

# **Economic Impacts and Compliance Costs of Proposed EPA Numeric Nutrient Criteria for Florida Agriculture**

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## **Abstract**

This document provides a projection of costs and total economic impacts for Florida agricultural producers to attempt to meet the U. S. Environmental Protection Agency's proposed numeric nutrient criteria through the implementation of typical Best Management Practices (BMPs) and additional on-farm storm water treatment and retention practices.

Because the agricultural implementation of the proposed criteria has not been described in the EPA proposal, there is uncertainty in estimating the final compliance costs. For this reason, the assessment is presented as a range of compliance costs. Throughout the state and among all agricultural sectors, these costs will vary and may require expenditures in excess of those estimated, depending on the implementation requirements. Furthermore, implementation of all described applicable practices will not necessarily lead to attainment of the EPA-proposed nutrient criteria.

The total initial and recurring costs for Florida agriculture (including planted tree farms) to implement all applicable practices necessary to attempt to meet the EPA-proposed numeric nutrient criteria will vary depending on the amount of land involved and the types of practices required. In addition to typical BMPs such as nutrient management, irrigation management, fencing and rotational grazing, the authors conclude that more extensive additional practices including the construction of on-farm water treatment/retention facilities will be necessary for all sectors of Florida agriculture. It is estimated that the total initial costs for Florida agriculture to implement all applicable practices will range from \$855 million to \$3.069 billion. The total recurring (annual) costs, which include the amortized initial capital costs, are estimated to range from \$271 to \$974 million. Lost revenues associated with land taken out of production to implement on-farm water treatment/retention practices are estimated to be \$631 million annually. Thus, total recurring expenditures and revenue reductions for agriculture are estimated to range from \$902 million to \$1.605 billion annually.

Beyond the direct impact on the agricultural sector, Florida's economy as a whole will be affected significantly by these lost agricultural revenues. The total output impacts resulting from the \$631 million in lost agricultural revenues and the secondary ripple effects on suppliers and employee spending are estimated to equal -\$1.148 billion annually. The value-added impacts of these lost agricultural revenues are estimated to equal -\$682 million per year. Annual impacts to Florida's labor income are estimated to be -\$326 million, and the estimated loss of full-time, part-time, and seasonal jobs is -14,545.

## **Introduction**

The numeric nutrient criteria for Florida water bodies recently proposed by the U. S. Environmental Protection Agency (EPA) would establish acceptable nutrient concentrations in surface waters at extremely low levels. This has created a great deal of controversy among stakeholders throughout the state, including local governments, utilities, businesses, agricultural producers, and others who are concerned that compliance with the proposed criteria may be impossible to achieve and may cause significant economic damages. Agricultural interests are particularly concerned that enforcement of these criteria would threaten the viability of agriculture in the state. The collective stakeholder concern is further escalated by the uncertainty and lack of transparency of the scientific basis from which the proposed numeric nutrient criteria were derived.

In its preliminary estimate of potential compliance costs, EPA estimated the annual costs for implementation of agricultural BMPs at \$34.8 million (\$27.9 million for nutrient management, \$5.0 million for forest buffers, and \$1.9 million for livestock fencing<sup>1</sup>). Initial capital costs for these BMPs were estimated at \$112.9 million. EPA's cost estimates were generated using the assumption that the Florida Department of Environmental Protection (FDEP) draft numeric nutrient criteria would already be in place as part of Florida's water quality standards, that actions would have been taken and paid for to meet those criteria, and that EPA's proposed criteria would have only an "incremental" impact. However, no such criteria have even been proposed for adoption by the FDEP. EPA's assumption results in an estimate that only 45% of Florida's agricultural lands (6.13 million acres) would be affected by its proposed criteria. This document was developed to provide a more realistic projection of compliance costs and total economic impacts for Florida agricultural producers to attempt to meet the proposed criteria, based on the fact that Florida has not yet adopted numeric nutrient criteria and the authors related conclusion that the EPA-proposed criteria, if adopted, will affect 13.6 million acres of agricultural land rather than the EPA-estimated 6.13 million acres.

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<sup>1</sup> U.S. EPA, Office of Water, Office of Science and Technology, "Preliminary Estimate of Potential Compliance Costs and Benefits Associated with EPA's Proposed Numeric Nutrient Criteria for Florida". January, 2010.

