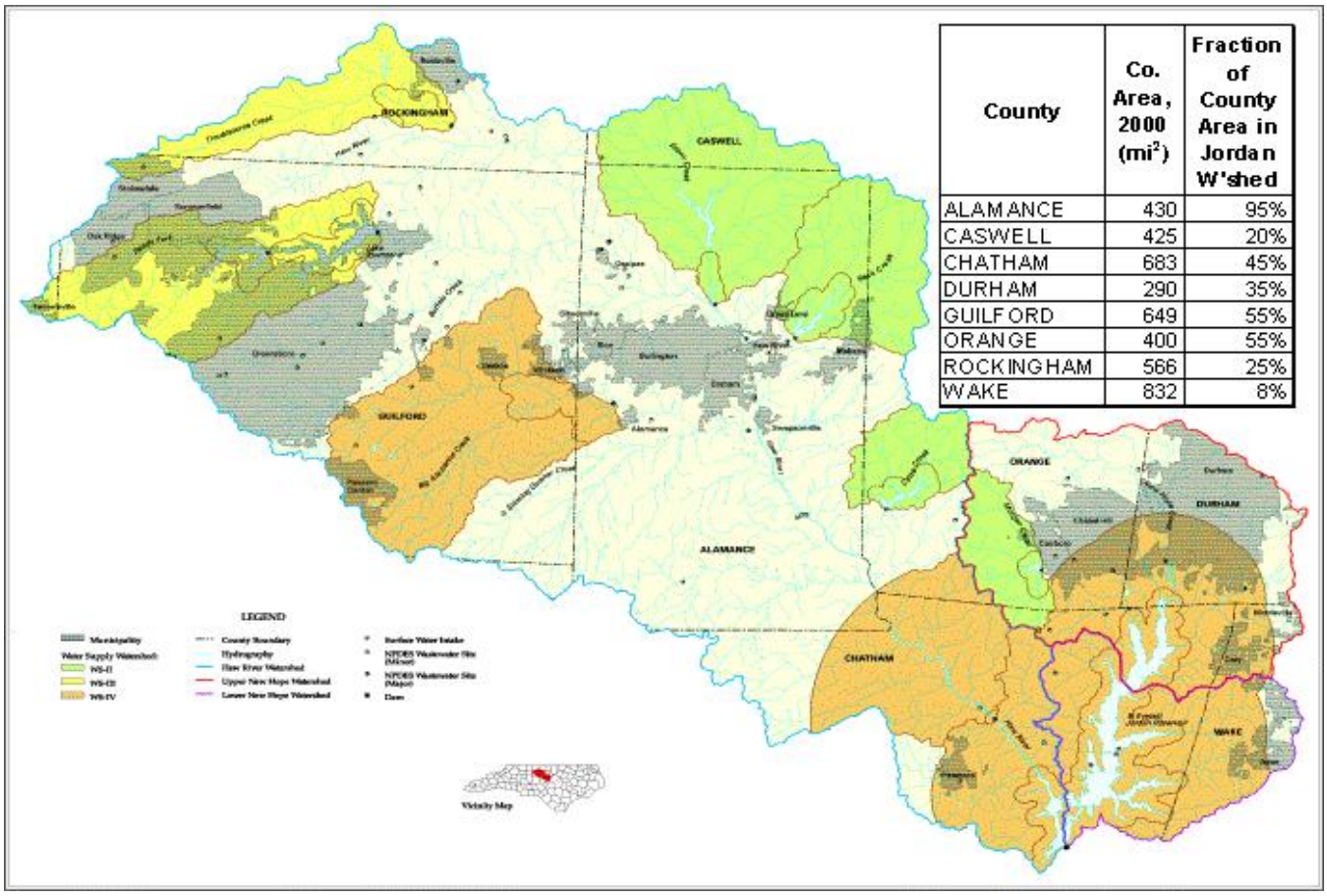
Proposed Nutrient Strategy for Jordan Reservoir Watershed
NC Division of Water Quality
June 2007

