

US EPA ARCHIVE DOCUMENT



TECHNICAL MEMORANDUM

TO: CHET THOMPSON,
BUCKEYE FLORIDA, LP

DATE: MAY 26, 2011

CC:

RE: ECONFINA RIVER TOTAL NITROGEN
AND TOTAL PHOSPHORUS CRITERIA

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FILE: BUCC.153275

1.0 INTRODUCTION

The analysis presented in this document summarizes the development of proposed Total Nitrogen (TN) and Total Phosphorus (TP) criteria for the Econfina River. The Econfina River has been employed by EPA Region 4 as the unimpaired reference system for estimation of anthropogenic effects on the Fenholloway River. Based on available nutrient water quality data, TN and TP values have been determined that are not to be exceeded with a certain predetermined frequency and duration for the Econfina River to be considered in compliance with its own long term measured nutrient levels. Because the Econfina River is considered a healthy system, minimally affected by anthropogenic sources, these measured long term nutrient concentrations have been employed as the basis for proposed nutrient criteria.

2.0 TN AND TP DATA ANALYSIS

The approach in determining the nutrient site specific alternative criteria for the Econfina River employed all available data for the Water Body Identification numbers (WBIDs) of interest (3402) as defined by the Florida Department of Environmental Protection (FDEP). Econfina River (WBID 3402) TN and TP data was retrieved from the Impaired Waters Rule database (IWR) as provided on the FDEP website (run43, April 21st 2011 update). TN is calculated as the sum of the nitrogen components Nitrate & Nitrite (NO₃ & NO₂) and Total Kjeldahl Nitrogen (TKN). Since calculated values do not contain data qualifiers, the individual nitrogen components for each TN value were needed in order to assess the usability of the data for this analysis. FDEP provided the IWR data for the nitrogen components (which includes their corresponding data qualifiers), grouping the NO₃ & NO₂ and TKN samples collected at each station on the same day and time, and at the same depths. Map 1 presents the location of the WBID of interest.

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Because EPA's recently promulgated (November 14, 2010) numeric nutrient water quality criteria for flowing waters within the State of Florida (Water Quality Standards for the State of Florida's Lakes and Flowing Waters; Final Rule, December 2010), specifically the final In-stream Protection Values (IPVs), are based on annual geometric means, an approach was developed that is also based on nutrient annual geometric means. Prior to any WBID nutrient annual geometric mean computation from the available IWR data, TN and TP data was pre-processed as to compute a representative annual value taking into account data qualifiers and IWR data manipulation procedures. The nutrient data pre-processing steps can be summarized as follows:

- As per general FDEP practices for screening data, TP, TKN and NO_2+NO_3 data with data qualifier flags equal to "J", "Q" or "Y" were discarded.
- TP, NO_3+NO_2 , and TKN data with a data qualifier flag equal to "U" was computed as half the value of the reported minimum detection limit (MDL/2). This approach in dealing with data reported as undetected is in agreement with general FDEP practices.
- For instances where the NO_3+NO_2 component was reported as zero or blank (meaning that no MDL value was reported or that only TKN was analyzed for at that station/date/time/depth) and there was a valid TKN value reported, only the TKN value was considered in the TN calculations. In these cases, because NO_3+NO_2 is a very small component of TN (the average of all the NO_3+NO_2 values from 1990-2010 is ~3% of the average TN value), the TKN values were used so as not to discard multiple measurements (mainly post-2000 data).
- Using ArcGIS, water quality stations less than 200 meters apart were identified and averaging zones were created. TN and TP daily averages were computed for each averaging zone (200-meter buffers). This calculation was performed as per FDEP IWR rules, Chapter 62-303, "Identification of Impaired Surface Waters", Aquatic Life-Based Water Quality Criteria Assessment section (62-303.320). Table 1 presents the water quality stations included in each 200-meter averaging zone.
- TN and TP WBID daily averages were computed from the previously obtained TN and TP 200-meter zone daily averages, respectively.
- TN and TP WBID annual geometric means were then computed. Table 2 presents a tabulation of the resultant TN and TP annual geometric means for each year and relevant statistics.

