria, although the traffic capacity and function of their street system is considerably different from highways. Very few communities recognize any local road categories that are different from established state and federal street categories. Many local traffic engineers have simply accepted the notion that wider streets adequately address these concerns and that wide streets are safe streets (Schueler 1995). Narrower road widths can reduce the road surface area by up to 35 percent.

A number of communities have implemented standards that promote narrower residential streets and have concluded this to be an attractive, safe and environmentally beneficial alternative.

Communities should also review their standards for turnarounds to reduce the need or unnecessary road surface. One of the most common types of turnaround is a cul-de-sac that may have a diameter of 80 to 100 feet or more (Schueler 1995). Some communities are recognizing that this is excessive and are choosing alternatives that create less impervious cover, such as T-shapes. A 60-foot by 30-foot T-shaped turnaround creates only about 36% as much impervious area as an 80-foot diameter cul-de-sac and is more than adequate for most vehicles.

Local governments should: (1) examine community regulations governing road width and turnaround size; (2) evaluate if the specified widths are necessary; and (3) where feasible, make changes to reduce unnecessary road surfaces.

Reducing Minimum Parking Requirements

Parking lots are often designed to accommodate parking needs on the busiest days of the year. For example, shopping center parking areas are often big enough to handle the busy holiday times, but then sit vacant for much of the rest of the year. This can result in increased nitrogen load (as opposed to maintaining open space).

Some management strategies that would contribute to a reduction in urban nitrogen from parking lots:

- Use angles and smaller parking spaces.
- Use more pervious construction materials in seldom-used parking areas (Land of Sky 1995).
- Provide public transportation to shopping centers during the peak holiday times and encourage people to use it.
- Design parking areas to drain in sheet flow into stable vegetated areas.

Minimizing Use of Curb and Gutter

Runoff is conveyed along streets and parking areas in one of two ways, either (a) in an open drainage channel located in the right of way, or (b) in an enclosed storm drain located under the street or right of way. The use of an open channel or storm drain in a particular street is determined by a number of factors, such as drainage area, slope, length, housing density, and street type. Open channels can be used on smaller streets, but at some point runoff velocities become too erosive to be adequately handled in an earthen channel and they must be enclosed in a storm drain. This erosive velocity is typically around 4 feet per second. A channel's maximum velocity is generally defined and computed using the peak discharge rate under the two year design storm event.

Open vegetated channels can have many water resource protection benefits. For example, a portion of stormwater pollutants may be removed through grass and soil as they pass through the channel. Performance monitoring has shown that open channels only realize these benefits under ideal conditions (e.g., low slope, sandy soils, dense grass cover, etc.). When these conditions are not met, drainage channels can have a low or even negative removal capability for many pollutants.

Only recently have engineers recognized the value of designing open channels explicitly for pollutant removal during small and moderate-sized storm events. Depending on the depth to the water table, they are known as either grass channels, dry swales or wet swales. Checkdams, underdrains, stone inlets, prepared soil mixes and landscaping are also used to enhance the pollutant removal capability of swales. The use of grass channels or swales along residential streets can be an economical and effective element of a BMP system, as long as the critical erosive velocity is not exceeded. In addition, open channels must be designed to prevent standing water, to ensure that mowing is convenient, and to avoid odors, mosquitoes, or other nuisances associated with standing water.

Even the moderate vertical break of a curb shelters airborne pollutants that blow in by the wind. Thus, dust, pollen, leaves, grass clippings, and other nitrogen-rich organic matter can be trapped by the curb, where they remain until they are washed into the storm drain system.

Some management strategies that may contribute to a reduction in urban nitrogen from roadside drainage systems are:

- Minimize the use of curb and gutter and maximize the use of vegetated swales where feasible.
- If curb and gutter is necessary, consider frequent curb cuts to divert manageable quantities of runoff into stable vegetated areas for infiltration. (Land of Sky 1995).
- Develop a site/landscaping plan that uses landscaped areas for infiltration or detention/retention areas (bioretention).
- Instead of grass that requires chemical applications, use trees, shrubs, ground cover, mulch or other materials that require little or no chemical applications.