Jordan Reservoir Nutrient Enrichment Problem

Since its impoundment in 1983, B. Everett Jordan Reservoir in the upper Cape Fear River Basin has consistently shown substantial nutrient over-enrichment, which leads to algal blooms and other water quality problems. The Lake was designated a 'Nutrient Sensitive Water' that same year by the NC Environmental Management Commission (hereafter, the Commission). Based on the water quality data for the Lake, in 2002, the Division of Water Quality determined that the Upper New Hope Creek Arm of the reservoir had excessive algal growth (as measured by chlorophyll *a*) indicating the water quality was impaired due to excess nitrogen and phosphorus loads to the Lake. In a 2005 data analysis, the Division found that similar conditions existed for the entire Lake. The water quality data also showed exceedences of the pH standard in the Haw River Arm. As a result, the entire reservoir is now listed as impaired under Section 303(d) of the federal Clean Water Act. The reservoir serves as a drinking water source for the growing cities of Cary, Apex, Morrisville, and all of Chatham County. In addition to supplying drinking water, the reservoir serves as a popular primary contact recreational resource and as aquatic habitat for a variety of wildlife.

Figure 1. Jordan Reservoir Watershed



County	Co. Area, 2000 (mi^2)	Fraction of County Area in Jordan W'shed
ALAMANCE	430	95%
CASWELL	425	20%
CHATHAM	683	45%
DURHAM	290	35%
GUILFORD	649	55%
ORANGE	400	55%
ROCKINGHAM	566	25%
WAKE	832	8%

Legislative and Congressional Mandates

The Commission is charged with protecting and restoring water quality throughout the state, and is empowered to adopt regulations to that end. More recently, the sweeping Clean Water Responsibility Act of 1997, S.L. 1997-458, included specific requirements to address water quality problems in Nutrient Sensitive Waters. These requirements apply to Jordan Reservoir. It mandated nutrient concentration limits for point source discharges and allowed for alternate limits based on modeling of the water body in question. It also directed the Commission to establish goals for reducing nutrient inputs to these waters and to ensure that point and nonpoint sources share proportionally in cleanup responsibility.

In addition to state legislative requirements, the reservoir's impaired status invokes federal Clean Water Act requirements to develop and implement nutrient loading reduction goals for the reservoir in the form of a total maximum daily load (TMDL).

Strategy Development

To meet the point source element of the legislative mandate, dischargers chose the modeling alternative and had a model developed for the reservoir in the late 1990's. To meet federal and state requirements, Division staff conducted a 1½-year collaborative evaluation process with stakeholders during 2003-2004 to apply the reservoir model to arrive at overall nutrient reduction goals for the reservoir and to assign loading allocations to point and nonpoint sources. The reservoir model estimates the magnitude of loading reductions needed to minimize exceedences of the water quality standard for chlorophyll-*a*, the primary standard on which nutrient impairment is based. The stakeholders also established recommendations for a conceptual nonpoint source strategy.

The Division drew heavily from the stakeholders' recommendations in developing rules to implement the strategy. Staff presented draft rules to the Water Quality Committee in October 2005, however stakeholder concerns resulted in an extended set of technical meetings during 2006. The Commission approved moving to public hearings and a formal public comment period in March 2007.

The Division plans to hold public hearings during July 2007, to request that the Commission adopt rules in November 2007 or January 2008, and for rules to reach the 2008 session of the General Assembly.

Proposed Jordan Reservoir Nutrient Rules

The strategy is designed around nitrogen (N) and phosphorus (P) percentage reduction goals for each of the three arms of Jordan Reservoir as shown in Table 1 below. Separate goals were needed for each arm because of the hydrologically distinct behavior exhibited by each arm. These goals are relative to a baseline period of 1997 through 2001, dictated by the data time span used in the model. The baseline period becomes important for implementation because all subsequent load-changing activities in the watershed need to be quantified either for reduction credit or as additional load to be offset in reaching the goals.