## **Costs of BMP & Water Treatment/Retention Implementation for Compliance**

A range of estimated BMP and on-farm water treatment/retention costs for various agricultural land uses are presented in Tables 1a, 1b, and 1c. Table 1a represents the low end of the compliance cost estimates, and was created using net (harvested) agricultural acres and estimated costs per acre of typical BMPs. Typical BMPs are practices that would only be applied to harvested acres as defined in the Census of Agriculture. Table 1b represents the incremental costs of additional on-farm water treatment/retention facilities that would be applied not only to harvested acreage, but to the gross farm area. Based on modeled reduction estimates for typical BMPs, it is assumed that these additional treatment/retention facilities will be required to attempt to achieve EPA-proposed nutrient criteria. Table 1c includes both typical BMP and water treatment/retention costs added together, and represents the high end of the estimated cost of compliance.

The net and gross area (acres) of land used in Florida for each agricultural industry or commodity that would be subject to the new standards was taken from the 2007 Census of Agriculture (USDA-NASS, 2009) and the Forest Inventory and Analysis (USDA-Forest Service). While the agricultural sectors shown in Tables 1a, 1b, and 1c were classified according to the North American Industry Classification System (NAICS), some sectors represent an amalgamation of several different commodities; for example, row crops includes oilseeds, grains, vegetables and melons, tobacco, cotton, peanuts, strawberries, and other crops. The net area of specified agricultural land uses in Florida for 2007 was 11.63 million acres, including 4.85 million acres for tree plantations, 4.55 million acres for improved/unimproved pasture for beef cattle, 665,000 acres for citrus, 379,000 acres for sugarcane, and 331,000 acres for row crops. Gross farm area of specified agricultural land uses in 2007 was 13.60 million acres. Note that the silviculture acreage in tables 1a and 1b includes only managed (planted) acres.

The estimated per-acre costs for agricultural producers to implement the required BMPs were taken from a report prepared for the South Florida Water Management District by Soil & Water Engineering Technology, Inc. (SWET, 2008). The cost estimates in the SWET report are based, in part, on actual expenditures by the Florida Department of Agriculture and Consumer Services for agricultural BMP implementation and cost-share programs during the eight-year period prior to the report. Subsequently, the cost estimates in the report formed the basis of annual budget requests to the Florida Legislature to fund the agricultural component of the Northern Everglades and Estuaries Protection Program.

The initial and annual operating costs per acre for each agricultural sector or land use are itemized in Tables 1a and 1b. BMPs covered in this analysis included the full range of typical owner-

implemented practices, such as fertilizer management, grazing management, and livestock exclusion from waterways. Additional on-farm water treatment/retention practices include wetland restoration, water recovery/re-use systems, and on-site water treatment/retention systems. Initial (capital) costs for implementation of all practices include materials, labor, and engineering. Annual operating costs were estimated at 20 percent of the initial costs, consistent with good engineering practice, plus amortization of the capital investment at 10 percent interest over 20 years.

Initial costs per acre for typical BMPs range from \$22 for Tree Plantations to \$1,045 for Dairy farms, while annual costs per acre range from \$8 to \$332 (Table 1a). Initial costs per acre for additional on-farm treatment/retention range from \$73 for Beef Cattle Ranching, to \$750 for Dairy farms, while annual per-acre costs for additional practices range from \$23 to \$238 (Table 1b).

The estimated statewide total initial and annual costs to comply with the proposed EPA numeric nutrient criteria were calculated simply by multiplying the average cost per acre against the appropriate total acreage for each agricultural sector in the state (Tables 1a & 1b). The combined total costs were calculated by simple addition (Table 1c). Total initial costs for the implementation of typical BMPs were highest in the Citrus, Dairy, and Beef sectors, at \$326, \$130 and \$115 million respectively. The largest total annual costs for typical BMPs occurred in the same three sectors, at \$104, \$41, and \$36 million per year, respectively (Table 1a). Row crops, Silviculture, and Citrus are estimated to incur the largest initial costs in implementing additional on-farm water treatment/retention practices, at \$681, \$534, and \$337 million respectively. The same three sectors are also projected to incur the largest recurring annual costs for implementing these practices, at \$216, \$169, and \$107 million per year, respectively (Table 1b).

Both modeling (Watershed assessment Model, SWET) and empirical water quality data (STORET, FDEP) indicate that all applicable typical BMPs and additional on-farm water treatment/retention practices would be required to attempt to meet the EPA-proposed numeric nutrient criteria. For this reason, the combined estimated costs shown in Table 1c reflect the best estimate of the costs of implementation to attempt to comply with EPA-proposed criteria. The total initial cost for implementing both typical BMPs and water treatment/retention practices for all agricultural sectors in Florida is estimated to be \$3.069 billion (Table 1c). The individual agricultural sectors expected to experience the greatest initial total costs for implementing all applicable practices are Row Crops, Citrus, and Silviculture, at \$754, \$663, and \$641 million respectively. Recurring annual costs for the operation, maintenance, and debt service for all applicable practices over all agricultural sectors are estimated to total \$974 million (Table 1c). Among the different agricultural sectors, total annual costs for all applicable practices combined were greatest for the same three sectors (Row Crops, Citrus, Tree Plantations), at \$239, \$211, and \$203 million per year, respectively.