Allowing Cluster or Open-Space Developments

Cluster or open-space developments rearrange density on each development tract so that a lower percentage of the tract is covered by impervious surfaces. This results in more land being retained in a natural state.

This approach respects private property rights and the ability of developers to create new homes for the expanding population. Such developments are “density-neutral” since the overall number of dwellings allowed is not less than it would be in a conventional development. This lessens the adverse impact on the remaining natural areas and cultural resources that make our communities such special places to live, work, and recreate.

The most important step in designing an “open space subdivision” is to identify the land to preserve. “Primary Conservation Areas” include unbuildable wetlands, waterbodies, floodplains, and steep slopes. “Secondary Conservation Areas” include mature woodlands, upland buffers around wetlands and waterbodies, prime farmland, natural meadows, critical wildlife habitats, and sites of historic, cultural or archeological significance.

Cluster developments can reduce road lengths by 50 to 70 percent (Arendt 1993). At an average cost of over \$100 to construct a linear foot of road, such reductions are extremely cost-effective. The reduction in road length may also reduce the overall capital costs for stormwater controls. The developer may realize a significant savings in the reduced need for storm drain pipes and best management practices. It has been reported that in some cases the overall reduction in capital costs associated with these developments can be 10 to 33 percent (Schueler 1995).

Property owners can realize indirect economic benefits from reduced impervious cover. While a host of factors influence future residential property values, some evidence indicates that homes located adjacent to well designed and maintained open or green space do appreciate at a faster rate than traditional subdivision properties. This premium has been found to range from 5 to 32 percent, according to Land Ethics (1994). Another study in Massachusetts indicated that homes in cluster subdivisions with open space

appreciated 13% more in value than similar homes in conventional subdivisions over a 21-year period (Arendt 1993).

For local governments, it is typically more expensive to provide public services on large residential lot developments compared to smaller ones. Clustered developments can greatly reduce the length of water and sewer pipes and roads that local governments have to construct and maintain.

Allowing Traditional Neighborhood Developments

Traditional neighborhood developments (TNDs) are designed so that dwellings, shops, and workplaces are in close proximity. They typically follow a rectilinear pattern of streets and blocks arranged to provide interesting routes of travel that also accommodate and promote pedestrian travel and bicycle travel rather than automobile travel. These developments also include greenways, landscaped streets, churches, stores, schools, and parks woven into the neighborhood for social activity, recreation, aesthetics, and environmental enhancement. See Figure G1 for a diagram of a TND.

One of the most important features of TNDs that affects water quality is their compactness. As these developments expand, they maintain their compact, rectilinear layout and their accessibility. Another environmental advantage offered by TNDs is that they may reduce automobile traffic and promote increased use of alternative forms of transportation, such as mass transit.

Environmental impacts of TNDs are affected by site conditions and the development intensity and design. Those TNDs that offer environmental benefits may also offer economic benefits. The increased value of real estate in a traditional development is illustrated in Raleigh. The “inside the beltline” neighborhoods in Raleigh that have city blocks, greenways, and accessibility to shopping areas, on the average, sell for 40 percent more per square foot than homes in North Raleigh subdivisions (pers. comm. Marilyn Marks, Simpson and Underwood Realtors, 1997).

Other Techniques

In many instances, subdivision codes contain rigid requirements that govern setbacks from the property lines. These requirements increase the length of driveways, roads, and sidewalks and thus increase the proportion of impervious cover to housing units. These requirements can inadvertently increase impervious surfaces and cause expense for developers and homeowners.

Large-lot zoning also impacts overall imperviousness. Although large-lot zoning reduces rooftop impervious cover in a watershed and spreads development over a wider geographic area, it can increase transport-related impervious cover because of longer road networks. Although large-lot zoning may be wise for individual sensitive watersheds, it is probably not practical as a uniform standard. An alternative is forming more compact neighborhoods in order to decrease impervious surfaces associated with transportation, a

factor that has long been overlooked. Another advantage to compact neighborhoods is that they decrease automobile use by allowing better accessibility for walkers and cyclists and facilitating public transportation.

Figure G1. Maytown Before and After (adapted from Stimmel Associates, 1993)