Table 1. Nutrient Percentage Reduction Goals, Jordan Nutrient Strategy

	Segment of Jordan Reservoir		
	Upper New Hope Arm	Lower New Hope Arm	Haw Arm
Nitrogen	35%	0%	8%
Phosphorus	5%	0%	5%

The Upper New Hope Arm faces the greatest reduction needs. Its watershed is heavily urbanized and includes a large portion of the rapidly growing Triangle area. The Lower New Hope Arm has the least reduction need. Its watershed is very small but is being rapidly developed at suburban residential densities. Finally, the Haw River arm, which compromises 80% of the entire Jordan watershed, contains the rapidly growing Piedmont Triad area.

The proposed set of rules would involve a comprehensive effort to address nutrient sources to Jordan Reservoir to meet the reduction goals established in the TMDL. It would entail reductions by point source discharges and in nutrient runoff from agriculture, existing development, and new development. Riparian buffer protection rules would largely stem loading increases that would otherwise result from loss of those landscape features, while requirements to establish buffers during a change in land use would achieve some loading reduction. A fertilizer management rule would result in training of fertilizer applicators in the watershed, potentially reducing nutrient inputs through education.

Changes from previous nutrient strategies implemented in the Neuse and Tar-Pamlico River Basins include stormwater requirements for *all* local governments in the watershed, *local* implementation of buffer rules, a rule requiring local governments to achieve loading reductions from existing developed lands, a separate stormwater rule for State and Federal entities, and a separate rule outlining a trading framework to maximize options for cost-effective reductions. Outside of these rules, staff is also evaluating possible improvements to Division rules for land application of wastes, and the potential for improved onsite wastewater management through the Division of Environmental Health. Following are brief descriptions of the twelve rules in the Strategy, all falling under Section 15A NCAC 2B:

.0262, Watershed Nutrient Reduction Goals - Overarching strategy framework. Includes intent to use adaptive management.
.0263, Nutrient Management – Would require fertilizer applicators to either take training offered by Cooperative Extension Service or have a certified plan in place for all lands to which they apply.
.0264, Agriculture – Commercial agriculture would collectively meet the percent reduction goals either within 5 years through voluntary enlistment of additional practice implementation, or within 8 years through additional measures imposed by the Commission. Annual reporting would aggregate county-scale accounting for each subwatershed.
.0265, Stormwater Management for New Development – All local governments would develop and implement programs requiring stormwater controls on new development projects to meet subwatershed loading rate targets based on the percent reduction goals.
.0266, Stormwater Management for Existing Development – All local governments would incrementally implement sustainable loading-reducing measures on existing developed lands toward the percent reduction goals. Local governments would conduct feasibility studies from which they would propose the pace and nature of implementation.
0267 (& .0268), Protection of (and Mitigation for) Existing Riparian Buffers – Local governments would ensure protection of existing vegetated riparian areas 50 feet wide adjacent to intermittent and perennial streams and impoundments. They would permit mitigation where no practical alternatives exist.
.0269, Options for Offsetting Nutrient Loads - Parties subject to the various rules could achieve partial compliance by obtaining more cost-effective loading reductions from other sources.
.0270, Wastewater Discharge Requirements – Point sources would meet annual mass loading allocations equating to the percent reduction goals within one year for P and 7 years for N. Includes effluent trading and group compliance options.
.0271, Stormwater Requirements for State and Federal Entities – NCDOT, the universities, and others would meet the same new and existing development requirements as imposed on local governments under rules .0265 and .0266. The Division would administer new development permitting.

.0272, Riparian Buffer Mitigation Fees – Would establish the mitigation payment rate to the NC Ecosystem Enhancement Program for buffer impacts deemed 'allowable with mitigation' under Rule .0267. Would update the current $.90/ft^2 rate in Neuse and Tar-Pamlico to $.70/ft^2 based on better information.
.0311, Cape Fear River Basin - Would amend this rule, the Schedule of Classifications for the Basin, to reclassify the non-WSW half of Jordan watershed to WS-V.

