

PROTECTING THE BIG HAYNES CREEK WATERSHED: A STRATEGY FOR LAND MANAGEMENT AND NONPOINT POLLUTION CONTROL

Denise L. Schmidt

AUTHOR: Principal Environmental Planner, Atlanta Regional Commission, 3715 Northside Pkwy., 200 Northcreek, Suite 300, Atlanta, Georgia 30327.

REFERENCE: *Proceedings of the 1995 Georgia Water Resources Conference*, held April 11 and 12, 1995 at the University of Georgia, Kathryn J. Hatcher, Editor, Carl Vinson Institute of Government, the University of Georgia, Athens, Georgia.

Abstract. Population growth has led metropolitan Atlanta and surrounding counties to evaluate and pursue new water supply sources. Rockdale County plans to construct a dam on Big Haynes Creek to create a reservoir and build a downstream, run-of-river intake. With 82 square miles, the Big Haynes Water Supply Watershed encompasses portions of four counties and three cities and is considered a small water supply watershed according to DNR minimum planning criteria. The Atlanta Regional Commission (ARC) facilitated a study to investigate alternatives to these criteria and to develop a proposal for implementing a management plan for the watershed. In order to protect water quality and reduce costs, the recommended alternative included allowing development anticipated in the local governments' 2020 land use scenario, coupled with requiring certain categories of new development be served by regional wet detention ponds.

BACKGROUND

This paper describes a study that recommended a watershed management plan for the Big Haynes Creek Water Supply Watershed. The plan focuses on structural and nonstructural control measures to minimize the effects of future urban development on water quality within the proposed Big Haynes Creek reservoir and at the downstream, run-of-river intake. Big Haynes will serve as the future water supply for Rockdale County.

Storm water runoff from urbanized areas carries many pollutants, including nutrients, oil and grease, heavy metals and organic pollutants such as residues from pesticides. Recent changes to Safe Drinking Water Act Regulations incorporate more stringent water treatment requirements designed to address the adverse impacts of these pollutants on human health. As these impacts become better understood, regulations will become even stricter. The solution is not to continually increase disinfection of polluted water, since disinfection byproducts also have human health consequences, but to minimize and control the pollution before it reaches the water treatment plant. Unless appropriate control measures are put in place, storm water

runoff pollution from the Big Haynes Creek Watershed will exceed water quality targets for Rockdale County's future water supply. The engineering consultant for the project developed quantifiable targets based on goals established by the Project Team. (Camp Dresser & McKee, 1994). These goals are described in the "Purpose of Study" section below.

Water quality problems associated with storm water pollutant loadings can be categorized as follows: eutrophication, toxic contamination and sedimentation. Eutrophication may result in taste and odor problems in the drinking water and is related to the formation of regulated disinfectant byproducts (eg. trihalomethanes, which are suspected carcinogens) in finished water. A highly eutrophic reservoir will also result in depleted oxygen levels in the water column, and this may have severe impacts on aquatic life. Toxicants of concern include heavy metals (lead, zinc, mercury), herbicides and pesticides that are potentially a threat to human and aquatic life. Sediment, besides transporting other pollutants, can scour streams and fill in reservoirs, thereby destroying aquatic habitat and reducing a reservoir's useful life.

Purpose of Study

The Georgia Department of Natural Resources (DNR) has adopted minimum planning criteria to protect water supply watersheds. Under the DNR criteria, basins smaller than 100 square miles are classified as small water supply watersheds. The minimum criteria for these watersheds include: 50 to 100 foot undisturbed river buffers; 75 to 150 foot impervious surface setbacks from rivers and streams in the watershed; and a restriction of a maximum impervious surface area of 25 percent of the entire basin (or existing percentage, if greater). The DNR criteria also permit local governments to adopt additional criteria for drinking water supply protection as well as alternatives to the 25% impervious surface limit. If alternative criteria are desired, all local governments in a basin must form a cooperative plan to present to DNR. The purpose of the study facilitated by ARC was to provide a mechanism for local governments within the Big Haynes watershed to develop a watershed management plan cooperatively. The goals of the plan are:

- To achieve and maintain a high quality water supply source;
- To meet the 1986 Federal Drinking Water Act Standards;
- To meet minimum Georgia DNR criteria or develop acceptable alternatives;
- To consider additional protection criteria as necessary to protect the watershed; and,
- To allocate permitted amounts of impervious surface among the jurisdictions in the basin effectively and equitably.

