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ECONOMIC ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE FAT THREERIDGE, SHINYRAYED POCKETBOOK, GULF MOCCASINSHELL, OCHLOCKONEE MOCCASINSHELL, OVAL PIGTOE, CHIPOLA SLABSHELL, AND PURPLE BANKCLIMBER

Final Report | October 2007

prepared for:

U.S. Fish and Wildlife Service

4401 N. Fairfax Drive

Arlington, VA 22203

prepared by:

Industrial Economics, Incorporated

2067 Massachusetts Avenue

Cambridge, MA 02140

INDUSTRIAL ECONOMICS, INCORPORATED

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EXECUTIVE SUMMARY

1. The purpose of this report is to identify and analyze the potential economic impacts associated with the proposed critical habitat designation for the fat threeridge, shinyrayed pocketbook, Gulf moccasinshell, Ochlockonee moccasinshell, oval pigtoe, Chipola slabshell, and purple bankclimber, collectively known as the seven mussels. Sections 3 to 6 of the analysis consider all future conservation-related impacts, including impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. That is, a portion of these "co-extensive" impacts are forecast to occur regardless of critical habitat designation for the seven mussels. Appendix B estimates the potential incremental impacts of critical habitat designation for the seven mussels by attempting to isolate those impacts that would not be expected to occur absent the designation of critical habitat for the seven mussels. Incremental impacts described in Appendix B and summarized in Exhibit ES-8 are those precipitated specifically by this rulemaking as proposed.

2. This final economic analysis analyzes the proposed designation as described in the proposed rule. This analysis does not reflect changes to the proposed critical habitat designation made in the final rule. Consequently, description of the habitat designation in the final rule may differ from maps and figures presented in this analysis.

3. The Service proposes to designate as critical habitat 1,186 river miles in 11 units with a lateral boundary of the "ordinary high-water mark" in 45 counties in Alabama, Florida, and Georgia.[1] Exhibit ES-1 provides a map of these rivers. The lands adjacent to the units comprise a mix of private, State, and Federal lands, which account for roughly 87 percent, 10 percent and three percent of the total area, respectively.

4. The economic analysis focuses on identifying and quantifying impacts of potential changes in existing water uses to maintain flows to conserve the seven mussels. The Service identifies "flow regime," specifically "permanently flowing water" in the Proposed Rule, as one of the Primary Constituent Elements (PCE) for the seven mussels. In addition, the Service states that the seven mussels cannot survive in impounded ponds, lakes, or intermittent streams. Thus, continuously flowing water is assumed to be a necessary habitat feature for the seven mussels. This analysis therefore assumes that changes in water management and use may occur to conserve the seven mussels, and that these changes could generate economic efficiency and regional economic impacts. This

[1] U.S. Fish and Wildlife Service, Proposed Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages, 71 FR 32746, June 6, 2006. U.S. Fish and Wildlife Service, Revised Proposed Rule; Reopening of the Comment Period, Availability of the Draft Economic Analysis and Revised Proposed Critical Habitat Units, and Announcement of Public Hearings, 72 FR 34215, June 21, 2007.

analysis does not make assumptions or recommendations regarding how such changes will occur, or who will bear the cost of these changes in water management and use.

5. This analysis expects most changes in water management and use within proposed critical habitat will occur in the Apalachicola-Chattahoochee-Flint (ACF) Basin. The Apalachicola, Chattahoochee, and Flint Rivers are particularly complex hydrological systems. Multiple management structures and numerous withdrawals currently exist on the Flint and Chattahoochee Rivers; these two rivers converge at Jim Woodruff Dam to form the Apalachicola River. The Chattahoochee River is managed through a series of dams and hydroelectric plants that provide water for hydropower production, flood control, municipal uses, recreation, and other uses. Water in the Flint River Basin is used primarily for agricultural irrigation. Freshwater flowing out of Jim Woodruff Dam supports recreational and commercial fisheries in Apalachicola Bay, and occasional commercial navigation.

6. Competition for water, and conflicts among water users in the ACF Basin system, exist independent of the seven mussels and will likely continue to occur absent seven mussels conservation efforts. Water demands in the summer and fall periodically exceed the supply of water in the ACF Basin; as the demands increase and the supply remains constant, these shortages are likely to become more frequent and more severe.[2] In the Chattahoochee basin, the U.S. Army Corps of Engineers (USACE) manages a complex system, considering both competing demands and past and future hydrologic conditions in order to optimize the use of stored water.[3] During times of drought in the system and reduced inflow from the Flint River due to agricultural irrigation, the USACE has historically used reservoir storage to maintain flows at or above 5,000 cubic feet per second (cfs) on the Apalachicola River.[4] Current management in support of federally listed species listed species in the Apalachicola River (i.e., fat threeridge, purple bankclimber, Chipola slabshell, and Gulf Sturgeon) consists of the Modified Interim Operation Plan (Modified IOP) for Jim Woodruff Dam, as described in the Biological Assessment submitted to the Service on February 16, 2007, with which the Service concurred on February 28, 2007. Debates continue regarding the appropriate allocation of Chattahoochee water; negotiations over this allocation have been ongoing between Alabama, Florida, and Georgia for over 15 years. These debates have delayed

[2] U.S. Army Corps of Engineers. 1998. Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin: Alabama, Florida, and Georgia. Draft Environmental Impact Statement, September.

[3] The USACE is responsible for management of four Federal reservoir projects within the Chattahoochee basin. There are other opportunities for conservation management within the basin that are outside the Federal Reservoir areas, but beyond the authority of the USACE.

[4] In their public comment the U.S. Army Corps of Engineers explained the influence of upstream flows on Unit 8 Apalachicola River. The "...Jim Woodruff Dam/Lake Seminole has very limited storage capacity and is dependent upon releases from the upstream reservoirs or flows from the Flint River to make releases to meet downstream flow needs. These factors influence a conservative operation at Lake Lanier, in order to conserve storage for future augmentation flows for balancing project purposes throughout the basin and to meet downstream minimum flows...." Public comment letter, submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District, U.S. Army Corps of Engineers, August 6, 2007.

finalization of the USACE's draft 1989 water control plan for the ACF Basin, and will shape the next water control plan for the System.

7. Meeting flows for the conservation of the seven mussels may place additional demands on a system that is already constrained. Estimation of the potential economic impacts that may result from meeting flows for the conservation of the seven mussels requires an understanding of the timing and magnitude of flows. For stream reaches proposed for critical habitat designation, no estimate of required minimum flow for seven mussels conservation has been developed by the Service or any other entity.[5] In the absence of such guidance, this analysis makes assumptions regarding conservation flows for the seven mussels on a site-specific basis.

8. Based on increased flows needed for the conservation of seven mussels, several changes in water use and management may occur. During dry periods, reallocation of water from either flood control or hydropower uses in the Chattahoochee River has been studied as an alternative to supply municipal and industrial needs.[6] In the Flint River Basin, water availability to irrigated agriculture – the primary water use in the basin – may be reduced in dry years. Municipal water demands in the Chattahoochee Basin are expected to increase in the future; however, the USACE has stated that during sustained drought, "some project purposes, such as navigation and hydropower, may be adversely impacted as we manage for drought; however, the public health and safety, water supply, and environmental demands, including releases for water quality, and fish and wildlife resources are still met."[7] The USACE provided further clarification that, "during droughts there are impacts on all project purposes, but the minimum water supply, water quality and environmental needs will likely be met even in future conditions."[8] However, it is not appropriate to state that reductions in hydropower "can fully offset future public health and safety, water supply and seven mussels needs during periods of sustained drought."[9] Accordingly, this analysis assumes that during sustained drought, all needs may not be met. See Exhibit 1-2 in Section 1 for information on authorized project purposes.

9. Although there may be impacts to municipal and industrial water uses associated with seven mussels conservation in areas proposed for critical habitat designation, quantification and monetization of these impacts is not possible absent additional

[5] Minimum flows and levels for aquatic habitat protection have been developed for the Santa Fe River complex.

[6] Although the USACE has never historically reallocated water from flood control storage during dry periods (according to public comments submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District Corps of Engineers, August 6, 2007), Congressional reallocation of reservoir management priorities may occur in future years as municipal and industrial water demands increase in the ACF basin. The potential benefits of such a reallocation were investigated in a 2004 study by the Atlanta Regional Commission (McMahon, et al. 2004. Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower, and Recreation Benefits. Prepared for the Atlanta Regional Commission. February).

[7] Peter F. Taylor, Jr. Colonel, Mobile District Commander, U.S. Army Corps of Engineers, Letter to Environmental Protection Division, Georgia Department of Natural Resources, April 30, 2007. The letter can be found in Appendix F.

[8] Written communication from Joanne U. Brandt, Biologist, Mobile District, U.S. Army Corps of Engineers, May 7, 2007.

[9] Ibid.

information.[10] To quantify municipal impacts in the Chattahoochee River Basin, the following additional information would be needed:

- The relationship between the lower reservoir levels in the Chattahoochee River Basin associated with the Modified IOP and the risk that current or future municipal water use will be restricted (i.e., the marginal increase in risk of droughts being declared in Georgia due to these lower reservoir levels). No hydrological models capable of establishing this relationship are currently available.[11]
- The quantity of water lost from each type of use (e.g., horticulture, industrial processes, lawn watering) within Chattahoochee River Basin municipalities due to drought restrictions and quantification of the effect of timing restrictions on water availability.[12]
- Data that may be applied to estimate the value of each use of the water affected by these drought restrictions (e.g., the per gallon value associated with lawn watering).

10. Similarly, if municipal and agricultural permit applications increase in the Santa Fe and New River Basins, permits may be altered or denied partly due to mussel conservation efforts. No information is publicly available on any increase in applications over the time period of this analysis, making estimation of municipal and agricultural impacts attributable to seven mussels conservation efforts infeasible.

11. This analysis relies on the best available information to estimate potential economic impacts of seven mussels conservation by considering the economic impact of an assumed change in water use and management. In doing so, the analysis makes several simplifying assumptions regarding the economic impacts of seven mussels conservation efforts.

12. The Key Findings of the analysis are highlighted below. Exhibit ES-2 summarizes the results of this analysis by activity. Exhibit ES-3 provides a pie chart of the summary information in Exhibit ES-2. Exhibit ES-4 ranks the units proposed for critical habitat designation in order of the magnitude of potential impact using total cost and cost per river

[10] Stakeholders in the ACF basin are concerned that critical habitat designation will impact municipal and industrial water uses, and that data is currently available to estimate these impacts. Public comments conveying these concerns were submitted to the Service by the following municipal interest groups: the Atlanta Regional Commission (written by Patricia Barmeyer of King & Spalding LLC) on August 6, 2007 and the City of LaGrange, Georgia (written by J. Maltese, Assistant to the City Manager) on August 2, 2007. Additional data necessary to estimate municipal and industrial impacts was not available.

[11] Ideally, such models would address potential changes in water management and use, including current and future demands for municipal and industrial, agricultural, and hydropower water uses, as well as the relationship between changes in reservoir storage and recreational use. Although Georgia EPD has assessed how future water demands in the Chattahoochee River Basin may affect water levels in Chattahoochee reservoirs (source: public comments, submitted by Carol Couch, Director, Environmental Protection Division, Georgia Department of Natural Resources, August 6, 2007), no information on the relationship between lower lake levels and drought frequency in the basin is currently available.

[12] The Atlanta Regional Commission has expressed concerns that certain industries in Atlanta, such as horticulture, may be particularly sensitive to increases in drought frequency or severity (based on personal communication with Pat Stevens, Chief of the Metropolitan North Georgia Water Planning District, August 28, 2007).

mile (discounted at three percent). The relative magnitude of impacts to each unit are shown in Exhibit ES-5, with detailed information regarding present value and annualized impacts in each unit. Exhibit ES-6 presents total cost by unit and activity type, discounted at three percent. Lastly, Exhibit ES-7 qualitatively discusses potential impacts to activities not quantified in this analysis.

EXHIBIT ES-1 PROPOSED CRITICAL HABITAT FOR THE SEVEN MUSSELS

KEY FINDINGS

Potential Future Impacts: This economic analysis estimates potential future impacts associated with conservation efforts for the seven mussels in areas proposed for designation to be $83.1 million to $135.0 million over the next 20 years (undiscounted). The present value of these impacts is $62.3 million to $101.0 million, using a discount rate of three percent, or $45.0 million to $71.7 million, using a discount rate of seven percent. The annualized value of these impacts is $4.13 million to $6.70 million, using a discount rate of three percent, or $4.13 million to $6.60 million, using a discount rate of seven percent.

Quantified Impacts: This analysis assumes that conservation efforts for the seven mussels may result in changes to water management and use, and that these changes may result in both economic efficiency and regional economic impacts. This analysis does not, however, make assumptions or recommendations regarding whether or how such changes in water use and management could occur.

Up to 87 percent of the total impacts estimated in this report are associated with water use and management changes to conserve the seven mussels. The opportunity costs of providing conservation flows reflect changes in the quality of reservoir recreation sites (44 percent to 54 percent of total impacts), as well as changes in agricultural irrigation (33 percent to 35 percent of total impacts). Note that these values range based on the scenario modeled (i.e., lower or upper bound) and may not sum due to rounding. Details on impacts to these activities follow:

- Recreation: This analysis forecasts the potential opportunity costs associated with a scenario in which lost recreational opportunities result from the need to provide flows for seven mussel conservation in Unit 8. USACE management may result in declines in water levels in the Buford, West Point and W.F. George reservoirs. This analysis estimates proportional declines in the opportunity for boater recreation at these impoundments. Specifically, 203,000 recreational visits to these water bodies are forecast to be lost in an average year. The estimated opportunity cost of these foregone visits is $27.7 million to $54.1 million (discounted at three percent). In addition, regional economic impacts are forecast in terms of reduced regional employment (304 employees) and output ($22.7 million) to industries that provide goods and services to the recreation sector.
- Agricultural Irrigation: This analysis considers a scenario in which reductions in agricultural groundwater withdrawals and surface water diversions associated with seven mussels conservation efforts may be necessary. As noted above, the analysis makes no assumptions regarding how such reductions would be accomplished (e.g., administrative procedures to accomplish this reduction, whether and how these reductions would be compensated for, etc.), but simply considers the potential economic impact of changes in water use in the agricultural sector. Specifically, this analysis considers a scenario in which reduced irrigation water deliveries provide water needed for seven mussels conservation efforts in Units 5 and 7 (Upper and Lower Flint Rivers). Changes in irrigation water use in the Lower Flint Basins may potentially reduce revenues in the agricultural sector by $26.8 million and $39.0 million during a single year in the 20-year period of analysis, which translates to an annualized range of between $1.34 million and $1.95 million. Total changes in irrigation water use in the Upper and Lower Flint Basins may potentially reduce revenues by between $1.46 million and $2.25 million annually. This could in turn generate a regional economic impact of up to $77.2 million and result in the loss of up to 740 jobs during the single year of drought restrictions in the Lower Flint Basin, and regional impacts up to $630,000 and a loss of 10 jobs during the remaining 19 years.
- Other economic activities: Potential impacts of seven mussels conservation efforts for other economic activities are estimated to be $12.9 million (discounted at three percent). These impacts are related to changes in water management facilities, transportation, water quality, species management, and administrative costs of section 7 consultations.

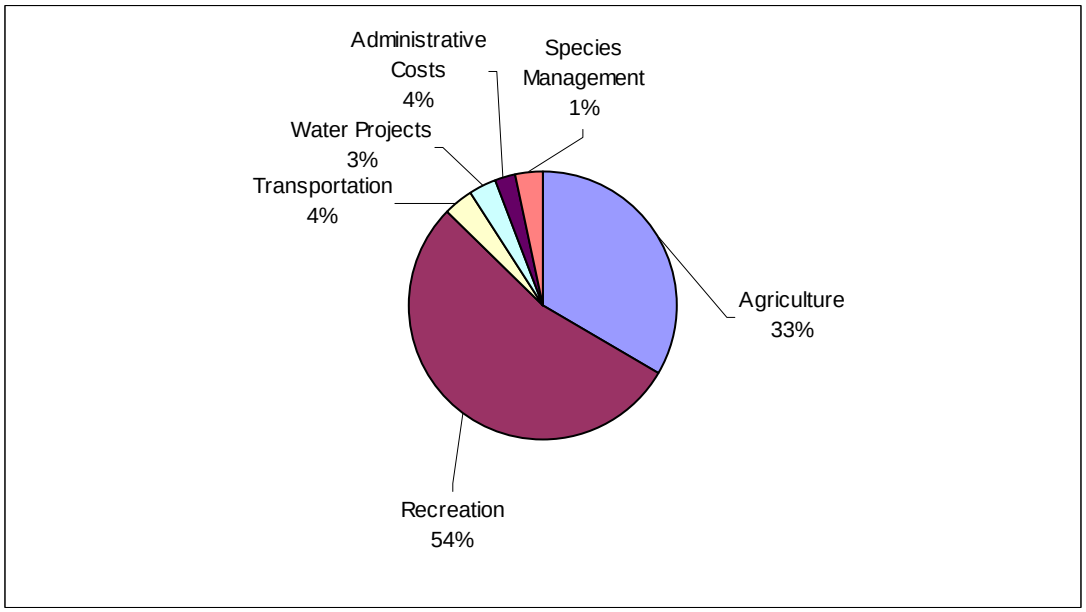
Critical Habitat Unit with Greatest Impacts: The unit with the highest potential impacts (discounted at three percent) is Unit 8, Apalachicola River Complex ($30.9 million to $57.3 million), followed by Unit 7, Lower Flint River ($20.6 million to $29.6 million). Unit 8 also has the highest forecast impacts per river mile. Most of the forecast impacts in Unit 8 are associated with changes in water use and management to conserve the seven mussels, 90 percent to 94 percent depending on the scenario modeled.

Incremental Impacts: Incremental impacts of critical habitat designation are forecast to be $510,000 (discounted at three percent) over 20 years. These incremental impacts are of additional administrative effort in considering adverse modification in section 7 consultation. All other impacts quantified in Sections 3 to 6 of this report are baseline impacts not expected to be affected by the critical habitat rulemaking.

EXHIBIT ES-2 SUMMARY OF POTENTIAL CO-EXTENSIVE IMPACTS BY ACTIVITY (2007-2026)

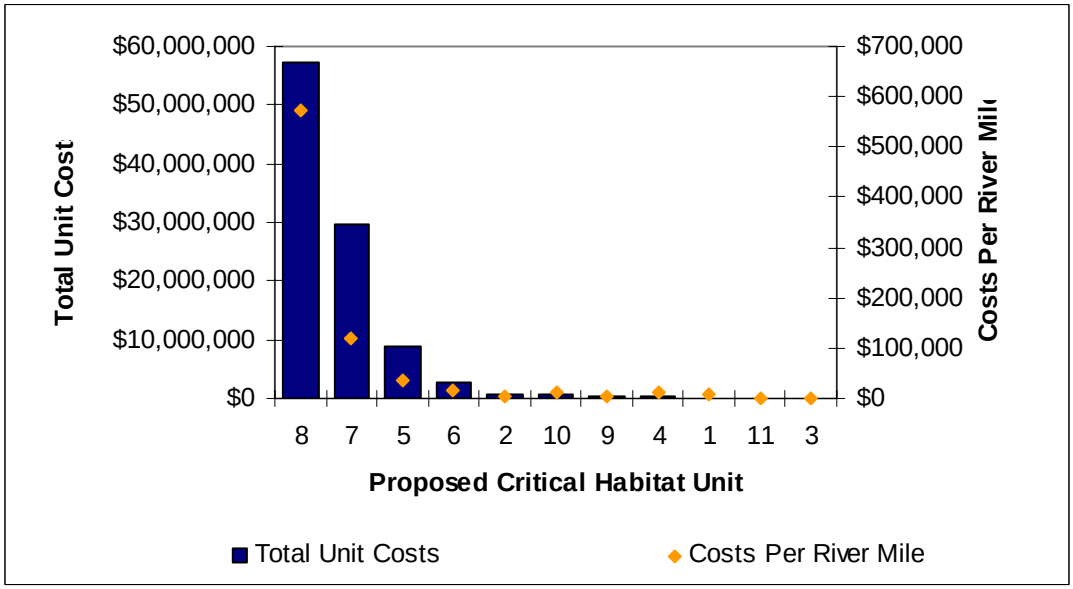
ACTIVITY	UNDISCOUNTED		PRESENT VALUE				ANNUALIZED			
			(3%)		(7%)		(3%)		(7%)	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Agricultural Water Supply	$29,200,000	$45,100,000	$21,700,000	$33,500,000	$15,500,000	$23,900,000	$1,460,000	$2,250,000	$1,460,000	$2,250,000
Recreation	$37,800,000	$73,900,000	$27,700,000	$54,100,000	$19,300,000	$37,800,000	$1,860,000	$3,640,000	$1,830,000	$3,560,000
Transportation	$4,590,000	$4,590,000	$3,790,000	$3,790,000	$3,070,000	$3,070,000	$255,000	$255,000	$290,000	$290,000
Water Management	$3,830,000	$3,830,000	$3,120,000	$3,120,000	$2,540,000	$2,540,000	$200,000	$200,000	$214,000	$214,000
Administrative Costs	$3,410,000	$3,410,000	$2,530,000	$2,530,000	$1,810,000	$1,810,000	$170,000	$170,000	$170,000	$170,000
Species Management	$4,260,000	$4,260,000	$3,430,000	$3,430,000	$2,720,000	$2,720,000	$185,000	$185,000	$165,000	$165,000
Total	**$83,100,000**	**$135,000,000**	**$62,300,000**	**$101,000,000**	**$45,000,000**	**$71,700,000**	**$4,130,000**	**$6,700,000**	**$4,130,000**	**$6,660,000**

EXHIBIT ES-3 POTENTIAL CO-EXTENSIVE IMPACTS BY ACTIVITY (HIGH-END IMPACTS, DISCOUNTED AT THREE PERCENT)



Source: IEc analysis. Note this exhibit presents estimates from the upper bound. The relative ranking of impact by unit does not change significantly applying other discount rates.

EXHIBIT ES-4 RANKING OF POTENTIAL CO-EXTENSIVE IMPACTS BY UNIT (HIGH-END IMPACTS, DISCOUNTED AT THREE PERCENT, 2007-2026)



Source: IEC analysis. Note this exhibit presents estimates from the upper bound. The relative ranking of impact by unit does not change significantly applying other discount rates.

EXHIBIT ES-5 POTENTIAL CO-EXTENSIVE IMPACTS BY UNIT (2007 - 2026)

UNIT	UNDISCOUNTED		PRESENT VALUE (3%)		PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
1- Econfina Creek	$138,000	$138,000	$124,000	$124,000	$113,000	$113,000	$8,350	$8,350	$10,700	$10,700
2 - Chipola River	$896,000	$896,000	$689,000	$689,000	$512,000	$512,000	$41,000	$41,000	$37,900	$37,900
3 - Uchee Creek	$643	$643	$643	$643	$643	$643	$43	$43	$61	$61
4 - Sawhatchee and Kirkland Creeks	$315,000	$315,000	$237,000	$237,000	$171,000	$171,000	$15,900	$15,900	$16,100	$16,100
5 - Upper Flint River	$7,500,000	$11,200,000	$6,030,000	$8,750,000	$4,790,000	$6,730,000	$396,000	$579,000	$428,000	$611,000
6 - Middle Flint River	$3,500,000	$3,500,000	$2,760,000	$2,760,000	$2,130,000	$2,130,000	$186,000	$186,000	$201,000	$201,000
7 - Lower Flint River	$27,500,000	$39,700,000	$20,600,000	$29,600,000	$14,700,000	$21,200,000	$1,380,000	$1,990,000	$1,390,000	$2,000,000
8 - Apalachicola River	$41,900,000	$78,100,000	$30,900,000	$57,300,000	$21,800,000	$40,200,000	$2,040,000	$3,810,000	$1,970,000	$3,710,000
9 - Upper Ochlockonee River	$376,000	$376,000	$282,000	$282,000	$202,000	$202,000	$18,900	$18,900	$19,100	$19,100
10 - Lower Ochlockonee River	$835,000	$835,000	$621,000	$621,000	$442,000	$442,000	$40,800	$40,800	$40,000	$40,000
11 - Santa Fe and New Rivers	$106,000	$106,000	$94,700	$94,700	$84,300	$84,300	$6,360	$6,360	$7,960	$7,960
Total	**$83,100,000**	**$135,000,000**	**$62,300,000**	**$101,000,000**	**$45,000,000**	**$71,700,000**	**$4,130,000**	**$6,700,000**	**$4,130,000**	**$6,660,000**

Note: Totals may not add due to rounding.

EXHIBIT ES-6 POTENTIAL CO-EXTENSIVE IMPACTS BY ACTIVITY AND UNIT (DISCOUNTED AT THREE PERCENT 2007 - 2026)

UNIT	AGRICULTURAL		RECREATION		TRANSPORTATION		WATER MANAGEMENT		ADMINISTRATIVE COSTS		SPECIES MANAGEMENT		DEADHEAD LOGGING		TOTAL	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$0	$0	$0	$0	$116,000	$116,000	$0	$0	$8,000	$8,000	$0	$0	$0	$0	$124,000	$124,000
2 Chipola River	$0	$0	$0	$0	$31,700	$31,700	$0	$0	$204,000	$204,000	$316,000	$316,000	$138,000	$138,000	$689,000	$689,000
3 Uchee Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$643	$643	$0	$0	$643	$643
4 Sawhatchee and Kirkland Creeks	$0	$0	$0	$0	$122,000	$122,000	$0	$0	$115,000	$115,000	$0	$0	$0	$0	$237,000	$237,000
5 Upper Flint River	$1,770,000	$4,490,000	$0	$0	$2,340,000	$2,340,000	$1,490,000	$1,490,000	$391,000	$391,000	$0	$0	$0	$0	$6,030,000	$8,750,000
6 Middle Flint River	$0	$0	$0	$0	$794,000	$794,000	$1,570,000	$1,570,000	$402,000	$402,000	$0	$0	$0	$0	$2,760,000	$2,760,000
7 Lower Flint River	$20,000,000	$29,000,000	$0	$0	$138,000	$138,000	$0	$0	$137,000	$137,000	$314,000	$314,000	$0	$0	$20,600,000	$29,600,000
8 Apalachicola River	$0	$0	$27,700,000	$54,100,000	$31,700	$31,700	$0	$0	$315,000	$315,000	$2,360,000	$2,360,000	$214,000	$214,000	$30,900,000	$57,300,000
9 Upper Ochlockonee River	$0	$0	$0	$0	$154,000	$154,000	$0	$0	$128,000	$128,000	$0	$0	$0	$0	$282,000	$282,000
10 Lower Ochlockonee River	$0	$0	$0	$0	$31,700	$31,700	$58,000	$58,000	$494,000	$494,000	$0	$0	$32,500	$32,500	$621,000	$621,000
11 Santa Fe and New Rivers	$0	$0	$0	$0	$31,700	$31,700	$0	$0	$3,000	$3,000	$60,000	$60,000	$0	$0	$94,700	$94,700
Total	**$21,700,000**	**$33,500,000**	**$27,700,000**	**$54,100,000**	**$3,790,000**	**$3,790,000**	**$3,120,000**	**$3,120,000**	**$2,200,000**	**$2,200,000**	**$3,050,000**	**$3,050,000**	**$385,000**	**$385,000**	**$62,300,000**	**$101,000,000**

Note: Totals may not add due to rounding.

EXHIBIT ES-7 SUMMARY OF UNQUANTIFIED IMPACTS BY ACTIVITY, 2007-2026

ACTIVITY	POTENTIAL IMPACTS
Municipal Water Supply	Flows for conservation of the seven mussels may increase the frequency and severity of the impacts on municipal and industrial water users during future droughts in the Chattahoochee River Basin (associated with Unit 8). The USACE has stated that "during droughts there are impacts on all project purposes, but the minimum water supply, water quality and environmental needs will likely be met even in future conditions."[13] In the Santa Fe/New River Basin (Unit 11), flows for seven mussels conservation may reduce the available withdrawal permits that can be issued.
Hydropower	Conservation efforts for the seven mussels may result in changes to hydropower production and/or revenues for the four USACE facilities in the ACF Basin. The USACE has determined that overall seven mussels conservation efforts will not have a significant impact on power generation at these facilities. However, the value of the power produced by this system is dependent on the timing of releases, and no model is currently available to estimate the potential change in timing of power production (i.e., peak versus non-peak) under the Modified IOP.
Water Quality Management	Activities affecting water quality are associated with limited economic costs resulting directly from conservation efforts for the seven mussels, particularly when compared to other categories of costs. Administrative costs of once expected section 7 consultation are included in Appendix A.
Navigational Dredging	USACE has undertaken species management efforts related to dredge material disposal for navigation projects. These actions typically included surveying and mussel relocation if warranted (the costs of these past efforts are included in the analysis). USACE representatives believe that seven mussels conservation efforts may reduce the likelihood of future dredging, but that the future ACF Basin was already uncertain as a result of broader legal, economic, and ecological concerns.
Sand and Gravel Mining	Sand and gravel extraction from riverbeds was common in the ACF Basin, but ceased several years ago and future operations are unlikely.
Benefits	Ancillary benefits of conservation efforts for the seven mussels may be associated with increased freshwater flows into Apalachicola Bay. Additional freshwater flows, managed for the seven mussels from the Apalachicola River, may enhance or support economic activity related to recreational fishing and the commercial fisheries industry in the region. Whether or to what degree the economy of the Apalachicola Bay may be influenced by upstream water management related to seven mussels conservation is unknown.

[13] Written communication from Joanne U. Brandt, Biologist, Mobile District, U.S. Army Corps of Engineers, May 7, 2007.

INCREMENTAL ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE SEVEN MUSSELS

13. Appendix B of the analysis estimates the potential incremental impacts of critical habitat designation for the seven mussels. It does so by attempting to isolate those direct and indirect impacts discussed in this report that are expected to be triggered specifically by the critical habitat designation. That is, the incremental conservation efforts and associated impacts would not be expected to occur absent the designation of critical habitat for the seven mussels.

14. The incremental impacts of critical habitat designation for the seven mussels are forecast to be $501,000 (present value at a three percent discount rate). These incremental impacts are associated with administrative costs of consultation above and beyond those impacts expected to occur due to the listing of the species. All remaining impacts quantified in this report are baseline impacts and are forecast to occur regardless of critical habitat designation for the seven mussels. Exhibit ES-8 presents the incremental impacts estimated for each Unit.