Costs and Benefits to Affected Parties

The state rule-making process includes a requirement for the adopting agency to describe and estimate the costs of proposed rules to all affected parties, as well as to describe benefits. Division staff developed the cost estimates summarized in Table 2 for these rules. This summary is taken from a full fiscal analysis document, which is available on request. Per rule-making requirements, a qualitative description of benefits is included in the fiscal analysis. Expected benefits to the reservoir would include reductions in the frequency and severity of harmful algal blooms, and of taste and odor problems in drinking water taken from the reservoir, improvements in recreational uses and in aquatic habitat. Secondary benefits would include broad improvements in water quality to streams in the watershed and downstream within the Cape Fear River Basin, benefiting a range of users.

Methods: In estimating costs, Division staff obtained input from primary implementing agencies, local governments, university technical experts, published and unpublished data sources, and experience gained and tools developed in implementing similar rules in the Neuse and Tar-Pamlico River Basins.

Costs Calculated: Two sets of costs are presented below. Per rule-making requirements, costs are estimated for the first five years after rule effective date. Where significant costs would occur beyond five years, we calculated full rule compliance costs. This is the case for point sources (Rule .0270) and for existing development stormwater requirements (Rules .0266 and .0271). Also following rule-making requirements, we addressed direct or accounting costs. However in two cases where opportunity costs would be significant, we estimated those also: lost revenue on croplands placed into conserved uses (Agriculture rule, .0264); and timber left unharvested to comply with buffer rule restrictions (Rule .0267).

Five-year Costs: We estimate total combined costs for all rules for the first five years of implementation at approximately $108 million. We note that Session Law SL 1997-458 established more stringent wastewater treatment plant requirements in Jordan watershed that led to the requirements proposed by these rules. The 5-year cost to dischargers if they had chosen to adopt those statutory requirements directly would have amounted to almost $40 million. The alternative chosen by dischargers involved modeling the reservoir and complying with resulting reduction goals, which in fact yielded more stringent point source requirements than the original legislation. The net or additional 5-year point source costs, combined with costs for the rest of the rules, is approximately $68 million. Five-year costs for individual rules range from less than $1 million for Stormwater New Development to $57 million for Wastewater.

Full Compliance Costs: We estimate total costs for full compliance with reduction requirements under all rules in this strategy at approximately $905 million. Again, considering that point sources would have incurred approximately $195 million in costs to comply directly with SL 1997-458, the net cost of full compliance with the entire set of rules by all affected parties is calculated to be approximately $710 million. As detailed in Table 12, seven of the twelve rules would involve costs. Four of the other five – Goals, Offset Options, Buffer Mitigation and Buffer Mitigation Fees - are administrative in nature. For the other one – Rule .0311 involving reclassification of part of the watershed WS-V– we project no new costs.

Costs beyond five years are associated with the existing development stormwater rule, the existing development portion of the state and federal stormwater rule (timeframes for both to be proposed by affected parties), and the wastewater rule (seven years). We estimated that existing development stormwater requirements would impose the greatest costs of all the rules. Local governments would incur $530 million

of that total under Rule .0266. State and federal entities would incur between $78 and $616 million under Rule .0271. The great majority of the state and federal costs, between $58 and $595 million, would go to the DOT. The lower value in this range represents the estimate cost to the DOT using EEP offsets, while the higher value is the DOT's estimate, which assumes a BMP at essentially every outfall on all of their existing roads in the watershed. We also developed a co-mingled drainage treatment scenario for DOT, which puts their costs at approximately $71 million. Point sources would incur the second largest full-compliance cost, with gross cost estimated at approximately $265 million occurring over seven years. Of this cost, local governments would incur the great majority, approximately $256 million. Point source full-compliance net costs beyond mandates in SL 1997-458 would be approximately $70 million.

