

*City of Jefferson
Curry Creek
Water Supply
Watershed*

**Estimate of Existing and
Projected Impervious
Cover
and
Assessment of
Watershed Protection
Provisions**

August 27, 2007

**Seth Wenger, PhD
Jamie Baker Roskie, JD**



**university of georgia
odum school of ecology**



City of Jefferson Curry Creek Water Supply Watershed

Estimate of Existing and Projected Impervious Cover and Assessment of Watershed Protection Provisions

August 27, 2007

**Seth Wenger, PhD
Jamie Baker Roskie, JD**

**UGA River Basin Center
UGA Land Use Clinic**

Contents

Introduction.....	1
1. Analysis of Existing Impervious Cover.....	2
2. Prediction of Impervious Cover under Watershed Buildout.....	4
3. Review of Jefferson Policies.....	7
4. Summary of Results and Recommendations.....	9
Reference.....	10
Acknowledgments.....	10

Introduction

Currently, the main water supply source for the City of Jefferson is the Curry Creek Reservoir on Curry Creek, immediately north of the city center. The Curry Creek watershed drains 6,717 acres of land, 48% of which lies within the boundaries of the city, and 52% of which lies within unincorporated Jackson County. The Curry Creek watershed is classified as a Small Water Supply Watershed by the State of Georgia for purposes of the Georgia Planning Act (GPA). In accordance with the provisions of the GPA, the City of Jefferson passed the Curry Creek Water Supply Watershed Protection Ordinance to place the following restrictions on the watershed:

- Perennial streams are protected with 100 foot natural vegetative buffers and an additional 50 foot impervious surface setback;
- Hazardous materials handling facilities are restricted;
- Streets do not require curb and gutter and road crossings minimize runoff; and
- No more than 25% of land area within the watershed may be covered with impervious surfaces.

The final requirement is challenging because the watershed is experiencing significant residential, commercial and institutional development, and the northern part of the watershed lies within an industrial zone.

In an effort to meet the 25% limit without imposing unreasonable restrictions on any individual landowners or development class, the City of Jefferson contracted with the University of Georgia in 2003 to develop recommendations for managing development within the watershed. The resulting report (“Recommendations to Manage Growth & Protect Water Quality,” Wenger and Roskie 2003) made six recommendations:

- An overlay zone that limits the amount of impervious cover within each parcel of the watershed based on zoning classification;
- A conservation subdivision ordinance to provide developers with flexibility to meet the impervious limit on residential parcels;
- The rezoning of one parcel that appears unsuitable for industrial development from industrial to residential classification;
- Acquisition and permanent protection of at least 100 acres of land in the watershed;
- A policy limiting rezonings within the watershed; and
- A stormwater ordinance.

The purpose of the recommendations was to meet the 25% limit and protect water quality while imposing minimal restrictions and respecting the property rights of landowners.

In this report, we evaluate the success of efforts to comply with the 25% impervious surface limit and the degree to which the previous recommendations have been implemented. This report is divided into four sections:

- 1) An analysis of existing impervious area in the city of Jefferson within Curry Creek watershed;
- 2) A projection of future impervious area at full buildout within Curry Creek watershed;
- 3) A review of the extent to which the City of Jefferson implemented the recommendations of the 2003 report; and
- 4) A summary of results and recommendations.

1. Analysis of Existing Impervious Cover

To date there has been no accurate estimate of the existing impervious cover in Curry Creek watershed. The Northeast Georgia Regional Development Center (NEGRDC) had previously estimated imperviousness of the watershed at over 10%, although this included water bodies as impervious surfaces and therefore was a significant overestimate (Wenger and Roskie 2003). As part of this study, we hand digitized impervious cover from aerial photographs, a method that is more accurate than commonly-used alternatives, such as derivation from satellite imagery.