EXHIBIT ES-8 INCREMENTAL IMPACTS OF CRITICAL HABITAT BY UNIT

UNIT	WATER MANAGEMENT	TRANSPORTATION	SPECIES MANAGEMENT	DEADHEAD LOGGING	WATER QUALITY	TOTAL
1- Econfina Creek	$0	$2,000	$0	$0	$0	$2,000
2 Chipola River	$0	$668	$0	$48,100	$0	$48,700
3 Uchee Creek	$0	$0	$0	$0	$0	$0
4 Sawhatchee and Kirkland Creeks	$0	$27,400	$0	$0	$0	$27,400
5 Upper Flint River	$80,700	$28,800	$0	$0	$0	$109,000
6 Middle Flint River	$68,800	$27,400	$0	$0	$0	$96,200
7 Lower Flint River	$0	$30,100	$10,800	$0	$0	$40,900
8 Apalachicola River	$53,000	$668	$0	$74,800	$0	$128,000
9 Upper Ochlockonee River	$2,650	$28,100	$0	$0	$0	$30,700
10 Lower Ochlockonee River	$0	$668	$0	$10,700	$5,360	$16,700
11 Santa Fe and New Rivers	$0	$668	$0	$0	$0	$668
Total	**$205,000**	**$146,000**	**$10,800**	**$134,000**	**$5,360**	**$501,000**

SMALL BUSINESS ANALYSIS

15. Appendix C of this analysis includes a Final Regulatory Flexibility Analysis (FRFA) considering the extent to which the incremental impacts analysis described in Appendix B could be borne by small entities and the energy industry. The incremental impacts of the rulemaking are considered most relevant for the small business and energy impacts analyses as they are expected to stem from the critical habitat designation, and are

therefore not expected to occur in the case that critical habitat is not designated for the seven mussels. The FRFA concludes that the primary land use activities for which impacts may affect small businesses are water management, and deadhead logging.

SECTION 1 | INTRODUCTION AND FRAMEWORK FOR ANALYSIS

1.1 PURPOSE OF THE ECONOMIC ANALYSIS

1. The purpose of this report is to estimate the economic impact of potential actions to protect seven federally listed species and their habitat: fat threeridge; shinyrayed pocketbook; Gulf moccasinshell; Ochlockonee moccasinshell; oval pigtoe; Chipola slabshell; and purple bankclimber. Collectively these species are referred to as the seven mussels. The report attempts to quantify the potential economic effects associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that could be associated with future economic activities that may adversely affect the habitat within the proposed critical habitat boundaries. The analysis looks retrospectively at costs incurred since the seven mussels were listed in 1998, and it attempts to predict future costs after the 2006 proposed critical habitat designation is finalized.

2. The main body of this analysis considers all future conservation-related impacts, including impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. That is, a portion of these "co-extensive" impacts are forecast to occur regardless of critical habitat designation for the seven mussels. Appendix B estimates the potential incremental impacts of critical habitat designation for the seven mussels by attempting to isolate those impacts that would not be expected to occur absent the designation of critical habitat for the seven mussels.

3. This information is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.[1] In addition, this information allows the U.S. Fish and Wildlife Service (the Service) to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).[2] This report also complies with direction from the U.S. Court of Appeals for the 10th Circuit that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[3]

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[1] 16 U.S.C. §1533(b)(2).

[2] Executive Order 12866, *Regulatory Planning and Review*, September 30, 1993; Executive Order 13211, *Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use*, May 18, 2001; 5. U.S.C. §§601 *et seq*; and Pub Law No. 104-121.

[3] In 2001, the U.S. Court of Appeals for the 10th Circuit instructed the Service to conduct a full analysis of all of the economic impacts of proposed critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

4. This final economic analysis analyzes the proposed designation as described in the proposed rule. This analysis does not reflect changes to the proposed critical habitat designation made in the final rule. Consequently, description of the habitat designation in the final rule may differ from maps and figures presented in this analysis.

5. This section provides background information on the species and the proposed designation. Next, it describes the regulatory alternatives considered by the Service. Then, it describes the approach to estimating impacts and lays out the scope of the analysis. Information sources relied upon are summarized in the next section. The section concludes with a description of the organization of the remainder of this report.

1.2 BACKGROUND[4]

1.2.1 REGULATORY HISTORY

6. In 1998, five mussels were listed as endangered (fat threeridge, shinyrayed pocketbook, Gulf moccasinshell, Ochlockonee moccasinshell, and oval pigtoe) and two as threatened (Chipola slabshell, and purple bankclimber). On June 6, 2006, the Service published a proposed rule to designate critical habitat for these species. On June 21, 2007, the Service proposed to modify the boundaries of two of the 11 proposed critical habitat units for the seven mussels.[5] The Service is required to publish a final rule by October 31, 2007. For a description of the seven species and the primary constituent elements that are essential to the conservation of the species, refer to the proposed rule.

1.2.2 PROPOSED CRITICAL HABITAT

7. The Service proposes for designation as critical habitat for the seven mussels 1,186 river miles in 11 units, with a lateral boundary of the "ordinary high-water mark," in 45 counties in Alabama, Florida, and Georgia. Exhibit 1-3 provides a map of the proposed critical habitat Units. Exhibit 1-4 lists the adjacent landownership in proposed critical habitat.

[4] U.S. Fish and Wildlife Service, Proposed Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages, 71 FR 32746, June 6, 2006.

[5] U.S. Fish and Wildlife Service, Revised Proposed Rule; Reopening of the Comment Period, Availability of the Draft Economic Analysis and Revised Proposed Critical Habitat Units, and Announcement of Public Hearings, 72 FR 34215, June 21, 2007.

1.2.3 REGIONAL HISTORICAL CONTEXT

8. The policy context into which the proposed designation is being made is complex. Negotiations between Alabama, Florida, and Georgia regarding allocation of the water in the Apalachicola-Chattahoochee-Flint (ACF) river system have been ongoing for over 15 years. Numerous modeling and planning activities have occurred as part of the negotiations, which to date remain unresolved. Recently, concerns have arisen that water needs for the seven mussels will impose an additional consideration in the water allocation process. The following timeline (Exhibit 1-1) outlines the historical context of the negotiations in which proposed critical habitat designation for the seven mussels is occurring. Exhibit 1-2 lists the U.S. Army Corps of Engineers (USACE) projects in the ACF basin and their authorized purposes to provide additional context on the management of the system.

EXHIBIT 1-1 TIMELINE OF MAJOR ACF BASIN NEGOTIATIONS

DATE	DESCRIPTION
1990	Dispute over shared water resources between Alabama, Georgia, and Florida begins, as Alabama files lawsuit against U.S. Army Corps of Engineers (USACE) for its 1989 proposed reallocation of water from hydropower to water supply purpose at Lake Lanier for metro Atlanta. Florida intervenes on the side of Alabama.
1992	States and USACE sign a memorandum of agreement to complete a comprehensive study of the shared basins. Negotiations between States for allocation begin (extension of deadline for negotiations is subsequently repeatedly pushed back through 2003).
1997	Compacts adopted by States and ratified by U.S. Congress, establishing a legal framework for addressing water allocation and management issues, as well as dispute resolution. (Does not establish an allocation formula).
1998	Draft Water Allocation study for the ACF River Basin published by USACE.
2000	Alabama and Georgia reach agreement for water sharing of the Alabama-Coosa-Tallapoosa (ACT) basin, pending agreement regarding the ACF.
2000	Georgia submits a water supply request to the USACE asking for permanent water supply contracts for Lake Lanier. USACE denied the request, citing need for congressional authorization, and Georgia filed suit challenging USACE's denial of the water supply request. Southeastern Federal Power Customers (SeFPC) files suit in District Court for the District of Columbia alleging that USACE was providing water storage in Lake Lanier to water supply providers, while SeFPC members were bearing the cost burden for their storage in Lake Lanier for hydropower purpose.
2003	Settlement Agreement in SeFPC case. The Settlement Agreement requires USACE to conduct a full NEPA review, and then to determine whether to execute interim water supply contracts with the water supply providers that will include mechanisms to compensate SeFPC. Alabama and Florida intervene, objecting to the Settlement Agreement. The Atlanta Regional Commission registers concern that it and other Settlement Agreement parties were not included in Alabama and Florida's request for an injunction to prevent its implementation. ACF Compact expires. Litigation resumes, and continues to date.
2004	ACT Compact expires.
2004	SeFPC court issues order rejecting all objections to the Settlement Agreement.
January, 2006	Florida renews efforts in Alabama Court filing a motion or a preliminary injunction against USACE for alleged violations of the Endangered Species Act.
March, 2006	USACE and Service begin formal consultation for Interim Operations Plan (IOP) at Jim Woodruff Lock and Dam.
June, 2006	Florida asks for more water to protect endangered mussels in the Apalachicola River. Georgia challenges request, and Judge rules against Florida on July 26. Georgia sues USACE to challenge the IOP as arbitrary and capricious, alleging that the 5,000 cfs flow was too much. Alabama Court grants Florida a temporary restraining order on implementation of the IOP, requiring 8,000 cfs to be released at Jim Woodruff. In a later hearing, court agrees that restraining order will need modification, because flow requirement is unsustainable, and parties reach a compromise through July.

DATE	DESCRIPTION
July, 2006	Negotiation agreements reach deadline, month-long agreement between States allowing more water into Apalachicola River, expires July 21. Florida renews motion to implement a temporary restraining order, based on new allegations under the Endangered Species Act, but it is not supported by the court.
September 5, 2006	Service publishes Biological Opinion and Conference Report on the USACE, Mobile District, IOP for Jim Woodruff Dam and the Associated Releases to the Apalachicola River.
September 6, 2006	Florida files suit against the Service in relation to the Biological Opinion of September 5, contending that the Service erred in its conclusion that this IOP would not result in take of endangered species. Alabama moves Alabama Court to allow it to challenge to the Biological Opinion.
Fall 2006	The Settlement Agreement is being appealed by Florida and Alabama in the United States Court of Appeals for the District of Columbia.
November 2006	Georgia water supply providers submit request for all cases related to the ACF negotiations to be transferred to the D.C. District Court.
Spring 2007	The USACE requested changes to the drought provision contained in the Reasonable and Prudent Measure 3 in the September 2006 Biological Opinion, and completed a Environmental Assessment. The Service approved the drought provision.
2007	Draft environmental impact statement (EIS) is being prepared to address the proposed implementation of interim water storage contracts at Lake Sidney Lanier/Buford Dam, Georgia, as contained in a settlement agreement associated with the Southeastern Federal Power Customers, Inc., (SeFPC) v. Secretary of the Army, et al. (1:00CV02954-TPJ) lawsuit. The Draft EIS will also address any changes in water management operations at Lake Lanier/Buford Dam, as well as the potential for other changes to operations in downstream reservoir projects in the Apalachicola, Chattahoochee, Flint Rivers (ACF) basin, which would result from implementation of the interim water storage contracts. Courts consolidate the various ACF lawsuits under one judge for a multi-district proceeding.

Sources:

Jordan and Wolf. 2006. *Interstate Water Allocation in Alabama, Florida, and Georgia: New Issues, New Methods, New Models.* University Press of Florida. Section I.

Metro Atlanta Chamber of Commerce. Fact Sheet - Interstate water conflicts: Georgia-Alabama-Florida. Accessed at: http://www.metroatlantachamber.com/macoc/initiatives/img/tri-statefactsheet.pdf.

Various media articles from June through August, 2006.

Motion to Transfer, In re Tri-State Water Litigation. Case 4:06-cv-00410-RH-WCS.

EXHIBIT 1-2 USACE ACF BASIN PROJECT AUTHORIZED PURPOSES

PROJECT	AUTHORIZED PURPOSES	OPERATING PURPOSES	AUTHORIZING LAWS
Buford Dam/ Lake Sidney Lanier[1]	Flood Control Fish/Wildlife Navigation[2] Hydroelectric Power Water Supply [3] Water Quality Recreation	Flood Control Fish/Wildlife Navigation[2] Hydroelectric Power Water Supply[3] Water Quality Recreation	PL 79-525 PL 85-624 PL 79-525 PL 79-525 PL 79-525 PL 79-525 PL 78-534
West Point Dam and Lake	Fish/Wildlife Flood Control Hydroelectric Power Navigation[2] Water Quality Recreation	Fish/Wildlife Flood Control Hydroelectric Power Navigation[2] Water Quality Recreation Water Supply[5]	PL 87-874 PL 87-874 PL 87-874 PL 87-874 PL 92-500 PL 87-874
Walter F. George Lock and Dam	Hydroelectric Power Water Quality Navigation[2] Fish/Wildlife Recreation	Hydroelectric Power Water Quality Navigation[2] Fish/Wildlife Recreation	PL 79-525 PL 92-500 PL 79-525 PL 85-624 PL 78-534
George W. Andrews Lock and Dam	Navigation[2] Water Quality Recreation[4]	Navigation[2] Water Quality	PL 79-525 PL 92-500 PL 78-534
Jim Woodruff Lock and Dam/ Lake Seminole	Fish/Wildlife Hydroelectric Power Navigation[2] Water Quality Recreation[4]	Fish/Wildlife Hydroelectric Power Navigation[2] Water Quality Water Supply[5]	PL 85-624 PL 79-525 PL 79-525 PL 92-500 PL 78-534

Source: U.S. Army Corps of Engineers (USACE), Institute of Water Resources, Hydrologic Engineering Center. 1994. Authorized and Operating Purposes of Corps of Engineers Reservoirs. July 1992, revised November 1994. PR-19.

Authorizing Law - Common Name:

PL 78-534 - Flood Control Act of 1944

PL 79-525 - River and Harbor Act of 1946

PL 85-624 - Fish and Wildlife Coordination Act, 1958

PL 87-874 - River and Harbor Act of 1962 (Title I); and Flood Control Act of 1962 (Title II)

PL 92-500 - Federal Water Pollution Control Act Amendments of 1972

Notes:

1. Lake Lanier was created for the explicitly authorized purposes of flood control, navigation, and electric power generation. In addition to these uses, the USACE has historically maintained that water supply use is an "incidental benefit" flowing from the creation of the reservoir. Thus, the USACE has allowed some of the Lake capacity to be used for municipal and industrial water supply use. State of Alabama and State of Florida vs. U.S. Army Corps of Engineers, 2005, in the 11th Circuit Court of Appeals. D.C. Docket No. 90-01331-CV-BE-E. As noted in the SeFPC vs. USACE 2004 case (C.A. 00-2975 (TPJ)), "Whether or not water supply was an original authorized use is a point of contention." Page 3.

2. As described in the USACE. 2006. Environmental Assessment Interim Operations Plan for Support of Endangered and Threatened Species, Jim Woodruff Dam, Gadsden and Jackson Counties, Florida, and Decatur County, Georgia. Prepared by USACE Mobile District, Planning and Environmental Division, Environment and Resources Branch, Inland Environment Team. October 2006, navigation windows have not been provided since 2000, and dredging has not

occurred since 2001. (Pages EA 7-8). More detail on the status navigation activities is provided in Section 6.

3. As described in the USACE 2006 EA, "No storage within the ACF projects is currently allocated to water supply, although there is currently a proposal being considered by the Corps to enter into interim water storage contracts at Lake Lanier for several municipalities and local governments, pursuant to the Southeastern Federal Power Customers, Inc. settlement agreement (1:00CV02954–TPJ)…" and "Various municipal and industry (M&I) entities withdraw water directly from Lake Lanier and others withdraw directly from the Chattahoochee River downstream of Lake Lanier" pursuant to withdrawal permits from the Georgia Department of Natural Resources. (Pages EA 9-10).

4. At George W. Andrews and Jim Woodruff, access and facilities are provided for recreation but water is not controlled for that purpose.

5. At West Point and Jim Woodruff, during drought periods, the project is regulated to maintain minimum flows downstream to protect M&I water supply intakes.

EXHIBIT 1-3 MAP OF PROPOSED CRITICAL HABITAT UNITS FOR THE SEVEN MUSSELS

EXHIBIT 1-4 SUMMARY OF RIVER MILES BY ADJACENT LANDOWNERSHIP

UNIT	ADJACENT LANDOWNER(S)	ADJACENT LANDOWNER TYPES (RIVER MILES)[1]			
		FEDERAL	STATE	PRIVATE	TOTAL
1: Econfina Creek	Northwest Florida Water Management District (Econfina Creek Water Management Area) Various Private Landowners	0.0	11.2	8.3	19.5
2: Chipola River Complex	Northwest Florida Water Management District (Upper Chipola River Water Management Area, Apalachicola River Water Management Area) Florida Division of Recreation and Parks (Florida Caverns State Park) City of Marianna (South Marianna Trail and Canoe Launch) Jackson County (Chipola River Greenway) Florida Fish & Wildlife Conservation Commission (Apalachicola River Wildlife and Environmental Area) Various Private Landowners	0.0	26.3	115.8	142.1
3:Uchee Creek	Various Private Landowners	0.0	0.0	21.2	21.2
4: Sawhatchee and Kirkland Creeks	Various Private Landowners	0.0	0.0	23.5	23.5
5: Upper Flint River Complex	Georgia Department of Natural Resources: Wildlife Resources Division (Big Lazer Wildlife Management Area, Montezuma Natural Area, Flint River Wildlife Management Area, Joe Kurz Wildlife Management Area, Sprewell Bluff State Park and Wildlife Management Area) Various Private Landowners	0.0	7.4	229.0	236.4
6: Middle Flint River Complex	Various Private Landowners	0.0	0.0	187.8	187.8
7: Lower Flint River Complex	US Army Corps of Engineers (Lake Seminole) Georgia Department of Natural Resources: Wildlife Resources Division (Radium Springs Tract, Chickasawhatchee Wildlife Management Area, Elmodel Wildlife Management Area) Private Conservation Lands (Flint River Greenway) Woodruff Foundation (Joseph Jones Ecological Research Center) Various Private Landowners	4.2	10.6	231.7	246.5
8: Apalachicola River Complex	Northwest Florida Water Management District Florida Division Recreation and Parks (Torreya State Park) FL Dept of Corrections (Apalachee Correctional Facility) United States (Apalachicola National Forest) Various Private Landowners	0.5	44.4	55.2	100.2
9: Upper Ochlockonee River Complex	Florida Division of Forestry (Lake Talquin State Forest) Northwest Florida Water Management District (Thompson Gray Conservation Easement) Florida Fish & Wildlife Conservation Commission (Joe Budd Wildlife Management Area) Service (St. Mark's National Wildlife Refuge) The Nature Conservancy of Georgia Red Hills Conservation Program (Mistletoe Plantation) Various Private Landowners	0.0	9.6	100.6	110.2
10: Lower Ochlockonee River	Improvement Trust of Florida, United States (Apalachicola National Forest) Various Private Landowners	25.9	2.9	18.0	46.9
11: Santa Fe River Complex	Florida Division of Recreation and Parks (O'leno State Park, River Rise Preserve State Park) Various Private Landowners	0.0	4.0	47.6	51.6
TOTAL		**30.6**	**116.4**	**1,038.7**	**1,185.9**

1. If public land is found on only one side of the proposed critical habitat river segment, the amount of "public land river miles" is halved. If both sides of the stream reach are on public land, these are considered public.

Note: Totals may not sum due to rounding

1.3 REGULATORY ALTERNATIVES

9. Executive Order 12866 directs Federal Agencies to evaluate regulatory alternatives. The Service identifies 11 units of proposed critical habitat for the seven mussels. Alternatives to the proposed rule are possible through section 4(b)(2) of the Act. Section 4(b)(2) allows the Service to exclude areas proposed for designation based on economic impact and other relevant impact. Consideration of impacts at a unit level may result in alternate combinations of units of proposed habitat that may or may not ultimately be designated. As a result, the impacts of multiple combinations of units are available for consideration by the Service.

1.4 THREATS TO THE SPECIES AND HABITAT

10. Degradation of riverine habitat is the primary cause of the declining range and abundance of the seven mussels. Specifically, the Service identifies channelization, sedimentation, impoundments, water withdrawals, water quality, host fish, and non-native species as threats contributing to the decline of the seven mussels and their habitat. Refer to the proposed rule for a detailed discussion of threats to the species.

1.5 APPROACH TO ESTIMATING ECONOMIC EFFECTS

11. This economic analysis considers both the economic efficiency and distributional effects that may result from efforts to protect the seven mussels and their habitat (hereinafter referred to collectively as "seven mussels conservation efforts"). Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. For example, if activities that can take place on a parcel of land are limited as a result of the designation or the presence of the species, and thus the market value of the land is reduced, this reduction in value represents one measure of opportunity cost or change in economic efficiency. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of seven mussels conservation efforts.

12. This analysis also addresses the distribution of impacts associated with the designation, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation efforts on small entities and the energy industry. This information may be used by decision-makers to assess whether the effects of seven mussels conservation efforts unduly burden a particular group or economic sector. For example, while conservation efforts may have a relatively small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience relatively greater impacts. The difference between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

1.5.1 EFFICIENCY EFFECTS

13. At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be

affected by a regulatory action. In the context of regulations that protect seven mussels habitat, these efficiency effects represent the opportunity cost of resources used or benefits foregone by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surpluses in affected markets.[6]

14. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a Federal landowner or manager may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The effort required for the consultation is an economic opportunity cost because the landowner or manager's time and effort would have been spent in an alternative activity had the parcel not been species' habitat. When compliance activity is not expected to significantly affect markets -- that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price -- the measurement of compliance costs can provide a reasonable estimate of the change in economic efficiency.

15. Where habitat protection measures are expected to significantly impact a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, a designation that precludes the development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the market.

16. This analysis begins by measuring costs associated with measures taken to protect the seven mussels and their habitat. As noted above, in some cases, compliance costs can provide a reasonable estimate of changes in economic efficiency. However, if the cost of conservation efforts is expected to significantly impact markets, the analysis will consider potential changes in consumer and/or producer surplus in affected markets.

1.5.2 DISTRIBUTIONAL AND REGIONAL ECONOMIC EFFECTS

17. Measurements of changes in economic efficiency focus on the net impact of conservation efforts, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.[7] This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally

[6] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see: Gramlich, Edward M., *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html.

[7] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

1.5.2.1 Impacts on Small Entities and Energy Supply, Distribution, and Use

18. This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the Regulatory Flexibility Act, might be affected by future seven mussels conservation efforts.[8] In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the future impacts of conservation efforts on the energy industry and its customers.[9]

1.5.2.2 Regional Economic Effects

19. Regional economic impact analysis can provide an assessment of the potential localized effects of conservation efforts. Specifically, regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using regional input/output models. These models rely on multipliers that represent the relationship between a change in one sector of the economy (e.g., expenditures by recreationists) and the effect of that change on economic output, income, or employment in other local industries (e.g., suppliers of goods and services to recreationists). These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.

20. The use of regional input/output models in an analysis of the impacts of species and habitat conservation efforts can overstate the long-term impacts of a regulatory change. Most importantly, these models provide a static view of the economy of a region. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response to this change. For example, these models provide estimates of the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by impacted businesses. In addition, the flow of goods and services across the regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.

21. Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

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[8] 5 U.S.C. § 601 *et seq.*

[9] Executive Order 13211, *Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use*, May 18, 2001.

CALCULATING PRESENT VALUE AND ANNUALIZED IMPACTS

For each land use activity, this analysis compares economic impacts incurred in different time periods in present value terms. The present value presents the value of a payment or stream of payments in common dollar terms. That is, it is the sum of a series of past or future cash flows expressed in today's dollars. Translation of economic impacts of past or future costs to present value terms requires the following: a) past or projected future costs of seven mussels conservation efforts; and b) the specific years in which these impacts have or are expected to be incurred. With these data, the present value of the past or future stream of impacts (PV_c) of seven mussels conservation efforts from year t to T is measured in 2007 dollars according to the following standard formula:[a]

$$PV_c = \sum_{t}^{T} \frac{C_t}{(1+r)^{t-2007}}$$

C_t = forecast cost of seven mussels conservation efforts in year t

r = discount rate[b]

Impacts of conservation efforts for each activity in each unit are also expressed as annualized values. Annualized values are calculated to provide comparison of impacts across activities with varying forecast periods (T). For this analysis, however, all activities employ a forecast period of 20 years, 2007 through 2026. Annualized impacts of future seven mussels conservation efforts (APV_c) are calculated by the following standard formula:

$$APV_c = PV_c \left[\frac{r}{1-(1+r)^{-(N)}} \right]$$

N = number of years in the forecast period (in this analysis, 20 years)

[a] To derive the present value of past conservation efforts for this analysis, t is 1998 and T is 2007; to derive the present value of future conservation efforts, t is 2007 and T is 2026.

[b] To discount and annualize costs, guidance provided by the OMB specifies the use of a real rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates such as three percent, which some economists believe better reflects the social rate of time preference. (U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, Feb. 3, 2003.)

1.6 SCOPE OF THE ANALYSIS

22. This analysis identifies those economic activities believed to most likely threaten the listed species and its habitat and, where possible, quantifies the potential economic impact to avoid, mitigate, or compensate for such threats within the boundaries of the proposed critical habitat designation. In instances where critical habitat is being proposed after a species is listed, some future impacts may be unavoidable, regardless of the final designation and exclusions under 4(b)(2). However, due to the difficulty in making a credible distinction between listing and critical habitat effects within critical habitat boundaries, this analysis considers all future conservation-related impacts to be co-extensive with the designation.[10,11]

23. Coextensive effects may also include impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. In past instances, some of these measures have been precipitated by the listing of the species and impending designation of critical habitat. Because habitat conservation efforts affording protection to a listed species likely contribute to the efficacy of the critical habitat designation efforts, the impacts of these actions are considered relevant for understanding the full effect of the proposed critical habitat designation. Enforcement actions taken in response to violations of the Act, however, are not included.

1.6.1 SECTIONS OF THE ACT RELEVANT TO THE ANALYSIS

24. This analysis focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act. Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as the critical habitat designation. In this section, the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."[12] Section 4 also requires the Secretary to designate critical habitat "on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat."[13] In addition, under section 4, the Service is required to develop a recovery plan that recommends actions necessary to satisfy the biological needs and assure the recovery of the species. The plan serves as guidance for interested parties, including Federal, State, and local agencies, private landowners, and the general public.

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[10] In 2001, the U.S. Court of Appeals for the 10th Circuit instructed the Service to conduct a full analysis of all of the economic impacts of proposed critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Assn v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

[11] In 2004, the U.S. Ninth Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat (*Gifford Pinchot Task Force v. United States Fish and Wildlife Service*). The Service is currently reviewing the decision to determine what effect it (and to a limited extent Center for Biological Diversity v. Bureau of Land Management (422F.Supp.2d 1115 (N.D. Cal. 2006)) may have on the outcome of consultations pursuant to section 7 of the Act.

[12] 16 U.S.C. 1533.

[13] 16 U.S.C. 1533.

25. The protections afforded to threatened and endangered species and their habitat are described in sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections are the focus of this analysis:

- Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent compliance costs associated with the listing of the species and critical habitat designation.[14]
- Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to " harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[15] The economic impacts associated with this section manifest themselves in sections 7 and 10.
- Under section 10(a)(1)(B) of the Act, an entity (i.e., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for an endangered animal species in order to meet the conditions for issuance of an incidental take permit in connection with the development and management of a property.[16] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs.

1.6.2 OTHER RELEVANT PROTECTION EFFORTS

26. The protection of listed species and habitat is not limited to the Act. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction. For the purpose of this analysis, such protective efforts are considered to be co-extensive with the protection offered by critical habitat, and costs associated with these efforts are included in this report. In addition, under certain circumstances, the critical habitat designation may provide new information to a community about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other State or local laws. In cases where

[14] The Service notes that the Ninth Circuit judicial opinion, *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, invalidated the Service's regulation defining destruction or adverse modification of critical habitat. The Service is currently reviewing the decision to determine what effect it (and to a limited extent *Center for Biological Diversity v. Bureau of Land Management* (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

[15] 16 U.S.C. 1532.

[16] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at http://endangered.fws.gov/hcp/.

these costs would not have been triggered absent the designation of critical habitat, they are included in this economic analysis.

1.6.3 ADDITIONAL ANALYTIC CONSIDERATIONS

27. This analysis also considers the potential for other types of economic impacts that can be related to section 7 consultations in general and critical habitat designation in particular, including time delay, regulatory uncertainty, and stigma impacts.

1.6.3.1 Time Delay and Regulatory Uncertainty Impacts

28. Time delays are costs due to project delays associated with the consultation process or compliance with other regulations. Regulatory uncertainty costs occur in anticipation of having to modify project parameters (e.g., retaining outside experts or legal counsel to better understand their responsibilities with regard to critical habitat designation).

1.6.3.2 Stigma Impacts

29. Stigma refers to the change in economic value of a particular project or activity due to negative (or positive) perceptions of the role critical habitat will play in developing, implementing, or conducting that policy. For example, changes to private property values associated with public attitudes about the limits and costs of implementing a project in critical habitat are known as "stigma" impacts.

1.6.4 BENEFITS

30. Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.[17] OMB's Circular A-4 distinguishes two types of economic benefits: direct *benefits and ancillary benefits.* Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.[18]

31. In the context of critical habitat designation, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.[19] *Rather than rely on economic measures, the Service believes that the direct benefits of the Proposed Rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*

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[17] Executive Order 12866, *Regulatory Planning and Review*, September 30, 1993.

[18] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[19] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

32. Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications. For example, additional flows for mussels associated with the Modified IOP for Jim Woodruff Lock and Dam ensure freshwater flows to Apalachicola Bay, which may protect the shellfish industry. Therefore, freshwater input benefits may accrue as a result of seven mussels if species specific conservation efforts include sustained freshwater inputs to Apalachicola Bay. While they are not the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat.

33. It is often difficult to evaluate the ancillary benefits of critical habitat designation. To the extent that the ancillary benefits of the rulemaking may be captured by the market through an identifiable shift in resource allocation, they are factored into the overall economic impact assessment in this report. For example, if flows used to conserve the species habitat lead to an increase in recreational opportunities in streams and rivers, the local economy may experience an associated measurable, positive impact. Where data are available, this analysis attempts to capture the *net* economic impact (i.e., the increased regulatory burden less any discernable offsetting market gains), of species conservation efforts imposed on regulated entities and the regional economy.

1.6.5 GEOGRAPHIC SCOPE OF THE ANALYSIS

34. The geographic scope of the analysis includes areas proposed for critical habitat designation. The analysis focuses on activities within or affecting these areas. Impacts are presented at the finest level of resolution feasible, given available data. For this proposed critical habitat designation, impacts are reported for each of the 11 Units identified in the proposed rule.

1.7 ANALYTIC TIME FRAME

35. The analysis estimates impacts based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. This analysis will summarize costs associated with past species conservation efforts since 1998 for the seven mussels (the year of the species' listing as threatened or endangered) and then forecast projected future impacts for the 20 year period from 2007 (the year of the species' final critical habitat designation) to 2026. Forecasts of economic conditions and other factors beyond the next 20 years would be speculative.