Table 2: Estimates of Costs to Affected Parties, Jordan Nutrient Strategy

			Regulated Parties						Implementing Agencies				
			Total	Capital (Incl'g Land)	Operation / Maint.	Planning	Regul'y Transax'n	Other	**Total**	Regul'y Developm't	Monitor'g/ Recordkpg	Permit-ting	Inspect/ Enforce
.0263	Nutrient Management		**Regulated Party: Fertilizer Applicators.** "Other" = Applicator's lost wages to attend NM Training						**Implementing Agency: DWQ - $0** new costs				
		2009	$0	$0	$0	$0	$0	$0					
		2010	$0	$0	$0	$0	$0	$0					
		2011	$31,500	$0	$0	$0	$0	$31,500					
		2012	$31,500	$0	$0	$0	$0	$31,500					
		2013	$0	$0	$0	$0	$0	$0					
		5-Yr Total:	$63,000	$0	$0	$0	$0	$63,000					
.0264	Agriculture		**Regulated Party: Agricultural Community.** 'Other' = opportunity cost of converting crop acres to conserved cover. Cap costs shown assume full cost-share (full cap cost = x4).						**Implementing Agency: DWQ - $0** new costs				
		2009	$ 298,000	$ 190,000	$ 57,100	$0	$0	$ 50,500					
		2010	$ 406,000	$ 190,000	$ 114,000	$0	$0	$ 101,000					
		2011	$ 513,000	$ 190,000	$ 171,000	$0	$0	$ 151,000					
		2012	$ 621,000	$ 190,000	$ 229,000	$0	$0	$ 202,000					
		2013	$ 728,000	$ 190,000	$ 286,000	$0	$0	$ 252,000					
		5-Yr Total:	**$ 2,570,000**	**$ 952,000**	**$ 857,000**	**$0**	**$0**	**$ 757,000**					
.0265	Stormwater, New Dev.		**Regulated Parties: Developers (Capital, Regulatory, Planning) & Property Owners (O&M)**						**Implementing Agency: DWQ - $0** new costs				
		2009	$0	$0	$0	$0	$0	$0					
		2010	$0	$0	$0	$0	$0	$0					
		2011	$203,000	$167,000	$19,800	$16,300	$0	$0					
		2012	$431,000	$338,000	$60,000	$33,200	$0	$0					
		2013	$479,000	$344,000	$100,800	$33,700	$0	$0					
		5-Yr Total:	**$1,113,000**	**$849,000**	**$181,000**	**$83,200**	**$0**	**$0**					
.0266	Stormwater, Existing Dev.		**Regulated Party: Local Governments- $0** (negligible regul'y transx'n).						**Implementing Agency: Local Gov'ts - $48,000,** 2010, rule developm't. Other costs incorporated under buffer rule implem.				
			Regulated Party: Local Gov'ts - BMP planning, implem, and o&m. Implementation begins yr. 5, thus these costs are both 1-yr and 5-yr total.						**Implementing Agency: DWQ - $0** new costs				
		5-Yr Total:	**$16,400,000**	**$14,500,000**	**$108,000**	**$1,720,000**	**$54,300**	**$ (23,200)**					
		Full Cost	**$528,000,000**	**$436,000,000**	**$50,000,000**	**$51,500,000**	**$1,629,000**	**$ (10,800,000)**					
.0267	Riparian Buffer Protection		**Regulated Party: Local Governments -** $0 (negligible o&m public land)						**Implementing Agency: DWQ - $0** new costs				
			Regulated Party: Property Owners - 'Other'=opportunity cost of unharvested timber. Capital costs include mitigation (developers and DOT).						**Implementing Agency: Local Governments** - net costs, stormwater & buffer permitting & compliance.				
		2009	$776,000	$727,000	$3,910	$45,500	$0	$0	$48,000	$ 48,000		$0	
		2010	$4,170,000	$3,030,000	$34,000	$108,000	$0	$1,000,000	$375,000	$ -		$375,000	
		2011	$4,200,000	$3,030,000	$64,100	$108,000	$0	$1,000,000	$375,000	$ -		$375,000	
		2012	$4,230,000	$3,030,000	$94,200	$108,000	$0	$1,000,000	$375,000	$ -		$375,000	
		2013	$4,260,000	$3,030,000	$124,000	$108,000	$0	$1,000,000	$375,000	$ -		$375,000	
		5-Yr Total:	**$17,600,000**	**$12,850,000**	**$320,000**	**$478,000**	**$0**	**$4,000,000**	**$1,550,000**	**$48,000**		**$1,500,000**	