**Table 1a. Estimated Costs of Typical BMPs for Florida's Agricultural Producers to Comply with EPA-proposed Numeric Nutrient Criteria**

Agricultural Sector by North American Industry Classification	Net Area Used or Harvested, 2007 (acres)	Typical BMP Costs per Acre		Typical BMP Total Costs	
		Initial (\$)	Annual (\$)	Initial (million \$)	Annual (million \$)
Row crops (1111, 11121, 11191, 111192, 111333)	330,582	220.0	69.8	72.7	23.1
Citrus (11131, 11132)	664,847	490.0	155.6	325.8	103.5
Ornamentals (1114) (net of sod and food crops under cover)	67,359	220.0	69.8	14.8	4.7
Sod production	84,430	110.0	34.9	9.3	2.9
Sugarcane farming (11193)	378,587	110.8	35.2	41.9	13.3
Hay farming (11194)	297,578	58.0	18.4	17.3	5.5
Non-citrus fruit and berry farming (11133)	17,242	490.0	155.6	8.4	2.7
Beef cattle ranching and farming (11211)	4,549,384	25.3	8.0	115.1	36.4
Dairy cattle and milk production (11212)	124,128	1,045.0	331.7	129.7	41.2
Horse and other equine production (11292)	202,176	49.5	15.7	10.0	3.2
Poultry and egg production (1123)	58,078	58.0	18.4	3.4	1.1
Silviculture tree plantations (1131) (net of woodland pastures)	4,852,527	22.0	7.0	106.8	34.0
<b>Total for All Agricultural Uses</b>	<b>11,626,918</b>			<b>855.2</b>	<b>271.6</b>

**Table 1b. Estimated Costs of Additional On-Farm Water Treatment/Retention for Florida Agricultural Producers to Comply with EPA- proposed Numeric Nutrient Criteria**

Agricultural Sector by North American Industry Classification	Gross Farm Area 2007 (acres)	Treatment/Retention Costs per Acre		Treatment/Retention Total Costs	
		Initial (\$)	Annual (\$)	Initial (million \$)	Annual (million \$)
Row crops (1111, 11121, 11191, 111192, 111333)	1,548,413	440.0	139.7	681.3	216.3
Citrus (11131, 11132)	1,394,373	242.0	76.8	337.4	107.1
Ornamentals (1114) (net of sod and food crops under cover)	67,359	440.0	139.7	29.6	9.4
Sod production	84,430	330.0	104.8	27.9	8.8
Sugarcane farming (11193)	378,587	275.0	87.3	104.1	33.1
Hay farming (11194)	297,578	110.0	34.9	32.7	10.4
Non-citrus fruit and berry farming (11133)	47,861	242.0	76.8	11.6	3.7
Beef cattle ranching and farming (11211)	4,549,384	73.3	23.3	333.6	105.9
Dairy cattle and milk production (11212)	124,128	750.0	238.1	93.1	29.6
Horse and other equine production (11292)	202,176	110.0	34.9	22.2	7.1
Poultry and egg production (1123)	58,078	110.0	34.9	6.4	2.0
Silviculture tree plantations (1131) (net of woodland pastures)	4,852,527	110.0	34.9	533.8	169.5
<b>Total for All Agricultural Uses</b>	<b>13,604,894</b>			<b>2,213.7</b>	<b>702.9</b>

Notes: Annual costs represent amortized initial capital costs at 10% interest over twenty-years, plus operation and maintenance at 20% of capital costs. Costs for beef cattle calculated as average for improved pasture, unimproved pasture and woodland pasture. No cost values available for non-citrus fruits and berries; citrus values used to calculate cost because of similarity in management.

Sources: Agricultural acreage: USDA-NASS, *2007 Census of Agriculture, Florida*, Vol. 1, Geographic Area Series, Part 9, State and County data, Tables 8, 37, 46. Forest acreage: USDA-Forest Service, *Forest Inventory and Analysis*. Data for Florida, 2007, available at <http://fiatools.fs.fed.us/fido/standardreport.html>. All Costs: Soil & Water Engineering Technologies, Inc. (SWET), 2008. *Nutrient Loading Rates, Reduction Factors and Implementation Costs Associated with BMPs and Technologies*, Appendix A, tables for phosphorous and nitrogen reduction BMPs.