1.8 INFORMATION SOURCES

36. The primary sources of information for this report were communications with and data provided by personnel from the Service, Federal action agencies, affected private parties, and local and State governments within Alabama, Florida and Georgia. Specifically, the analysis relies on data collected in communication with personnel from the following entities:

- U.S. Army Corps of Engineers (USACE);
- U.S. Fish and Wildlife Service (Service);
- U.S. Forest Service;
- Natural Resources Conservation Service;
- State and intergovernmental agencies:
    - Alabama Department of Conservation and Natural Resources;
    - Alabama Department of Transportation
    - Atlanta Regional Commission
    - Florida Department of Environmental Protection
    - Florida Department of Transportation
    - Florida Fish and Wildlife Conservation Commission
    - Florida State Parks
    - Florida Farm Bureau Federation
    - Georgia Department of Agriculture, Livestock and Poultry Field Forces
    - Georgia Department of Natural Resources
    - Georgia Department of Transportation
    - Georgia Environmental Protection Division
    - Northwest Florida Water Management District
    - St. John's River Water Management District
    - Suwannee River Water Management District
- County and City governments:
    - City of Griffin, Georgia
    - Fayette County, Georgia
    - City of LaGrange, Georgia
- Private stakeholder groups, and others:
    - Crisp County Power Commission

- Engineering Strategies, Inc.
- HDR, Inc.
- Law Offices of Wm. Thomas Craig
- McNally, Fox & Grant
- Troutman Sanders LLP

In addition, this analysis relies upon the Service's section 7 consultation records, public comments, and published journal sources. The reference section at the end of this document provides a full list of information sources.

1.9 STRUCTURE OF REPORT

37. The remainder of this report is organized as follows:

- Section 2: Potential Changes in Water Use and Management for Conservation of the Seven Mussels;
- Section 3: Potential Economic Impacts Related to Changes in Water Use and Management;
- Section 4: Potential Economic Impacts to Water Supply, Hydropower, and Other Impoundment Projects;
- Section 5: Potential Water Quality-Related Impacts;
- Section 6: Economic Impacts to Other Activities;
- References;
- Appendix A: Administrative Costs;
- Appendix B: Incremental Analysis of Critical Habitat Designation for the Seven Mussels;
- Appendix C: Small Business Impacts and Energy Impacts Analysis;
- Appendix D: Detailed Impacts by Activity;
- Appendix E: Cotton, Peanuts, And Corn Acreages In Georgia's Critical Habitat Counties;
- Appendix F: Summary of Agricultural, Municipal, and Recreational Water Valuation Studies; and
- Appendix G: U.S. Army Corps of Engineers Letter to Georgia Department of Natural Resources Environmental Protection Division.

SECTION 2 | POTENTIAL CHANGES IN WATER USE AND MANAGEMENT FOR CONSERVATION OF THE SEVEN MUSSELS

38. This section discusses potential changes in water use and management resulting from actions to conserve the seven mussels. The purpose of this section is to characterize hydrogeological conditions, water management, and water use types for each of the proposed critical habitat units. This information is then used for estimating the potential economic impacts, as presented in the next section.

39. In the Proposed Rule, the Service identifies "flow regime" as one of the Primary Constituent Elements for the seven mussels. In addition, the Service states that the seven mussels cannot survive in impounded ponds, lakes or intermittent streams.[20] Thus, continuously flowing water is a necessary habitat feature for the seven mussels.

40. Maintenance of flow to conserve the seven mussels, especially during dry periods, is a concern in all of the proposed critical habitat units for the seven mussels.[21] However, the Proposed Rule states that, due to the large variation in the physical size of river systems included in the proposed critical habitat for the seven mussels and the complex relationship between the habitats for seven mussels and their host fish, quantifying the amount of flowing water that is essential to the conservation of seven mussels "is complicated."[22] For evaluating Federal actions that may affect the seven mussels, the Service currently applies a set of instream flow guidelines designed for protecting riverine ecosystems in general. These instream flow guidelines "are definitions of measures of flow magnitude, duration, frequency, and seasonality that may serve as thresholds for ''may affect'' determinations for proposed Federal actions that would alter a flow regime (for example, water withdrawals and dam operations)." [23] Depending on the nature of the threat to the species, the Service makes particular recommendations for maintaining flow regimes that would not cause adverse impacts to the species.

[20] A known exception listed in the Proposed Rule is a single large purple bankclimber found in Goat Rock Reservoir on the Chattahoochee River.

[21] Personal communication with Biologist, Panama City Field Office, U.S. Fish and Wildlife Service, on October 16, 2006.

[22] U.S. Fish and Wildlife Service, Proposed Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages, 50 FR 32746, June 6, 2006.

[23] U.S. Fish and Wildlife Service, Proposed Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages, 50 FR 32746, June 6, 2006; pp. 32755.

2.1 SUMMARY OF METHODS FOR ESTIMATION OF ECONOMIC IMPACTS ASSOCIATED WITH FLOW-RELATED CONSERVATION EFFORTS

41. Maintaining flows that would conserve the seven mussels can constrain the availability of water for human use. The Proposed Rule states that water withdrawals for agriculture, municipal and industrial use can cause a reduction in streamflow and negatively affect the seven mussels.[24] This analysis therefore recognizes that because of the seven mussels' need for streamflow, situations may arise during which water that would have been otherwise available for consumptive use or power generation could become "unavailable" for such uses. This is expected to be more likely during "low flow" events, (e.g. during summer or drought conditions) when stream flow reduces to such low levels that flows cannot simultaneously meet the needs of the seven mussels and human users.

42. This section focuses on the potential changes in water use and management that may result from flow-related species conservation efforts. This analysis finds that flow in Units 5, 6, 7, 8 and 11 is affected by water withdrawals that may appreciably change the natural instream flow regimes in the seven mussels' proposed critical habitat. Therefore, it is assumed that economic costs could be associated with maintaining flow regimes in these streams for conservation of the seven mussels (see Exhibit 2-1).

43. This analysis utilizes the best available information solicited from resource managers on the likely efforts that would be needed to protect the mussels. The analysis would ideally include impacts of minimum flow requirements for the conservation of the mussels, but neither the Service, nor any other Federal or State agency has, to date, established or identified a minimum flow threshold for maintaining instream flows for conservation of the seven mussels. Also, currently there is no policy that would regulate the availability of water to agricultural users for purposes of protection of the seven mussels and their habitat. Therefore, the current estimates of conservation related costs presented in this analysis are likely to differ from the true costs of conservation efforts in the future, especially if minimum flow requirements are put in place.

44. For Units 5 and 7, this analysis quantifies the potential impacts on irrigated agriculture in the Flint River Basin. For Unit 6, although this analysis acknowledges that potential impacts might be incurred by the irrigated agriculture sector, it does not have enough information to quantify those costs. For Unit 8, this analysis finds that flow-related conservation efforts could potentially affect both the quantity and quality of municipal and industrial water supply to the Atlanta metropolitan region, curtail generation of electricity at hydropower projects on the Chattahoochee River in Georgia, and limit recreational opportunities normally available at reservoirs on the Chattahoochee River. However, this analysis can quantify only those economic costs that are associated with reduced recreational opportunities—the potential costs associated with reduced water availability for the Atlanta metropolitan region and lost hydropower capacity cannot be quantified because of a lack of sufficient existing information. For Unit 11, this analysis considers agricultural, municipal and industrial use impacts that could result in the future due to the establishment of minimum flow levels for protecting the seven mussels.

[24] Other facilities that can affect flow in the proposed critical habitat units are discussed in Section 4.

However, the long-term impacts of those protective flow measures are unknown and hence not quantifiable. Finally, no appreciable economic impacts arising out of efforts to maintain flow for seven mussels conservation are expected for Units 1, 2, 3, 4, 9 and 10.

2.2 WATER USE IN PROPOSED CRITICAL HABITAT AREAS

45. To identify areas where water use could result in inadequate flow conditions, this analysis considers available water use data for areas surrounding the proposed critical habitat. Based on these data, this analysis identifies major consumptive use types affecting the proposed critical habitat. Exhibit 2-1 lists those critical habitat units for which major sources of water demand exist and where conservation needs of the species could potentially lead to future changes in water management and water use.

EXHIBIT 2-1 MAJOR WATER USE CATEGORIES POTENTIALLY AFFECTING CRITICAL HABITAT UNITS

CRITICAL HABITAT UNIT		STREAM REACH	MAJOR WATER USE CATEGORIES
Unit 1	Econfina	Econfina	None
Unit 2	Chipola	Chipola	None
Unit 3	Uchee	Uchee	None
Unit 4	Sawhatchee Creek Kirkland Creek	Sawhatchee Creek Kirkland Creek	None
Unit 5	Upper Flint River Complex	Upper Flint River	Irrigated Agriculture
Unit 6	Middle Flint River Complex	Muckalee Creek Kinchafoonee Creek Middle Flint River	Irrigated Agriculture (*not quantified*)
Unit 7	Lower Flint River Complex	Chickasawhatchee Creek	None
		Ichawaynochaway Creek Lower Flint River Spring Creek	Irrigated Agriculture
Unit 8	Apalachicola River Complex	Apalachicola River	Municipal & Industrial Water Supply (*not quantified*) Thermal Electricity (*not quantified*) Hydropower Generation (not quantified) Agricultural Irrigation (*not quantified*)
Unit 9	Upper Ochlocknee	Upper Ochlocknee	None
Unit 10	Lower Ochlocknee	Lower Ochlocknee	None
Unit 11	Santa Fe River Complex	New River Santa Fe River	Municipal & Industrial Water Supply (*not quantified*) Irrigated Agriculture (*not quantified*)

- **Upper, Middle, and Lower Flint River Basin (Units 5, 6, and 7).** Numerous agricultural water diversions (both from surface and groundwater) exist along stream reaches proposed for critical habitat designation in the Upper, Middle, and Lower Flint River basins in Georgia. This analysis assumes that seven mussels' conservation efforts could potentially limit water withdrawals by these agricultural users.[25] Surface water withdrawals dominate in the Middle Flint basin whereas groundwater withdrawals dominate in the Lower Flint River basin (see Exhibits 2-2 and 2-3).[26] Because the geology of the Lower Flint basin is such that streams are in direct hydrological connection with the underlying Floridan aquifer, groundwater pumping affects flow in the Lower Flint River.[27] Therefore, economic impacts associated with these units are estimated in this analysis to be primarily due to the irrigated agriculture sector for Unit 5 and 7. Although it is known that agricultural withdrawals likely affect instream flow in the Middle Flint River, and the Muckalee and Kinchafoonee Creeks, because neither long-term hydrological data nor information on future policies for regulating flow in Unit 6 is available, this analysis does not estimate any flow-related economic costs associated with Unit 6.
- **Apalachicola River Complex (Unit 8).** Flow in the Apalachicola River Complex is directly dependent on the releases from the Jim Woodruff dam. However, because this dam has limited storage and is operated essentially as a run-of-the-river facility, maintaining flows in the Apalachicola River for conservation of threatened and endangered mussels and Gulf Sturgeon, and their designated or proposed critical habitat, affects the operations of dams located upstream on the Chattahoochee River. The concerns associated with maintaining flows in Unit 8 for mussel conservation are based on the fact that water management for Unit 8 can negatively impact quantity and quality of water for municipal and industrial water supply, as well as hydropower generation, and recreation around lakes, during sustained periods of drought. This analysis therefore identifies recreation, hydropower production, and municipal and industrial water supply as the important economic activities that may be affected by mussel conservation efforts in the Apalachicola River Complex. Section 3 estimates the potential economic impacts of mussel conservation efforts on these activities.
- **Santa Fe (Unit 11).** This unit is unique in that the Suwannee River Water Management District (SRWMD) has already proposed minimum flow levels that are considered to be protective of the species. Based on available data on water

[25] The Georgia Department of Natural Resources, Wildlife Resources Division, plans to develop a Habitat Conservation Plan (HCP) for the seven mussels in the lower Flint River, based on concerns related to agricultural withdrawals. It is unknown at this time what conservation efforts may be included in this HCP. Section 6 of this analysis provides estimates the cost of developing this HCP.

[26] Based on agriculture withdrawals permit data from Dr. Jim Hook, University of Georgia and National Environmentally Sound Production Agriculture Laboratory. Received on October 6, 2006.

[27] Georgia Department of Natural Resources Environmental Protection Division. Flint River Basin Regional Water Development And Conservation Plan, March 20, 2006.

withdrawals near the Santa Fe River complex (Unit 11), this analysis acknowledges that flow in this unit is affected primarily by municipal and industrial use water users.[28] However, it is not known if and how seven mussels conservation efforts will impact water users in the future. This analysis therefore does not estimate any economic costs for Unit 11.

- **Other Units.** This analysis is unaware of any major uses of water or impoundments that strongly affect stream flow in the remaining units: Econfina Creek (Unit 1); Chipola River Complex (Unit 2); Uchee Creek (Unit 3); Sawhatchee Creek and Kirkland Creek (Unit 4), Upper Ochlockonee River (Unit 9), and Lower Ochlockonee River (Unit 10). It is assumed, therefore, that additional water cannot be provided in these units by limiting consumptive use.

2.3 POTENTIAL CHANGES IN WATER USE IN THE FLINT RIVER BASIN

46. This section discusses potential water use restrictions to provide flows for conservation of the seven mussels in Units 5 and 7 on the Flint River in Georgia. As discussed above, streamflow in these units is primarily affected by agricultural water withdrawals. Based on historical information on streamflow and the findings of the Georgia Department of Natural Resources, Environmental Protection Division (EPD), this analysis considers future scenarios in which it is not possible to meet the water needs of both the seven mussels and irrigators during low flow periods. In such cases, this analysis assumes that additional water will be made available for instream flow by reducing agricultural withdrawals to protect the mussels and their habitat. The following sections discuss the potential impacts of these restrictions in Units 5, 6, and 7.

2.3.1 UPPER FLINT RIVER COMPLEX (UNIT 5)

47. Neither the Service nor any other Federal or State agency has, to date, established or identified a minimum flow threshold for maintaining instream flows for conservation of the seven mussels in the Upper Flint River. There are also currently no policies that would regulate the availability of water to agricultural users for purposes of protection of the seven mussels and their habitat. To establish a streamflow level that will conserve the seven mussels, this analysis uses the "7Q10" streamflow measure to establish a low flow threshold. The 7Q10 streamflow measure is defined as the minimum average flow that occurs for seven consecutive days and occurs on an average once in ten years.[29] It is typically used as a threshold flow level to regulate point and non-point source discharge permits. Georgia EPD has also used this measure to evaluate agricultural surface-water withdrawal permits, which can impair stream water quality by reducing flows to below the level necessary to maintain water quality.

48. Next, this analysis uses the calculated 7Q10 threshold flow to estimate the volume of water that could potentially be made unavailable due to conservation efforts for the seven

[28] Suwannee River Water Management District (SRWMD), Florida. GIS well points data ("MWI.shp"). Received on October 11, 2006.

[29] Flint River Basin Regional Water Development And Conservation Plan, March 20, 2006; pp.77.

mussels in the basin of the Upper Flint River complex (Unit 5) in a given year. This volume of water is later used in Section 3 to estimate the potential economic impacts associated with species conservation efforts for Unit 5 in the future. To estimate the volume of water to conserve the seven mussels and their habitat, this analysis utilizes available daily streamflow data from the USGS stream gage (02349605) located near Montezuma, Georgia.[30] This is the only gage on the Upper Flint River for which historical data exist for a long period of time (65 years).[31]

49. Specifically, this analysis uses the following steps to first estimate the 7Q10 level at the Montezuma USGS gage, and then estimates the volume of water that would be used for irrigation but for the need to conserve the seven mussels' habitat in the Upper Flint River Complex:

i. **Calculate the 7Q10 low flow threshold**: This value is calculated as the tenth percentile of the distribution of the annual minimum of the seven-day average of daily flow values for all days between January 1, 1931 and December 31, 2005. Based on the recorded daily average flow data for the stream gage at Montezuma, this analysis calculates the 7Q10 flow level to be 621 cfs.

ii. **Calculate frequency and magnitude of flows lower than 7Q10**: Subtract the low flow threshold from daily flow rates to estimate the historical frequency of low flow days (i.e., days for which average daily flow was less than 7Q10), and the magnitude of the differences between the observed (lower) flows and the desired 7Q10 flow. The analysis calculates 300 days (from a total of 27,400) in the historical record under consideration that were below the 7Q10 flow level.

iii. **Calculate average annual number of deficit days**: Calculate the ratio of number of low flow days to the total number of days in the record considered; convert this ratio to an estimate of the average number of low flow days in a year in the baseline period (i.e., multiply ratio with 365). This calculation shows that on an average there will be four days per year for which flows can be expected to be below the 7Q10 level of 621 cfs.

iv. **Estimate average daily deficit**: Estimate the average of the daily differences between observed low flow days and the threshold flow (i.e., sum up the differences for all low flow days and divide by the total number of low flow days in the baseline period). This value was calculated to be 80.12 cfs.

v. **Estimate the annual average for the volume of water required to prevent flows below 7Q10 flow threshold**: Calculate the product of average daily deficit volume and the average annual number of days below the threshold to estimate the average volume of water that would have been needed annually on an average in the period of record to ensure that stream flow always exceeds the

[30] Historical (and real-time) flow data are available for free download from the USGS National Water Information System website <http://waterdata.usgs.gov/nwis>. Last accessed on May 11, 2007.

[31] Although data are also available for some years before 1931, this analysis uses flow data from 1931 to 2005, which is the longest continuous period of record for this gage.

low flow threshold. Based on steps (iii) and (iv) this analysis estimates that the average annual volume of water that would be required to prevent flows below the 7Q10 threshold is 207 million gallons.

Note that this procedure uses historical data to estimate the annual difference in flow volumes between observed lower flows and the 7Q10 flow threshold level established for Unit 5. In the absence of a hydrological model that can predict future flows, this analysis assumes that the statistical distribution of flows in the future will be similar to that observed in the past. Hence, expected future annual flow volume that could potentially be unavailable for agricultural withdrawals is assumed to be the same as that estimated based on the historical data.

2.3.2 MIDDLE FLINT RIVER COMPLEX (UNIT 6)

50. As mentioned above, although this analysis acknowledges that flows in the Middle Flint River complex (Unit 6) may be affected by water withdrawals for irrigated agriculture, sufficient hydrologic data (e.g., streamflow data) do not exist to allow further investigations of impacts of designating Unit 6. Because the 7Q10 measure is strongly affected by extremely low flow values, it is preferable to have a continuous long-term stream flow data for estimating the 7Q10. However, streamflow data exist only from 1929 to 1958 and from 1988 to 2006 for the Middle Flint River. Similarly, streamflow data are not available for a sufficiently long period for the two tributaries, Muckalee Creek and Kinchafoonee Creek. Therefore, the economic impacts of potential efforts to maintain flows in Unit 6 for seven mussels conservation are not quantified in this analysis.[32]

2.3.3 LOWER FLINT RIVER COMPLEX (UNIT 7)

51. Unlike the Upper Flint River, the Lower Flint River and some of its tributaries are in hydraulic connection with the Floridan aquifer in an area, known as "Subarea 4 of the Apalachicola-Chattahoochee-Flint (ACF) Basin."[33] This area lies south of Dooly County, Georgia. Water use in Subarea 4 is dominated by agricultural irrigation, which can account for 90 percent of the water used during the April-September growing season.[34] Both surface and ground water are used for agricultural irrigation in this region; however, groundwater use is three to four times as greater, both in terms of irrigated areas and water withdrawal volumes.[35]

52. Exhibit 2-2 shows the distribution of surface water and groundwater pumping wells in the Lower Flint River Basin. Groundwater agricultural withdrawals in this area can have an especially strong impact on streamflow in this area. Hydrological studies have also shown that, due to extensive development of agriculture in the region, drought-year flows are

[32] Impacts on dam managers for this Unit are discussed in Section 4.

[33] Flint River Basin Regional Water Development And Conservation Plan, March 20, 2006; pp.15.

[34] Municipal and industrial use in Unit 8 is equivalent to 3 percent of agricultural groundwater use and is therefore not considered in this section.

[35] Flint River Basin Regional Water Development And Conservation Plan, March 20, 2006; pp.15.

reached sooner and are lower than those observed in the pre-irrigation period. Because agricultural withdrawals cause a reduction in the base streamflow, they magnify the negative impact on the seven mussels and their habitat during periods of sustained low flows. These impacts are minimal during wetter years. For example, during the 1999-2002 drought, seven mussels populations in many locations in the Lower Flint River complex, especially in parts of Ichawaynochaway Creek and Spring Creek sub-basins, were substantially reduced.[36] It has been demonstrated that low-flow-criteria established by the Service designed to protect aquatic habitats are "not met more frequently and for longer periods of time since development of irrigation."[37] It should also be noted that Spring Creek is especially a cause of concern because it went dry in several segments during the 1999-2002 drought, and has already exceeded its safe yield in terms of agricultural water withdrawals.[38]

53. Although it is likely that agricultural water use would have to be curtailed in some areas in the Unit 7 basin during dry periods to conserve the seven mussels, it is not yet known what measures would be implemented to meet this objective. In the absence of such information, this analysis relies on the recommendations made by the Georgia EPD. According to Georgia EPD, "If, under the Rules for Flint River Drought Protection (Chapter 391-3-28) irrigation withdrawals are reduced by 20% in those sub-basins with the greatest risk of experiencing irrigation-induced low flows, stream discharges that will prevent drying and harm to endangered fresh-water mussels will likely be sustained."[39] This analysis assumes that future mitigative measures will be based on this recommendation for this proposed critical habitat unit. The economic analysis presented in Section 3 uses this information to estimate the economic impact associated with potential changes in water withdrawal rates on irrigators in the Lower Flint River Basin.

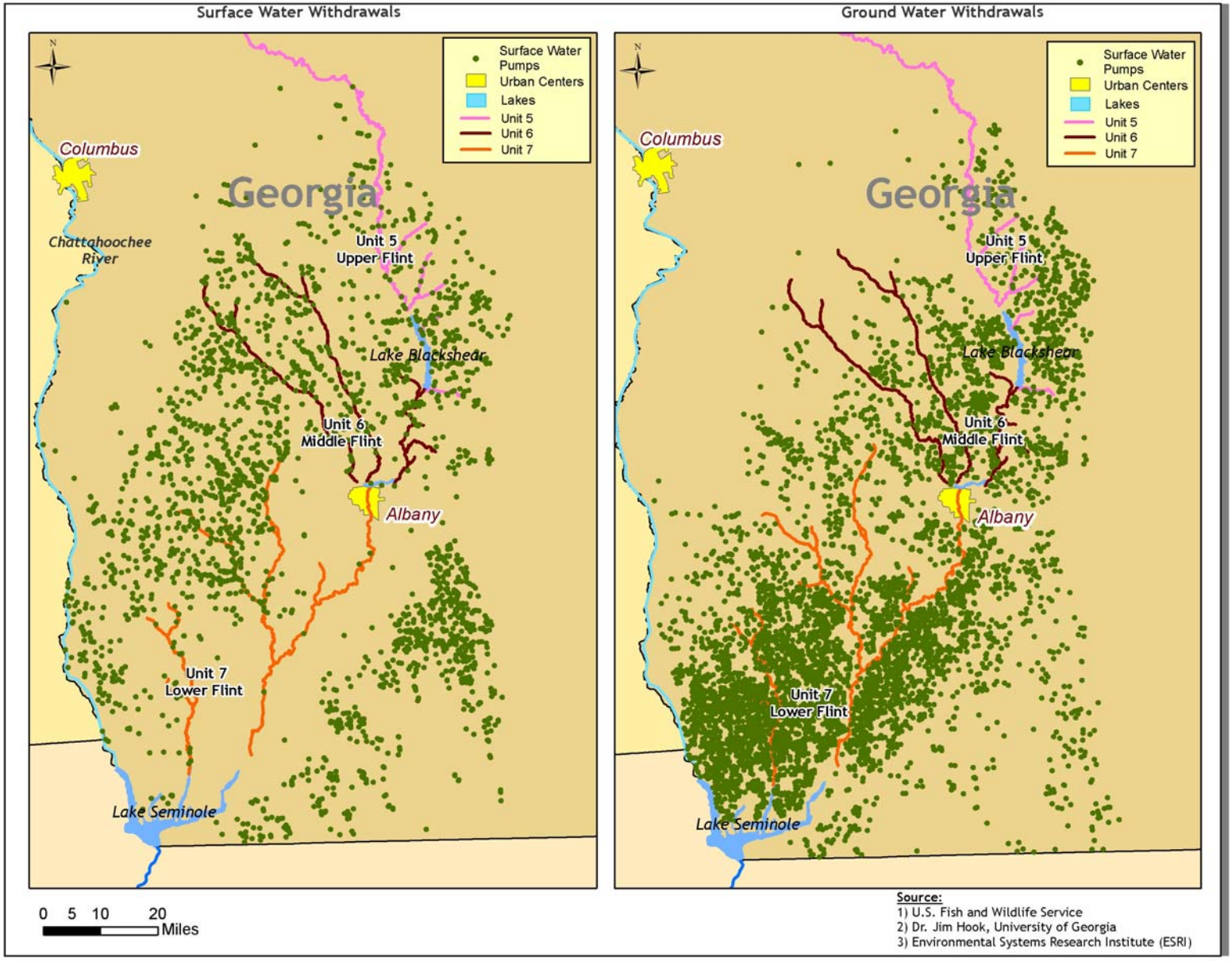
[36] Flint River Basin Regional Water Development And Conservation Plan, March 20, 2006; pp.16.

[37] Ibid; pp.22.

[38] Ibid; pp.22.

[39] Ibid; pp. 23.

EXHIBIT 2-2 GEOGRAPHIC DISTRIBUTION OF AGRICULTURAL SURFACE AND GROUNDWATER WITHDRAWALS IN THE FLINT RIVER BASIN, GEORGIA



2.4 POTENTIAL CHANGES IN WATER MANAGEMENT IN THE APALACHICOLA RIVER COMPLEX (UNIT 8)

54. The USACE operates four federal dams on the Chattahoochee River and another federal dam (Jim Woodruff) at the confluence of the Apalachicola and Flint River (see Exhibit 2-4).[40] In a comment letter on the draft economic analysis, the USACE wrote:

"Flows in Unit 8, i.e., the Apalachicola River, are dependent on water releases from Jim Woodruff Dam. Minimum releases in support of listed species [threatened and endangered mussels and their host fish, and the Gulf Sturgeon] on the Apalachicola River are made under an Interim Operations Plan which specifies minimum releases and maximum rates of fall which vary as basin inflows within the ACF system decline. A Modified IOP was approved by USFWS [Service] on February 28, 2007, which introduced a drought provision plan for the federally endangered Gulf Sturgeon and freshwater mussels found in the Apalachicola River. The current water control plan provides for a minimum flow of 5,000 cfs under all conditions. The Modified IOP provides for a higher minimum flow when hydrological and climatic conditions permit; and identifies a drought provision when the lower 5,000 cfs minimum flow would be prudent in order to conserve storage in the upstream reservoirs to assure the ability to augment releases in support of sustaining the minimum flow. The minimum flow prescribed by the Modified IOP is not the only factor in releases made from Jim Woodruff Dam. The Modified IOP flow rates are described as minimum, and not target, releases for Jim Woodruff Dam. During a given month and basin inflow rate, releases will generally be greater than the Modified IOP minimum releases consistent with the maximum fall rate schedule due to releases made for other project purposes such as hydropower operation, flood control operations, balancing of reservoir levels, etc. During wet periods, releases may substantially exceed the prescribed Modified IOP minimum flows, but during dry periods, releases will more closely match these values, as the Corps [USACE] operates to conserve reservoir storage for authorized project purposes and future augmentation flow needs for endangered and threatened species and other project purposes".[41]

55. Thus, the Modified IOP primarily affects two water management factors: (1) the timing and (2) the quantity of releases made from the Jim Woodruff Dam. As stated in the USACE comment letter on the draft economic analysis:

"Because the USACE operates the five dams on the Chattahoochee [River] as a system to determine releases, changes to the operations or conditions of the Jim Woodruff Dam can also affect the operations of the four other dams. Likewise, operations or conditions upstream can potentially affect releases from the Jim Woodruff Dam, which is the downstream most dam. Lake Lanier stores the majority of the water in the system but has small drainage basin and is therefore slow to refill. The downstream reservoirs within the

[40] U.S. Army Corps of Engineers, Mobile District. Environmental Assessment, Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species: Jim Woodruff Dam, Gadsen and Jackson Counties, Florida and Decatur County, Georgia. March 3, 2007.

[41] Public comment letter, submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District, U.S. Army Corps of Engineers, August 6, 2007.

basin (West Point Lake and Walter F. George Lake) are often drawn on to meet downstream flows, since they are easier to refill due to larger drainage basins and ability to receive releases from upstream reservoirs. Jim Woodruff Dam/Lake Seminole has very limited storage capacity and is dependent upon releases from the upstream reservoirs or flows from the Flint River to make releases to meet downstream flow needs. These factors influence a conservative operation at Lake Lanier, in order to conserve storage for future augmentation flows for balancing project purposes throughout the basin and to meet downstream minimum flows ".[42]

56. The Atlanta metropolitan area depends on Lake Lanier for most of its water supply. Additionally, the USACE and Southeastern Power Administration depend on timely releases from the dams to provide hydropower to the region, especially during periods of peak electricity demand. Recreation activities at the three major lakes (Lake Sidney Lanier, West Point Lake and Walter F. George Reservoir) benefit from higher reservoir levels, and are adversely affected when reservoir levels decline. Water supply for industrial and municipal use, hydropower generation, and recreation are all affected by the amount of water available as storage in the three major reservoirs (Buford, West Point, and Walter F. George). Because the Modified IOP affects the amount of water available as storage, especially during sustained droughts, this analysis assumes that it will affect recreation, hydropower production, and municipal and industrial water supply in the future.

57. Exhibits 2-3, 2-4 and 2-5 show the ACF reservoir operational specifications under the Modified IOP. Note that, during June through February, the operations are intended to protect the endangered and threatened freshwater mussels and their host fish, and the young endangered Gulf sturgeon found in the Apalachicola River Complex; from March through May, the operations are intended to protect the threatened Gulf Sturgeon, and the host fish of the endangered and threatened freshwater mussels found in the Apalachicola River.

[42] Public comment letter, submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District, U.S. Army Corps of Engineers, August 6, 2007.