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Table 2 (continued): Estimates of Costs to Affected Parties, Jordan Nutrient Strategy

.0270	Wastewater Dischargers		**Regulated Party: Local Governments.** Annual O&M starting Yr. 8 = $12.1 m. ***Net costs post-HB515: 5-Yr Total = $17.4 m, 7-Yr Total = $65 m.***						**Implementing Agency: DWQ - $0** new costs
		2009	**$25,800,000**	$0	$1,260,000	$24,500,000	$0	$0	
		2010	**$25,800,000**	$0	$1,260,000	$24,500,000	$0	$0	
		2011	**$1,260,000**	$0	$1,260,000	$0	$0	$0	
		2012	**$1,260,000**	$0	$1,260,000	$0	$0	$0	
		2013	**$1,260,000**	$0	$1,260,000	$0	$0	$0	
		5-Yr Total	**$55,400,000**	**$0**	**$6,300,000**	**$49,000,000**	**$0**	**$0**	
		7-Yr Total	**$256,000,000**	**$198,000,000**	**$8,790,000**	**$49,000,000**	**$0**	**$0**	
			Regulated Party: Private (Domestic & Indust). Annual O&M starting Yr.8 = $552k. ***Net costs post-HB515: 5-Yr Total =$1.2m, 7-Yr Total=$4.9m.***						
		2009	**$868,000**	$0	$58,000	$810,000	$0	$0	
		2010	**$868,000**	$0	$58,000	$810,000	$0	$0	
		2011	**$58,000**	$0	$58,000	$0	$0	$0	
		2012	**$58,000**	$0	$58,000	$0	$0	$0	
		2013	**$58,000**	$0	$58,000	$0	$0	$0	
		5-Yr Total	**$1,910,000**	**$0**	**$290,000**	**$1,620,000**	**$0**	**$0**	
		7-Yr Total	**$8,586,000**	**$6,560,000**	**$406,000**	**$1,620,000**	**$0**	**$0**	
.0271	State & Fed Stormwater		**Regulated Party: State Entities - DOT and Universities.** Includes new dev (Univ's begin Yr 1, DOT begins Yr 2.5) and existing dev (begins Yr 3 for DOT, Yr 5 for Univ's) costs.						**Implementing Agency: DWQ - $0** new costs
		2009	**$16,000**	$13,000	$2,000	$1,000	$0	$0	
		2010	**$16,000**	$13,000	$2,000	$1,000	$0	$0	
		2011	**$1.9m - $17m**	$1.9m - $13m	$2.3k - $215k	$1.2k - $3.3m	$0	$0	
		2012	**$1.9m - $17m**	$1.9m - $13m	$2.3k - $428k	$1.2k - $3.3m	$0	$0	
		2013	**$2.6m - $18m**	$2.5m - $14m	$8.1k - $647k	$68k - $3.4m	$0	$0	
		5-Yr Total	**$6.5m - $52m**	**$6.4m -$40m**	**$17k -$1.3m**	**$73k - $10m**	**$2.2k**	**$0**	
		Exist'g Dev. Full Cost	**$78m - $616m**	**$75m - $413m**	**$2.0m-$100m**	**$2.0m - $102m**	**$4.3k**	**$0**	

Rulemaking and Implementation Timeframes

The current schedule for the rulemaking process is as follows:

2007	March 8 Mar-Apr	EMC approval of rules for public comment and hearings Review of fiscal analysis by DENR, OSBM
	June 1	Notice and Rules in NC Register – starts 60-day public comment period
	June-July Early July	Public comment period Public hearings
	Aug-Oct	Hearing Officers deliberate
	Nov or Jan	Seek adoption by EMC
2008	Dec-Apr	Review by RRC
	Jan-May	Effective date (< 10 objections)
	May-Aug	Review by General Assembly (if ≥ 10 objections)
	July-Sept	Effective date (if subjected to legislative review)

Implementation timeframes following effective date are illustrated as follows: