

The Watershed Performance Zone

A Strategy for Protecting High Point's Water Supply

Realizing that a good water supply is an essential ingredient in economic development and that future water resources such as Randleman Lake are both uncertain and expensive, the City of High Point decided to evaluate its present water supply resources. The objectives of the study were to assess the quality and quantity of present water supplies, to identify potential problems, and to recommend strategies to address the problems so that the City will continue to have an adequate supply of good quality water to meet future needs.

For High Point, located in the headwaters of the Cape Fear River Basin, the main concern is the quality and quantity of the stormwater runoff from the watershed rather than the wastewater discharges from points upstream. Unlike most cities, High Point does not receive water from rivers originating outside of the area. Instead it depends entirely on stormwater runoff that results when rain falls in the watershed, accumulates and flows over the land via drainageways and small streams into water supply lakes.

The quality and quantity of the stormwater depends on the type of land use in the watershed. If the watershed contains substantial

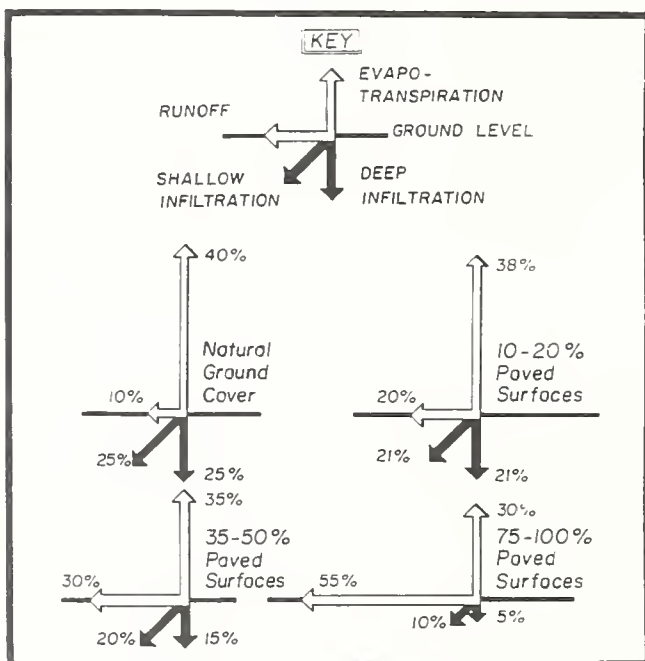


Figure 1. Typical hydrographic changes due to increasing area of impermeable paved surface in a developing area.

amounts of impervious surfaces such as parking lots, streets, or other pavement which cannot absorb the rain, the amount of stormwater runoff is two to four times greater than would occur with natural ground cover (See Figure 1). With this increase in the volume of runoff, more flooding occurs and groundwater supplies are not replenished. Impervious surfaces also collect petroleum products, toxic and heavy metals, litter, and other substances from motor vehicles and building materials. These pollutants along with fertilizers, pesticides and other contaminants from lawns, gardens and fields become part of the stormwater runoff that is washed into the lakes and thus adversely affect the quality of the water supply.

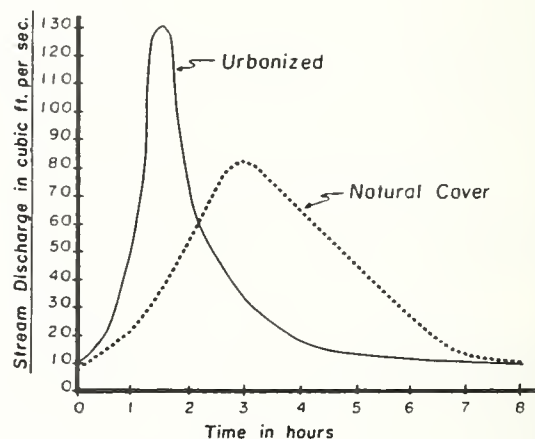


Figure 2. Contrast in stormwater runoff discharge/time in urban and forested land uses for a one hour storm event on two small streams draining similarly-sized areas.

Impervious surfaces also speed up the flow of stormwater since there is no vegetation to slow the water and no soil to absorb it (see Figure 2). At higher velocities, larger amounts of stormwater can cause extensive erosion as the runoff scours the landscape on its way downstream. Substantial amounts of impervious surfaces in a watershed will result in more stormwater which causes larger floods and depletes groundwater reserves, more sediment which diminishes the capacity of the reservoirs, and more pollutants which degrade the quality of the water supply.

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| Maximum Point Value | LAKE MANAGEMENT RATING SYSTEM - RESIDENTIAL | Point Value | Points Earned |
|---------------------|--|-------------|---------------|
| 20 | 1. Density - low density and clustering of development in developable areas | | |
| | <40,000 sq. ft. subdivided | 0 | |
| | 40,000 sq. ft. - 2 acres subdivided | 5 | |
| | <40,000 sq. ft. single estate | 5 | |
| | > 2 acres subdivided | 10 | |
| | 40,000 sq. ft. - 2 acres single estate | 10 | |
| | 2-4 acres single estate | 15 | |
| | > 5 acres single estate | 20 | |
| | Planned Unit Development | 20 | |
| 20 | 2. Impervious Surface - low percentage of non-permeable surface | | |
| | 0-3% | 20 | |
| | 3-7% | 15 | |
| | 7-10% | 10 | |
| | 10-15% | 5 | |
| | > 15% | 0 | |
| 25 | 3. Proximity to Lake, Deep River, Boulding Branch - long distance from the Lake or major tributary | | |
| | > 2000 ft. from nearest point of Lake or stream | 25 | |
| | 1000-2000 ft. | 20 | |
| | 500-1000 ft. | 15 | |
| | 100-500 ft. | 10 | |
| | 50-100 ft. | 5 | |
| | 50 ft. | 0 | |
| 10 | 4. Soil Type - suitable for residential development | | |
| | suitable for development | 10 | |
| | moderately suitable | 5 | |
| | unsuitable for development | 0 | |

Figure 3. An excerpt from High Point's Lake Management Rating System for residential areas. Copies of the full rating system for both residential and nonresidential areas are available from Mary Joan Pugh, Department of Planning and Development, P.O. Box 230, High Point, NC 27261.

According to yearly averages of sample data collected weekly, the water quality of both High Point water supply lakes is excellent. However, a water quality study conducted during the summer of 1980 noted several occurrences which indicated that increased development in the watershed will affect the water quality of the lake.

In one instance, the level of nitrate, a nutrient that contributes to the rapid growth of algae and other problem plants, increased from 0.8 to 2.0 parts per million in one stream after a light rain. It was discovered that the nitrate in the fertilizer that was applied to a lawn in an apartment complex near the stream accounted for the unusually high nitrate reading.

In addition, in a study of water supply lakes conducted by the North Carolina Division of Environmental Management, Oak Hollow Lake and High Point City Lake were rated on a scale of 1 to 6 (6 being the most eutrophic or poorest quality due to excessive amounts of nutrients and oxygen deficiency). It was determined that City Lake, which is over 50 years old with less development within its watershed, rated a 4 whereas Oak Hollow Lake which is only 10 years old with substantially more development already rated a 3. Eutrophication is a natural aging process in which all lakes are eventually rendered useless, and Oak Hollow Lake is aging faster due to development within its watershed. Unless measures are taken to control the quality of stormwater runoff entering the lake, it will continue to age at an accelerated rate.

After identifying uncontrolled stormwater runoff from development in the watershed as a threat to High Point's water supplies, ways to manage the quality of the stormwater were exam-

ined. Like all nonpoint sources of pollution, stormwater runoff does not originate from any discernable points, and is a difficult source of pollution to control. However, since the first flush of stormwater runoff carries 70 to 90 percent of the sediment and pollutants, the amount of these pollutants can be substantially reduced by controlling this first portion of runoff.

Therefore, most methods for managing runoff attempt to control the source of the runoff by regulating the type and intensity of land use in the watershed through zoning. High Point chose to manage its land use by means of a watershed performance zone. The performance zone is an overlay district with performance standards which must be met in addition to the zoning requirements. The performance standards are in the form of a rating system based on the factors that were found to affect the impact of stormwater runoff on the quality of a water supply (See Figure 3). The factors are:

1. Density or building coverage
2. Amount of impervious surface
3. Proximity to the lake or major tributary
4. Soil type
5. Type of drainage system
6. Slope
7. Land cover
8. Runoff control strategies
9. Sewage disposal
10. Road and driveway design

Each of these factors was given a specific value based on its relative effect on stormwater quality in the High Point watersheds. The rating system was tested thoroughly and 100 out of

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Responding to increased residential development activity in the Falls watershed, the Wake County Board of Health adopted more stringent standards for surface-discharge treatment plants. The rules and regulations were adopted in September 1983, effective October 1, 1983. The Wake County considerations were developed concurrent with revisions to the state health laws. Actions by the Wake County Board of Health were initiated when evidence suggested that manpower and oversight responsibilities by the N.C. Department of Natural Resources and Community Development did not provide sufficient protection to the drinking water supply of the Falls of the Neuse impoundment.

The Board of Health set effluent standards that specified a phosphorus limit of one part per million. In addition to a valid permit from the N.C. Division of Environmental Management, a package treatment plant operating in Wake County's portion of the watershed must secure an operating permit from the county health department. The operating permit also specifies design standards, operator certification, and a 24-hour capacity for emergency storage of untreated wastewater. Duration of the permit runs concurrent with the Division of Environmental Management permit and is renewable every five years. Existing plants in the water supply watershed must also meet the same requirements. When publicly-owned sewer lines become available, use of package plants must be discontinued, except in certain circumstances.

Conclusions

Public health and other officials are just beginning to examine local management options for private wastewater systems. Conflicts between developer concerns for expediency and governmental assurances of adequate performance over time have yet to sort themselves out.

The following agencies and individuals have developed some expertise in this issue and can serve as resources to jurisdictions facing similar problems:

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(919) 549-0551

Wake County Board of Health
Wake County Courthouse
Raleigh, NC
(919) 755-6107

Ed Holland, of Triangle J Council of Governments, contributed to the development of ideas contained in this article.

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a possible 200 points were determined to be the level that provides the minimum acceptable stormwater management. The performance zone requirement applies to all subdivision, business and office development proposed for the part of the watershed in the jurisdiction of High Point and to all single lot development within 2,000 feet of the two lakes and Deep River which connects the lakes.

The performance zone and rating system were chosen over other land use strategies including large lot zoning, low density zoning, and planned unit development districts for several reasons. First, the rating system directly assesses the impact of the stormwater on the quality of the water supply. Second, it gives a developer flexibility in designing a project since if a proposal rates poorly on one factor, it can atone for it by scoring higher on another factor. Third, it does not arbitrarily treat each case the same such as with a blanket density restriction, but instead treats each situation based on its unique set of circumstances.

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Fourth, since the rating system requirement is in addition to the zoning regulations, it does not mix environmental concerns with rezoning issues involving the appropriate land use, density and building style. These advantages are the reason developers and local officials have overwhelmingly preferred the rating system to a density limitation or other inflexible zoning regulation. For example, after studying other solutions, Guilford County (in which most of High Point and its water supply watersheds are located) is seriously considering adoption of an adapted version of the rating system for the water supply watersheds that comprise over half of its jurisdiction.

Conclusion

Recognizing the importance of a good water supply, High Point adopted a watershed performance zone with a rating system to protect its two water supply lakes. Although the rating system is not based on scientifically proven relationships between types of development and water quality, it is an attempt to make the best judgement based on the most complete and reliable knowledge available at the present. When weighed against the alternative of taking no action until the exact effects of development on the quality of water supplies can be accurately predicted, the rating system is a useful tool to protect water supply resources before they become deteriorated or perhaps unusable.