EXHIBIT 2-3 LOCATION OF MAJOR USACE MANAGED DAMS ON CHATTAHOOCHEE RIVER

EXHIBIT 2-4 MODIFIED IOP MINIMUM DISCHARGE FROM JIM WOODRUFF DAM BY MONTH AND BY BASIN INFLOW RATES[43]

MONTHS	BASIN INFLOW (BI) (CFS)		RELEASE FROM JIM WOODRUFF DAM (CFS)
March - May	High	≥ 35, 800	≥ 25,000
	Mid	< 35, 800 and ≥ 18,000	≥ 70% BI; ≥ 18,000
	Low	<18,000	≥ BI; ≥ 6,500 (Desired Flow)[1] ≥ BI; ≥ 5,000 (Required Flow)[1]
June - February	High	≥ 23, 000	≥ 16,000
	Mid	≥ 23,000 and < 10, 000	≥ 70% BI; ≥10,000
	Low	<10,000	≥ BI; ≥ 6,500 (Desired Flow)[1] ≥ BI; ≥ 5,000 (Required Flow)[1]

Source: U.S. Army Corps of Engineers, Mobile District. Environmental Assessment, Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species: Jim Woodruff Dam, Gadsen and Jackson Counties, Florida and Decatur County, Georgia. March 3, 2007; pp. EA-9.

Note:

1. Minimum desired flow of 6500 cfs is maintained when the Composite Storage (combined storage of Buford, West Point and Walter F. George dams) is within Zones 1 or 2. When composite storage falls below top of Zone 3, the release is reduced to 5000 cfs to conserve more water in the system. When Composite Storage is restored to above the top of Zone 2 (i.e., within Zone 1), then the higher minimum release of at least 6,500 cfs is again reinstated. (Zones lie between threshold water elevations and are used to decide the course of dam operations. Zone 1 corresponds to the highest levels, and Zone 4 to the lowest water levels in the reservoirs).

EXHIBIT 2-5 MODIFIED IOP MAXIMUM FALL RATES FOR DISCHARGE FROM JIM WOODRUFF DAM BY RELEASE RANGE

APPROXIMATE RELEASE RANGE (CFS)	MAXIMUM FALL RATE (FEET/DAY)
≥ 30, 000	Fall rate is not limited
≥ 20, 000 and < 30,000	1.0 - 2.0
> 16,000 and < 20,000	0.5 - 1.0
> 8,000 and ≤ 16,000	0.25 - 0.5
≤ 8,000	≤ 0.25

Source: U.S. Army Corps of Engineers, Mobile District. Environmental Assessment, Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species: Jim Woodruff Dam, Gadsen and Jackson Counties, Florida and Decatur County, Georgia. March 3, 2007; pp. EA-9.

[43] Basin inflow thresholds are measured by the USACE as the running seven day average daily inflow to the ACF reservoir projects, excluding releases from project storage.

2.4.1 ANALYSIS OF PROJECTED RESERVOIR WATER ELEVATIONS AND STORAGE CAPACITY USING HEC-5 HYDROLOGIC MODELS

58. The Modified IOP reflects the current management plan for regulating the minimum flow from Jim Woodruff Dam. The USACE currently manages its operations in accordance with the 1989 Draft Water Control Plan for the ACF system; it makes adjustments as necessary to accommodate changes in water needs (e.g., changes made as part of the Modified IOP to protect the three endangered mussels, their host fish and the gulf sturgeon).[44] Finalization of this plan will depend on the outcome of ongoing litigation filed by the State of Alabama in 1990. Although it is expected that this plan and the Modified IOP will be updated subsequent to the resolution of this litigation, this analysis cannot predict when updates might occur or what changes will be made to water management in the ACF system as a result of the litigation. This analysis therefore assumes that water management as defined by the Modified IOP is the best representation of what operations will look like after the designation of critical habitat.

59. To assess the potential impacts of the Modified IOP, this analysis applies results of the USACE's HEC-5 models.[45] Changes in reservoir storage elevation and storage volumes due to the Modified IOP are analyzed for three reservoirs—Buford (Lake Lanier), Walter F. George, and West Point. These reservoirs account for most of the storage in the Chattahoochee River system. Reservoir levels and water volumes are estimated under two scenarios, one with and one without the Modified IOP in effect. In other words, an analysis of the difference of modeled conditions under these two scenarios is used to understand how the Modified IOP changes the quantity and quality of water available in the reservoir systems.[46] Note that this economic analysis is concerned with the *marginal* impact of the Modified IOP on reservoir water levels. The Modified IOP represents the changes made to the water management plans for conservation of listed species (including endangered and threatened mussels and their host fish) and their designated or proposed critical habitat. Therefore, this analysis examines the difference between the with/without Modified IOP scenarios.

60. There is considerable uncertainty about present and future hydrological conditions in the ACF basin.[47] The USACE and Georgia EPD hold differing opinions regarding the quantity of current agricultural water withdrawals in the ACF basin, as well as the current

[44] U.S. Army Corps of Engineers, Mobile District. Environmental Assessment, Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species: Jim Woodruff Dam, Gadsen and Jackson Counties, Florida and Decatur County, Georgia. March 3, 2007; pp. EA-2.

[45] U.S. Army Corps of Engineers. 1998. HEC-5: Simulation of Flood Control and Conservation Systems, Version 8, Hydrologic Engineering Center, Davis CA. Details accessible at http://www.hec.usace.army.mil/software/legacysoftware/hec5/hec5.htm. Last accessed on 08/31/2007.

[46] The Modified IOP also addressed the timing of releases, thus affecting hydropower generation schedules. However, it is not possible to evaluate the impact on hydropower generation due to insufficient information on how the Modified IOP will affect the timing of water releases during the day. See Section 4 for more details on impact on hydropower generation.

[47] Note that this analysis is not intended to provide a comprehensive comparison of the HEC-5 model assumptions made by the USACE or Georgia EPD. This discussion is intended to highlight the range of impacts on lake levels that could possibly result due to the Modified IOP, assuming different possible scenarios. For more details about the HEC-5 model readers are encouraged to contact the USACE and Georgia EPD for the reasoning underlying their assumptions. Also note that these lake levels are not used in this economic analysis to quantify any economic impacts associated with water supply.

level of municipal and industrial water withdrawals in the upper reaches of the Chattahoochee River. Additionally, Georgia EPD disagrees with the USACE's decision to include the requirement minimum flow of 5,000 cfs in the "without Modified IOP" scenario. According to Georgia EPD, this minimum flow level was established partly due to consultation with the Service regarding the three threatened and endangered mussels, and should therefore be included in the "with-Modified IOP" scenario.[48] There are also differences in the opinions of the two agencies regarding forecast future reservoir levels. Specifically, in addition to simulating year 2000 water demands, Georgia EPD also uses another HEC-5 model to analyze Modified IOP impacts at increased water demand levels. Georgia EPD uses projected water demand levels for year 2030 for the Metropolitan Atlanta Area for this additional analysis.[49] The USACE does not provide any HEC-5 models for future water demand levels.

61. Because of the differences in opinion about the hydrological conditions in the ACF basin, this analysis assesses the potential impact of the Modified IOP for multiple hydrological scenarios. As discussed above, the USACE and Georgia EPD assume different amounts of current water withdrawals for the ACF basin in their respective HEC-5 models. Thus, this analysis distinguishes USACE and Georgia EPD HEC-5 hydrological models (see Exhibits 2-7 and 2-8). Additionally, Georgia EPD also used the HEC-5 model to estimate lake levels for the with/without Modified IOP scenarios under year 2030 water demand levels. The USACE limits its analysis to only year 2000 water withdrawal rates; therefore, Georgia EPD also provided this analysis with simulations of lake levels under year 2030 water demands, based on the USACE's hydrological model of the ACF basin. Thus, this analysis has four sets of comparisons for the with/without Modified IOP scenarios:

- USACE HEC-5 (2000 water demand levels)
- USACE HEC-5 (2030 water demand levels)
- Georgia EPD HEC-5 (2000 water demand levels)
- Georgia EPD HEC-5 (2030 water demand levels)

The USACE provided data for the first scenario; Georgia EPD provided data for the remaining three scenarios.[50]

62. Currently, the time period for which input hydrological data for HEC-5 simulations are available starts January 1, 1939 and ends December 31, 2001.[51] This time period includes multiple drought and wet years, and is thus assumed to be sufficiently inclusive of the

[48] Public comment letter, submitted by Carol Couch, Director, Environmental Protection Division, Georgia Department of Natural Resources, August 6, 2007.

[49] The projected water demand level used for the rest of the ACF basin is based on year 2050.

[50] As mentioned above, Georgia EPD believes that any quantitative analysis of the impact of water management actions on water supply should consider maintaining a minimum flow 5,000 cfs as, at least partly, due to species conservation efforts. However, to simplify the comparative analysis presented in this section, Georgia EPD assumes that the 5,000 cfs minimum flow requirement is part of the "without Modified IOP" scenario, and not the "with Modified IOP" scenario.

[51] The simulation period ends in 2001, because the U.S. Army Corps of Engineers is still preparing HEC-5 input hydrological data for years later than 2001.

variable climatic conditions that could exist in the future. Hence, all four simulations use this input hydrological data assuming that they adequately capture possible variations in future hydrological conditions.

63. Exhibit 2-6 summarizes the results of the HEC-5 simulations conducted by the USACE. According to the USACE, the maximum difference between with/without Modified IOP scenarios will be observed for Buford Dam. Decline in lake levels are expected to be smaller for the other two reservoirs, under both 2000 and 2030 water demand assumptions.[52] However, the HEC-5 model simulations conducted by Georgia EPD suggest more severe impacts.[53] As shown in Exhibit 2-7, the difference between the two scenarios for Buford Dam is 4.1 feet, assuming the lower 2000 water demands; the difference for year 2030 water demand level is 6.9 feet. Comparatively larger impacts are also realized at Walter. F. George and West Point reservoirs.

64. For illustration of how lake levels may be affected in periods of extreme drought, this analysis also compares the with/without Modified IOP scenarios for the period between 1999 and 2001. The period 1999 – 2001 is recognized as the basin-wide critical drought period in the simulation period.[54, 55] Exhibit 2-8 compares the two scenarios for 2000 and 2030 water demands in terms of the average and the maximum difference in reservoir levels. Georgia EPD's simulations suggest that the potential maximum difference in lake levels between the two scenarios could be considerable for all reservoirs, under both year 2000 and 2030 water demands. For example, Lake Lanier would be drawn down an additional 5.5 and 9.3 feet, under 2000 and 2030 water demands, respectively. Similarly, the differences between the two scenarios for the other two reservoirs are also considerable. Under both year 2000 and 2030 water demand levels, West Point reaches inches above the conservation pool; Walter F. George reaches the bottom of the conservation pool.[56] This happens even without the Modified IOP being in effect.[57] As can be seen in Exhibit 2-8 and Exhibit 2-9, the Modified IOP would further reduce lake levels during these critical periods. A time series comparison of the reservoir levels during 1999-2001 also suggests that there is consistently less water available for storage due to the Modified IOP in this period; the difference is magnified if year 2030 water demands are assumed for Metropolitan Atlanta. For example, the average difference for

[52] Simulations for year 2030 water demand levels for U.S. Army Corps of Engineers' (USACE) HEC-5 model were not provided by the USACE; they are estimated by this analysis based on USACE's HEC-5 model.

[53] Written communication from Wei Zeng, Georgia Environmental Protection Division, August 30, 2007.

[54] The critical period extended beyond 2001, but U.S. Army Corps of Engineers currently provides unimpaired HEC-5 model input data only until year 2001.

[55] Because the goal is to simply illustrate a possible scenario, rather than document the range of impacts based on the USACE's and Georgia EPD's hydrological assumptions, only Georgia EPD's HEC-5 is used to analyze the impact during the extreme drought period. Georgia EPD's HEC-5 model was chosen because the potential impacts are more severe under its hydrological assumptions.

[56] The conservation pool can be interpreted as the zone of low reservoir levels, which trigger off conservation actions by the U.S. Army Corps of Engineers.

[57] Public comment letter, submitted by Carol Couch, Director, Environmental Protection Division, Georgia Department of Natural Resources, August 6, 2007.

Lake Lanier is 2.2 feet under year 2000 water demands; this doubles to 4.4 feet under year 2030 water demands.

65. Finally, this analysis examines the average monthly decline in reservoir storage volumes due to the Modified IOP. This analysis provides an estimate of the average seasonal variation in the impact of the Modified IOP. Exhibit 2-9 summarizes the difference for USACE's HEC-5 model under USACE determined 2000 water demand levels. Exhibits 2-10 and 2-11 present similar information for Georgia EPD's HEC-5 model, and its estimates under year 2000 and 2030 water demands levels.[58] The information in the three exhibits reinforces the results presented above: due to the Modified IOP, storage capacity will consistently be less throughout the year, especially during summer. Also, the impacts of the Modified IOP simulated by Georgia EPD are more severe than that suggested by USACE's HEC-5 model. However, Exhibits 2-10 and 2-11 also show that the impact of the Modified IOP on average monthly reservoir storage is not directly related to water demand levels. This can be inferred from the similarity of the Modified IOP's impact on average volumes under year 2000 and 2030 water demands.

EXHIBIT 2-6 PROJECTED MINIMUM RESERVOIR LEVELS WITH AND WITHOUT THE MODIFIED IOP FOR DIFFERENT WATER DEMAND LEVELS (USACE HEC-5 MODEL)

RESERVOIR	SCENARIO	MINIMUM ELEVATION (FEET)	
		YEAR 2000 DEMAND [1]	YEAR 2030 DEMAND [1]
Buford	Without-Modified IOP	1,057.4	1,047.8
	With-Modified IOP	1,056.3	1,046.7
	Difference	*1.1*	*1.1*
West Point	Without-Modified IOP	621.7	621.0
	With-Modified IOP	621.1	620.7
	Difference	*0.6*	*0.3*
Walter F. George	Without-Modified IOP	185.0	185.4
	With-Modified IOP	184.6	184.0 (empty)
	Difference	*0.4*	*1.4*

1. As estimated by Georgia Environmental Protection Division (EPD).

[58] Note that Section 3 utilizes these volumes to quantify the impact of conservation efforts for Unit 8.

EXHIBIT 2-7 PROJECTED MINIMUM RESERVOIR LEVELS WITH AND WITHOUT THE MODIFIED IOP FOR DIFFERENT WATER DEMAND LEVELS (GEORGIA EPD HEC-5 MODEL)

RESERVOIR	SCENARIO	MINIMUM ELEVATION (FEET)	
		YEAR 2000 DEMAND [1]	YEAR 2030 DEMAND [1]
Buford	Without-Modified IOP	1056.7	1047.7
	With-Modified IOP	1052.6	1040.8
	Difference	*4.1*	*6.9*
West Point	Without-Modified IOP	621.9	621.0
	With-Modified IOP	620.4	620.5
	Difference	*1.5*	*0.5*
Walter F. George	Without-Modified IOP	185.1	184.5
	With-Modified IOP	184.0 (empty)	184.0 (empty)
	Difference	*1.1*	*0.5*

1. As estimated by Georgia Environmental Protection Division (EPD).

EXHIBIT 2-8 PROJECTED REDUCTION IN RESERVOIR LEVELS DUE TO THE MODIFIED IOP DURING THE CRITICAL DROUGHT PERIOD (1999-2001) (GEORGIA EPD HEC-5 MODEL)

RESERVOIR	MEASURE OF DIFFERENCE BETWEEN RESERVOIR LEVELS	REDUCTION IN ELEVATION (FEET)	
		YEAR 2000 DEMAND [1]	YEAR 2030 DEMAND [1]
Buford	Average Difference	2.2	4.4
	Maximum Difference	5.5	9.3
West Point	Average Difference	1.3	1.0
	Maximum Difference	5.9	3.6
Walter F. George	Average Difference	0.9	0.8
	Maximum Difference	4.0	3.3

1. As estimated by Georgia Environmental Protection Division (EPD).

EXHIBIT 2-9 SIMULATED AVERAGE MONTHLY REDUCTION IN RESERVOIR STORAGE VOLUMES CAUSED BY THE MODIFIED IOP UNDER YEAR 2000 WATER DEMAND LEVELS (USACE HEC-5 MODEL)

MONTH	REDUCTION IN RESERVOIR STORAGE CAPACITY (MILLION GALLONS)			REDUCTION IN RESERVOIR STORAGE CAPACITY (PERCENTAGE OF MAXIMUM STORAGE) [1]		
	BUFORD	WEST POINT	WALTER F. GEORGE	BUFORD	WEST POINT	WALTER F. GEORGE
Jan	3,058	800	135	0.45%	0.33%	0.04%
Feb	2,462	606	13	0.36%	0.25%	0.00%
Mar	1,628	409	128	0.24%	0.17%	0.04%
Apr	983	399	626	0.14%	0.16%	0.20%
May	1,532	1,245	1,192	0.22%	0.51%	0.38%
Jun	3,303	2,204	**3,264**	0.48%	0.91%	**1.04%**
Jul	3,990	2,351	2,041	0.58%	0.97%	0.65%
Aug	4,217	3,194	1,308	0.61%	1.32%	0.42%
Sep	**4,601**	3,580	1,520	**0.67%**	1.48%	0.48%
Oct	4,511	4,820	1,299	0.66%	1.99%	0.41%
Nov	4,216	**4,916**	993	0.61%	**2.03%**	0.32%
Dec	3,872	2,253	659	0.56%	0.93%	0.21%

1. Maximum storage is the maximum volume during the entire simulation period for the without Modified IOP scenario under Georgia EPD's 2000 water demands.

EXHIBIT 2-10 SIMULATED AVERAGE MONTHLY REDUCTION IN RESERVOIR STORAGE VOLUMES CAUSED BY THE MODIFIED IOP UNDER YEAR 2000 WATER DEMAND LEVELS (GEORGIA EPD HEC-5 MODEL)

MONTH	REDUCTION IN RESERVOIR STORAGE CAPACITY (MILLION GALLONS)			REDUCTION IN RESERVOIR STORAGE CAPACITY (PERCENTAGE OF MAXIMUM STORAGE) [1]		
	BUFORD	WEST POINT	WALTER F. GEORGE	BUFORD	WEST POINT	WALTER F. GEORGE
Jan	4,189	591	204	0.61%	0.24%	0.06%
Feb	3,503	203	64	0.51%	0.08%	0.02%
Mar	2,987	370	464	0.44%	0.15%	0.15%
Apr	2,715	896	1,484	0.40%	0.37%	0.47%
May	6,455	3,832	7,128	0.94%	1.58%	2.27%
Jun	**11,439**	**5,585**	**8,016**	**1.67%**	**2.30%**	**2.55%**
Jul	9,729	4,409	4,530	1.42%	1.82%	1.44%
Aug	7,940	3,732	3,907	1.16%	1.54%	1.24%
Sep	6,716	3,058	4,179	0.98%	1.26%	1.33%
Oct	6,327	2,643	3,136	0.92%	1.09%	1.00%
Nov	5,929	2,360	1,825	0.87%	0.97%	0.58%
Dec	5,289	1,542	1,100	0.77%	0.64%	0.35%

1. Maximum storage is the maximum volume during the entire simulation period for the without Modified IOP scenario under Georgia EPD's 2000 water demands.

EXHIBIT 2-11 SIMULATED AVERAGE MONTHLY REDUCTION IN RESERVOIR STORAGE VOLUMES CAUSED BY THE MODIFIED IOP UNDER YEAR 2030 WATER DEMAND LEVELS (GEORGIA EPD HEC-5 MODEL)

MONTH	REDUCTION IN RESERVOIR STORAGE CAPACITY (MILLION GALLONS)			REDUCTION IN RESERVOIR STORAGE CAPACITY (PERCENTAGE OF MAXIMUM STORAGE) [1]		
	BUFORD	WEST POINT	WALTER F. GEORGE	BUFORD	WEST POINT	WALTER F. GEORGE
Jan	5,898	597	362	0.86%	0.25%	0.12%
Feb	5,392	96	61	0.79%	0.04%	0.02%
Mar	4,431	463	585	0.65%	0.19%	0.19%
Apr	4,295	1,004	1,644	0.63%	0.41%	0.52%
May	7,159	3,562	7,338	1.05%	1.47%	2.34%
Jun	**10,918**	**5,810**	**8,700**	**1.59%**	**2.40%**	**2.77%**
Jul	9,921	4,360	5,664	1.45%	1.80%	1.80%
Aug	8,817	3,821	4,957	1.29%	1.58%	1.58%
Sep	8,031	3,306	5,013	1.17%	1.36%	1.60%
Oct	7,982	3,150	3,972	1.17%	1.30%	1.26%
Nov	7,732	2,753	2,031	1.13%	1.14%	0.65%
Dec	7,697	1,602	1,163	1.12%	0.66%	0.37%

1. Maximum storage is the maximum volume during the entire simulation period for the without Modified IOP scenario under Georgia EPD's 2000 water demands.

2.4.2 CONCERNS RELATED TO STORAGE REDUCTIONS DUE TO THE MODIFIED IOP

66. During normal and wetter periods, the reduction in storage due to the Modified IOP is likely to have a negligible to modest impact. This is suggested by an examination of the average seasonal variation due to the Modified IOP (Exhibits 2-10 and 2-11). The USACE has stated that "during droughts there are impacts on all project purposes, but the minimum water supply, water quality and environmental needs will likely be met even in future conditions."[59] However, stakeholders such as the Atlanta Regional Commission, and the State of Georgia have raised concerns over reduced reservoir storage during critically dry periods (especially sustained droughts), when water needed for municipal and industrial water supply could have been stored in the reservoirs, but will have been released under the Modified IOP for conservation of the freshwater mussels and their host fish. During such critical periods, the depletion in reservoir storage volumes caused by the Modified IOP could potentially have a greater impact. The basis of these concerns are the results of the simulations conducted by Georgia EPD, using its version of the HEC-5 model, and its estimates of year 2000 and 2030 water demand levels (Exhibits 2-6, 2-7, and 2-8).

[59] Written communication from Joanne U. Brandt, Biologist, Mobile District, U.S. Army Corps of Engineers, May 7, 2007.

67. As mentioned by Georgia EPD in its comments (and also acknowledged by the USACE), public water intake structures become exposed at lower reservoir levels.[60, 61] For example, at Lake Lanier, water supply intake pipes start getting exposed as lake elevations decline to below 1,063 feet. At elevations of 1,048 feet, intake structures of several local governments in Georgia (e.g., Gwinnett and Forsyth Counties, and cities of Buford, Cumming, and Gainesville) would be exposed, reducing their capacity to supply water to their consumers. The concern is that the Modified IOP increases the likelihood of these conditions. The decline of lake levels to near conservation storage levels has already been discussed above. These declines are forecast under historically observed drought conditions; if more severe droughts were to occur, reservoir levels would be lower, thus increasing the marginal impact of the Modified IOP. Georgia EPD's analysis also suggests that under the Modified IOP scenario, there will be an increase in the number of days during which desired flows for wastewater assimilation at Columbus, Georgia will not be met.[62] If the Modified IOP leads to the USACE not being able to store enough water to make releases to meet the desired flows at Columbus and downstream locations during dry periods, potential water quality concerns could arise.

68. In light of the analysis of the HEC-5 model simulation results, this analysis acknowledges that the Modified IOP will lead to economic impacts in the future. Ideally, the analysis should quantify the incremental economic burden on municipal and industrial water users due to the Modified IOP. However, this analysis does not currently have information that it can use to predict the magnitude of the economic impacts of the Modified IOP on municipal and industrial water supply. Therefore, the economic analysis of municipal and industrial water supply in Section 3 is limited to a qualitative discussion of how modifications made as part of the Modified IOP are likely to affect lake levels. The impact of declining lake levels, on water supply quantity and quality, during drought periods, is too uncertain to quantify.

69. Note that the Modified IOP is also likely to negatively impact the hydropower generation schedule and reduce releases during peak electricity demand times. The impact on hydropower production capacity is discussed qualitatively in Section 4. A quantitative analysis is not possible at this time because sufficiently precise information is not available to predict how conservation efforts for the endangered and threatened species and their habitat in the Apalachicola River will limit hydropower production capacity at peak production times. However, this analysis quantities impacts of the Modified IOP on recreation (see Section 3).

[60] Public comment letter, submitted by Carol Couch, Director, Environmental Protection Division, Georgia Department of Natural Resources, August 6, 2007.

[61] Public comment letter, submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District, U.S. Army Corps of Engineers, August 6, 2007.

[62] The states of Alabama, Georgia, Florida, and the USACE assume minimum flows of 1850 cfs weekly average, and 1350 cfs daily average at Columbus, Georgia for analysis of the various modes of operations of the federal reservoirs under USACE management.

2.5 POTENTIAL CHANGES IN WATER MANAGEMENT IN THE SANTA FE RIVER COMPLEX (UNIT 11)

70. The Santa Fe River is one of the three major tributaries of the Suwannee River system in Florida, and is located within the purview of the SRWMD. The Suwannee River system has been identified as one of the 42 "intact" drainages in the country, which means that it has more than 200 kilometers of stream reach unaffected by any major dams, flow diversions, or navigation projects. Moreover, the Santa Fe River is additionally designated as an Outstanding Florida Water (OFW). [63]

71. According to Chapter 373.042 of the Florida Statutes, to protect freshwater supply sources, the Governing Board of the SRWMD and the Florida Department of Environmental Protection is responsible for establishing:

- **Minimum flow level (MFL)—**for all surface watercourses in the area, this is the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area; and
- **Minimum water level**—the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area.

72. To meet these mandates, the Governing Board of the SRWMD is currently involved in establishing MFLs for several streams, springs, and lakes within its district. Based on hydrologic data availability and other geophysical and ecological considerations, the Santa Fe River has been divided into the Upper and Lower Santa Fe segments for purposes of MFL establishment.[64] However, identical procedures and considerations will be used to establish the MFLs for the two segments. The ecological considerations that are being used for establishing MFLs in the Santa Fe River specifically include the maintenance and protection of suitable habitat for freshwater mussels. Note that the critical habitat for Unit 11 overlaps with both the Upper and Lower Santa Fe rivers, and also includes the New River.

73. The recommended MFL to avoid significant ecological risk to the Upper Santa Fe River, at the Graham and Worthington USGS gages, is 2.3 cfs and 42 cfs, respectively. The MFLs identified for each gage on the Upper Santa Fe River represent the point at which an increase in the frequency of the seventy-fifth percentile flow (or above) represents significant ecological risk to the overall ecological health of the Upper Santa Fe River.[65] In other words the MFL represents the point below which flow has occurred for 25 percent of the time for the gage's period of record.

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[63] Suwannee River water Management District, Florida. Draft Technical Report, MFL Establishment for the Upper Santa Fe River, December 2006; pp. 1-3.

[64] The Upper Santa Fe River is defined as the portion of the stream from the headwaters to the stream gage at Worthington Springs. The Lower Santa Fe River is the stream reach between the River Rise within the River Rise State Preserve, and the confluence of the river with the Suwannee River.

[65] Suwannee River Water Management District, Florida. Draft Technical Report, MFL Establishment for the Upper Santa Fe River, December 2006; pp. 5-17.

74. In addition to establishing the MFL, the effects of flow reductions at each gage were also compared to understand the amount of water available for future use, with respect to the MFL. It was found that at flows in excess of MFL, a reduction of 15 percent in the baseline flow would still be protective of ecological conditions and human use. Below the MFL, the amount of flow reduction that can be allowed decreases to zero at a regular interval on the MFL flow duration curve (FDC). For example, the Baseline and MFL FDCs are compared for the Graham and Worthington Springs gages in Exhibits 2-12 and 2-13, respectively.[66]

EXHIBIT 2-12 COMPARISON OF PROPOSED BASELINE AND MFL FLOW DISTRIBUTION CURVES FOR THE UPPER SANTA FE RIVER AT GRAHAM

FLOW DURATION CURVE	PROBABILITY OF OCCURRENCE AND CORRESPONDING (MAXIMUM) DISCHARGE LEVELS (CFS)						
	5%	10%	25%	50% (MEDIAN)	75% (MFL)	90%	95%
Baseline	201.0	128.0	52.0	15.0	2.3	0.4	0.2
MFL	170.9	108.8	44.2	12.8	2.0	0.4	0.2
Difference	30.0	19.2	7.8	2.2	0.3	0.0	0.0

EXHIBIT 2-13 COMPARISON OF PROPOSED BASELINE AND MFL FLOW DISTRIBUTION CURVES FOR THE UPPER SANTA FE RIVER AT WORTHINGTON SPRINGS

FLOW DURATION CURVE	PROBABILITY OF OCCURRENCE AND CORRESPONDING (MAXIMUM) DISCHARGE LEVELS (CFS)						
	5%	10%	25%	50% (MEDIAN)	75% (MFL)	90%	95%
Baseline	1780.0	1100.0	432.0	131.0	42.0	15.0	8.5
MFL	1513.0	935.0	367.0	111.4	35.7	14.1	14.1
Difference	267.0	165.0	64.8	19.6	6.3	0.9	0.2

75. Thus, in the future for the Upper Santa Fe (and according to the current plan for the Lower Santa Fe as well) minimum flow levels will be used to regulate water withdrawals from Unit 11. For the Upper Santa Fe, for flows in excess of MFL, water withdrawals will be allowed until flows are reduced to 15 percent of the Baseline FDC. Below the MFL, the amount of water that can be withdrawn will reduce to zero as flows continue to

[66] Suwannee River Water Management District, Florida. Draft Technical Report, MFL Establishment for the Upper Santa Fe River, December 2006; pp. 5-18, 5-19.

decline below the MFL. Note that the SRWMD Governing Board is expected to establish MFLs for the Lower Santa Fe River by 2008.

76. The impact of water withdrawal restrictions for both the Upper and Lower Santa Fe will most likely to be borne by the irrigated agriculture and municipal and industrial water users. However, the relationships between current water use levels, potential increases in future water use demands, and the impact of the use of MFLs to restrict flows have not been studied. Moreover, according to the SRWMD, when and if MFL related restrictions are implemented in the future, almost all users would be able to avail themselves of alternative water supply from groundwater aquifers. Based on this best available information, this analysis is unable to quantify any costs associated with the adoption of the MFLs for the Santa Fe River complex. However, Section 3 qualitatively discusses the likely economic impacts of the MFLs.

SECTION 3 | POTENTIAL ECONOMIC IMPACTS RELATED TO CHANGES IN WATER USE AND MANAGEMENT

77. This section estimates the potential opportunity costs of changes in water management and use associated with conservation efforts for the seven mussels.[67] Changes in water use are mainly expected to occur within the ACF Basin. Conservation efforts for the seven mussels may also result in changes in water use in the Santa Fe and New Rivers.