**Table 1c. Estimated Combined Costs of Typical BMPs and Additional On-Farm Water Treatment/Retention for Florida Agricultural Producers to Comply with EPA-proposed Numeric Nutrient Criteria**

Agricultural Sector by North American Industry Classification	Combined Total Costs	
	Initial (million \$)	Annual (million \$)
Row crops (1111, 11121, 11191, 111192, 111333)	754.0	239.4
Citrus (11131, 11132)	663.2	210.6
Ornamentals (1114) (net of sod and food crops under cover)	44.4	14.1
Sod production	37.2	11.7
Sugarcane farming (11193)	146.0	46.4
Hay farming (11194)	50.0	15.9
Non-citrus fruit and berry farming (11133)	20.0	6.4
Beef cattle ranching and farming (11211)	448.7	142.3
Dairy cattle and milk production (11212)	222.8	70.8
Horse and other equine production (11292)	32.2	10.3
Poultry and egg production (1123)	9.8	3.1
Silviculture tree plantations (1131) (net of woodland pastures)	640.6	203.5
<b>Total for All Agricultural Uses</b>	<b>3,069.0</b>	<b>974.5</b>

Notes: Annual costs represent amortized initial capital costs at 10% interest over twenty-years, plus operation and maintenance at 20% of capital costs. Costs for beef cattle calculated as average for improved pasture, unimproved pasture and woodland pasture. No cost values available for BMPs on non-citrus fruits and berries; citrus values used to calculate cost because of similarity in management. No cost values available for poultry operations; hay farming values used to calculate cost because of land application use

Sources: Agricultural acreage: USDA-NASS, *2007 Census of Agriculture, Florida*, Vol. 1, Geographic Area Series, Part 9, State and County data, Tables 8, 37, 46. Forest acreage: USDA-Forest Service, *Forest Inventory and Analysis*. Data for Florida, 2007, available at <http://fiatools.fs.fed.us/fido/standardreport.html>. All Costs: Soil & Water Engineering Technologies, Inc. (SWET), 2008. *Nutrient Loading Rates, Reduction Factors and Implementation Costs Associated with BMPs and Technologies*, Appendix A, tables for phosphorous and nitrogen reduction BMPs.

### **Regional Economic Impacts of Production Land Displacement**

For Florida agricultural producers to attempt to comply with the EPA-proposed numeric nutrient criteria, it is anticipated that a significant amount of agricultural land will be displaced from production due to implementation of on-farm water treatment/retention systems. According to estimates provided by Florida agricultural engineer Del Bottcher, approximately 10 percent of the agricultural land affected by the EPA-proposed criteria will be needed to construct on-farm water treatment/retention systems (personal communication). This will lead to a recurring reduction in agricultural industry output (revenues).

It is expected that agricultural producers will strive to locate on-farm treatment/retention systems on marginal or non-productive lands to the extent possible, such that overall production volume and value would decrease by less than 10 percent. Economic research has documented that farmers respond to reductions in their production acreage through a variety of adaptive strategies, including intensification of production on the remaining land base, and shifting cultivation to less marginal

land<sup>2</sup>. The effective reduction in production volume is typically 60 to 80 percent of the acreage reduction. For this analysis, we chose a mid-range value of 70 percent, meaning that for a 10-percent reduction in production acreage, production volume would fall by 7 percent.

Total industry output (revenue) for agricultural sectors in Florida was about \$9.02 billion in 2008 (latest data available, Table 2). Therefore, if the projected 7-percent decrease in annual output due to land displacement occurred uniformly across all agricultural sectors, the total annual revenue loss would be \$631 million (Table 2). The largest changes in direct output would occur for Vegetable and Melon Farming (\$152 million), Greenhouse and Nurseries (\$135 million), and Fruit Farming (\$138 million). Note that this analysis includes some additional agricultural sectors/commodities beyond those evaluated in Tables 1a, 1b, and 1c.

Exhibit 6-1 in the January 2010 Economic Analysis report by EPA indicated that the total area of agricultural and forest lands in Florida surrounding water bodies incrementally affected by their proposed numeric nutrient criteria is 6.13 million acres (Figure 1)<sup>3</sup>. This contrasts with a total of 13.6 million acres estimated by the USDA to be used for agricultural and planted forestry activities in Florida. Thus, by EPA estimates, only around 45 percent of Florida's agricultural lands will be affected by EPA-mandated numeric nutrient criteria (though this percentage varies across different agriculture sectors).

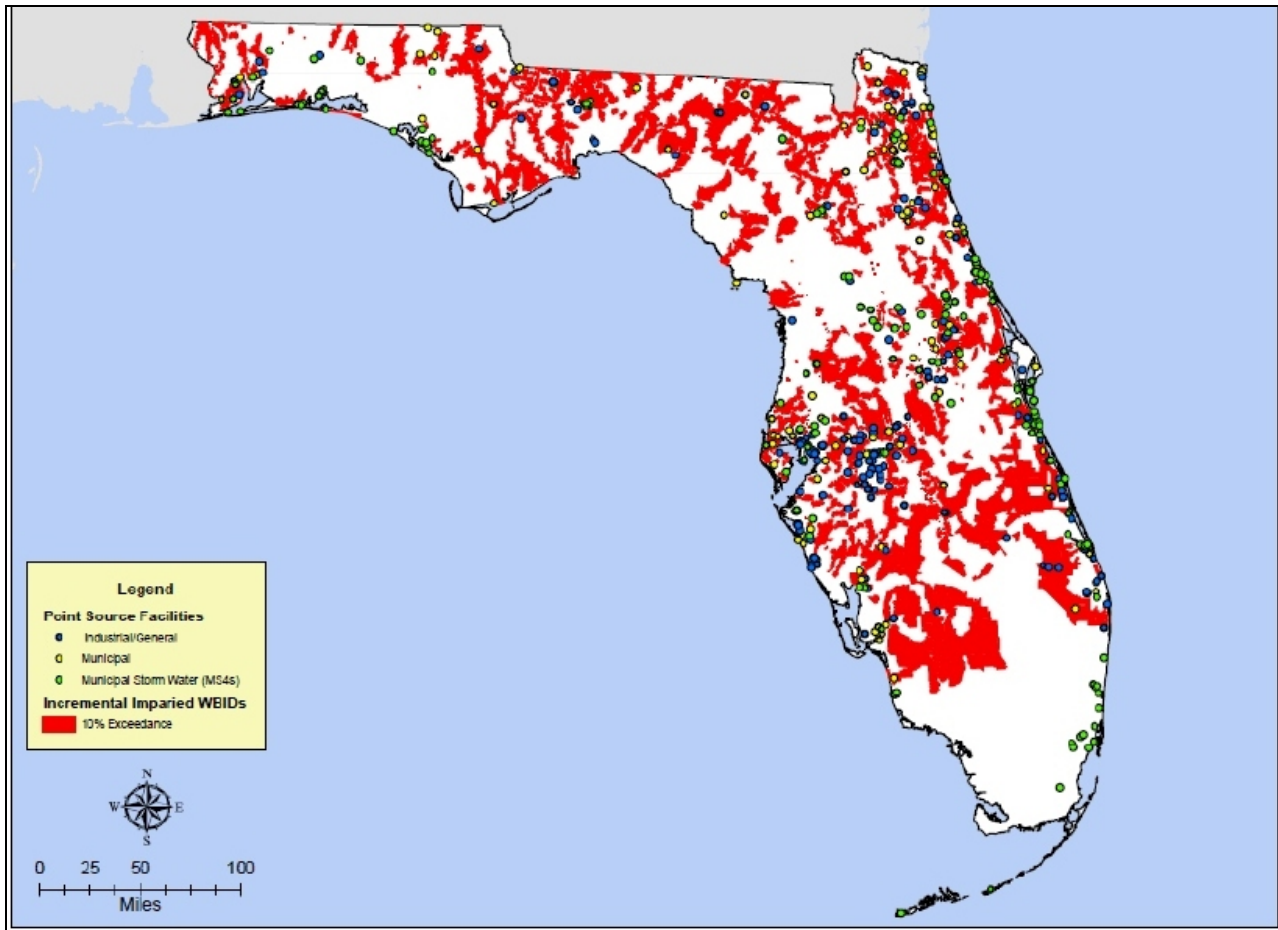
The authors contend that, rather than 6.13 million agricultural acres being affected by the EPA-proposed numeric nutrient criteria, a more realistic estimate of affected acres, based on modeling and water quality data, is 13.6 million acres. EPA assumed that Florida had adopted into its water quality standards draft numeric nutrient criteria being developed by FDEP and that agriculture is already in compliance with these FDEP draft criteria. However, no such criteria have been proposed or adopted into Florida law, and virtually all agricultural acreage statewide will be subject to implementation of typical BMPs and additional on-farm water treatment/retention practices to attempt to comply with EPA's proposed criteria. Consequently, the analysis that follows uses the latter estimate of affected agricultural acres to derive a high-end estimate of economic impact and uses the EPA-estimated acreage to derive a low-end estimate of economic impact. The analysis includes direct and indirect impacts to agriculture and related industries.

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<sup>2</sup> For example, see paper by Erickson, M.H. and K. Collins, Effectiveness of acreage reduction programs. USDA-Economic Research Service, AER-530, *Agricultural-Food Policy Review*, July 1985, pp. 166-84.

<sup>3</sup> Incrementally impaired waters represent those water bodies that would not meet the new water quality standard above and beyond the baseline standard. This differs from the basis used in estimating compliance costs in Tables 1a, 1b, and 1c.

**Figure 1. Incrementally Impaired Waters and Point Sources with Potential to Discharge Nutrients (Exhibit 6-2. EPA Jan. 2010)**



The total regional economic impacts of reduced output by Florida agriculture were estimated using the Impact Analysis for Planning (IMPLAN) input-output software, and 2008 state dataset for Florida (Minnesota Implan Group, Inc., 2009). Input-output analysis is a well-established methodology for estimating the economy-wide effects of changes in industry activity arising from associated changes in business supply chain purchases of inputs and employee household spending, known as the indirect and induced multiplier effects, respectively. <sup>4</sup>

As shown in Tables 3 and 4, the high-end economic impact scenario results in a direct loss of annual industry output of \$631 million, which leads to a total output impact of -\$1.148 billion, including the indirect (supply chain) and induced (employee spending) effects. The direct loss of employment to the agricultural sectors is estimated at 7,780 full-time and part-time jobs, and total employment losses to the Florida economy are estimated at 14,545 jobs. Total value-added impacts to the state are estimated at -\$682 million, including -\$327 million in impacts on labor income (wages, salaries,

<sup>4</sup> Miller, R.E. and P.D. Blair, *Input-Output Analysis: Foundations and Extensions*, 2<sup>nd</sup> Edition, Cambridge Press, 750 pages, 2009.

benefits, proprietor income), and -\$317 million in impacts on property income (rents, dividends, interest, etc.). Impacts on indirect business taxes paid to local and state governments were estimated at -\$38 million, including taxes on property and sales, as well as other minor taxes, licenses and fees.

While total economic impacts of BMP implementation would be greatest in the agricultural sector, significant impacts would also occur in other industries due to the indirect/induced multiplier effects, as shown in Table 4. Other industries projected to incur significant employment impacts include Retail Trade (-608 jobs), Health and Social Services (-578 jobs), Government (-538 jobs), and Accommodation and Food Services (-333 jobs).

**Table 2. Current Industry Output in Florida Agricultural Sectors and Projected Reduction in Output due to Implementation of On-farm Water Treatment/Retention for Compliance with EPA-proposed Numeric Nutrient Criteria**

Agricultural Sector	Output (Revenue) in 2008 (million \$) <sup>1</sup>	Projected Revenue Losses from a 7 % reduction on <b>13.6</b> million acres (million \$)	Projected Revenue Losses from a 7 % reduction on <b>6.1</b> million acres (million \$)
Oilseed farming	7.5	-0.53	-0.4
Grain farming	20.1	-1.41	-1.2
Vegetable and melon farming	2,164.3	-151.50	-124.0
Fruit farming	1,972.0	-138.04	-49.7
Tree nut farming	8.6	-0.60	-0.2
Greenhouse, nursery, & floriculture	1,930.2	-135.12	-85.0
Tobacco farming	4.0	-0.28	-0.2
Cotton farming	42.1	-2.95	-2.4
Sugarcane & sugar beet farming	442.2	-30.95	-25.3
All other crop farming	322.6	-22.58	-24.2
Cattle ranching and farming	404.0	-28.28	-9.9
Dairy cattle and milk production	463.8	-32.46	-1.6
Poultry and egg production	403.0	-28.21	-2.5
Animal production except cattle & poultry	174.8	-12.24	-1.1
Forestry, forest products & timber tracts	658.5	-46.10	-22.4
<b>Total All Sectors</b>	<b>9,017.8</b>	<b>-631.24</b>	<b>-350.3</b>

Source: *IMPLAN Professional* software, and Florida regional data. Minnesota Implan Group, Inc., Stillwater, MN, 2009.

**Table 3. Summary of Annual Economic Impacts in Florida from Change in Agricultural Industry Output due to Implementation of On-farm Water Treatment/Retention for Compliance with EPA-proposed Numeric Nutrient Criteria on 13.6 Million acres (2008 dollars)**

Impact Type	Employment (fulltime & part-time jobs)	Labor Income (million \$)	Value Added (million \$)	Output (million \$)
Direct Effect	-7,780	-121.1	-370.1	-631.2
Indirect Effect	-2,967	-65.4	-82.6	-145.9
Induced Effect	-3,798	-140.0	-229.1	-371.3
<b>Total</b>	<b>-14,545</b>	<b>-326.5</b>	<b>-681.8</b>	<b>-1,148.4</b>

Source: *IMPLAN Professional* software and Florida regional data. Minnesota Implan Group, Inc., Stillwater, MN, 2009.

**Table 4. Total Economic Impacts in Florida, by Major Industry Group, of Change in Agricultural Industry Output due to Implementation of On-farm Water Treatment/Retention for Compliance with EPA-proposed Numeric Nutrient Criteria on 13.6 million acres (2008 dollars)**

Industry Group	Employment (fulltime & part-time jobs)	Output (million \$)	Value Added (million \$)	Labor Income (million \$)	Other Property Type Income (million \$)	Indirect Business Taxes (million \$)
Agriculture, Forestry, Fisheries	-10,147	-685.0	-402.9	-160.5	-229.0	-13.4
Mining	-7	-2.5	-0.5	-0.2	-0.3	0.0
Utilities	-24	-13.4	-9.4	-2.8	-5.2	-1.5
Construction	-244	-26.6	-10.6	-9.6	-0.9	-0.1
Manufacturing	-103	-42.1	-9.2	-5.5	-3.3	-0.5
Wholesale Trade	-194	-30.3	-19.7	-11.4	-4.1	-4.2
Retail Trade	-608	-35.8	-24.4	-14.9	-4.2	-5.3
Transportation & Warehousing	-163	-15.3	-8.3	-5.8	-2.2	-0.4
Information	-53	-14.5	-5.8	-3.4	-1.9	-0.5
Finance & Insurance	-243	-42.5	-23.0	-12.8	-9.3	-1.0
Real Estate & Rental	-278	-72.7	-51.4	-5.9	-37.6	-7.9
Professional & Tech. Services	-286	-29.8	-18.0	-14.9	-2.6	-0.4
Management of Companies	-24	-4.3	-2.6	-2.0	-0.6	0.0
Administrative & Waste Services	-241	-11.8	-7.3	-5.7	-1.4	-0.2
Educational Services	-89	-4.4	-2.6	-2.4	-0.2	0.0
Health & Social Services	-578	-43.6	-27.3	-23.3	-3.7	-0.4
Arts- Entertainment & Recreation Accommodation & Food Services	-83	-6.7	-3.6	-2.1	-1.0	-0.5
Other Services	-333	-17.8	-9.9	-6.5	-2.3	-1.1
Government & non-classified	-310	-15.3	-8.6	-6.2	-1.7	-0.7
<b>Total All Industries</b>	<b>-538</b>	<b>-34.0</b>	<b>-36.6</b>	<b>-30.7</b>	<b>-5.9</b>	<b>0.0</b>
<b>Total All Industries</b>	<b>-14,545</b>	<b>-1,148.4</b>	<b>-681.8</b>	<b>-326.5</b>	<b>-317.4</b>	<b>-38.0</b>

Source: *IMPLAN Professional* software and Florida regional data. Minnesota Implan Group, Inc., Stillwater, MN, 2009.

The reductions in agricultural revenues under the low-end scenario, based on EPA estimates of affected agricultural acres, are shown in Tables 2, 5, and 6. The projected decrease in annual output on affected acreage due to land displacement to construct on-farm water treatment/retention facilities would be about \$350 million per year. The largest changes in direct output would occur for Vegetable and Melon Farming (\$124 million), Greenhouse and Nurseries (\$85 million), and Fruit Farming (\$50 million) as shown in Table 2.

The direct loss of annual industry output of \$350 million leads to a total output impact of -\$635 million, including the indirect (supply chain) and induced (employee spending) effects. The direct loss of employment to the agricultural sectors is estimated at 3,546 full-time and part-time jobs, and total employment losses to the Florida economy are estimated at 6,660 jobs (Table 5). Table 6 shows total value-added impacts for the state, which are estimated at -\$388 million, including -\$177 million in impacts on labor income (wages, salaries, benefits, proprietor income), and -\$190 million in impacts on property income (rents, dividends, interest, etc.). Impacts on indirect business taxes paid to local and state governments are estimated at -\$21 million, including taxes on property and sales as well as other minor taxes, licenses and fees.

While total economic impacts would be greatest in the agricultural sector, significant impacts would also occur in other industries due to the indirect/induced multiplier effects, as shown in Table 6. Other industries projected to incur significant employment impacts include Retail Trade (-284 jobs), Health and Social Services (-269 jobs), Government (-252 jobs), and Accommodation and Food Services (-155 jobs).

**Table 5. Summary of Annual Economic Impacts in Florida from Change in Agricultural Industry Output due to Implementation of On-farm Water Treatment/Retention for Compliance with EPA-proposed Numeric Nutrient Criteria on 6.1 Million acres (2008 dollars).**

Impact Type	Employment (fulltime & part-time jobs)	Labor Income (million \$)	Value Added (million \$)	Output (million \$)
Direct Effect	-3,546	-65.9	-217.1	-350.3
Indirect Effect	-1,342	-34.9	-45.8	-78.5
Induced Effect	-1,771	-76.6	-125.2	-206.6
Total	-6,660	-177.4	-388.1	-635.4

Source: *IMPLAN Professional* software and Florida regional data. Minnesota Implan Group, Inc., Stillwater, MN, 2009.

**Table 6. Total Economic Impacts in Florida, by Major Industry Groups, of Change in Agricultural Industry Output due to Implementation of On-farm Water Treatment/Retention for Compliance with EPA-proposed Numeric Nutrient Criteria on 6.1 Million acres (2008 dollars)**

Industry Group	Employment (fulltime & part-time jobs)	Output (million \$)	Value Added (million \$)	Labor Income (million \$)	Other Property Type Income (million \$)	Indirect Business Taxes (million \$)
Agriculture, Forestry, Fisheries	-4,600	-377.3	-234.6	-86.5	-140.9	-7.2
Mining	-3	-1.4	-0.3	-0.1	-0.2	0.0
Utilities	-11	-7.0	-5.1	-1.5	-2.8	-0.8
Construction	-116	-14.3	-5.9	-5.4	-0.5	-0.1
Manufacturing	-48	-22.8	-5.0	-3.0	-1.8	-0.3
Wholesale Trade	-88	-16.1	-10.5	-6.1	-2.2	-2.2
Retail Trade	-284	-19.5	-13.3	-8.2	-2.3	-2.9
Transportation & Warehousing	-74	-8.2	-4.4	-3.0	-1.2	-0.2
Information	-25	-7.9	-3.1	-1.8	-1.1	-0.2
Finance & Insurance	-113	-23.2	-12.6	-7.0	-5.0	-0.5
Real Estate & Rental	-142	-40.8	-29.4	-3.5	-21.4	-4.5
Professional & Tech. Services	-132	-16.6	-9.8	-8.1	-1.5	-0.2
Management of Companies	-11	-2.4	-1.4	-1.1	-0.3	0.0
Administrative & Waste Services	-113	-6.5	-4.0	-3.1	-0.8	-0.1
Educational Services	-41	-2.5	-1.4	-1.3	-0.1	0.0
Health & Social Services	-269	-23.8	-14.9	-12.7	-2.0	-0.2
Arts- Entertainment & Recreation	-38	-3.7	-2.0	-1.1	-0.6	-0.3
Accommodation & Food Services	-155	-10.0	-5.4	-3.6	-1.2	-0.6
Other Services	-144	-8.6	-4.7	-3.4	-0.9	-0.4
Government & non-classified	-252	-22.6	-20.1	-16.8	-3.2	0.0
<b>Total All Industries</b>	<b>-6,660</b>	<b>-635.4</b>	<b>-388.1</b>	<b>-177.4</b>	<b>-190.0</b>	<b>-20.8</b>

Source: *IMPLAN Professional* software and Florida regional data. Minnesota Implan Group, Inc., Stillwater, MN, 2009.

### Summary

EPA's analysis of economic impact to Florida agriculture and related industries was incomplete, both in terms of the estimated number of agricultural acres affected and the methods used to determine economic impact. Even using EPA's estimates of affected acreage (6.13 million acres), our analysis, excluding the direct implementation costs of all applicable practices, reveals that annual lost revenues associated with land taken out of production to implement on-farm water treatment/retention practices would be \$350 million a year. A more realistic assessment, using water quality modeling and monitoring data, shows that 13.6 million acres of agriculture will experience direct costs. Rather than the \$34.9 million total annual cost that EPA suggested, the authors assert that a more justifiable estimate of direct costs is from \$902 million to \$1.605 billion annually, with additional indirect economic impacts to the state of \$1.148 billion annually.