Watershed Characteristics

The Big Haynes Creek Water Supply Watershed covers an 82 square mile area and includes portions of four counties (Rockdale, Gwinnett, Newton, and Walton) and three cities (Grayson, Loganville, and Snellville). Figure 1 shows a map of the watershed. This area drains to a proposed river-run intake just upstream of Big Haynes Creek's confluence with the Yellow River. A future water supply reservoir will be located upstream of Georgia Highway 138.

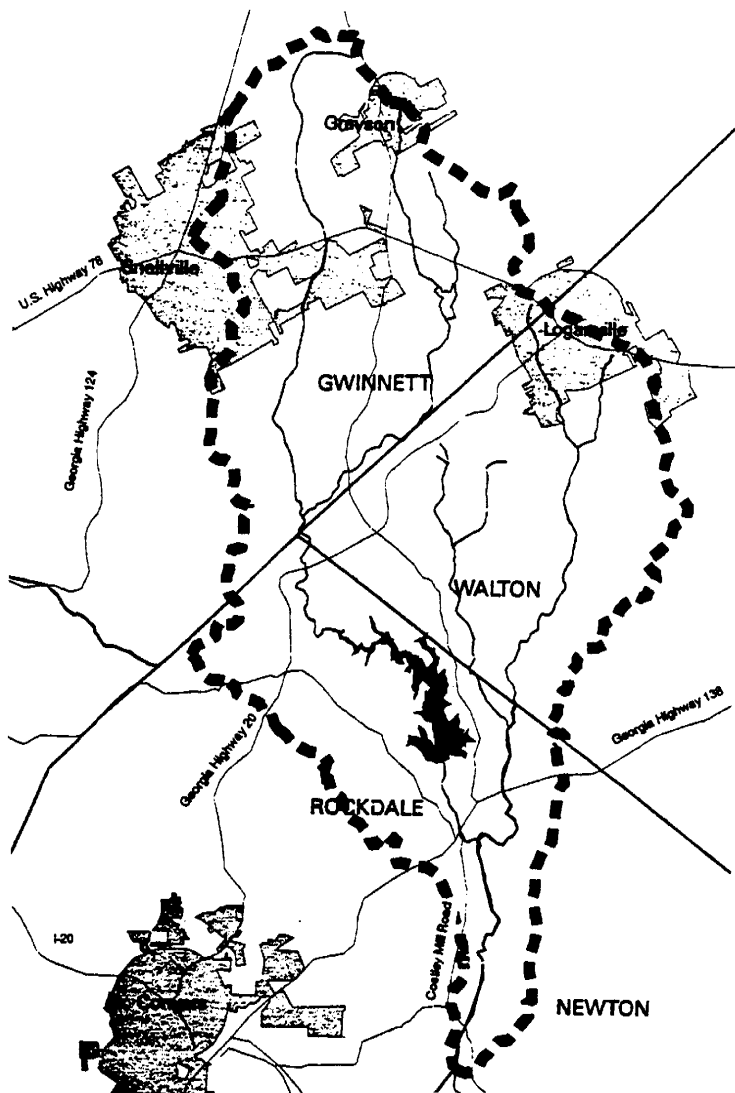


Figure 1. Big Haynes water supply watershed.

Study Participants

Representatives of the local governments named above, along with the City of Conyers and the Conyers-Rockdale Impoundment Authority, served as decision makers on a study Project Team. The Project Team selected Camp Dresser & McKee (CDM), an engineering consulting firm, to conduct the technical analysis. The Atlanta Regional Commission (ARC) acted as facilitator for this group, organized meetings, managed the contract with CDM and conducted other activities in support of the Project Team. In addition, Georgia Department of Community Affairs (DCA) and Environmental Protection Division (EPD), along with the McIntosh Trail Regional Development Center (RDC) and the Northeast Georgia RDC participated on the Project Team.

STUDY ELEMENTS

The elements of the study included:

- Analyze watershed characteristics, including 1992 land coverage, and estimate impervious surface percentages;
- Develop 2020 land coverage scenario, and estimate future impervious surface percentages;
- Estimate nonpoint pollution loadings for 1992 and 2020 land coverage;
- Identify and analyze alternative watershed management strategies;
- Analyze cost of strategies; and,
- Develop implementation plan.

Land Cover Analysis

Existing land cover was evaluated using ARC's land cover database which is based on 1990 aerial photographs. The Project Team updated the database to reflect actual 1992 coverage. This analysis revealed that nearly 80% of the Big Haynes Creek Watershed is currently comprised of nonurban land uses. Most of the urban development consists of lower density residential units. In addition, Project Team members developed future (Year 2020) land use projections based on local land use plans. The land cover analysis was used to estimate the percentage of impervious cover under existing and projected future conditions. Under conditions projected for 2020, approximately 70% of the total area will be covered by residential development, and 8% will be covered by other urban development (e.g., commercial, office, industrial, major roads).

Water Quality Analysis

Data from national studies on urban runoff were supplemented with Atlanta Region data collected under the National Pollutant Discharge Elimination System (NPDES) stormwater program to develop nonpoint pollutant loading factors for each land use category in the watershed. Coupled with watershed specific information on rainfall/runoff relationships, point source discharges, and baseflow characteristics, these data were used to develop a water

quality model of the Big Haynes Watershed. The model selected to evaluate the watershed was CDM's Watershed Management Model (WMM). (Camp Dresser & McKee, 1994). WMM is a spreadsheet-based, planning level tool used to estimate annual or seasonal nonpoint loads and predict in-reservoir water quality concentrations. WMM may be applied to various land use scenarios and management strategies to assess the relative benefits of different alternatives for protecting water quality.

Watershed Management Strategies

Management strategies for water supply protection alternatives include "nonstructural" and "structural" best management practices (BMPs). Pollution from urban storm water runoff is directly related to the amount of imperviousness associated with each land use category within a drainage area. Impervious surfaces such as roads, rooftops, parking lots and driveways are major sources of pollution runoff. Therefore, when looking at alternatives for managing storm water runoff pollution, limiting impervious surfaces is a key component of non-structural BMP alternatives. Nonstructural BMPs include density restrictions, locational restrictions, prohibition or restriction of highly impervious land uses, land acquisition, and buffer zones. Alternatives to nonstructural controls include allowing higher density development if it is served by structural controls such as wet detention ponds, grassed swales, constructed wetlands or sand filters. Compared to high density development with structural BMPs, nonstructural controls do not have to be regularly maintained to achieve pollution loading reductions. They also have less risk of pollutant loadings due to the lower levels of imperviousness.

According to data currently available, wet detention basins remove a higher percentage of pollutants from urban development than do other types of structural controls. All structural BMPs, including wet detention ponds, require a capital investment for construction. In addition, a long-term commitment of funding is required for proper operation and maintenance (O&M) to sustain effective performance levels of structural controls.

Land Use Scenarios

The Project Team evaluated alternative management scenarios in developing a recommended plan. Three different future land use scenarios were evaluated against target water quality levels necessary for protecting the reservoir and downstream intake:

- **Local 2020 Land Use:** As noted previously, the future land use projections indicate that by the year 2020, most of the existing rural land uses are expected to be developed, mostly into residential land uses.
- **Watershed At 25% Impervious:** This land use scenario assumed the Big Haynes Creek Watershed will be developed to the maximum DNR watershed criteria of 25 percent impervious coverage over the entire watershed.

This scenario represents more intensive levels of development within the watershed than the Local 2020 Land Use scenario. Within each jurisdiction, this scenario assumed the same mix of urban land uses as the Local 2020 Land Use scenario.

- **Watershed At 10% Impervious:** Under this scenario, the primary future development would be large lot (2-5 acres), single family residential development. To achieve the 10% impervious over target, this scenario would also require future commercial and industrial development to be limited to less than 2% of the total watershed area.

A set of impervious factors, based on a national literature search, as well as watershed-specific data, was applied to existing and future land use scenarios. Based on this analysis, the composite percentage impervious cover for the watershed is 4.8% for existing conditions. Percent impervious cover is expected to increase to 18.2% within the watershed under the Local 2020 Land Use scenario.

Each future land use scenario was evaluated both with and without structural controls using WMM. In the absence of structural BMPs, only the Watershed at 10% future land use scenario was capable of achieving recommended water quality goals. The most severe water quality deterioration was projected for the highest intensity land use plan (Watershed at 25%). Based on this evaluation, it was determined that structural BMPs would be required for the Local 2020 Land Use and Watershed at 25% scenario to reduce adverse water quality impacts.

Structural BMP Implementation Strategies

Several strategies were considered for implementation of structural BMPs under the Local 2020 Land Use and the Watershed at 25% Impervious scenarios. Wet detention basins were evaluated under the following conditions:

- **BMPA:** Wet detention ponds serve all new development in the townhouse/apartments and nonresidential urban land use categories. In addition, ponds serve all new single family developments with less than 1.0 acre lots and provide retrofit coverage of 30% of the existing acreage of the same land use categories.
- **BMPB:** Wet detention ponds serve all new development in the land use categories listed under BMPA. In addition, ponds serve all new single family developments with less than 2.0 acre lots with retrofit coverage of 30% of the existing acreage in those land use categories.

There are two options for siting wet detention ponds in the Big Haynes Creek Watershed: on-site (each developer builds a pond on an individual development site), or regional (sites are strategically located by the local governments to serve multiple upstream developments). The regional approach generally has advantages over the on-site approach because fewer facilities are required, and it reduces capital costs for construction, reduces maintenance costs, is more feasible to retrofit to existing development, and offers greater reliability. The estimated number of on-site ponds needed in the Big Haynes watershed is shown in Table 1.

Table 1. Estimated Number of Wet Detention Ponds

	Structural BMPs	On Site BMPs	Regional BMPs
(1) Local 2020 Land Use Scenario			
BMPA		640	80
BMPB		860	110
(2) Watershed at 25% Impervious Scenario			
BMPA		990	120
BMPB		1,270	160

RESULTS

Table 2 summarizes the effectiveness of each BMP scenario in meeting the recommended water quality targets for chlorophyll-a and lead. The table also presents an estimate of annual construction, land and O&M costs for on-site and regional pond approaches associated with each scenario. These costs represent "planning level" estimates for average annual construction, land and O&M costs for wet detention ponds under the varying scenarios. The costs presented include water quality protection only and do not include flood control storage costs. In general, water quality design features are estimated to add 40-50% to the cost of typical drainage control ponds in the watershed. Construction and land costs associated with water quality protection will be on average \$1,100 to \$3,100 per acre, depending on the watershed management approach selected.

Table 2. Comparison of Three Watershed Management Strategies for Four Land Use Scenarios

Land Use Scenario	BMP Scenario	Meets Target?		Ann. BMP Cost (\$000)	
		Chlor-a	Lead	On-Site	Regional
Watershed at 10% Impervious	No BMPs	Yes	Yes	\$0	\$0
Watershed at 25% Impervious	No BMPs	No	No	\$0	\$0
	BMPA	Yes	Yes	\$3,597	\$1,723
	BMPB	Yes	Yes	\$3,935	\$1,923
2020 Land Use	No BMPs	No	No	\$0	\$0
	BMPA	Yes	Yes	\$2,157	\$1,059
	BMPB	Yes	Yes	\$2,419	\$1,214
Existing	No BMPs	Yes	Yes	NA	NA

O&M costs for water quality are estimated at approximately \$500 per year for an on-site pond. Due to their larger size and drainage area, O&M costs for regional ponds are higher, at approximately \$2,300 per year for each pond. However, far fewer ponds are required under the regional approach. For each scenario, the regional approach is estimated to reduce costs by approximately 40% in comparison with the on-site approach.