EPA has established TN and TP IPVs of 1.03 mg/L and 0.18 mg/L, respectively, for the Panhandle East region of Florida. EPA established that these TN and TP IPV concentrations should not be exceeded more than once in any three year period. In the case of TN, it is clear that the EPA TN IPV concentration would be exceeded more than once in some three year periods. In the case of TP, the EPA TP IPV is quite high compared to the measured historical long term TP trends and therefore the waterbody attains the final EPA TP water quality standards. In order to compute the appropriate nutrient values that, similarly to EPA's IPVs, should not be exceeded more than once in

any three year period (when expressed as annual geometric means) the following calculations were performed:

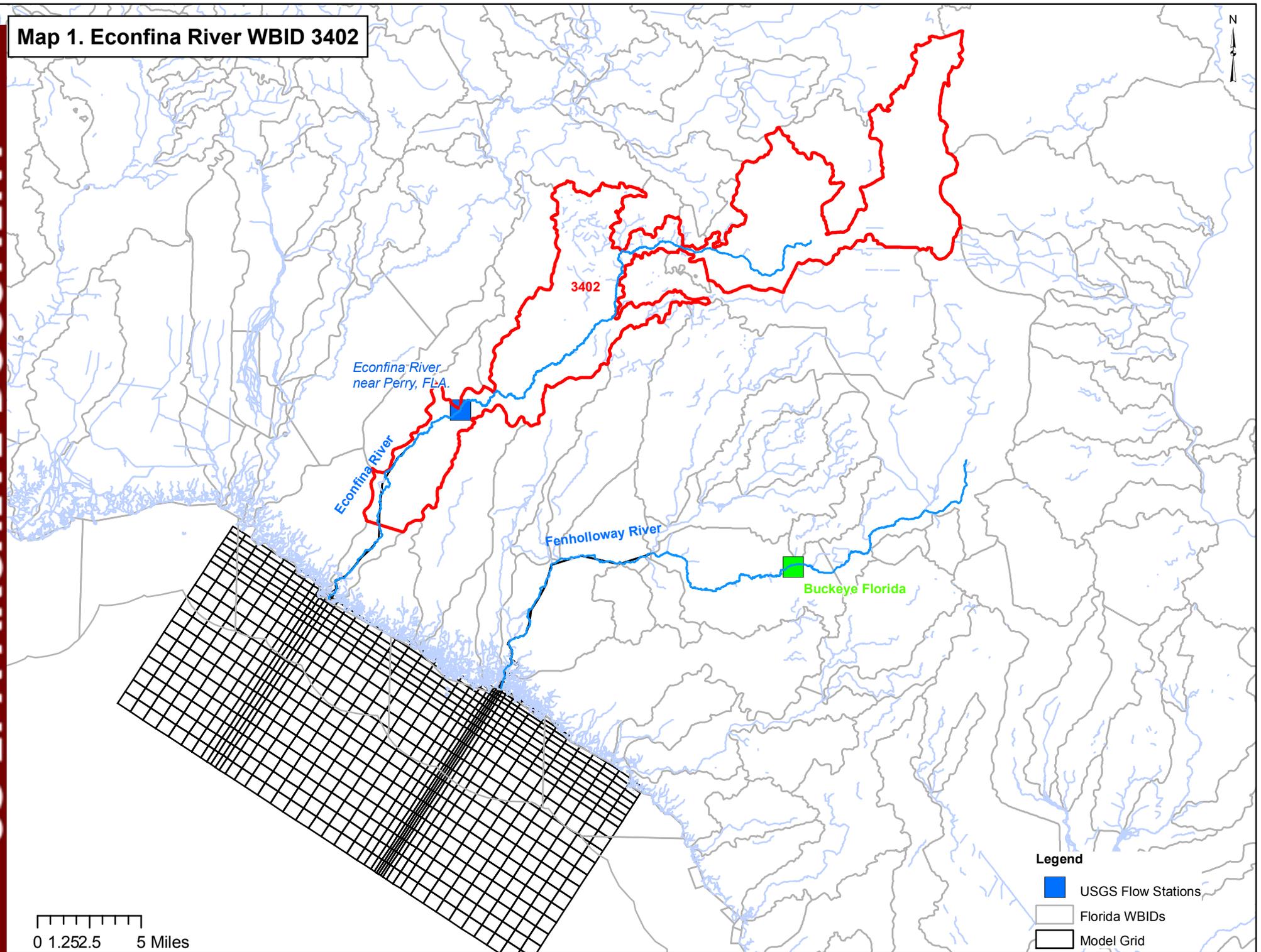
- Using the binomial distribution with no more than one exceedance in any 3-year period, the percentile of the nutrient annual geometric mean distribution that is consistent with a type I error of 5% was selected. Effectively, the 86th percentile was selected and computed. A type I error of 5% was considered appropriate because the Econfina River is considered a healthy system and furthermore it has been employed by EPA Region 4 as the unimpaired reference system for estimation of anthropogenic effects on the nearby Fenholloway River. The TN and TP nutrient data were shown to be log-normally distributed using the Kolmogorov-Smirnov test for a significant fit at 5%. Accordingly, all calculations were performed using log transformed nutrient data and the corresponding statistics. The computed long term average TN and TP values are 0.80 mg/L and 0.08 mg/L, respectively. The 86th percentile of the nutrient annual geometric mean distributions for TN and TP are 1.26 mg/L and 0.10 mg/L, respectively.
- To appropriately account for inherent uncertainty in the nutrient statistical descriptors and therefore the computed upper percentile, a one-sided 90% upper confidence interval limit (UCL) was computed around the previously computed 86th percentile. The procedure is documented in "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance", March 2009 (EPA 530/R-09-007). The applicable document section is 21.1.4 (page 21-11), Confidence Interval Around Upper Percentile. The required "t" factor for a 90% upper confidence interval around the 86th nutrient percentile (not provided in the document tables) was obtained using "StInt - A Computer Program for Computing Statistical Intervals", William Q. Meeker and I. Shang Jackson Chow (Department of Statistics, Iowa State University); computer program available online. For the problem conditions, the "t" factor is 1.51. The TN and TP UCLs are 1.49 mg/L and 0.11 mg/L, respectively.

Therefore, the TN and TP criteria for the Econfina River are annual geometric means of 1.49 mg/L and 0.11 mg/L not to be exceeded more than once in any three year period for TN and TP, respectively.

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Map 1. Econfina River WBID 3402



0 1.252.5 5 Miles

Table 1. Water Quality Stations Included in each 200-meter Averaging Zone.

200-meter Zone ID	Station ID
1	21FLGW 13997
2	21FLGW 14054
3	21FLGW 14074
4	21FLA 22050023
4	21FLGW 3525
4	21FLSUW ECN015C1
5	21FLWQA 300843708351395
6	21FLGW 14079
7	21FLGW 14067
8	21FLGW 14077
9	112WRD 02326000
9	21FLA 22050038
9	21FLGW 6976
9	21FLSUW ECN010C1
10	21FLGW 14060
10	21FLGW 14073
11	21FLGW 21626
12	21FLGW 14057
13	21FLGW 14053
14	21FLGW 14068
15	21FLSUW ECN005C1
16	21FLA 22050026
16	21FLGW 14058
16	21FLWQA 301504808342030
17	21FLA 22050037
18	21FLWQSPTAY170LR

Table 2. Econfina River (WBID 3402) Measured TN and TP Annual Geometric Means and Relevant Statistical Descriptors.

Year	Count	Annual Average	Annual Geometric Mean	Year	Count	Annual Average	Annual Geometric Mean
		ln TN (mg/L)	TN (mg/L)			ln TP (mg/L)	TP (mg/L)
1990	6	-0.549	0.58	1990	6	-2.292	0.10
1991	6	-0.119	0.89	1991	6	-2.471	0.08
1992	9	-0.218	0.80	1992	9	-2.461	0.09
1993	4	-0.647	0.52	1993	4	-2.597	0.07
1994	6	0.378	1.46	1994	6	-2.488	0.08
1995	10	0.063	1.07	1995	10	-2.226	0.11
1996	11	0.149	1.16	1996	11	-2.669	0.07
1997	11	-0.066	0.94	1997	11	-2.521	0.08
1998	11	-0.033	0.97	1998	11	-2.740	0.06
1999	12	-0.736	0.48	1999	13	-2.548	0.08
2000	14	-1.033	0.36	2000	13	-2.545	0.08
2001	20	-0.935	0.39	2001	23	-2.262	0.10
2002	26	-0.438	0.65	2002	28	-2.256	0.10
2003	22	0.395	1.48	2003	21	-2.393	0.09
2004	26	0.161	1.17	2004	25	-2.240	0.11
2005	23	0.011	1.01	2005	24	-2.497	0.08
2006	28	-0.222	0.80	2006	29	-2.694	0.07
2007	19	-0.631	0.53	2007	18	-2.737	0.06
2008	22	-0.254	0.78	2008	22	-2.311	0.10
2009	22	-0.179	0.84	2009	24	-2.289	0.10
2010	17	0.256	1.29	2010	17	-2.786	0.06
	count=	21			count=	21	
	Long Term TN (log)=	-0.221			Long Term TP (log)=	-2.477	
	stdev (log)=	0.412			stdev (log)=	0.182	