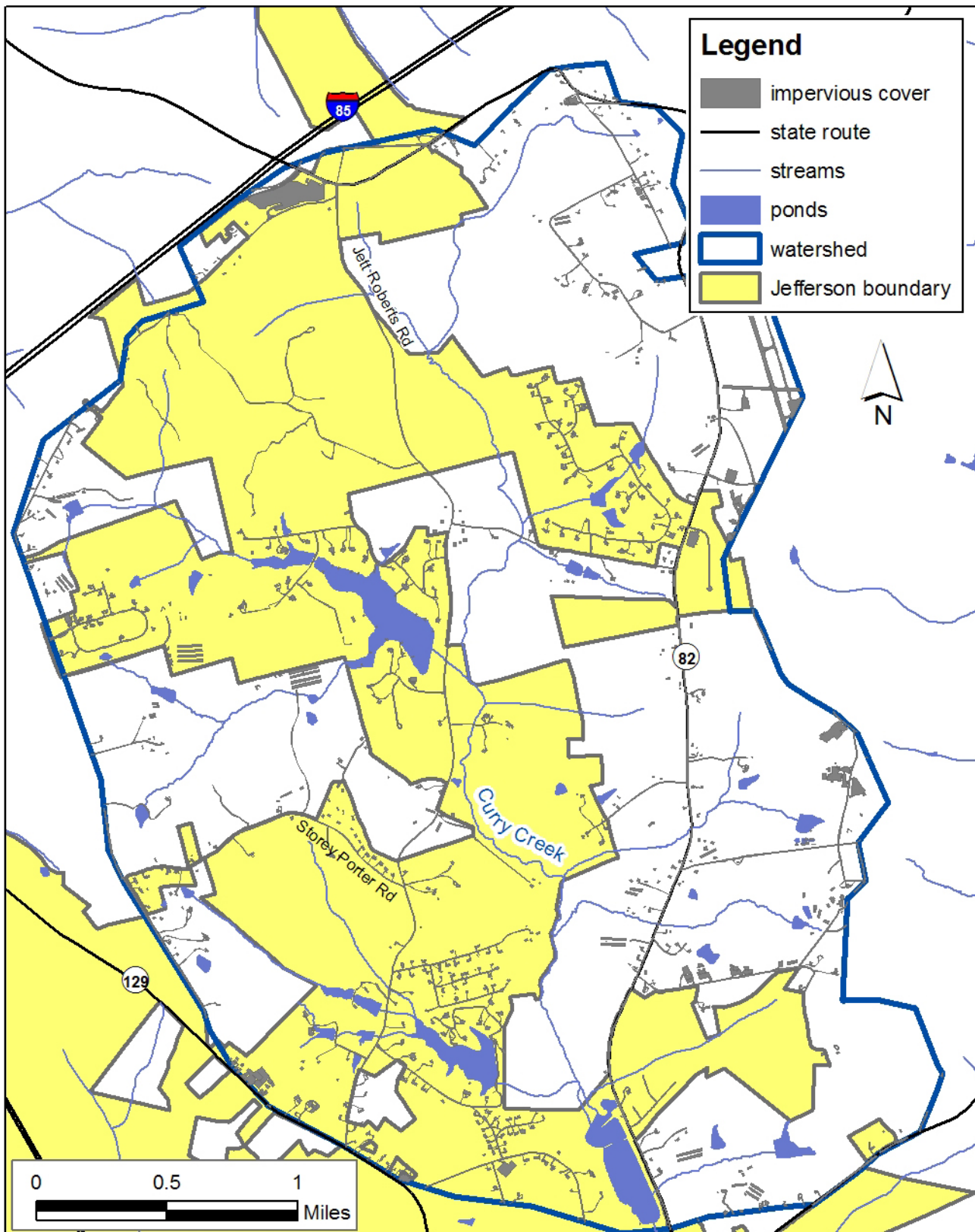
Methods

Using digitized aerial photographs from November 2005 (the most recent available), we hand delineated roofs, driveways, and other impervious surfaces using a Geographic Information System (GIS). For the road network, we based impervious cover on the most recent available road coverage supplied by the NEGRDC and adjusted the results based on aerial photographs as necessary. For the watershed boundary we used a map supplied by Engineering Management Incorporated, which differed slightly from the boundary used in the 2003 report. We calculated total imperviousness within all of Curry Creek watershed and within the subset of the watershed that lies within the municipal limits of the City of Jefferson, using the latest available municipal boundaries (2004).

Results

The total area within Curry Creek watershed is 6,712 acres. Of this, 3.3% is impervious cover. The portion of Curry Creek watershed within the City of Jefferson is 3,233 acres, of which 3.6% is impervious (Figure 1, next page).

Figure 1. Existing impervious cover within Curry Creek watershed.



2. Prediction of Impervious Cover under Watershed Buildout

We next projected the impervious cover under full buildout for (a) the portion of Curry Creek watershed that lies within the City of Jefferson and (b) the entire Curry Creek watershed.

Methods

We assumed that parcels currently developed in accordance with zoning and future land use designations would not change in impervious cover. For example, an industrial-zoned parcel with an industrial building and parking lot was assumed not to change in imperviousness, in contrast to an industrial-zoned parcel with only a farmhouse.

We assumed other parcels would develop according to their zoning designations and within impervious limits set by the City of Jefferson Curry Creek Watershed Overlay District Regulations. These regulations limit commercial and industrial development to 60% imperviousness, residential development to 12% imperviousness and institutional development to 40% imperviousness. We used the Jefferson 2004 zoning map supplied by the NEGRDC and updated it with recent annexations and rezonings supplied by Jeff Killip of the City of Jefferson.

Based on aerial photography, three subdivisions appeared to be partially built out. To increase the accuracy of impervious cover projections for these subdivisions, the imperviousness of the built portion was calculated and the resulting impervious surface ratio was applied to the undeveloped portion. Of the three subdivisions analyzed in this way, one was 16% impervious, one 10% impervious and one 8% impervious. It was assumed that the subdivided, unbuilt parcels in the subdivision with 16% imperviousness were grandfathered and exempt from the 12% impervious limit of the Overlay District Regulations.

For one recently annexed industrial parcel (65-003), a preliminary site plan was provided by the City of Jefferson. This plan showed that imperviousness on this site was 30%, so this value was used in preference to the standard 60% figure for this parcel. For parcels within the Curry Creek watershed that were not currently in city limits, Jeff Killip indicated that most or all would eventually be annexed by the city. Mr. Killip estimated that all those in the northeastern portion of the watershed would be eventually zoned industrial and the balance would be residential. A small strip of the watershed along the northern boundary fell within the I-85 right-of-way and was assumed to be 80% impervious.

Figure 2 shows the classes assigned to different parcels for purposes of estimating buildout impervious cover.

Results and Discussion

The estimated impervious cover at buildout for Curry Creek watershed is 24.8% (Table 1). This is just within the 25% impervious cover limit. The majority (61%) of this impervious cover is associated with industrial-zoned parcels. Counting only the parcels currently within the City of Jefferson produces an estimate of 26.4% impervious cover at buildout. Parcels expected to be annexed in the future have a predicted impervious cover of 23.2% at buildout.

Figure 2. Classes assigned to parcels to estimate buildout impervious cover in the Curry Creek watershed.

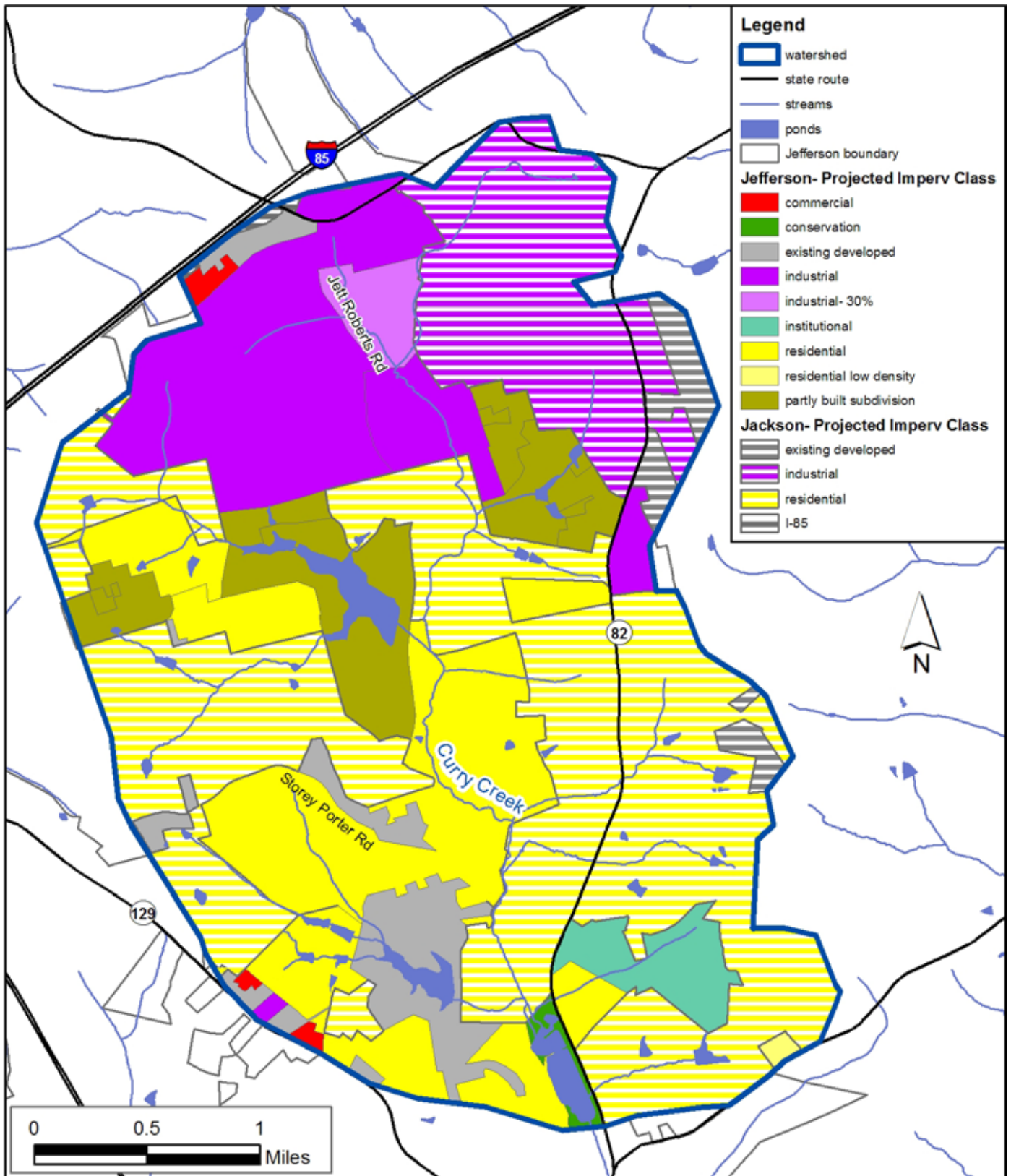


Table 1. Estimate of Impervious Cover at Buildout for Curry Creek Watershed, City of Jefferson.

Class	Total Acres	% Impervious	Impervious Acres
<i>Currently in Jefferson</i>			
Commercial	27.5	70.0%	19.2
Conservation	45.9	2.0%	0.9
Existing Developed	349.5	13.1%	45.9
Industrial	1007.0	60.0%	575.5
Industrial – 30%	95.4	30.0%	28.6
Institutional	150.4	40.0%	60.2
New Residential (12% imp.)	1310.9	12.0%	157.3
Other Residential	591.6	9.6%	56.5
<i>Currently in Jackson County</i>			
Existing Developed	132	19.0%	25.0
Industrial	750	60.0%	450
New Residential	2479	12.0%	298
I-85	10	80.0%	8.3
Total	6949.5	24.8%	1725.0

Notes: “Existing Developed” only includes a portion of existing impervious cover; some areas are assumed to further develop and are included in other categories. Partially developed subdivisions are included in the category of “Other Residential” along with large-lot residential development. “Industrial-30%” is a single industrial development project (parcel 65-003) estimated at 30% impervious cover.

Note that these estimates differ somewhat from those of the 2003 report. This analysis includes a more accurate and detailed estimate of existing imperviousness than the previous study, and therefore should produce more accurate predictions of imperviousness at watershed buildout. According to these calculations, it is not necessary for Jefferson to acquire and permanently protect additional land in the Curry Creek watershed in order to meet the 25% limit (such acquisition had been a recommendation of the 2003 report). Considering that the projected future imperviousness is already close to the 25% limit, however, there is essentially no latitude for upzoning parcels unless the additional imperviousness is offset by land conservation or downzoning of other parcels. In addition, these estimates are predicated on broad assumptions about the zoning of future annexations. If a portion of the land expected to be annexed as residential is actually annexed at a more dense zoning classification, the impervious cover of Curry Creek watershed will exceed the 25% limit. If this should occur, it is recommended that the city acquire and preserve conservation land to offset the excess.

3. Review of Jefferson Policies

We reviewed the policies passed by the Jefferson City Council to assess consistency with the 2003 Curry Creek Watershed “Recommendations to Manage Growth & Protect Water Quality” (Wenger and Roskie 2003). In the 2003 report, the team made the following recommendations:

- 1) Creation of an overlay zone that limits the amount of impervious cover in the watershed according to zoning classifications (A draft model ordinance was appended to the report.).
- 2) Adoption of a conservation subdivision ordinance to help developers meet impervious cover limits on residential properties.
- 3) The rezoning of one parcel from industrial to residential.
- 4) Adoption of a general policy limiting rezonings in the watershed and managing annexations into the watershed.
- 5) Acquisition and/or permanent preservation of at least 100 acres of land in the watershed.
- 6) Adoption of a stormwater ordinance that protects water quality across the jurisdiction.

Following is the status of these recommendations:

- 1) An overlay zone was adopted that limits impervious cover according to zoning classification and also contains provisions related to annexation and rezonings (per number 4 above). However, modifications were made to the suggested model ordinance. An analysis of the substantive differences between the model and the adopted ordinance, along with changes recommended by the 2007 study team to the adopted ordinance, are included below.
- 2) A conservation subdivision ordinance was adopted by the City. An analysis of the main provisions of that ordinance pertaining to water quality appears below.
- 3) The particular parcel remains zoned industrial.
- 4) As explained above, acquisition or permanent preservation is no longer a key recommendation.
- 5) A somewhat different policy regarding annexations and rezonings was adopted by the Council—see the analysis of the overlay zone below.
- 6) A stormwater ordinance has not been adopted. This is discussed below.

Curry Creek Watershed Impervious Cover Overlay Zone

After the 2003 report was submitted, the City of Jefferson passed an overlay ordinance for the Curry Creek watershed. This ordinance, while not exactly the same as the study team’s model ordinance, contained most of the model’s substantive requirements, including the impervious cover limitations in residential, commercial, and industrial zones (as well as an additional, and appropriate, institutional zone.)

However, the model ordinance suggested by the study team in the 2003 report contained a provision *requiring* that development plans submitted for sites within the watershed overlay should include an estimate of the overall impervious cover on the site and that this plan should

be prepared by a licensed surveyor. In the ordinance that was adopted, the Zoning Administrator has *discretion* to require “a numerical estimate and graphical depiction of impervious cover areas and locations to be prepared by a registered land surveyor or other qualified professional.” (See Section 10.4.18.) The study team repeats its original recommendation that the impervious cover estimate by a licensed surveyor be mandatory. This is necessary to ensure maintenance of accurate measurements of impervious cover within the watershed.

Also, in Section 10.4.19 of the adopted regulations, entitled “Stormwater Treatment,” there is a section allowing the Zoning Administrator and City Engineer to authorize a development to exceed the impervious surface limitations “upon meeting the requirements of this section,” including that the “directly connected impervious area within the development” not exceed 15%. Although the intent behind this section is good, the provision is problematic. First, the Georgia Planning Act requires a 25% limit on total impervious surfaces and does not consider whether or not such impervious surfaces are directly connected (although we agree that a directly connected impervious surface standard would be an improvement over the total impervious surface standard). Therefore, allowing exceptions to the impervious surface limits will in all likelihood cause the total imperviousness of the watershed to exceed 25%, placing the City of Jefferson out of compliance with the state requirement. In addition, even if Georgia were to move to a directly connected impervious cover standard, the 15% level is too high for residential districts. Finally, the section provides insufficient guidance on stormwater management best management plans. It should at least include appropriate references to the Georgia Stormwater Management Manual (GSMM), and preferably should refer to a stormwater ordinance adopted by the City of Jefferson (see below for more on necessary elements of a stormwater ordinance). For now, we recommend that Section 10.4.19 be struck.

The 2003 report’s model overlay ordinance contains provisions *barring* rezonings and annexations that have the effect of increasing impervious cover in the watershed beyond acceptable levels. The ordinance adopted by the City *allows* the Council to *deny* rezoning requests based on potential increases of impervious cover. There is no provision for annexations. It may be that in passing the ordinance the Council was concerned about improperly limiting the discretion of future Councils and thus did not bar inappropriate rezonings but rather allowed discretion to deny. This is a policy choice appropriately left to the Council. However, the adopted ordinance should at least contain a provision requiring the Council to consider the effect of future annexations and rezonings on impervious cover limits in the watershed.

Conservation Subdivision Ordinance

The 2003 report made several recommendations for necessary elements of a conservation subdivision. These recommendations were:

- 1) Conservation subdivisions should be a use by right in residential zones.
- 2) The minimum required open space should be 40%.
- 3) Permissible and prohibited activities in the open space should be clearly defined.
- 4) The open space should be permanently protected.
- 5) Conservation subdivision regulations should give developers flexibility in design to allow developments to meet the open space requirements.
- 6) Conservation subdivision regulations should be compatible with stormwater regulations.
- 7) Conservation subdivision regulations should be “density neutral” when compared with the jurisdiction’s traditional subdivision regulations.

Following the 2003 report, the City adopted a conservation subdivision ordinance which largely meets the 2003 team's recommendations. Conservation subdivisions are a use by right in RR-1, RR-2, RR-3, R-1, R-2, R-3 and R-4 zones. The minimum open space requirement is 40%. Permissible and prohibited activities in the open space are clearly defined. Permanent protection of the open space through a conservation easement is required. Developers are given flexibility in subdivision design to enable them to meet the open space requirement while maintaining the density allowed by the underlying zoning. The ordinance requires that the density of the underlying zone should not be exceeded by the conservation subdivision; thus, the ordinance is density neutral. However, as Jefferson has not adopted a stormwater ordinance, it is not possible for the conservation subdivision ordinance to be in compliance with the stormwater regulations.

Stormwater Regulation

The 2003 report contained recommendations regarding stormwater regulations and included a model ordinance. The stormwater ordinance was designed to address the concern that without good stormwater control significant water quality deterioration can occur even under the 25% impervious cover limitation. As mentioned above, Jefferson has not adopted a stormwater ordinance. There are some provisions regarding stormwater design in the Quad Cities UDC Suburban/Urban and Exurban/Rural Design and Improvement Requirements, and the Planning Commission has adopted the Georgia Stormwater Management Manual by resolution. However, this study team reiterates the recommendation that the City adopt an actual stormwater ordinance, in order to create a more certain environment for water quality protection. The team would be willing to once again make model provisions available upon the City's request.

4. Summary of Results and Recommendations

Based on delineation from aerial photography from November 2005, the proportion of Curry Creek watershed within the City of Jefferson covered in impervious surfaces is 3.6%. Our forecast of future imperviousness at watershed buildout, based on the latest available data, is 24.8%. This meets the state-mandated 25% limit. The estimate assumes the implementation of recommendations 1-3, below.

We make the following recommendations to the City of Jefferson to provide a high level of surety that the 25% impervious limit will be met and that water quality within Curry Creek Reservoir will be protected:

- 1) We recommend that an estimate of impervious cover be mandatory for all submitted development plans within the overlay zone.
- 2) We recommend that Section 10.4.19 of the overlay district regulations be struck.
- 3) We recommend adding a provision to the overlay district regulations requiring that the Council consider the effect of any proposed rezonings and annexations in Curry Creek Watershed on the ability of the City of Jefferson to meet the 25% impervious cover limit.
- 4) We recommend that the City of Jefferson adopt a stormwater ordinance consistent with the Georgia Stormwater Management Manual. This is not necessary to meet the 25% impervious limit but would be very valuable in protecting the water quality in Curry Creek Reservoir.

Reference

Wenger, S. J. and J. B. Roskie, 2003. City of Jefferson Curry Creek Watershed: Recommendations to Manage Growth and Protect Water Quality. University of Georgia, Athens, GA.

Acknowledgments

Greg Anderson and Rachel Katz digitized 2005 impervious cover. Jody Rhodes reviewed the Quad Cities conservation subdivision ordinance. Janna Custer reviewed the Quad Cities Curry Creek Reservoir watershed protection overlay.

**University of Georgia River Basin Center
110 Riverbend Road, Room 101
Athens, GA 30602-1510
(706) 583-0463 • Fax (706) 583-0612
www.rivercenter.uga.edu**