RECOMMENDATIONS

The Big Haynes Project Team developed a recommended watershed management strategy based on cost, the ability to meet water quality targets, and allocations of impervious surface in the watershed.

Nonstructural Controls

Minimize impervious acreage by requiring local governments in the watershed to restrict development to levels in the Local 2020 Land Use scenario. This strategy relies heavily on a very low density scenario in Rockdale County's portion of the watershed, with higher intensity land uses located in the upstream jurisdictions.

Require buffer zones along perennial streams according to DNR criteria.

Structural Controls

Require construction of structural BMPs to control nonpoint pollution from all new nonresidential urban development and all new residential development with lot sizes smaller than 1.0 acre. This control measure includes retrofit coverage of 30% of existing development in these same categories.

Designate regional wet detention ponds as the preferred structural control method.

Require structural BMPs to be designed to maximize pollutant removal efficiencies. Multi-purpose facilities providing flood control and downstream streambank erosion control should be promoted.

Maintenance Program

Implement an effective maintenance program for structural BMPs. All regional BMPs and on-site BMPs serving residential areas should be maintained with public funds. Maintenance agreements should be secured for on-site BMPs serving nonresidential urban development.

Compliance

Require stringent compliance with state and local erosion and sediment control for construction sites through effective inspection and enforcement programs.

Monitoring

Implement a comprehensive water quality monitoring program that includes reservoir and tributary monitoring under baseflow and storm event conditions.

Benefits

The benefits of the recommended watershed management plan include public health protection, an increased factor of safety in preventing contaminants from reaching the public water supply, and a prolonged useful life span for the water supply reservoir.

NEXT STEPS

In order to meet administrative and regulatory requirements to implement the watershed management plan effectively, the Project Team has drafted an intergovernmental agreement. This agreement would establish local governments' commitments to 1) adopt elements of the recommended management plan; and 2) establish a Big Haynes Watershed Council to address future implementation issues such as regional wet detention pond siting, financing, construction and maintenance of ponds, monitoring impervious surface and water quality in the watershed, and updating the plan.

REFERENCES

- American Water Works Association Research Foundation, 1991. Effective Watershed Management for Surface Water Supplies.
- Camp Dresser & McKee, January 23, 1995. Big Haynes Creek Watershed Management Plan Study.

PANEL DISCUSSION: STREAMBANK STABILIZATION

MODERATOR: Susan Hendricks, Education Coordinator, NonPoint Source Education Program, Water Protection Branch, Georgia Environmental Protection Division, 205 Butlet Street SE, Floyd Towers East, Atlanta, Georgia 30334.

REFERENCE: *Proceedings of the 1995 Georgia Water Resources Conference*, held April 11 and 12, 1995, at The University of Georgia, Kathryn J. Hatcher, Editor, Carl Vinson Institute of Government, The University of Georgia, Athens, Georgia.

Moderator: Susan Hendricks, Georgia EPD

Panelists:

DeKalb County Vegetative Streambank Stabilization Program;
Gina Tiernan, Program Manager, DeKalb County Parks and Recreation, DeKalb Parks Division, 3681 Chestnut Street, Scottdale, Georgia 30076.

Availability of Materials - When and Where to Find Them;
Elaine Nash, Volunteer, Georgia Wildlife Federation, Former Rockdale County Soil and Water Conservation District Agent, 3390 Highway 20 SE, Conyers, Georgia 30208.

DeKalb County Streambank Stabilization Program;
John Gurbal, Program Manager, DeKalb County Roads and Drainage, 120 W. Trinity Place, Room 209, Decatur, Georgia 30030.

Soil Bio-Engineering in the Watershed;
Robbin Sotir, Robbin Sotir and Associated, 434 Villa Rica Road, Marietta, Georgia 30064.