78. As described in Section 2, the ACF Basin is a complex hydrological system. Multiple management structures and numerous withdrawals currently exist on the Flint and Chattahoochee Rivers, which converge at Jim Woodruff Dam to form the Apalachicola River. The Chattahoochee River is managed through a series of dams and hydroelectric plants that provide water for hydropower production, flood control, municipal uses, recreation, and other uses. Water in the Flint River Basin is used primarily for agricultural irrigation, which makes up as much as 90 percent of total use.[68] Freshwater flowing out of Jim Woodruff Dam supports recreational and commercial fisheries in Apalachicola Bay.

79. Competition for water and conflicts among water users in the ACF system exists independent of the seven mussels and will likely continue to occur absent seven mussels conservation efforts. Water demands in the summer and fall periodically exceed the supply of water in the ACF Basin; as the demands increase and the supply remains constant, these shortages are likely to become more frequent and more severe.[69] In the Chattahoochee basin, the USACE manages a complex system, considering both competing demands and past and future hydrologic conditions in order to optimize the use of stored water.[70] Debates continue regarding the appropriate allocation of Chattahoochee water; negotiations over this allocation have been ongoing between Alabama, Florida, and Georgia for over 15 years.

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[67] *Opportunity cost* in this context refers to the costs of decreasing water deliveries to these activities. Decreases in the provision of water can have real costs, including: reductions in agricultural production (and therefore profits) from lower crop yields or lost economic welfare resulting from fewer recreational trips to reservoirs due to reduced water levels.

[68] Approximately 160,000 acres are irrigated from surface water and an additional 403,000 acres are irrigated using groundwater from the hydrologically connected Floridian aquifer. Georgia Environmental Protection Division 2006. Flint River Basin Regional Water Development And Conservation Plan, March 20; pp.15.

[69] U.S. Army Corps of Engineers. 1998. Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin: Alabama, Florida, and Georgia. Draft Environmental Impact Statement, September.

[70] The U.S. Army Corps of Engineers is responsible for management of four Federal reservoir projects within the Chattahoochee basin. There are other opportunities for conservation management within the basin that are outside the Federal Reservoir areas, but beyond the authority of the USACE.

80. Meeting flows for seven mussels conservation may place additional demands on a system that is already constrained. To estimate the potential economic impacts that may result from meeting conservation efforts requires an understanding of the timing and magnitude of these flows. As discussed in Section 2, for stream reaches proposed for critical habitat designation, no estimate of required minimum flow for seven mussels conservation has been developed by the Service or any other entity.[71] In the absence of such guidance, this analysis establishes flows for the conservation of the seven mussels on a site-specific basis, as described in Section 2.

81. Based on increased flows needed for the conservation of seven mussels in the above units, several changes in water use and management may occur. During dry periods, reallocation of water from either flood control (i.e., loss of storage capacity in regional reservoirs) or hydropower uses in the Chattahoochee River has been studied as an alternative to supply municipal and industrial needs.[72] In the Flint River Basin, water availability to irrigated agriculture – the primary water use in the basin – may be reduced in dry years. Municipal water demands in the Chattahoochee Basin are expected to increase in the future; however, the USACE has stated that during sustained drought "some project purposes, such as navigation and hydropower, may be adversely impacted as we manage for drought; however, the public health and safety, water supply, and environmental demands, including releases for water quality, and fish and wildlife resources are still met."[73] The USACE provided further clarification that "during droughts there are impacts on all project purposes, but the minimum water supply, water quality and environmental needs will likely be met even in future conditions."[74] However, it is not appropriate to state that reductions in hydropower "can fully offset future public health and safety, water supply and seven mussels needs during periods of sustained drought."[75] Accordingly, this analysis assumes that during sustained drought, all needs may not be met.

82. Although there may be impacts to municipal and industrial water uses associated with seven mussels conservation in areas proposed for critical habitat designation, quantification and monetization of these impacts is not possible absent additional

[71] Minimum flows and levels for aquatic habitat protection have been developed for the Santa Fe River complex.

[72] Although the U.S. Army Corps of Engineers has never historically reallocated water from flood control storage during dry periods (according to public comments submitted by he submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, U.S. Army Corps of Engineers, Mobile District, August 6, 2007), Congressional reallocation of reservoir management priorities may occur in future years as municipal and industrial water demands increase in the ACF basin. The potential benefits of such a reallocation were investigated in a 2004 study by the Atlanta Regional Commission (McMahon, et al. 2004. Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower, and Recreation Benefits. Prepared for the Atlanta Regional Commission. February).

[73] Peter F. Taylor, Jr. Colonel, Mobile District Commander, U.S. Army Corps of Engineers, Letter to Environmental Protection Division, Georgia Department of Natural Resources, April 30, 2007. The letter can be found in Appendix F.

[74] Written communication from Joanne U. Brandt, Biologist, Mobile District, U.S. Army Corps of Engineers, May 7, 2007.

[75] Ibid.

information.[76] To quantify municipal impacts in the Chattahoochee River Basin, the following additional information would be needed:

- **Increased risk of drought.** Restrictions are placed on municipal water use in the Chattahoochee River Basin when droughts are called in Georgia. These droughts are declared, in part, based on regional reservoir elevations. No hydrological models capable of establishing how marginal changes in these reservoir levels (i.e., associated with the Modified IOP) increase the risk that droughts will be declared are currently available.[77]
- **How drought restrictions will affect users.** Information on the quantity of water lost from each type of use (e.g., horticulture, industrial processes, lawn watering) within Chattahoochee River Basin municipalities due to drought restrictions and quantification of the effect of timing restrictions on water availability is currently unavailable.[78]
- **The marginal cost of increased drought conditions.** The economic impacts to each use associated with these drought restrictions (e.g., the per gallon value associated with lawn watering) are currently unavailable.

83. Similarly, if municipal and agricultural permit applications increase in the Santa Fe and New River Basins, permits may be altered or denied partly due to seven mussels conservation efforts. No information is publicly available on any increase in applications over the time period of this analysis, making estimation of municipal and agricultural impacts attributable to seven mussels conservation efforts infeasible.

84. This analysis relies on the best available information to estimate potential economic impacts of seven mussels conservation by considering the economic impact of an assumed change in water use and management. In doing so, the analysis makes several simplifying assumptions regarding the economic impacts of seven mussels conservation efforts. Specifically, the analysis:

[76] Stakeholders in the ACF basin are concerned that critical habitat designation will impact municipal and industrial water uses, and that data is currently available to estimate these impacts. Public comments conveying these concerns were submitted by: the Atlanta Regional Commission (written by Patricia Barmeyer of King & Spalding LLC) on August 6, 2007 and the City of LaGrange, Georgia (written by J. Maltese, Assistant to the City Manager) on August 2, 2007. Based on follow-up with these stakeholders, it was determined that additional data necessary to estimate municipal and industrial impacts was not available.

[77] Ideally, such models would address potential changes in water management and use, including current and future demands for municipal and industrial, agricultural, and hydropower water uses, as well as the relationship between changes in reservoir storage and recreational use. Although Georgia EPD has assessed how future water demands in the Chattahoochee River Basin may affect water levels in Chattahoochee reservoirs (source: public comments, submitted by Carol Couch, Director, Environmental Protection Division, Georgia Department of Natural Resources, August 6, 2007), no information on the relationship between lower lake levels and drought frequency in the basin is currently available.

[78] The Atlanta Regional Commission has expressed concerns that certain industries in Atlanta, such as horticulture, may be particularly sensitive to increases in drought frequency or severity (based on personal communication with Pat Stevens, Chief of the Metropolitan North Georgia Water Planning District, August 28, 2007).

- Uses well-documented approaches to develop values for water use in agriculture and recreation based on available information.[79,80]
- Applies these values to the estimated water uses to conserve the seven mussels, to provide an estimate of the economic impacts associated with potential changes in agricultural and recreational water use between 2007 and 2026.
- Estimates the regional economic impact of modeled changes in water use in the agriculture and recreation sectors.

Exhibit 3-1 provides background information on Apalachicola Bay, and potential benefits associated with seven mussels conservation efforts.

[79] Capturing the economic value of water can be challenging due to its unpredictable seasonal supply, status as a public good, its long history of being under priced and overused, and a host of other legal, institutional, and physical factors; however, research in recent decades has addressed these challenges and has valued water in a variety of settings.

[80] If the Modified IOP was revised in future years to allow reductions in agricultural diversions in the Flint River Basin to partly offset the need for conservation flows in the Chattahoochee River Basin, this analysis may overestimate impacts. Absent knowledge of how the Modified IOP may change, this analysis treats agricultural and recreational impacts independently.

EXHIBIT 3-1 POTENTIAL BENEFITS OF SEVEN MUSSELS CONSERVATION EFFORTS

Introduction

Ancillary benefits of conservation efforts for the seven mussels may be associated with increased freshwater flows into Apalachicola Bay (see Section 2, and the Modified IOP for detail on conditions, timing and duration related to increased flows in Apalachicola River). Additional freshwater flows, managed for the seven mussels from the Apalachicola River, may enhance or support economic activity related to recreational fishing and the commercial fisheries industry in the region. Whether or to what degree the economy of the Apalachicola Bay may be influenced by upstream water management related to seven mussels conservation is unknown.

It is known that Apalachicola Bay is an important ecosystem, and that commercial and recreational harvests of fish and shellfish are important to the region's economy. Due to unique ecological characteristics, and productive fisheries, Apalachicola Bay holds the following designations by the State of Florida: Aquatic Preserve, Outstanding Florida Waters, and Class II Shellfish Harvesting Waters. In addition, it is a National Estuarine Research Reserve and the area is designated as a Biosphere Reserve by the United Nations UNESCO.[1] There is concern that changing management of the ACF system will negatively impact the cultural and ecological value of Apalachicola Bay.[2]

This analysis did not identify any applicable studies that estimate the economic value of Apalachicola Bay, though the Bay is well-known for its productive fisheries.[3] This section qualitatively discusses the fisheries industry in Apalachicola Bay.

Fisheries

Apalachicola Bay supports both commercial and recreational fisheries. It is commonly cited as producing 90 percent of Florida's average oyster harvest, and 10 percent of the United States' oyster harvest.[4] The Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute maintains data on commercial fisheries landings by county. Franklin County borders the majority of Apalachicola Bay, and Gulf County borders the westernmost tip. Landings data for the two counties are presented below.[5] Franklin's total landings have ranged from five to eight million pounds. Seafood landings from Apalachicola Bay are worth $14 to $16 million dockside annually. At the consumer level, this represents a $70 to $80 million industry.[6]

While it is believed that freshwater flow is important to this fishery, no models are available that relate changes in freshwater flows to harvest levels. That is, it is not clear how enhanced flows resulting from management for the seven mussels would benefit this fishery.

FRANKLIN AND GULF COUNTY COMMERCIAL FISHERIES LANDINGS (POUNDS)[7]

YEAR	FRANKLIN		GULF	
	TOTAL	OYSTER	TOTAL	OYSTER
2000	6,010,662	2,327,402	4,519,352	3,262
2001	6,363,665	2,333,968	7,569,468	1,634
2002	5,856,441	1,725,776	7,593,567	1,943
2003	5,224,172	1,449,890	8,191,347	604
2004	8,408,432	9,012,698	1,516,573	315
2005	5,199,293	1,270,443	5,517,016	1,739

Notes:

(1) Apalachicola NERR Information Page. http://www.dep.state.fl.us/coastal/sites/apalachicola/info.htm Accessed February 4, 2007.

(2) Personal Communication with David McLain, Franklin County Oyster and Seafood Task Force. December 15, 2006.

(3) For information on Florida's coastal economy, see Kildow. 2006. Florida's Ocean and Coastal Economies Report. National Ocean Economic Programs.

(4) Florida Department of Environmental Protection, Apalachicola Aquatic Preserve. http://www.dep.state.fl.us/COASTAL/sites/apalachicola-ap/ Accessed October 17, 2006.

(5) Florida Fish and Wildlife Conservation Commission, Marine Fisheries Information System. 2000-2005 Annual Landings Summaries, by County. Edited Landings Data Batch 900 through Batch 926. Accessible at: http://www.floridamarine.org/features/view_article.asp?id=19224

(6) Apalachicola National Estuarine Research Reserve. http://www.dep.state.fl.us/COASTAL/sites/apalachicola/ Accessed October 17, 2006.

(7) Florida Fish and Wildlife Conservation Commission, Marine Fisheries Information System.

3.1 SUMMARY

3.1.1 PRE-DESIGNATION COSTS

85. To date, limited costs have been incurred associated with potential water needs for the seven mussels. A modest reduction in water available in the Chattahoochee Reservoir system under the Modified IOP may be realized from the time it was established in February 2007 to the publication of the Final Rule designating critical habitat for the seven mussels (anticipated October 2007).

3.1.2 POST-DESIGNATION COSTS

86. Total present value forecast post-designation impacts to water users (discounted at three percent) associated with seven mussels conservation efforts are estimated to be between $49.5 million and $87.6 million. Exhibit 3-2 reports the post-designation impacts to agricultural and recreational activities, by unit. These impact estimates reflect the economic value of water diverted from agriculture and made unavailable to recreationists associated with seven mussels conservation.[81,82]

87. In addition to the efficiency losses shown in Exhibit 3-2, this analysis also considers the regional economic impacts potentially associated with changes in water use and management. Changes in irrigation water use in the Lower Flint Basins may potentially

[81] This analysis makes no assumptions about how reductions in agricultural water will occur, or who will bear these costs.

[82] Note that impacts in the Lower Flint River Basin (all of which are agricultural) are modeled to occur during only one of the 20-years in the period of analysis. Because the probability of these occurrences during the 20-year period is unknown, discounted values presented in Exhibit 3-2 assume that the impacts are spread evenly over the period (that is, there is an even probability of impacts occurring in any one year).

reduce revenues in the agricultural sector by $26.8 million and $39.0 million during a single year in the 20-year period of analysis, which translates to an annualized range of between $1.34 million and $1.95 million. Total changes in irrigation water use in the Upper and Lower Flint Basins may potentially reduce revenues by between $1.46 million and $2.25 million annually. This could in turn generate a regional economic impact of up to $77.2 million and result in the loss of up to 740 jobs during the single year of drought restrictions in the Lower Flint Basin, and regional impacts up to $630,000 and a loss of 10 jobs during the remaining 19 years.[83] Changes in water levels at Lake Lanier, West Point, and W.F. George Reservoirs would be expected to impact recreationists, resulting in a reduction in trips taken to these lakes, and thus a loss in expenditures by recreationists of between $14.2 million and $21.0 million per year.[84] This change in expenditures could in turn generate $22.7 million in regional economic impacts; in addition, approximately 304 jobs could be lost if this change in expenditures occurs.[85]

EXHIBIT 3-2 POTENTIAL POST-DESIGNATION ECONOMIC IMPACTS ON AGRICULTURAL AND RECREATIONAL ACTIVITIES (2007 TO 2026)

CRITICAL HABIAT UNIT, STREAM NAME	UNDISCOUNTED		PRESENT VALUE				ANNUALIZED			
			3%		7%		3%		7%	
	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
5 - Upper Flint River	$2,380,000	$6,040,000	$1,770,000	$4,490,000	$1,260,000	$3,200,000	$119,000	$302,000	$119,000	$302,000
7 - Lower Flint River	$26,800,000	$39,000,000	$20,000,000	$29,000,000	$14,200,000	$20,700,000	$1,340,000	$1,950,000	$1,340,000	$1,950,000
8 - Apalachicola River	$37,800,000	$73,900,000	$27,700,000	$54,100,000	$19,300,000	$37,800,000	$1,860,000	$3,640,000	$1,830,000	$3,560,000
Total	$67,000,000	$119,000,000	$49,500,000	$87,600,000	$34,800,000	$61,700,000	$3,320,000	$5,890,000	$3,290,000	$5,810,000

Note: Totals may not sum due to rounding. Impacts related to hydropower operations are discussed in Section 4.
Source: IEc Analysis

3.2 POTENTIAL ECONOMIC IMPACTS RELATED TO AGRICULTURAL WATER USES

88. This analysis considers a scenario in which reductions in agricultural groundwater withdrawals and surface water diversions associated with seven mussels conservation efforts may be necessary. As noted above, the analysis makes no assumptions regarding how such reductions would be accomplished (e.g., administrative procedures to accomplish this reduction, and whether or how any compensation would accompany the reduction), but simply considers the potential economic impact of changes in water use in the agricultural sector. Specifically, this analysis considers a scenario in which reduced

[83] Based on an IMPLAN analysis described below.

[84] Public comments submitted by J. Maltese, Assistant to the City Manager, City of LaGrange, Georgia, on August 2, 2007, indicate that property values may decline in areas surrounding the affected lakes. Although these lower lake levels may affect property values, insufficient information is available to reliably estimate these impacts.

[85] Based on an IMPLAN analysis described below.

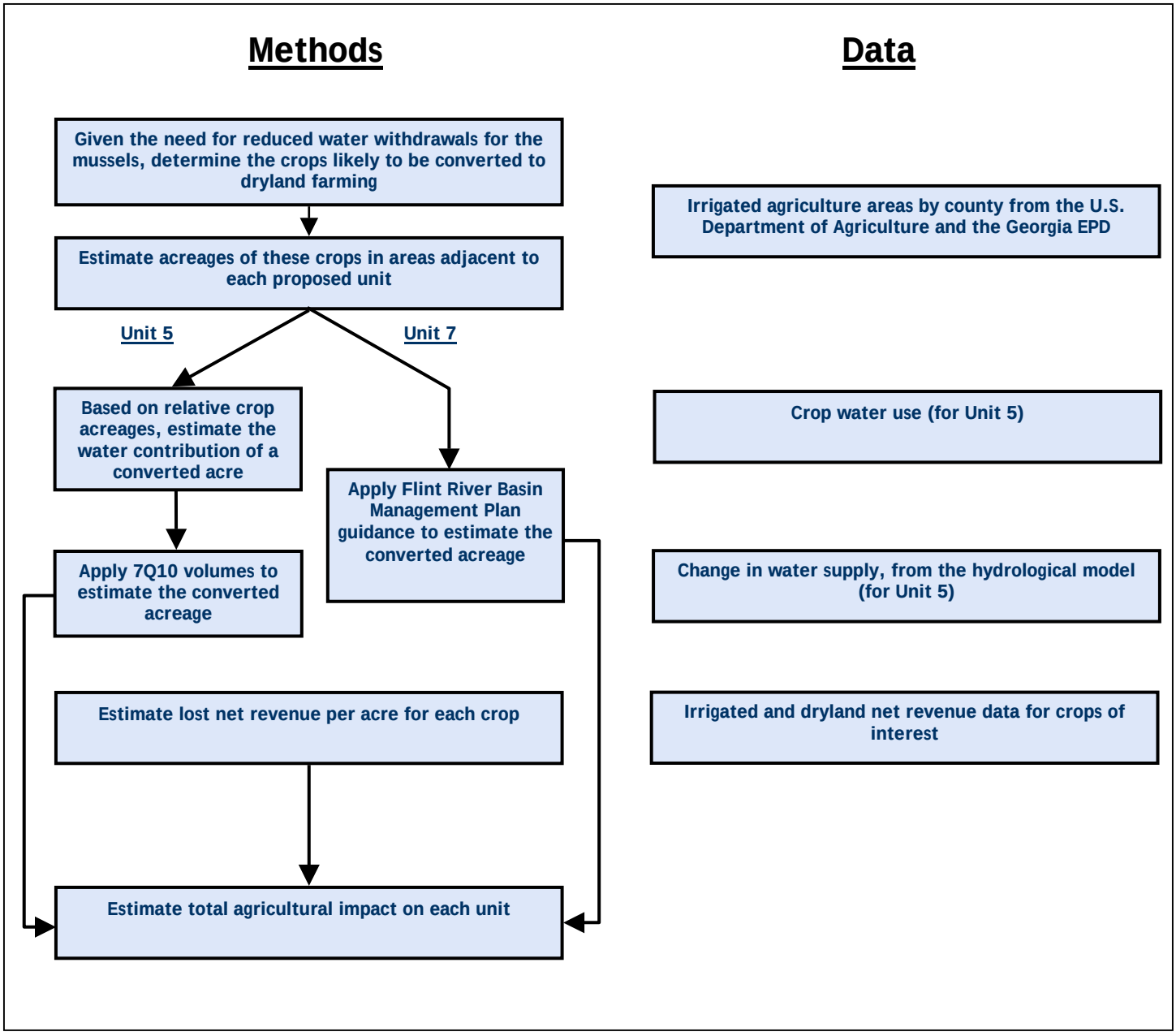
irrigation water deliveries provide water for seven mussels conservation efforts in Units 5 and 7 (Upper and Lower Flint Rivers).[86] It accomplishes this by modeling a scenario in which irrigation water use is curtailed through conversion of some acres to dryland farming.[87]

89. Dryland farming involves growing crops without supplemental water, at a reduced yield. On a given acre, both the potential reduction in water use for irrigation and the resultant economic impact depend on the crop type. Exhibit 3-3 provides an overview of the steps and data used in the agricultural analysis. The remainder of this subsection describes the valuation approach and results.

[86] In previous versions of this report, the analysis assumed that reductions in municipal withdrawals would be needed to provide for flows for conservation of the seven mussels in the Upper Flint (Unit 5) due to insufficient irrigated agricultural acreage in the upper portion of the basin. This analysis estimates that sufficient acreage (i.e., sufficient opportunity for changes in agricultural water use) is available to meet the lower flow needs of Georgia's 7Q10 guidance based on county irrigated acreage data from the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS). 2002 Census of Agriculture. Available at: http://www.nass.usda.gov/. Additionally, previous versions of this report estimated costs associated with irrigation curtailment in the Middle Flint River (Unit 6) to meet conservation flows for the seven mussels. As discussed in Section 2, 7Q10 flows could not be estimated based on available hydrological data. If flows for seven mussels conservation were established for Unit 6, this analysis would estimate associated economic impacts.

[87] In a drought year, it is likely that irrigators would be notified of these reductions in water deliveries after they have already made considerable pre-irrigation season agricultural investments (e.g., seeding) in their properties. Under these conditions, landowners would be limited in their adaptive ability (based on personal communication with Mark Masters, Director of Projects, Flint River Water Planning and Policy Center, on August 29, 2007).

EXHIBIT 3-3 STEPS FOR FORECASTING POTENTIAL ECONOMIC IMPACTS ON AGRICULTURE ASSOCIATED WITH CONSERVATION EFFORTS FOR THE SEVEN MUSSELS (UNITS 5 & 7)



3.2.1 APPROACH

90. This analysis forecasts potential impacts to agriculture associated with conservation efforts for the seven mussels based on the modeled differences in net revenues between irrigated and dryland acres. Data on water use, gross revenues, and costs for irrigated and dryland acres are used to estimate these differences. Dryland farming is assumed to take place under one of two scenarios that establish the low and high cost estimates modeled in this analysis:

(1) Under the low impact scenario, conversion of acres to dryland farming first occurs in areas where it has the smallest economic impact (i.e., on acres of crops that have the smallest difference between irrigated and dryland net revenues during dry years). [88,89]

(2) Under the high impact scenario, conversion to dryland farming occurs according to the crop acreage mix in areas adjacent to each proposed unit.

The following paragraphs outline this approach.

- **Determine crops likely to be converted to dryland in each county:** Available crop data indicates that peanuts, cotton, and corn make up the majority of agricultural production in most of the counties adjacent to Units 5 and 7.[90] Accordingly, this analysis considers these three crops in forecasting potential economic impacts and water returns from reductions in irrigation.[91] County acres and relative areal percentages for peanuts, corn, cotton, and an aggregated "other crops" category are provided in Appendix D.[92]
- **Estimate crop percentage in areas adjacent to each proposed unit:** This analysis extrapolates crop shares from the county to the unit level. Exhibit 3-4

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[88] Net revenues are gross revenues (crop price per unit times number of units) less costs (labor and capital).

[89] This scenario may require some form of water auction or market to be in place. Cummings, et al. (2004) describe a reverse water auction implemented in the Flint River basin by EPD in 2001 to meet environmental water demands: Cummings, R.G., C.A. Holt, S.K. Laury. 2004. Using Laboratory Experiments for Policymaking: An Example from the Georgia Irrigation Reduction Auction. *Journal of Policy Analysis and Management*. 22: 2. 341-363. In this auction, irrigators posted their proposed water permit sales prices, from which EPD selected the least expensive set of permits to meet their water needs. The average purchase price was $135.70 per acre. A variety of other water value studies are reviewed in Appendix E.

[90] As described in Section 2, metropolitan Atlanta extends into the northernmost regions of the Upper Flint basin; these regions therefore contain relatively little agriculture. Although water needed for seven mussels conservation efforts in these regions is likely to be minimal due to the lower baseline flow in the upper reaches of the basin (and therefore lower 7Q10 requirement), the source of this water is uncertain.

[91] Although several of the northernmost counties in the Upper Flint basin (Unit 7) are made up primarily of orchards and other high value crops, enough acres are currently dedicated to cotton and corn in those counties to provide, given potential changes in water use, flows for the conservation of the seven mussels. This analysis assumes that these lower value crops will be converted to dryland first (i.e., before the conversion of these higher value crops to dry land agriculture), even if only small acreages are present.

[92] Obtained from the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS). 2002 Census of Agriculture. Available at: http://www.nass.usda.gov/. Total estimated percentages of peanuts, cotton, and corn in all Upper and Lower Flint counties are 29 percent, 53 percent, and 18 percent, respectively. These are very similar to data collected by Couch, C.A. and R.J. McDowell. 2006. Flint River Basin Regional Water Development and Conservation Plan. Georgia Department of Natural Resources Environmental Protection Division. March 20.

shows those counties in which a proposed unit is present, as well as the total acreage and share of peanuts, cotton, and corn in these areas. Total acreages adjacent to the Upper Flint are calculated by summing the acres of the three crops in each county listed in Exhibit 3-4, whereas acreages adjacent to the Lower Flint were provided by the Service based on information in EPD's Flint River Basin Regional Water Development and Conservation Plan.[93]

EXHIBIT 3-4 SHARE OF CORN, COTTON, AND PEANUTS IN AREAS ADJACENT TO EACH CRITICAL HABITAT UNIT

CRITICAL HABITAT UNIT, STREAM NAME	POTENTIALLY AFFECTED COUNTIES	CROP ACREAGES BASED ON BASIN AND USDA IRRIGATED ACREAGES (PERCENT OF TOTAL)		
		PEANUTS	COTTON	CORN
5. Upper Flint	Crawford; Dooly; Macon; Peach; Pike; Spalding; Sumter; Talbot; Taylor; Upson	10,600 (20.0%)	33,500 (63.0%)	9,050 (17.0%)
7. Lower Flint: Ichawaynochaway	Baker	21,000 (39.6%)	20,000 (37.7%)	12,100 (22.7%)
7. Lower Flint: Spring Creek	Miller; Decatur; Seminole	53,400 (33.2%)	81,500 (50.6%)	26,200 (16.3%)
7. Lower Flint: Mainstem	Dougherty; Baker; Mitchell; Decatur; Miller	77,600 (33.0%)	117,000 (49.9%)	40,100 (17.1%)

Source: Obtained from the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS). 2002 Census of Agriculture. Available at: http://www.nass.usda.gov/.

- **Estimate annual acreage of dryland conversion in Unit 5:** As described in Section 2, roughly 207 million gallons of water per year may be needed to meet conservation needs of the seven mussels under Georgia's 7Q10 flow guidance.[94] Assuming this water would come from the conversion of irrigated agriculture to dryland farming, this analysis undertakes the following analytic steps:
  - Estimate the water contribution of a representative acre under the two scenarios: The University of Georgia College of Agricultural and Environmental Sciences provides data on water use by irrigated- and dryland-farmed acres for various crops during a dry water year.[95] The

[93] Georgia Environmental Protection Division 2006. Flint River Basin Regional Water Development And Conservation Plan, March 20; pp.15.

[94] Note that this annual volume is an average estimate: volumes needed to meet conservation needs of the seven mussels are likely to vary considerably on an annual basis during future years (as described in Section 2). As such, impacts during any single year are likely to vary as well.

[95] University of Georgia, College of Agricultural and Environmental Sciences. Agricultural Water: Potential Use and Management Plan in Georgia: Ag Water Pumping. Accessed on November 2, 2006 at http://www.nespal.org/awp/. These data were collected from observations of on-farm applications during dry years. This analysis assumes that these data represent consumptive use rather than diversions, such that unused water would directly contribute to the stream.

difference between these values represents the volume of water made available by converting an individual acre from irrigated to dryland agriculture. The estimated volumes are 0.294 million gallons, 0.304 million gallons, and 0.437 million gallons per acre of peanuts, cotton, and corn, respectively. Under the least cost scenario in Unit 5, reductions in irrigation are assumed to occur on corn acres only (because dryland farming has the lowest per acre impact), such that each acre converted from irrigated- to dryland-farming contributes 0.437 million gallons towards instream flow. In the crop mix scenario, a representative converted acre is assumed to be made up of 20 percent peanuts, 63 percent cotton, and 17 percent corn, providing an estimated 0.325 million gallons of water for instream flow.

- Apply the 7Q10 volumes to estimate converted acres: Next, crop acreages are estimated for the least cost and crop mix scenarios by dividing Upper Flint water needs (207 million gallons) by the above per-acre water usage estimates. Peanut, cotton, and corn acreages for each scenario are presented in Exhibit 3-5, along with the percentages of total regional area for each respective crop that these areas represent.

EXHIBIT 3-5 POTENTIAL ANNUAL REDUCTION IN IRRIGATED ACREAGE IN THE UPPER FLINT BASIN, UNIT 5

SCENARIO	CROP ACREAGE (PERCENT OF TOTAL IN REGION)		
	PEANUTS	COTTON	CORN
Least Cost	0	0	474
	(0%)	(0%)	(5.24%)
Crop Mix	128	402	109
	(1.20%)	(1.20%)	(1.20%)
Source: IEc Analysis			

- **Estimate annual acreage of dryland conversion in Unit 7:** In the Lower Flint Basin, seven mussels conservation efforts could involve curtailing irrigation on a specified fraction of acreage in sensitive stream reaches rather than taking actions to reduce agricultural irrigation to meet an estimated in stream flow. Based on available guidance (discussed in Section 2), a scenario is modeled in which 20 percent of agriculture adjacent to these sensitive stream reaches is impacted once every 20 years.[96] Given that the total acreage in the Lower Flint is roughly 449,000

[96] Based on written communication with David Stooksbury, Georgia State Climatologist, on July 9, 2007 [through Todd Rasmussen, Professor of Hydrology and Water Resources, University of Georgia, Athens]. Note that in 2000, Georgia EPD established new hydrological criteria for declaring droughts. According to Georgia EPD, if the new criteria are used to evaluate historical conditions, the estimated drought frequency is likely to increase (source: Personal communication, Wei Zeng, Georgia Environmental and Protection Division, August 30, 2007). However, as no study has forecasted drought frequency for future years, this analysis uses the pre-2000 estimate provided by the Georgia State Climatologist. If updated

acres, this implies that irrigation is curtailed on approximately 90,000 acres once every 20 years.[97,98] Exhibit 3-6 provides the distribution (and percentages by stream reach) of these 90,000 acres given the least cost and crop mix scenarios.

EXHIBIT 3-6 POTENTIAL ONE IN 20-YEAR REDUCTION IN IRRIGATED ACREAGE IN THE LOWER FLINT BASIN, UNIT 7

LOWER FLINT STREAM REACH	SCENARIO (ACRES AND PERCENT OF TOTAL)					
	LEAST COST			CROP MIX		
	PEANUTS	COTTON	CORN	PEANUTS	COTTON	CORN
Ichawaynochaway	0 (0%)	0 (0%)	10,600 (87.6%)	4,200 (20.0%)	3,990 (20.0%)	2,410 (19.9%)
Spring Creek	6,000 (11%)	0 (0.00%)	26,200 (100%)	10,700 (20.0%)	16,300 (20.0%)	5,250 (20.0%)
Mainstem	6,880 (9%)	0 (0.00%)	40,100 (100%)	15,500 (20.0%)	23,400 (20.0%)	8,020 (20.0%)
Total	**12,880 (8%)**	**0 (0.00%)**	**76,900 (98.1%)**	**30,400 (20.0%)**	**43,700 (20.0%)**	**15,700 (20.0%)**

Source: IEc Analysis
Note: Totals may not sum due to rounding.

- **Gather data on the estimated economic impact of conversion to dryland farming:** Per acre economic impacts of conversion to dryland farming are measurable in terms of lost net revenues. Dryland farming simultaneously reduces gross revenues (from lost yield) and variable input costs (labor, irrigation system operating costs, etc.). The Flint River Water Planning and Policy Center provides data on net revenues for irrigated and dryland farming of peanuts, cotton, and corn. Based on these data, this analysis estimates the per acre value of water applied to these crops at $315, $584, and $251 (see Exhibit 3-7).[99]

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frequencies were made available, forecasted impacts in the Lower Flint Basin would increase (i.e., if drought frequency increased from one in 20 years to one in 10 years, impacts would increase roughly by a factor of two).

[97] These acreages are not unreasonable; during the 2001 irrigation reduction auction in the Flint River Basin, farmers received payments to reduce irrigation on 33,006 acres of cropland: Cummings, R.G., C.A. Holt, S.K. Laury. 2004. Using Laboratory Experiments for Policymaking: An Example from the Georgia Irrigation Reduction Auction. Journal of Policy Analysis and Management. 22: 2. 341-363.

[98] Since the future occurrence of this event is unknown, this analysis assumes that the event has an equal probability of occurring each year during the period of analysis (i.e., a five percent chance of a 20 percent reduction in irrigation each year). By this logic, the analysis assumes that irrigated acreage each year is reduced by five percent of 20,000 acres, or approximately 1,000 acres annually.

[99] Crop prices and total production costs are taken from Lamb, M.C. et al. 2007. Economic Returns of Irrigated and Non-Irrigated Peanut Based Cropping Systems. *Peanut Science*. 34. P. 10-16. Irrigated and dryland crop yields are an average of 2002 and 2006 data, which were the driest years during the study period (yield data for these years were provided through written communications with Mark Masters, Director of Projects, Flint River Water Planning and Policy Center, on August 29, 2007). Note that corn is unprofitable whether it is dryland farmed or irrigated and cotton is highly unprofitable under

EXHIBIT 3-7 LOST NET REVENUES PER ACRE FROM CONVERTING TO DRYLAND FARMING

CROP	NET REVENUES		VALUE OF IRRIGATION WATER (PER ACRE)
	IRRIGATED	DRYLAND	
Peanuts	$667.00	$352.00	$315.00
Cotton	$243.00	-$341.00	$584.00
Corn	-$7.74	-$259.00	$251.00

Sources: (1) Lamb, M.C. et al. 2007. Economic Returns of Irrigated and Non-Irrigated Peanut Based Cropping Systems. *Peanut Science*. 34. P. 10-16; and (2) written communications with Mark Masters, Director of Projects, Flint River Water Planning and Policy Center, on August 29, 2007.

3.2.2 RESULTS

91. Exhibit 3-8 presents potential impacts on the agricultural sector associated with seven mussels conservation efforts in each affected unit between 2007 and 2026. These values are calculated by multiplying the lost net revenues per acre (given by Exhibit 3-7 above) by the irrigation reductions necessary to meet the applicable guidelines for each proposed unit (expressed in acres). Total costs are estimated to be between $21.7 million and $33.5 million, and annualized impacts may be between $1.46 million and $2.25 million (discounted at three percent).

EXHIBIT 3-8 SUMMARY OF POTENTIAL FUTURE COSTS TO AGRICULTURE (2007-2026)

CRITICAL HABITAT UNIT, STREAM NAME	TOTAL UNDISCOUNTED DOLLARS		PRESENT VALUE			
			3%		7%	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
5. Upper Flint	$2,380,000	$6,040,000	$1,770,000	$4,490,000	$1,260,000	$3,200,000
7. Lower Flint	$26,800,000	$39,000,000	$20,000,000	$29,000,000	$14,200,000	$20,700,000
Total	$29,200,000	$45,100,000	$21,700,000	$33,500,000	$15,500,000	$23,900,000
Total Annualized 3 percent					$1,460,000	$2,250,000
Total Annualized 7 percent					$1,460,000	$2,250,000

Source: IEc Analysis
Note: Totals may not sum due to rounding.

3.3 POTENTIAL ECONOMIC IMPACTS RELATED TO RECREATIONAL WATER USES

92. This analysis forecasts the potential opportunity costs associated with a scenario in which lost recreational opportunities result from the need to provide flows for seven mussels

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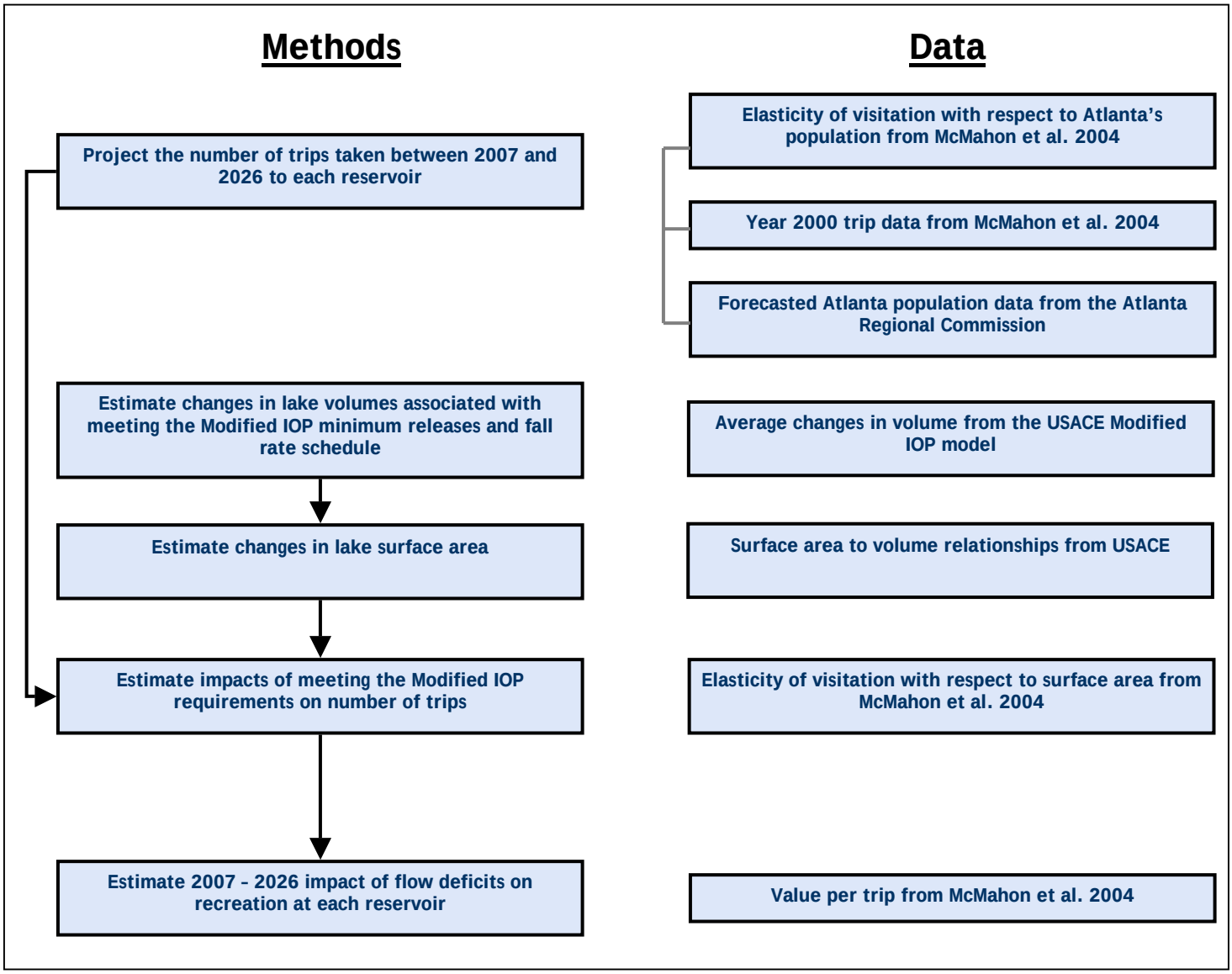
dryland management. Under these conditions, idling these acres may appear to be more profitable than dryland farming. However, this analysis assumes that although the early season (when droughts are declared) may be dry, farmers – who have already incurred pre-irrigation season costs (i.e., seeding) – choose to risk these losses rather than idle their lands, based on the possibility of late-season precipitation that will bring about higher yields.

conservation in Unit 8. This analysis translates the Modified IOP-related declines in water levels at Lake Lanier to recreational opportunity costs.[100] It also estimates recreational opportunity costs associated with seven mussels conservation efforts as the regional population (and population of recreationists) grows. Exhibit 3-9 provides a schematic overview of the methodologies and data sources used to assess economic impacts to recreation.

EXHIBIT 3-9 STEPS FOR FORECASTING POTENTIAL ECONOMIC IMPACTS TO RECREATION ASSOCIATED WITH CONSERVATION EFFORTS FOR THE SEVEN MUSSELS IN APALACHICOLA RIVER, UNIT 8



[100] Recreationists are concerned that critical habitat designation will impact recreational opportunities. Public comments were submitted to the Service by the following recreation user groups: Middle Chattahoochee Water Coalition. July 7, 2006. Prepared by J. Maltese, and West Point Lake Coalition on July 7, 2006 and on August 1, 2007. Prepared by D. Timmerberg.

3.3.1 APPROACH

93. This analysis uses recreational value estimates from a 2004 study on the potential water supply, hydropower, and recreation benefits of adjusting Lake Lanier management priorities (McMahon, et al.).[101] Their study uses a random utility model (RUM) based on 1995 boater visitation data to estimate the impacts on recreational activity associated with various water levels.[102] There were roughly 6.9 million visits to Lanier in 1995, and total travel expenditures were $378 million that year. This analysis uses results from the RUM to estimate the potential impact on changes in visitors' compensating variation associated with conservation efforts. In this context, compensating variation is the amount of money needed to make recreationists just as well off as they were prior to the decline in lake levels. Random Utility Models are useful for recreation studies because they control for the availability of substitute recreational opportunities; that is, the compensating variation per trip is adjusted downward to account for the fact that recreationists can go elsewhere. This analysis applies certain parameters developed in the McMahon et al. study to West Point and W.F. George Reservoirs, implicitly assuming that these reservoirs have similar characteristics to Lake Lanier. These parameters include: (1) the estimated values per boating trip and (2) the elasticity of visitation with respect to surface water area (i.e., the relationship between percentage changes in surface water area and percentage changes in visitation).

94. This analysis models low and high impact scenarios based on the independent USACE and Georgia EPD modeling efforts described in Section 2:

- Under the low impact scenario, impacts are estimated using the USACE-modeled average changes in lake levels given year 2000 water demands. As the USACE conducted no modeling of future water demands, changes in lake surface area are assumed to be constant at year 2000 levels throughout the 2007 to 2026 period.
- Under the high impact scenario, impacts are estimated using the Georgia EPD model results, which provide average changes in lake levels given year 2000 and year 2030 water demands under a different set of hydrological assumptions than are made in the USACE model. Changes to lake surface areas for the 2007 to 2026 period are linearly interpolated based on surface area changes in 2000 and 2030.

The steps taken in this analysis are outlined below.

- **Review available estimates of recreation values from the literature:** The value of lake and reservoir recreation has been studied extensively over the past few decades (see Appendix E for a review of a subset of these studies). This analysis assessed how readily these studies could be transferred to Lake Lanier, and West Point, and W.F. George Reservoirs, and selected McMahon, et al. due to geographic focus, appropriateness of the model, and the data provided.

[101] McMahon, et al. 2004. Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower, and Recreation Benefits. Prepared for the Atlanta Regional Commission. February.

[102] Actual 2007 recreational conditions may vary considerably from the values presented in their study.

- **Obtain estimates of per trip value from McMahon, et al. report:** McMahon, et al. use their RUM to estimate a total change in compensating variation of between $9.85 and $17.77 per trip per boating visitor; the average of this range, $13.81, is taken as the value per trip in this analysis.[103] Their model results conclude that lake levels do not meaningfully affect visitation between November and March, so this analysis calculates values of lost trips only between April to October.
- **Estimate the number of trips taken each year between 2007 and 2026 at each reservoir:** Different approaches are used to forecast future trips to each reservoir. As the population of Atlanta increases, recreation at Lake Lanier is expected to increase as well. McMahon, et al. estimate an average elasticity of overall visitation to Lake Lanier with respect to Atlanta's population of 0.575.[104] 2007 through 2026 visitation for Lake Lanier is estimated using this elasticity estimate, population growth data from Atlanta Regional Commission forecasts, and 2006 visitation data from the USACE.[105] Because no similar study was available for either West Point or W.F. George Reservoirs, the analysis assumes that the average annual change in visitation observed between 2001 and 2006 is maintained between 2007 and 2026.[106] Based on this approach, total 2007 to 2026 visitation at the three reservoirs is forecast to increase from 15.2 million to 18.7 million (see Exhibit 3-10).
- **Estimate the changes in lake surface area given the Modified IOP forecasts at each reservoir:** The USACE and Georgia EPD have used independent models to forecast water volumes in each of the three reservoirs due to the Modified IOP; Section 2 provides a table of forecasted average monthly changes in volume based on USACE and Georgia EPD modeling (Exhibit 2-8). These changes in storage volume were converted to changes in surface area, based on volume to surface area

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[103] This analysis has two key assumptions pertaining to trip values: (1) Non-boater visitation is not affected by changes in lake level. Roughly 50 percent of trips were taken by non-boaters, so inclusion of this group would increase estimates of opportunity costs. From their review of the literature, McMahon, et al. conclude that non-boaters may experience a loss of between $1 and $5 per trip, so including these values would increase the estimated potential economic impacts. (2) Boater and non-boater trips taken to the lakes do not lose value as lake levels decline. In reality, the same forces driving decreases in visitation would cause per-trip values to decline.

[104] This is the average of two elasticities (0.44 and 0.71) based upon two separate models and implies that with each one percent increase in Atlanta's population there will be a corresponding 0.575 percent increase in overall recreation.

[105] Atlanta Regional Commission. ARC's 20 County Forecasts. Accessed on October 15, 2006 from http://www.atlantaregional.com/cps/rde/xchg/arc/hs.xsl/205_ENU_HTML.htm; 2000, 2007, and 2026 population estimates are 4.23 million, 4.91 million, and 6.50 million in the Atlanta Region. The calculation performed is: [(1.65 million increase in population from 2006 to 2026)/(4.85 million 2006 population)]*(0.575 elasticity of recreation with respect to population) equals a 19.5 percent increase in trips. Using Lake Lanier as an example, (1.195 times the 7.55 million trips taken in 2006 equals the estimated number of 2026 trips to Lanier of 9.03 million). Source of 2006 visitation data: Personal communication with Mark Williams, U.S. Army Corps of Engineers, August 29, 2007.

[106] 2001 to 2006 visitation information at West Point Reservoir was provided through written communication with Steve Logan, Operations Manager at West Point Reservoir, U.S. Army Corps of Engineers, on August 29, 2007. For W.F. George, the information was provided through written communication with Brian Johnson, Park Ranger at W.F. George Reservoir, U.S. Army Corps of Engineers, on August 29, 2007. These changes in visitation reflect an underlying trend observed at these reservoirs over the past 15 years.

relationships for each reservoir made available by USACE.[107] Based on the elasticity of visitation with respect to lake surface area provided by McMahon, et al., this analysis estimates the following changes:

- The USACE modeling scenario forecasts declines in lake surface area of 0.402 percent, 0.555 percent, and 0.292 percent at Lake Lanier, and West Point and W.F. George Reservoirs, respectively, for the 2007 to 2026 period.
- The Georgia EPD scenario forecasts average 2007 to 2026 declines in lake surface area of 0.880 percent, 0.834 percent, and 0.743 percent at Lake Lanier, and West Point and W.F. George Reservoirs, respectively.

- **Estimate the impact of seven mussels conservation efforts on the number of trips taken each year between 2007 and 2026:** McMahon, et al. estimate an elasticity of boating trips with respect to surface area of 1.9.[108] This analysis estimates the decrease in trips each year from reduced lake surface areas associated with meeting the Modified IOP. Exhibit 3-10 summarizes the results for selected years. Based on changes in visitation, this analysis estimates that 118,000 fewer trips take place in 2007 and 158,000 fewer trips occur in 2026.[109]

3.3.2 RESULTS

95. This analysis calculates economic impacts to recreationists using the two separate estimates of value per trip given above. This subsection presents both annual and 20-year estimates of the potential recreational economic impacts of seven mussels conservation efforts.

96. The potential annual economic impacts between 2007 and 2026, given population increases in the Atlanta region and a scenario in which the elevations of the three lakes are lowered for the conservation of the seven mussels, are presented in Exhibit 3-10. This analysis estimates annual economic impacts from 2007 to 2026 by multiplying the average value per trip for each lake ($13.81) by the reduction in boating trips associated with seven mussels conservation efforts for selected years in Unit 8.

[107] This analysis assumes that lake levels, prior to effect of the IOP, are 200 feet, 645 feet, and 1071 feet for W.F. George and West Point Reservoirs, and Lake Lanier. The analysis further assumes that the need to release water to maintain instream flow affects lake levels for the entire year (i.e., if the annual deficit requires depletion of two feet of lake level, that these decreased lake levels persist for the year). Note, however, that reduced trips are only estimated between April and October.

[108] This implies that with each one percent decrease in lake surface area, 1.9 percent fewer boaters visit the lake each year.

[109] For example, for Lake Lanier: (0.402 percent reduction in surface area)*(1.9 elasticity of trips with respect to surface area) equals a 0.764 percent reduction in trips. 0.764 percent times 7,610,000 trips equals a 58,100 reduction in 2007 trips (see Exhibit 3-10).

EXHIBIT 3-10 POTENTIAL ANNUAL RECREATIONAL IMPACTS ASSOCIATED WITH SEVEN MUSSELS CONSERVATION EFFORTS IN THE APALACHICOLA RIVER, UNIT 8 (2007 TO 2026)

YEAR	TOTAL ANNUAL VISITATION TO THREE LAKES	NUMBER OF FEWER TRIPS PER YEAR (PERCENT OF TOTAL)		ECONOMIC IMPACT	
		USACE	EPD	USACE	EPD
LAKE LANIER					
2007	7,610,000	58,100 (0.76%)	121,000 (1.59%)	$800,000	$1,670,000
2016	8,210,000	62,700 (0.76%)	137,000 (1.67%)	$863,000	$1,880,000
2026	9,030,000	69,000 (0.76%)	158,000 (1.75%)	$949,000	$2,180,000
WEST POINT RESERVOIR					
2007	3,490,000	36,800 (1.06%)	55,300 (1.59%)	$507,000	$761,000
2016	5,180,000	54,700 (1.06%)	82,100 (1.59%)	$752,000	$1,130,000
2026	7,060,000	74,500 (1.06%)	112,000 (1.59%)	$1,030,000	$1,540,000
W.F. GEORGE RESERVOIR					
2007	4,080,000	22,600 (0.56%)	50,400 (1.24%)	$222,000	$495,000
2016	3,370,000	18,700 (0.56%)	47,200 (1.40%)	$183,000	$464,000
2026	2,580,000	14,300 (0.56%)	41,000 (1.59%)	$141,000	$402,000
TOTAL					
2007	**15,200,000**	**118,000 (0.78%)**	**227,000 (1.49%)**	**$1,530,000**	**$2,920,000**
2016	**16,800,000**	**136,000 (0.81%)**	**266,000 (1.59%)**	**$1,800,000**	**$3,480,000**
2026	**18,700,000**	**158,000 (0.85%)**	**311,000 (1.67%)**	**$2,120,000**	**$4,120,000**

Note: Totals may not sum due to rounding.
Sources: IEc analysis using visitation data (sources provided above) and information in: McMahon, et al. 2004. Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower, and Recreation Benefits. Prepared for the Atlanta Regional Commission. February.

97. Exhibit 3-11 presents economic impacts to recreationists associated with conservation efforts for the seven mussels Unit 8 (Apalachicola River) between 2007 and 2026. The present value of total cost is between $27.7 million and $54.1 million, and annualized impacts are between $1.86 million and $3.64 million (discounted at three percent).

EXHIBIT 3-11 SUMMARY OF POTENTIAL FUTURE COSTS TO RECREATION (2007-2026)

CRITICAL HABITAT UNIT, STREAM NAME	TOTAL UNDISCOUNTED DOLLARS		PRESENT VALUE			
			3%		7%	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
8. Apalachicola	$37,800,000	$73,900,000	$27,700,000	$54,100,000	$19,300,000	$37,800,000
Total Annualized 3 percent					$1,860,000	$3,640,000
Total Annualized 7 percent					$1,830,000	$3,560,000
Source: IEc Analysis						

3.4 POTENTIAL ECONOMIC IMPACTS RELATED TO OTHER WATER USES

98. This section qualitatively assesses potential impacts to water uses other than agriculture and recreation. Flows for conservation of the seven mussels may increase the frequency and severity of the impacts on municipal and industrial water users of future droughts in the Chattahoochee River Basin (associated with Unit 8). In the Santa Fe/New River Basin (Unit 11), flows for seven mussels conservation may reduce the available withdrawal permits that can be issued given MFL requirements. Specifically, these increases may affect the following uses:

- Flood control, hydropower, and/or municipal and industrial uses may be affected by conservation efforts for the seven mussels in Unit 8 (Apalachicola River); and/or
- Agricultural and/or municipal and industrial uses in Unit 11 (Santa Fe/New River) could potentially be affected by seven mussels conservation efforts.

99. Lacking a publicly available model capable of forecasting water availability associated with the above restrictions given future water demands, this analysis is unable to quantify the costs of changes in water use associated with seven mussels conservation. This subsection therefore describes these potential costs qualitatively, focusing on the potential effect of seven mussels conservation efforts in these basins.

3.4.1 APALACHICOLA RIVER (UNIT 8)

100. Georgia has established a drought management plan to designate and mitigate droughts.[110] In Georgia, announcement of droughts in any one of the nine "climate divisions" is based on four hydrological considerations: precipitation, reservoir levels, stream flow, and groundwater levels. Within climate division two (which contains Atlanta), water levels at Lake Lanier are used as one of the indications of drought; as water levels decline, increasingly severe restrictions are implemented for municipal water diversions. Georgia's drought restrictions are delineated into four levels of severity for municipal and industrial users; these limit the times of day that outdoor watering can occur. Droughts range from level one, which allows outdoor water use (e.g., watering lawns, washing vehicles, filling installed swimming pools) between 4 p.m. and 10 a.m. every other day (i.e., no watering during the hottest part of the day), and level four, which calls for a complete outdoor water use ban. During dry periods, if management under the Modified IOP causes Lake Lanier levels to decline, then the frequency and severity at which Georgia responds to droughts with mitigation measures may increase marginally, imposing costs on municipal water users. As water use in Atlanta continues to increase, the Atlanta Regional Commission has expressed concerns that any additional restrictions placed on water use would have significant economic impacts on Chattahoochee River Basin municipalities.[111]

[110] Georgia Environmental Protection Division. 2003. Georgia Drought Management Plan. Accessed on May 16, 2007 from http://www.gaepd.org/Files_PDF/gaenviron/drought/drought_mgmtplan_2003.pdf.

[111] Letter to IEc from Pat Stevens, Chief of the Metropolitan North Georgia Water Planning District, October 13, 2006.

101. USACE currently manages the Chattahoochee hydrosystem to balance a diverse set of goals, including provision of municipal supplies, maintenance of water quality, generation of hydropower, and maintenance of a flood control buffer.[112] Accordingly, reservoir capacity could be reallocated from flood control and the timing of hydropower generation could be modified in the Chattahoochee River Basin to increase reservoir levels for municipal and industrial purposes when needed.[113] This could partly or wholly adjust for decreases imposed by the Modified IOP, and thus mitigate the increases in frequency and severity of the effects of drought associated with conservation efforts for the seven mussels.[114] The Metropolitan North Georgia Water Planning District has studied reallocation toward municipal uses as a supply alternative, and the Atlanta Regional Commission has evaluated its benefits.[115] The costs associated with reallocation are dependent upon the value of flood control, the effect of changes in timing on hydropower revenues, and the probability of drought in the Chattahoochee River Basin given escalating municipal demands. Section 4 discusses other potential hydropower impacts.

3.4.2 SANTA FE AND NEW RIVERS (UNIT 11)

102. The Suwannee River Water Management District (the organization that manages water in the Santa Fe/New River system) awards a permit for a new use only if the new use will not violate existing MFL requirements. Currently, water is not in short supply in the region, partly due to plentiful groundwater resources; however, permit applications for both agricultural and municipal water uses are expected to increase considerably in future years.[116] At some point in the future, demand may exceed permitted supply; at that point, conservation flows for the seven mussels could constrain new permits. Either agricultural or municipal water permits may be restricted in the Santa Fe Basin as water supplies

[112] U.S. Army Corps of Engineers. 1998. Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin: Alabama, Florida, and Georgia. Draft Environmental Impact Statement, September.

[113] Reallocation involves adjusting the relative priorities of management goals, in this case to emphasize municipal water supply and deemphasize hydropower production and flood control. Reallocation for the seven mussels would involve storing more water during wet periods in order to maintain historical average reservoir elevations while accommodating IOP requirements. This may require that hydropower miss peak pricing opportunities during certain times of the year, decreasing revenues. Hydropower facilities in the ACF basin have cost obligations to the U.S. Treasury; if decreases in hydropower revenues limit the ability of these facilities to fulfill their obligations, funding may need to be provided by other sources (based on personal communication with Douglas Spencer, Southeastern Power Administration, September 4, 2007).

[114] According to the USACE, it would not be appropriate to indicate that reductions in hydropower "can fully offset future public health and safety, water supply and seven mussels needs during periods of sustained drought…During droughts there are impacts on all project purposes, but the minimum water supply, water quality and environmental needs will likely be met even in future conditions". [Written communication from Joanne U. Brandt, Biologist, Mobile District, U.S. Army Corps of Engineers, May 7, 2007].

[115] Jordan, Jones, and Goulding. 2003. Water Supply and Conservation Management Plan. Prepared for the Metropolitan North Georgia Water Planning District. September. And McMahon, et al. 2004. Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower, and Recreation Benefits. Prepared for the Atlanta Regional Commission. February.

[116] Suwannee River Water Management District, Florida. Draft Technical Report, MFL Establishment for the Upper Santa Fe River, December 2006; pp. 5-18, 5-19.

become constrained. This may cause farmers to dryland farm certain acres; or may result in decreased water availability to municipalities. Since insufficient information is available on how permit applications will progress in future years, this analysis does not estimate the economic impacts in Unit 11.

3.5 POTENTIAL REGIONAL ECONOMIC IMPACTS RELATED TO WATER USES

103. If agricultural land is retired from production in the Flint River Basin and fewer recreational trips are taken to Lake Lanier, West Point, and W.F. George Reservoirs, a reduction in regional economic activity related to these sectors may result. Changes in these economic sectors may affect the regional economy in a number of ways. For recreation, changes would manifest primarily through decreased spending on fuel, food, equipment, sporting goods, and lodging; for agriculture, lost spending on farm machinery, fuel, fertilizer, seeds, and other farm inputs might result from changes in farm revenues. Decreased expenditures in these industries would also result in secondary effects on related sectors. Some of these related sectors may be closely associated with the agricultural and recreation industries, such as crop seed or boating industries; however, some sectors may be less closely associated with the industries, such as the food service industry.

104. This analysis relies on regional economic modeling to estimate the economic impacts of these initial and secondary effects. In particular, it utilizes a software package called IMPLAN to estimate the total economic effects of the reduction in economic activity in the agricultural and recreation-related industries in the counties associated with seven mussels conservation efforts. IMPLAN is commonly used by State and Federal agencies for policy planning and evaluation purposes. The model draws upon data from several Federal and State agencies, including the Bureau of Economic Analysis and the Bureau of Labor Statistics.[117] To group related industries into sectors, IMPLAN utilizes the categories defined by the U.S. Office of Management and Budget's North American Industry Classification System (NAICS) code.

3.5.1 POTENTIAL AGRICULTURAL IMPACTS

105. This analysis considers a scenario in which water withdrawals are reduced to provide flows for seven mussels conservation. Given this approach, the analysis forecasts the regional economic impacts of decreased agricultural production, using the economic impact estimates presented above. The following subsections present the methodologies and results of this analysis.

3.5.1.1 Approach

106. Regional agricultural impacts could result from decreased gross agricultural revenues and activity associated with conversion of irrigated acres to dryland farming. IMPLAN

[117] The IMPLAN model is owned and maintained by the Minnesota IMPLAN Group, Inc. (MIG). Information in this section is compiled in part from: *IMPLAN Professional, Social Accounting, and Impact Analysis Software, User's Guide, Analysis Guide, Data Guide*, Minnesota IMPLAN Group, Inc., 1997.

considers changes in the gross revenues of particular crops and generates an assessment of the indirect and induced output and employment effects associated with each crop type. These estimates are aggregated into single measures of decreased output associated with meeting assumed flows. Differences in gross revenues associated with each crop are provided in Exhibit 3-12, and direct economic impacts (inputs to IMPLAN) are provided in Exhibit 3-13. As reductions in agricultural diversions are only forecast to occur in the Lower Flint Basin once during the 20-year period, potential decreases in Lower Flint Basin gross agricultural revenues during that single year are presented in Exhibit 3-13. As such, impacts to both gross revenues and the regional economy will be much higher during that year than the average impacts presented in the subsections above. Modeled impacts are not likely to be sustained in the other 19 years in the Lower Flint Basin.

EXHIBIT 3-12 REVENUE DIFFERENCES FOR AN ACRE OF FARMLAND (UPPER AND LOWER FLINT RIVER, UNITS 5 AND 7)

CROP	AVERAGE IRRIGATED GROSS REVENUE (PER ACRE)	AVERAGE DRYLAND GROSS REVENUE (PER ACRE)	GROSS REVENUE DIFFERENCE (PER ACRE)
Peanuts	$1.150	$711	$438
Cotton	$938	$265	$673
Corn	$477	$46	$431

Sources: (1) Lamb, M.C. et al. 2007. Economic Returns of Irrigated and Non-Irrigated Peanut Based Cropping Systems. *Peanut Science*. 34. P. 10-16; and (2) written communications with Mark Masters, Director of Projects, Flint River Water Planning and Policy Center, on August 29, 2007.

EXHIBIT 3-13 POTENTIAL ANNUAL GROSS REVENUE IMPACTS ASSOCIATED WITH DECREASED AGRICULTURAL PRODUCTION (UPPER AND LOWER FLINT RIVER, UNITS 5 AND 7)

CRITICAL HABITAT UNIT, SCENARIO	NAICS CODE		
	PEANUTS	COTTON	CORN
	111992	111920	111150
5. UPPER FLINT RIVER			
Least Cost	$0	$0	$204,000
Crop Mix	$56,100	$271,000	$47,000
7. LOWER FLINT RIVER			
Least Cost	$5,640,000	$0	$33,200,000
Crop Mix	$13,300,000	$29,400,000	$6,760,000
TOTALS			
Least Cost	**$5,640,000**	**$0**	**$33,400,000**
Crop Mix	**$13,400,000**	**$29,700,000**	**$6,810,000**

Note: Totals may not sum due to rounding.
Source: IEc analysis

3.5.1.2 Results

107. Incorporating multiplier effects in the regional economy, the estimated impact of a loss in agricultural revenues under the crop mix scenario of $49.9 million during the single year of Lower Flint Impacts – and $374,000 for the remaining 19 years – associated with Units 5 and 7 (Upper and Lower Flint River) would generate a regional loss in economic activity of approximately $77.2 million during the single year and $630,000 during the remaining 19 years. This loss represents roughly 0.39 percent and 0.003 percent of the annual baseline economy of the counties included in this analysis adjacent to the Upper and Lower Flint Rivers during one year of 20 and during the remaining 19 years, respectively. The loss of these revenues would be expected to impact up to 740 jobs during the single year and 10 jobs during the remaining 19 years. These effects are summarized in Exhibit 3-14; note that impacts during 19 of the 20 years are provided as impacts occurring in the Upper Flint Basin: no impacts are forecast to occur in the Lower Flint Basin during this period. These estimates represent snapshots of the changes in revenues, jobs, and local taxes that may result changes in agriculture to meet flows for seven mussels conservation. These impacts would occur once and persist for some period of time until the economy adjusts to the change.[118]

EXHIBIT 3-14 POTENTIAL REGIONAL ECONOMIC IMPACTS OF REDUCED AGRICULTURAL PRODUCTION (UPPER AND LOWER FLINT RIVER, UNIST 5 AND 7)

CRITICAL HABITAT UNIT, IMPACT	DIRECT EFFECT	INDIRECT EFFECT	INDUCED EFFECT	TOTAL EFFECT
5. UPPER FLINT				
Output	$374,000	$155,000	$102,000	$630,000
Employment	5.1	3.3	1.2	9.6
7. LOWER FLINT				
Output	$49,500,000	$12,600,000	$14,500,000	$76,600,000
Employment	380.0	189.0	162.0	731.0
TOTALS				
Output	**$49,900,000**	**$12,700,000**	**$14,600,000**	**$77,200,000**
Employment	**385.0**	**192.0**	**163.0**	**740.0**

Source: IEc IMPLAN Analysis

3.5.2 POTENTIAL RECREATIONAL IMPACTS

108. This analysis considers a scenario in which recreational expenditures are reduced in response to the Modified IOP. To forecast the regional economic impact of fewer trips to Lake Lanier, West Point, and W.F. George Reservoirs that could potentially result from these changes in water management, the analysis relies on the forecasted number of lost trips and estimates of the expenditures made per recreational boating trip to the three

[118] Changes in output and employment are not annual losses. That is, IMPLAN assumes that if 47 jobs are lost in 2007, no jobs are lost each year thereafter. IMPLAN does not account for long-term adjustments made by the regional economy in response to the initial change in spending by recreationists.

reservoirs during an average year (i.e., the average of changes in expenditures during 2007 and 2026). Absent information on the relative accuracy of the USACE and Georgia EPD models, changes in visitation and expenditures forecasted between the two models are averaged as well. The following subsections present the methodologies and results of this analysis.

3.5.2.1 Approach

109. This study assesses the recreational impacts on counties surrounding Lake Lanier, West Point and W.F. George Reservoirs using data in McMahon, et al. (2004) and Chang, et al. (2003).[119] The steps taken are provided below.

- **Estimate lost lake trips:** Based on the analysis described above, this analysis assumes that 203,000 trips are lost in an average year between 2007 and 2026.
- **Estimate per trip expenditures:** Estimates for average expenditures per boating recreation trip are from McMahon, et al. (2004), who report the total boater visits at Lake Lanier in 1995 as being 3.3 million and that total boater spending was $213 million (in 2004 dollars) within 30 miles of the site. This converts to $68.60 per boater trip in 2006 dollars. This analysis applies this value to West Point and W.F. George Reservoir trips as well.[120]
- **Parse per trip costs into individually affected sectors:** IMPLAN requires that overall recreational expenditures be parsed into expenditures for each of the appropriate sectors. Chang et al. (2003) provide average spending profiles for annual boater expenditures on visits to all USACE facilities within the U.S., which allows for the parsing of estimated expenditures by sector. IMPLAN NAICS codes are then applied to these expenditures, as appropriate (accessed from the U.S. Census Bureau).[121] Exhibit 3-15 provides the average annual expenditures foregone between 2007 and 2026 to meet flows for seven mussels conservation. These annual expenditures are calculated by multiplying per-trip spending in each sector by the decrease in trips taken (Exhibit 3-10 above). Between 2007 and 2026, the average reduction in annual recreational expenditures is roughly $13.9 million.

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[119] Chang, W., D.B. Propst, D.J. Stynes, and R.S. Jackson. 2003. Recreation visitor spending profiles and economic benefits to corps of engineering projects. U.S. Army Corps of Engineers. December.

[120] Note that the total spending per trip (i.e., both within and beyond 30 miles from the lakes) is roughly $95. Public comments were submitted by the City of LaGrange, Georgia on August 2, 2007 (written by J. Maltese) that indicate this value may be low for boating trips to West Point Lake. Additional information was submitted from the City of LaGrange on August 28, 2007 (written by J. Maltese) indicating that the LaGrange-Troup County Chamber of Commerce uses a value of $169 per trip for West Point Lake. However, personal communications with Diane LaVec (Executive Tourism Director, LaGrange-Troup County Chamber of Commerce on August 31, 2007) indicated that this figure includes overnight trips only rather than total trips; it therefore could not be incorporated into the analysis.

[121] U.S. Census Bureau. 2002 NAICS Codes and Titles. Accessed on November 3, 2006 from http://www.census.gov/epcd/naics02/naico602.htm

EXHIBIT 3-15 INPUTS TO IMPLAN: REDUCED BOATING RECREATION EXPENDITURES WITHIN 30 MILES OF LAKE LANIER, WEST POINT AND W.F. GEORGE RESERVOIRS (APALACHICOLA RIVER, UNIT 8)

NAICS CODE	DESCRIPTION	PER TRIP SPENDING	2007	2026	AVERAGE
721110	Hotels, motels, cabins, B&B, and rental homes	$1.43	$246,000	$335,000	$290,000
721211	Camping fee	$0.55	$93,800	$128,000	$111,000
722110	Restaurants, bars, etc.	$8.06	$1,390,000	$1,890,000	$1,640,000
424410	Groceries and take out food	$14.30	$2,450,000	$3,340,000	$2,900,000
447110	Gas and oil	$21.30	$3,670,000	$5,000,000	$4,330,000
811111	Other auto expenses	$4.17	$718,000	$978,000	$848,000
441222	Other boat expenses	$5.91	$1,020,000	$1,380,000	$1,200,000
713990	Entertainment and recreation fees	$2.46	$423,000	$576,000	$499,000
423910	Sporting good and boat equipment	$10.40	$1,780,000	$2,430,000	$2,100,000
TOTALS		**$68.60**	**$11,800,000**	**$16,100,000**	**$13,900,000**

Note: Totals may not sum due to rounding
Sources: (1) Chang, W., D.B. Propst, D.J. Stynes, and R.S. Jackson. 2003. Recreation visitor spending profiles and economic benefits to corps of engineering projects. U.S. Army Corps of Engineers. December; (2) McMahon, et al. 2004. Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower, and Recreation Benefits. Prepared for the Atlanta Regional Commission. February; and (3) IEc analysis using visitation data (sources provided above).

3.5.2.2 Results

110. Incorporating multiplier effects in the regional economy, the estimated impact of a loss of 203,000 trips to the three lakes in an average year is $22.7 million (Exhibit 3-16).[122] Losses at each lake represent between 0.015 and 0.024 percent (at Lake Lanier and W.F. George Reservoir) of the annual baseline economy of the counties included in this analysis. The loss of 203,000 trips could also impact as many as about 304 jobs. These estimates represent snapshots of the changes in revenues, jobs, and local taxes that may result from the modeled scenario. These impacts would occur once and persist for some period of time until the economy adjusts to the change.

[122] According to public comments submitted by the City of LaGrange, Georgia on August 2, 2007 (written by J. Maltese) the annual impacts to West Point Lake modeled in this analysis may be low, based on the preliminary results of a study they have commissioned. According to written communication with J. Maltese, Assistant to the City Manager for Special Projects, City of LaGrange, Georgia on August 28, 2007, final results of their study were not available at the time of this analysis.

EXHIBIT 3-16 POTENTIAL REGIONAL ECONOMIC IMPACT OF CHANGES IN RECREATIONAL ACTIVITY (APALACHICOLA RIVER, UNIT 8)

RESERVOIR, IMPACT TYPE	DIRECT EFFECT	INDIRECT EFFECT	INDUCED EFFECT	TOTAL
LAKE LANIER				
Output	$6,960,000	$2,100,000	$2,590,000	$11,600,000
Employment	100	16.5	22.3	139
WEST POINT				
Output	$4,770,000	$1,280,000	$1,580,000	$7,630,000
Employment	81	12.1	16.5	110
W.F. GEORGE				
Output	$2,200,000	$496,000	$697,000	$3,390,000
Employment	41.4	5.5	7.8	54.8
TOTALS				
Output	**$13,900,000**	**$3,870,000**	**$4,870,000**	**$22,700,000**
Employment	**223**	**34.1**	**46.6**	**304**

Source: IEc IMPLAN a**nalysis**

3.6 CAVEATS TO METHODOLOGY USED TO ESTIMATE ECONOMIC IMPACTS RELATED TO WATER NEEDS FOR THE SEVEN MUSSELS

111. This analysis relies on several assumptions, those used to estimate potential changes in water management and likely responses to those changes are below.

- No information is available on minimum flows for seven mussels conservation. Lacking this information, the analysis uses the Modified IOP for conservation flows in the Apalachicola River (Unit 8), 7Q10 guidelines for conservation flows in the Upper Flint River (Unit 5), and guidelines on reductions in agricultural acreage to support conservation flows in the Lower Flint River (Unit 7). It is important to note that these guidelines do not specifically establish minimum flows for the seven mussels, and therefore this analysis assumes that these are a suitable substitute. If alternative guidelines were used to establish these flows, the economic impacts on agriculture and recreation would depend on requirements specified in those guidelines.
- Absent a publicly available model that can forecast changes in the frequency and severity of drought impacts in the Chattahoochee Basin (associated with conservation flows in Unit 8), and absent information on how future water permit applications may be affected by flows for seven mussels conservation in the Santa Fe and New Rivers (Unit 11), potential impacts associated with these data are not included in the analytical results. If this information were available, economic impacts would increase.
- The analysis assumes that seven mussels conservation flows will be met. It makes no assumptions about either the institutional mechanisms that will provide these flows or about who will bear the costs of these reductions. Economic impacts

would decrease if water use reduction mechanisms and/or the cost-bearing entities did not exist.

- Water users and managers in the basin, such as irrigators or USACE, may be able to more readily adapt operations in order to meet flows for the conservation of the seven mussels than is assumed in this analysis. These adaptations may result in less costly solutions (i.e., implement less costly adaptive measures), decreasing economic impact estimates.
- Although lower lake levels associated with seven mussels conservation efforts may affect property values surrounding these lakes, insufficient information is available to reliably estimate these impacts. Inclusion of these effects would likely increase the economic impact associated with lake level declines in future years.[123]

3.6.1 CAVEATS TO THE AGRICULTURAL ANALYSIS

112. Agricultural impact estimates are dependent upon the following additional caveats below.

- Corn, cotton, and peanuts are the crops for which irrigation water is assumed to have the lowest value in the Upper and Lower Flint Basins. The value of irrigation water may be lower as applied to other crops in the region. This would provide other, less costly alternatives that may reduce the estimated economic impacts on agriculture.
- Dryland farming always occurs on lands that would have been irrigated that season. Farmers may be able to build mandatory crop idling during dry years into their rotations. This and other adaptive management strategies could reduce estimated economic impacts on agriculture.
- Crop prices are invariant for the period of analysis. Crop prices (in real dollars) vary dramatically from year to year. As crop prices change, economic impacts would also change.
- Net revenue differences assume that dryland-farmed acres do not have existing irrigation equipment. Covering the fixed costs of idled irrigation equipment would increase the observed difference between irrigated and dryland-farmed acres, increasing the overall economic impacts to agriculture.

3.6.2 CAVEATS TO THE RECREATIONAL ANALYSIS

113. Recreational impact estimates are dependent upon the following additional caveats below.

- Historical data on the number of trips taken by recreationists can be used to forecast future trips. If fewer trips are taken than forecasted, overall impacts will be lower.

[123] Public comment letter submitted by J. Maltese, Assistant to the City Manager, City of LaGrange, Georgia, on August 2, 2007.

- Lake level has no effect on recreational visits between November and March. Modeling of any effect during these months would increase estimated costs to recreation.
- Lake level has no effect on non-boaters. Non-boaters also experience losses in welfare from lowered reservoir levels, particularly associated with changes in the amount of lake shoreline.[124] Including those populations in the analysis would increase costs.
- Increased future municipal water demand has no effect on recreational economic impacts. As municipal demand increases, average annual lake levels may fall. Since the relationship between average lake level and Modified IOP requirements is uncertain, the impact of this effect is unknown.
- Elasticity of recreation and trips are constant values. Elasticity of recreation with respect to Atlanta's population may change as population increases, and elasticity of trips taken with respect to lake surface area may change as lake level declines (e.g., as it reaches docks or boat ramps).
- Welfare from each trip does not change as overall recreation increases, when it may in fact decline. Due to congestion effect, it is likely that the value per trip will fall. This would decrease the economic impacts on recreation in future years.

[124] Based on public comments submitted by J. Maltese, Assistant to the City Manager, City of LaGrange, Georgia, on August 2, 2007.

SECTION 4 | POTENTIAL ECONOMIC IMPACTS TO HYDROPOWER, WATER SUPPLY, AND OTHER IMPOUNDMENT PROJECTS

114. This section considers the potential impacts of seven mussels conservation efforts on management of hydropower, water supply, and other impoundments and projects, by addressing changes to facilities and operations that may occur. The Proposed Rule identifies impoundments as a threat to the seven mussels, and dam operations as potentially altering flow regimes to a degree that could adversely affect the seven mussels. The Proposed Rule also specifically highlights dams on the Flint River as impeding passage of host fishes for the seven mussels, and thus separating the populations of the seven mussels within the river.[125]

115. This section first provides a summary of the estimated economic impacts. It then presents information on the USACE hydropower facilities that may be affected by seven mussels conservation efforts, and the potential associated economic impacts. Next it presents information on other water projects including non-Federal hydropower dams, and other water impoundment and water management projects. Finally, it estimates the costs of conservation efforts for the seven mussels for these water projects.

4.1 SUMMARY

4.1.1 PRE-DESIGNATION IMPACTS

116. Pre-designation costs of seven mussels conservation efforts related to water supply, hydropower, and impoundment projects have been associated with the Lake Blackshear relicensing process, and the City of Griffin's Still Branch Reservoir permitting process (costs associated with surveys and monitoring for mussels). Total pre-designation costs to water projects are estimated to be $187,000 (discounted at three percent). Exhibit 4-1 presents the total pre-designation impacts to water projects by proposed critical habitat unit.

[125] U.S. Fish and Wildlife Service, Proposed Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages, 50 FR 32746, June 6, 2006. Page 32750.

EXHIBIT 4-1 PRE-DESIGNATION IMPACTS TO WATER PROJECTS

UNIT	UNDISCOUNTED	PRESENT VALUE	
		3%	7%
5 - Upper Flint River	$93,900	$99,300	$107,000
6 - Middle Flint River	$81,000	$87,800	$97,600
TOTAL	$175,000	$187,000	$205,000
Note: Totals may not sum due to rounding.			

4.1.2 POST-DESIGNATION IMPACTS

117. Total forecast post-designation impacts to water projects (discounted at three percent) are estimated to be up to $3.12 million. Exhibit 4-2 presents total post-designation impacts to water projects by unit.[126]

EXHIBIT 4-2 TOTAL POST-DESIGNATION IMPACTS TO WATER PROJECTS

UNIT	UNDISCOUNTED	PRESENT VALUE		ANNUALIZED	
		3%	7%	3%	7%
5 - Upper Flint River	$1,830,000	$1,490,000	$1,250,000	$91,700	$93,300
6 - Middle Flint River	$1,920,000	$1,570,000	$1,250,000	$105,000	$118,000
10 - Lower Ochlockonee River	$81,000	$58,000	$37,800	$2,900	$1,890
TOTAL	$3,830,000	$3,120,000	$2,540,000	$200,000	$214,000
Note: Totals may not sum due to rounding.					

118. Water management projects expected to be affected by seven mussels conservation efforts during the 2007-2026 timeframe include construction of the Lake McIntosh reservoir project in Fayette County, and FERC relicensings for the Lake Blackshear and Lake Talquin hydroelectric projects. The costs of continued conservation efforts at the Still Branch Reservoir are also included in this analysis. The Tired Creek Lake recreation reservoir project in Grady County, Georgia is discussed qualitatively.

[126] Conservation efforts for the seven mussels are expected to occur with a higher frequency and at a higher cost for water projects in the future than in the past. Consistent with recent expansion of the Georgia and Florida Departments of Transportation mussel survey protocol, smaller-scale water projects are expected to undertake mussel conservation efforts (i.e., intensive surveying and monitoring) more extensively than in the past.

119. In addition, conservation efforts for the seven mussels may result in changes to hydropower production and/or revenues for the four USACE facilities in the ACF Basin. The USACE has indicated that overall the Modified IOP (as discussed Section 2) will not "significantly impact" power generation at these facilities.[127] However, the value of the power produced by this system is dependent on the timing of releases, and no model is currently available to estimate the potential change in timing of power production (i.e., peak versus non-peak). Therefore, this analysis does not provide a monetized estimate of the impact of mussel conservation on net hydropower revenues in the ACF Basin. Instead, this section identifies potentially affected facilities, and discusses types of potential impacts. It does so by providing information:

- on hydropower facilities and generation that may affect critical habitat;
- on the potential impacts to hydropower operations associated with timing of releases at the hydropower dams;
- from the USACE describing its assessment of the system; and
- from stakeholders on their concerns related to system management.

120. Exhibit 4-3 displays the projects considered in this section.

[127] Environmental Assessment of Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species, Jim Woodruff Dam, Gadsden and Jackson Counties, Florida, and Decatur County, Georgia. March 2007. Prepared by U.S. Army Corps of Engineers, Mobile District Planning and Environmental Division Environment and Resources Branch Inland Environment Team. Page EA-30.

EXHIBIT 4-3 DAMS WITHIN PROPOSED CRITICAL HABITAT

4.2 USACE HYDROPOWER FACILITIES

4.2.1 USACE HYDROPOWER BACKGROUND AND PROFILE

121. Hydropower contributes a relatively small portion of Georgia's overall electricity supply, but can provide important power during peak demand. Exhibit 4-4 presents the relative contribution of hydropower in Georgia's electricity sector. USACE hydroelectric dams on the Chattahoochee River are important to regional power production, with the Buford, West Point, and Walter F. George facilities contributing more than 15 percent of the total electricity supplied by the Southeastern Power Administration's (Southeastern) system (Exhibit 4-5). These dams have the ability to affect the Apalachicola River Complex (Unit 8).

EXHIBIT 4-4 GEORGIA'S NET ELECTRICITY GENERATION, JANUARY 2007

POWER SOURCE/TYPE	MEGAWATT HOURS	PERCENTAGE
Petroleum-Fired	17,000	<1%
Natural-Gas Fired	711,000	6%
Coal-Fired	7,558,000	64%
Nuclear	2,920,000	25%
Hydroelectric*	344,000	3%
Other Renewables	263,000	2%
Total	11,847,000	100%

Source: Energy Information Administration, State Profiles, Georgia. Accessed at: http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=GA#Pr on May 16, 2007, and August 27, 2007.
*Conventional hydroelectric, not including pumped storage.

122. Exhibit 4-5 presents information on the capacity of the four USACE hydropower dams, and recent annual power generation. Although annual estimates provide context for total power generation in the system, it is the timing of power generation (and associated water releases) rather than total annual power generated that has the potential to affect the seven mussels.[128] Hydropower revenues per megawatt hour in the last two years have been $34.83 and $40.64 (2006 dollars).[129] Note that the value of power fluctuates on an hourly basis, and that if releases for hydropower cannot be made, replacement power must be

[128] Timing of releases is the critical component of facility operations that may affect the mussels, and is the subject of the USACE 2007 Environmental Assessment of the IOP. The Environmental Assessment states that in relation to endangered and threatened species and critical habitat, "the primary operational consideration at this time is the timing and quantity of flows released from the dam." Page EA-4.

[129] Personal communication with Jennifer Wilburn, Southeastern Power Administration on May 9, 2007.

purchased to meet demand.[130] Data is not available to estimate the range in revenues associated with "peaking" versus non-peaking power (as discussed below in Section 4.2.2), though peaking power can be as high as three times more valuable than non-peaking power.[131]

123. Power generated by the USACE projects on the ACF Basin system is marketed through Southeastern. Southeastern is concerned that conservation efforts for the seven mussels will have a negative impact on hydropower operations, contracts, and replacement energy purchases in the ACF basin.[132, 133] Specific concerns relate to operating under the Modified IOP, which may impact storage during springtime filling months, potentially resulting in lower upstream summer pool elevations, and reduced power generation during peak demand in the summer months.[134] Southeastern manages the hydroelectric power from the USACE projects in the ACF basin as an integrated generation system that is linked hydraulically, electrically, and financially to production in other basins (i.e., as part of its Alabama-South Carolina-Georgia system); therefore, if production at one or more of the projects is impacted, other projects may also be impacted.[135]

[130] Replacement power in this system is generated by combustion turbine for use when hydropower is not produced. The cost of replacement power is the cost of the next best alternative if hydropower could not be produced, and is wholly dependent on the cost of the replacement source (e.g., gas). One estimate that considers the cost of replacement power is $47.85 per megawatt hour. Note that this estimate is only one data point, and is not representative of the potential range of replacement power costs. Estimate provided by Bernard Moseby, Economist/Operations Research Analyst, Mobile District, U.S. Army Corps of Engineers, May 10, 2007.

[131] Personal communication with Herb Nadler, Douglas Spencer, and Jennifer Wilburn, Southeastern Power Administration, September 4, 2007.

[132] Public comment submitted by Charles A. Borchardt on behalf of the U.S. Department of Energy's Southeastern Power Administration, August 3, 2006.

[133] Letter from Kenneth E. Legg, Assistant Administrator for Power Resources, Southeastern Power Administration, to Joanne Brandt, NEPA Compliance Manager, Inland Environmental Team, U.S. Army Corps of Engineers Mobile District, dated January 10, 2007. Accessed at: http://www.sam.usace.army.mil/ACF%20Water%20Resources%20Management/DroughtProvisionComments/SEPA-COE_ltr_RPM3_01-10-07.pdf

[134] Letter from Kenneth E. Legg, Assistant Administrator for Power Resources, Southeastern Power Administration, to Joanne Brandt, NEPA Compliance Manager, Inland Environmental Team, U.S. Army Corps of Engineers Mobile District, dated January 10, 2007. Accessed at: http://www.sam.usace.army.mil/ACF%20Water%20Resources%20Management/DroughtProvisionComments/SEPA-COE_ltr_RPM3_01-10-07.pdf; and Public comment letter from Southeastern, submitted by Kenneth E. Legg, Assistant Administrator for Power Resources, Southeastern Power Administration, August 3, 2007; and http://www.sepa.doe.gov/.

[135] Public comment letter from Southeastern Power Administration, submitted by Kenneth E. Legg, Assistant Administrator for Power Resources, Southeastern Power Administration, August 3, 2007; and http://www.sepa.doe.gov/.

EXHIBIT4-5 FEDERAL DAMS WITHIN PROPOSED CRITICAL HABITAT

RELATED UNIT	DAM/WATERBODY	NAMEPLATE CAPACITY (KILOWATTS)[1]	PORTION OF REGIONAL ELECTRICITY SUPPLY (%)	LAKE SIZE (ACRES)	TYPE OF POWER	MEGAWATT HOURS[4]	
						FISCAL YEAR 2005	FISCAL YEAR 2006
8	Buford Dam	130,000	5.96[3]	38,542	Peaking	153,689	217,676
8	West Point Dam	73,300	3.36[3]	25,900	Peaking	38,487	205,447
8	Walter F. George Dam	130,000	5.96[3]	45,180	Peaking	310,414	501,508
8	Jim Woodruff Lock and Dam	43,500	1.6[2]	37,500	Run-of-the-river with limited peaking operation	214,588	239,133

Sources: Federal Energy Regulatory Commission. "Issued Licenses." Available at: http://www.ferc.gov/industries/hydropower.asp; and Georgia Power, Florida Fish & Wildlife Conservation Commission, and Crisp County Power Commission websites. U.S. Army Corps of Engineers. Apalachicola-Chattahoochee-Flint River Basin. Accessed at http://water.sam.usace.army.mil/acfframe.htm on October 31, 2006. U.S. Army Corps of Engineers. 1998. Draft Environmental Impact Statement. Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Main Report. Lead Agency: U.S. Army Corps of Engineers, Mobile District.

Notes:

1. Multiple descriptions of capacity exist for these facilities. To provide information consistent across all dams, the nameplate capacity is used, as reported by the Energy Information Administration (EIA) in "Existing Generating Units in the United States by State, Company, and Plant, 2004, Current as of January 1, 2005" in "Annual Electric Generator Report". Accessed at: http://www.eia.doe.gov/ on November 7, 2006.
2. Regional supply defined as all electricity generating plants in the counties containing proposed critical habitat, by State, as identified in EIA 2005.
3. Regional supply defined as total "Georgia-Alabama-South Carolina System" operated by Southeastern, that include Buford, West Point, and Walter F. George hydroelectric facilities.
4. Source: Personal communication with Jennifer Wilburn, Southeastern Power Administration on May 9, 2007.

4.2.2 POTENTIAL IMPACTS TO USACE ACF BASIN HYDROPOWER PRODUCTION (UNIT 8)

124. The Modified IOP for the Jim Woodruff Dam prescribes operational changes for the listed mussels in the Apalachicola River that may have implications for the entire ACF Basin system. The changes involve minimum discharges and maximum fall rates at the Jim Woodruff Dam, the most downstream of the USACE dams, as discussed in Sections 2 and 3 of this analysis. [136, 137]

125. Storage in the larger reservoirs above the Jim Woodruff Dam is specifically allocated to hydropower generation.[138] The USACE hydroelectric facilities are generally operated as peaking power generation facilities, and thus are used to provide power at times of high demand. The ability to produce power on demand is dependent on the storage of water behind the dam with the flexibility to schedule releases at times of peak demand. To the extent that timing or scale of releases is changed to support the listed mussels in the Apalachicola River, impacts to hydropower may occur.[139] These potential impacts may be offset by the power produced under the Modified IOP at times other than peak demand; however, the extent to which peaking power revenue losses could be offset is not known. Note that, in the absence of information on how operations under the Modified IOP for the listed mussels in the Apalachicola River may affect the timing of hydropower generation during drought or otherwise, potential impacts to hydropower generation cannot be quantified. The remainder of this section therefore provides contextual information on hydropower generation at the USACE projects in the ACF basin.

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[136] "Fall rate" also known as down-ramping rate, is defined as the vertical drop in river stage (water surface elevation) that occurs over a given period. Source: U.S. Fish and Wildlife Service. Biological Opinion and Conference Report on the U.S. Army Corps of Engineers, Mobile District, Interim Operating Plan for Jim Woodruff Dam and the Associated Releases to the Apalachicola River. September 5, 2006.

[137] For example, the Crisp County Power Commission (CCPC) has proposed to avoid pulsing from March to May to benefit populations of shoal bass downstream of Lake Blackshear, at a yearly cost to CCPC of $95,000 (undiscounted). This example, though not specific to the seven mussels, indicates that species protection can result in change to operations and costs associated with those changes.

[138] "There are currently no water supply contracts in the ACF basin – previous contracts were allowed to expire in 1989-1990, and have not been renewed due to ongoing litigation. Water withdrawals are currently being made under water withdrawal permits issued by the State of Georgia. No allocation of storage in the upstream reservoirs has been made in support of water supply, and no contracts from the Corps authorize water withdrawals or provide for storage in support of water supply." Source: Page 86. U.S. Fish and Wildlife Service. Biological Opinion and Conference Report on the U.S. Army Corps of Engineers, Mobile District, Interim Operating Plan for Jim Woodruff Dam and the Associated Releases to the Apalachicola River. September 5, 2006.

[139] Environmental Assessment of Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species, Jim Woodruff Dam, Gadsden and Jackson Counties, Florida, and Decatur County, Georgia. March 2007. Prepared by U.S. Army Corps of Engineers, Mobile District Planning and Environmental Division Environment and Resources Branch Inland Environment Team. Note that this Environmental Assessment was written for the purpose of evaluating modifications to the Modified IOP and releases made to support listed species, and does not represent an in-depth analysis of impacts to hydropower specifically (See Public comment letter, submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District Corps of Engineers, August 6, 2007).

126. The USACE has indicated that, in general, implementation of the Modified IOP will not significantly affect the timing or capacity of power generation for the facilities in the ACF Basin, noting that changes in power production result primarily from reduced basin inflows (e.g., climatological factors) unrelated to operations for the listed species.[140] However, in times of drought, impacts to hydropower are possible. Specifically, recent documentation states: [141, 142]

- "Results from our modeling and our experience during previous drought conditions, as in 1998-2001, demonstrate that some project purposes, such as navigation and hydropower, may be adversely impacted as we manage for drought; however, the public health and safety, water supply, and environmental demands, including releases for water quality, and fish and wildlife resources are still met." (*Letter from USACE to Georgia Environmental Protection Division, April 30, 2007*.)
- "Hydroelectric power generation is reduced proportionally as pool levels decline to as low as 2 hours per day generation at each "peaking plant" project during extreme low flow conditions. Peak generation may be eliminated or limited to conjunctive releases during severe drought conditions." (*USACE 2007 Environmental Assessment, page EA-30*).

In a public comment letter, USACE notes that all releases consider all concurrent project purposes, though every attempt is made to maximize hydropower value for all releases through the dams.[143] Although the USACE has stated that basin inflows and drought conditions unrelated to the Modified IOP, rather than the Modified IOP itself, are likely to impact power generation, stakeholder concerns remain about the Modified IOP's potential effects.[144]

127. USACE has undertaken modeling efforts to determine the magnitude of potential impacts to hydropower generation in the system. The models compare two management scenarios over a historical time period from 1939 to 2001: power generation with and

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[140] Ibid.

[141] Letter dated April 30, 2007, from U.S. Army Corps of Engineers, Mobile District to the Georgia Environmental Protection Division. Accessed at: http://www.sam.usace.army.mil/ACF%20Water%20Resources%20Management/JWDSect7/COE-GA-EPD-Couch_Responseto04-09-07Ltr.pdf

[142] Environmental Assessment of Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species, Jim Woodruff Dam, Gadsden and Jackson Counties, Florida, and Decatur County, Georgia. March 2007. Prepared by U.S. Army Corps of Engineers, Mobile District Planning and Environmental Division Environment and Resources Branch Inland Environment Team. Page EA-30.

[143] Public comment letter, submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District Corps of Engineers, August 6, 2007.

[144] In its January 10, 2007 letter, Southeastern notes that "Lower upstream elevations and reductions in generation could occur irrespective of the system's actual hydrological drought status." Note: Stakeholders including the City of LaGrange, Georgia, on West Point Lake, Columbus Water Works (Columbus Board of Water Commissioners), have commented on the Proposed Rule in relation to concern about the increase in demand for stored water, and reduced storage. In addition, the Tri-Rivers Waterway Development Association, the Southeastern Power Administration, the City of LaGrange, Georgia and the Southeastern Federal Power Customers, Inc. submitted public comments stating concern about potential impacts to hydropower-related activities.

without implementation of the Modified IOP. Both scenarios incorporate estimates of municipal, industrial and agricultural demand for water expected in 2010.[145] The results show that on an annual basis a net increase in power generation occurs under the Modified IOP operations (See Exhibit 4-6). On a monthly basis, the fluctuation of power generation through the year as modeled under the Modified IOP shows a general pattern of higher generation in the spring months, followed by lower generation in the summer months. That is, generation occurs at levels both higher and lower than without the Modified IOP on a monthly basis. In general, the greatest fluctuations are shown for Buford and Walter F. George Dams (See Exhibit 4-7). In the USACE public comment letter, it is noted that "the additional annual hydropower generation under the Modified IOP should not be solely attributed to conservation efforts for the mussels. The allowable hydropower schedule remains unchanged from the existing hydropower operations prior to the IOP. Increased hydropower generation may result from prescribed releases to match basin inflow and ramping rate restrictions."[146] Exhibit 4-7 highlights differences in generation under the Modified IOP using the most recent five years of available data.

128. As noted above, a net increase in annual power production does not necessarily represent a net increase in revenues due to the sensitivity to timing of generation. That is, the data presented below do not account for timing of releases, and though they represent the best available information, cannot be used to quantify impacts to hydropower.

129. Estimating impacts to future hydropower generation is further complicated by ongoing litigation. The USACE is currently under court order to implement the Southeastern Federal Power Customers, Inc. Settlement Agreement.[147] This settlement involves issuing interim water storage contracts at Lake Lanier pending future permanent reallocation of storage capacity from hydropower generation to water supply.[148] The proposed reallocation will undergo section 7 consultation; however, given that these changes have not been defined, this analysis is unable to estimate the costs of any mussel conservation efforts that may be recommended.

[145] Note: The 2010 demands were developed strictly for use in the Environmental Assessment of the IOP. Per written communication from James Hathorn, U.S. Army Corps of Engineers, Mobile District, on May 8, 2007.

[146] Public comment letter, submitted by Curtis M. Flakes, Chief, Planning and Environmental Division, Inland Environment Team, Mobile District Corps of Engineers, August 6, 2007.

[147] Settlement Agreement of 2003 between Southeastern Federal Power Customers, U.S. Army Corps of Engineers, Water Supply Providers. Note: The Southeastern Federal Power Customers expressed concern related to the proposed designation of Unit 8 - the Apalachicola River Complex, and related to the science relied on in the Proposed Rule in a public comment letter dated August 7, 2006.

[148] U.S. Fish and Wildlife Service. Biological Opinion and Conference Report on the U.S. Army Corps of Engineers, Mobile District, Interim Operating Plan for Jim Woodruff Dam and the Associated Releases to the Apalachicola River. September 5, 2006. Page 86.

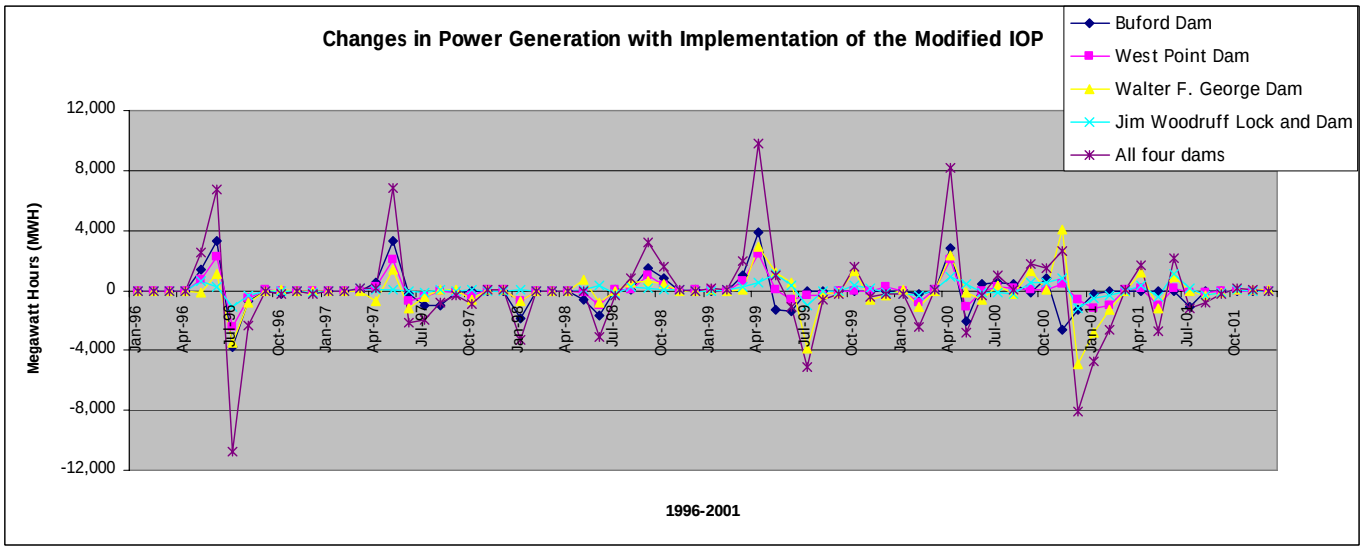
EXHIBIT 4-6 MODELED COMPARISON OF HYDROPOWER GENERATION WITH AND WITHOUT IMPLEMENTATION OF THE MODIFIED IOP (1989 - 2001)[149]

YEAR	BUFORD DAM			WEST POINT DAM			WALTER F. GEORGE DAM			JIM WOODRUFF LOCK AND DAM			USACE DAMS ON ACF
	ANNUAL POWER GENERATION (MEGAWATT HOURS)		DIFFERENCE IN POWER GENERATION	ANNUAL POWER GENERATION (MEGAWATT HOURS)		DIFFERENCE IN POWER GENERATION	ANNUAL POWER GENERATION (MEGAWATT HOURS)		DIFFERENCE IN POWER GENERATION	ANNUAL POWER GENERATION (MEGAWATT HOURS)		DIFFERENCE IN POWER GENERATION	NET SYSTEM DIFFERENCE IN POWER GENERATION (MEGAWATT HOURS)
	WITHOUT IOP	WITH IOP		WITHOUT IOP	WITH IOP		WITHOUT IOP	WITH IOP		WITHOUT IOP	WITH IOP		
1989	81,010	82,012	1,002	146,810	146,985	175	375,545	375,645	100	239,230	241,262	2,032	3,309
1990	194,728	195,209	481	180,263	181,424	1,161	412,131	411,762	-369	190,560	191,491	931	2,204
1991	144,126	144,139	13	165,790	165,794	4	405,486	405,491	5	246,782	246,652	-130	-108
1992	182,450	181,774	-676	179,380	177,497	-1,883	435,818	432,207	-3,611	231,354	232,201	847	-5,323
1993	183,052	183,061	9	156,021	156,080	59	401,028	401,071	43	215,018	215,269	251	362
1994	121,614	121,597	-17	170,475	170,369	-106	460,624	460,096	-528	251,408	251,282	-126	-777
1995	157,671	158,009	338	154,296	155,694	1,398	396,334	397,905	1,571	224,212	227,904	3,692	6,999
1996	192,078	191,985	-93	152,444	152,395	-49	425,460	422,092	-3,368	228,997	228,239	-758	-4,268
1997	131,512	133,109	1,597	162,732	163,332	600	453,315	451,777	-1,538	235,342	235,555	213	872
1998	207,511	205,695	-1,816	189,119	188,605	-514	479,518	480,247	729	213,764	214,263	499	-1,102
1999	73,575	75,765	2,190	67,281	69,519	2,238	217,046	218,018	972	188,229	189,634	1,405	6,805
2000	56,300	55,005	-1,295	57,228	57,752	524	177,632	178,641	1,009	157,839	158,822	983	1,221
2001	34,255	32,843	-1,412	90,231	87,062	-3,169	284,431	280,806	-3,625	189,836	189,713	-123	-8,329
NET DIFFERENCE IN GENERATION			**321**			**438**			**-8,610**			**9,716**	**1,865**
AVERAGE DIFFERENCE IN GENERATION			**25**			**34**			**-662**			**747**	**143**

Notes:
1. A negative sign, "-", in the "Difference in Power Generation" columns represents *less* power generated with implementation of the Modified IOP.
2. This model uses historical data and the Mobile District's estimated 2010 M&I and Agricultural demands. This demand set was developed strictly for use in the Environmental Assessment of the Modified IOP.
Source: Hathorn, James. U.S. Army Corps of Engineers Mobile District. Provided via email on May 8, 2007.

[149] Note: Model results are shown beginning in 1989 because it was the first year during which the current draft water control plan was implemented on the ACF basin. See U.S. Army Corps of Engineers, Mobile District. 2007. Environmental Assessment Modifications to the Interim Operations Plan for Support of Endangered and Threatened Species, Jim Woodruff Dam, Gadsden and Jackson Counties, Florida, and Decatur County, Georgia. Page EA-2.

EXHIBIT 4-7 MODELED MONTHLY CHANGES IN HYDROPOWER GENERATION (MEGAWATT HOURS) BY USACE DAM UNDER THE MODIFIED IOP



Note: Values at "0" represent no difference in power generation between operation with and without the IOP. Values that depart from zero represent changes. The positive-signed values, those above the zero line, represent more power produced, whereas those negatively-signed, below the zero line, represent less power produced.

4.3 IMPACTS TO WATER RESERVOIRS, NON-FEDERAL HYDROPOWER FACILITIES, AND OTHER WATER PROJECTS

4.3.1 BACKGROUND

130. Water resources in Georgia are highly developed, and population growth, particularly in the greater Atlanta area, continues to increase the demand for water for municipal, commercial and industrial use. It has become more difficult to obtain approval for main stem dams; as a result, it is increasingly common to build water supply reservoirs on smaller streams (e.g., Lake McIntosh on Line Creek). These reservoirs are referred to as "off-stream," but are typically not located entirely away from a stream or river.[150] Still Branch Reservoir and Lake McIntosh are the only water supply reservoirs within proposed critical habitat that have been permitted since the listing of the seven mussels. Water resources in the critical habitat units in Alabama and Florida are not expected to face the same development pressures as those projected for northern Georgia. As a result, there are currently no plans for impoundment projects in the proposed critical habitat units in Alabama or Florida.[151]

[150] Cowie, et al. 2002. "Reservoirs in Georgia: Meeting Water Supply Needs While Minimizing Impacts." River Basin Science and Policy Center, University of Georgia.

[151] There are no planned water supply or hydropower projects in the streams proposed for critical habitat in Alabama or Florida (Personal Communication, Bill Bunkley, Inland Branch Chief, Mobile District Regulatory Division, August 25, 2006, and February 2, 2007; and Personal Communication, Graham Lewis, Northwest Florida Water Management District (NWFWMD), October 6, 2006, and Louis Mantini, Suwannee River Water Management District (SRWMD), October 4, 2006. In

131. In addition to water supply projects, three non-Federal hydropower facilities occur in proposed critical habitat. Combined, these power projects contribute 1.1 percent of the total electricity generated from all energy sources in the counties containing critical habitat.

EXHIBIT 4-8 NON-FEDERAL HYDROPOWER FACILITIES IN PROPOSED CRITICAL HABITAT

UNITS	DAM/WATERBODY	OPERATOR	NAMEPLATE CAPACITY (KILOWATTS) [1]	PORTION OF REGIONAL ELECTRICITY SUPPLY (%)[2]	LAKE SIZE (ACRES)	FERC LICENSE EXPIRATION DATE
6	Warwick Dam, Flint River, Lake Blackshear	Crisp County Power Commission	17,200	0.52	8,700	2008
6/7	Flint River, Muckalee and Kinchafoonee Creeks, Lake Worth	Georgia Power Company	5,400	0.16	1,400	2039
10	Jackson Bluff Dam/ Ochlockonee River, Lake Talquin	City of Tallahassee	12,200	0.46	8,850	2022

Sources: Federal Energy Regulatory Commission. "Issued Licenses." Available at: http://www.ferc.gov/industries/hydropower.asp; and Georgia Power, Florida Fish & Wildlife Conservation Commission, and Crisp County Power Commission websites.
Notes:
1. Multiple descriptions of capacity exist for these facilities. To provide information consistent across all dams, the nameplate capacity is used, as reported by the Energy Information Administration (EIA) in "Existing Generating Units in the United States by State, Company, and Plant, 2004, Current as of January 1, 2005" in "Annual Electric Generator Report". Accessed at: http://www.eia.doe.gov/ on November 7, 2006.
2. Regional supply defined as all electricity generating plants in the counties containing proposed critical habitat, by State, as identified in EIA 2005.

4.3.2 APPROACH

4.3.2.1 Reservoirs

132. Monetized costs presented in this section associated with water projects are primarily the result of surveying and monitoring requirements. Costs to downstream municipal, agricultural, and recreational users associated with potential flow changes are discussed in Section 3. Compliance costs are presented for the following reservoir projects, and described in further detail in Section 4.3:[152]

- Lake McIntosh/ Line Creek Reservoir (proposed water supply), Fayette County, Georgia; and
- Griffin Still Branch Reservoir (recent water supply project), Pike County, Georgia.

addition, current permitted withdrawals in northwest Florida are expected to meet 2025 demands in most of the region (Northwest Florida Water Management District. 2003. "Water Supply Projections 2005-2025." Water Resources Assessment 2003-01).

[152] Reservoirs identified through stakeholder communications, USACE data, and State of Georgia Board of Natural Resources "Water Issues White Paper" 2001.

Costs were provided for the Griffin Still Branch Reservoir project, and estimates of future costs were provided for Lake McIntosh.

4.3.2.2 FERC Licensed Facilites

133. Of the non-Federal FERC-licensed dams, two will undergo relicensing within the timeframe of this analysis. The relicensing process involves consultation between FERC and the Service, that may result in compliance costs to the permittee. The third hydropower dam at Lake Worth on the Flint River, has consulted with the Service in the past on an informal basis. Costs of this consultation are captured in Appendix A.

134. Facility operators were contacted to obtain cost estimates of seven mussels conservation efforts. The Crisp County Power Commission (CCPC) provided costs associated with the relicensing of the Lake Blackshear hydroelectric project. This analysis assumes that similar costs will be incurred by the City of Tallahassee for the relicensing of the Lake Talquin hydroelectric project, scheduled for 2022. Both are existing facilities and are of comparable size.

4.3.2.3 Other Water Projects

135. Construction of smaller scale water supply, dam, culvert or pond projects in Georgia may also result in compliance costs associated with surveying and monitoring to permittees. In Georgia, a total of 52 water projects (an average of five per year) have been permitted by the USACE in waterways within proposed critical habitat since the time of the seven mussels' listing.[153] These permits have primarily involved activities in the Middle and Upper Flint River and its tributaries (Units 5 and 6). This analysis estimates that five USACE permitted water projects may be affected by mussel conservation efforts per year during the analysis period, at a cost similar to those incurred by other efforts in the Upper Flint River basin.

136. The Georgia EPD also indicated that there are five permits pending for water projects, and all are in counties in the Upper Flint River basin.[154] Consultation with the Service and associated survey and monitoring costs may be recommended for future projects. Similar cost assumptions are applied from other water supply projects. These potential compliance costs are quantified for five projects per year in the Upper Flint (Units 5 and 6), based on costs to Still Branch Reservoir, and estimated costs to Lake McIntosh. Consultation costs are captured in Appendix A.

[153] Permitted project data for projects completed between 1998 and 2006 by David Crosby, USACE Savannah District on October 25, 2006. This subset of data was identified from project permit information at the County level. Of 652 projects, 133 had information linking them to a waterway - it is possible that others in fact are associated with waterways, but this information is not available. Of these, 72 were associated with waterways proposed for critical habitat designation. Removing projects associated with transportation (accounted for in Section 6), a total of 52 projects remained.

[154] Written communication with Clay Burdette, Georgia EPD, October 31, 2006.

4.3.3 PROJECT-SPECIFIC IMPACTS

4.3.3.1 Griffin Still Branch Reservoir (Unit 5)

137. The Griffin Still Branch Reservoir was completed in 2005. Designated as a regional water supply reservoir serving six counties (60,000 people), it has a capacity of 3.5 billion gallons and a permitted withdrawal of 24.5 million gallons per day (MGD).[155] Seven mussels conservation efforts have included surveying, equipment installation, and monitoring (e.g., flow, dissolved oxygen). Pre-designation costs through 2006 have totaled $99,300 (discounted at three percent). Continued monitoring costs are expected for five years (2007 - 2011) at a cost of $23,000 per year (undiscounted), or $108,000 total (discounted at three percent). [156]

4.3.3.2 Line Creek Reservoir/Lake McIntosh (Unit 5)

138. Line Creek Reservoir, also known as Lake McIntosh, is the only water supply reservoir identified as currently in development. It is planned for Fayette County (with a population of 98,400), below the confluence of Shoal and Line Creeks in Unit 5. It is designed as a 650 acre drinking water supply reservoir with a storage capacity of 1.5 billion gallons, and a permitted withdrawal of 10.4 MGD.

139. A 2006 amendment to a 2005 section 7 formal consultation for this project estimated take of all shinyrayed pocketbooks and oval pigtoes (including eight oval pigtoes identified in a May 2006 survey). The amendment listed the following reasonable and prudent measure: "Implement a monitoring plan to measure long-term effects of flow alteration on the oval pigtoe population within the action area portion of Line Creek for the life of the project," requiring water level monitoring gauges upstream and downstream of the project.[157]

140. Future seven mussel conservation efforts are expected to include surveys and monitoring - an initial survey estimated at $375,000 (undiscounted), and subsequent surveys every three years, as listed in the terms and conditions of the amendment referenced above.[158] Monitoring surveys are estimated to cost $25,000 each (undiscounted).[159] Total costs are estimated to be $500,000 (discounted at three percent).

4.3.3.3 Lake Blackshear (Unit 6)

141. Lake Blackshear was created on the Flint River by a dam in 1930. The CCPC operates the dam to provide hydroelectric power to Crisp County, serving an estimated 12,000

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[155] City of Griffin Water and Wastewater Department. Accessed at: http://www.griffinstorm.com/WWW/Home.htm

[156] Written communication from Ron Harris, Engineering Strategies, Inc. October 30, 2006.

[157] The amendment to the Biological Opinion of January 13, 2006 for the proposed Lake McIntosh water supply reservoir located on Line Creek in Fayette and Coweta Counties, Georgia, updates and changes the expected amount of take, reasonable and prudent measures, and associated terms and conditions, based on discovery of presence of oval pigtoe mussels in the action area of Line Creek. The Amendment is dated October 23, 2006.

[158] U.S. Fish and Wildlife Service. 2006. Amendment to the Biological Opinion of January 13, 2006 for the proposed Lake McIntosh water supply reservoir located on Line Creek in Fayette and Coweta Counties, Georgia. Page 6.

[159] Fax received from Bill McNally, McNally, Fox & Grant, for Fayette County on October 25, 2006.

homes or businesses with water meters.[160] Lake Blackshear also provides recreational opportunities, including fishing, and boating, and is primarily managed to maintain lake levels for recreation.

142. As part of the ongoing FERC relicensing process for the dam operations, CCPC has conducted various mussel surveys, and produced a biological assessment for section 7 consultation with the Service. The CCPC also proposed conducting three post-licensing mussel studies at five-year intervals. Costs to date are $87,800 (discounted at three percent). Three future surveys at a cost of $40,000 each, are scheduled to occur at five year intervals after re-licensing and are expected to cost a total of $87,300 (discounted at three percent).[161]

4.3.3.4 Other Water Projects (Units 5 and 6)

143. This analysis estimates that an average of five water projects each year in Units 5 and 6 will require mussel survey efforts at a cost of $24,000 each for mussel survey efforts. In 2007, four of the five are expected to be the off-stream withdrawal projects currently permitted or under review by the Georgia EPD, all are located in Unit 6. Conservation efforts are likely to include surveying and monitoring. Initial surveying for the off-stream withdrawal projects is expected to cost $45,000 (undiscounted), and subsequent monitoring for five years is expected cost $24,000 per year (undiscounted).[162] The total estimated costs to other water projects may be up to $2.36 million (discounted at three percent).

4.3.3.5 Tired Creek Lake (Unit 9)

144. Grady County has expressed concern that its proposed non-consumptive recreational lake project on Tired Creek will be burdened with delays in permitting due to the seven mussels proposed critical habitat designation.[163] Grady County's planning process included hydrologic modeling, and a mussel survey. Tired Creek itself is not proposed for critical habitat designation, but it is a tributary to the Upper Ochlockonee River (Unit 9), therefore these costs are not included in this analysis.

4.3.3.6 Lake Talquin/ Jackson Bluff Dam (Unit 10)

145. Built in 1927, the Jackson Bluff Dam impounds Lake Talquin on the Ochlockonee River in Florida, which is between Units 9 and 10. Operated by the City of Tallahassee, the

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[160] Crisp County Power Administration. Accessed at: http://www.crispcountypower.com/ on November 9, 2006.

[161] Written communication from Steve Rentfrow, General Manager, Crisp County Power Commission. October 25, 2006.

[162] There is uncertainty regarding whether initial surveying and/or annual monitoring will be required for water projects within these units, the exact nature of these requirements, and the expected cost of these requirements. As an estimate of the potential future costs to these projects, the cost of one year's monitoring ($24,000, taken as an average from Still Branch Reservoir, and Lake McIntosh annual monitoring estimates) is applied to five projects per year in Units 5 and 6 (i.e., an average of 2.5 projects per Unit). For the four EPD projects in Unit 5 in 2007, full costs from Still Branch Reservoir are applied, including an initial cost of $45,000 specifically for surveying for the mussels, followed by annual surveys for up to five years.

[163] Public Comment. "Re: 50 CFR 17: Endangered and Threatened Wildlife and Plants, Critical Habitat for Five Endangered and Two Threatened Mussels, in Four Northeast Gulf of Mexico Drainages; Proposed Rule." Submitted by the Grady County Board of Commissioners, August 4, 2006.

C.H. Corn Hydroelectric Plant dam has a capacity to produce 12,200 kilowatts of hydroelectric power, or approximately three percent of the power required by Tallahassee.[164] The dam's FERC license is set to expire in 2022.[165] Absent specific cost estimates associated with seven mussel conservation efforts, costs from the current re-licensing at Lake Blackshear on the Flint River are applied.[166] These costs include section 7 consultation costs, surveys and studies of the seven mussels. The timing of the various conservation activities are assumed to be the same for the Jackson Bluff Dam (e.g., the biological assessment production would begin three years before the license expiration date). The post-licensing monitoring studies included in the analysis for Lake Blackshear are not included for Lake Talquin, as they would be expected to occur after 2026. Total post-designation costs for this project are estimated (discounted at three percent) to be $58,000.

[164] C.H. Corn Hydroelectric Power Plant. Accessed at http://www.talgov.com/you/electric/corn.cfm on November 9, 2006.

[165] Federal Energy Regulatory Commission. "Issued Licenses." Available at: http://www.ferc.gov/industries/hydropower.asp

[166] Personal Communication with Gordon King, City of Tallahassee, January 31, 2007 indicated that costs specific to Lake Talquin relicensing were not available, and that applying those from Lake Blackshear would be reasonable.

SECTION 5 | POTENTIAL WATER QUALITY-RELATED IMPACTS

146. Habitat for the seven mussels is influenced by a variety of water pollutants, including coliform, nutrients, pesticides, temperature, pH, dissolved oxygen, and sedimentation. Water quality can affect the seven mussels directly as well as indirectly through impacts on host fish. The analysis gives primary attention to agricultural and urban runoff issues, but describes a variety of other economic activities and sources affecting water quality.

5.1 SUMMARY

147. Overall, activities affecting water quality generate limited economic costs associated directly with conservation efforts for the seven mussels, particularly when compared to other categories of costs. While much of the proposed critical habitat lies in agricultural areas, several factors limit likely costs for agricultural operations. Most notably, management agencies indicate that voluntary resource management projects in the most affected regions have little direct impact on water quality and that past evaluations have not resulted in seven mussels conservation efforts. Likewise, livestock operations, while numerous, generally are small and are therefore not managed under point-source permit programs.

148. Data suggest that urban runoff is a limited contributor to impairment of the proposed critical habitat rivers and stormwater permitting experts anticipate no modification of permits for seven mussels conservation. Survey data suggest that runoff from forestry operations in the affected region is controlled by widespread use of best management practices (BMPs). Finally, while approximately 65 municipal and industrial wastewater treatment facilities are located on proposed critical habitat rivers, available data do not list these sources as contributors to impaired water quality; as such, they would not likely be the focus of seven mussels conservation efforts. Therefore, this analysis does not estimate costs of conservation efforts for the seven mussels for activities contributing to the pollution of surface waters.

5.2 BACKGROUND

149. In considering each of the activities described below, it is important to keep in mind the overall system of water quality management called for by the Clean Water Act (CWA). Under the CWA, States develop water quality standards designed to be protective of water uses and aquatic life. If a waterbody does not meet its designated uses, it is identified as impaired and becomes the focus of enhanced water quality management measures. Exhibit 5-1 shows the status of impaired waters within proposed critical habitat (i.e., fully, partially, or not supporting designated uses).

150. Enhanced water quality management measures may include development of total maximum daily load (TMDL) specifications that allocate allowable discharges of a particular pollutant across sources to achieve the total loadings identified in the TMDL and to restore water quality. For example, effluent limitations contained in point-source permits might be revised to ensure achievement of the State's fecal coliform standard in a given river basin. Exhibit 5-2 presents selected characteristics of impaired waters within proposed critical habitat in Alabama, Florida, and Georgia. As long as water quality criteria are protective of seven mussels health, additional conservation efforts are unlikely. Therefore, the system implicitly minimizes (but does not eliminate) the potential for increased costs associated with seven mussels conservation efforts.

EXHIBIT 5-1 STATUS OF IMPAIRED WATERS WITHIN PROPOSED CRITICAL HABITAT FOR THE SEVEN MUSSELS

EXHIBIT 5-2 SELECTED CHARACTERISTICS OF IMPAIRED WATERS WITHIN PROPOSED CRITICAL HABTIAT FOR THE SEVEN MUSSELS

RIVER	LENGTH (MILES)	COUNTY	LOCATION	CRITICAL HABITAT UNIT	IMPAIRMENTS	TMDL(S)
Non-Point						
Red Oak Creek	8	Meriwether	Little Red Oak Creek to Flint River near Imlac	5	Fecal Coliform Bacteria	N
Swift Creek	7	Turner/Crisp	u/s Lake Blackshear	6	Fecal Coliform Bacteria	N
Turkey Creek	4	Dooly	Pennahatchee Creek, NW Cordele to Flint River	5	Fecal Coliform Bacteria	N
Cooleewahee Creek	16	Dougherty/Baker	Piney Woods Branch to Flint River near Newton	7	Fecal Coliform Bacteria/Biota Impacted	N
Aycocks Creek	15	Miller	Kaney Head Creek to Spring Creek	7	Fecal Coliform Bacteria	N
Lanahassee Creek	6	Webster	W. Fork Lanahassee Creek to Kinchafoonee Creek	6	Fecal Coliform Bacteria	N
Mercer Mill Creek (Mill Crk)	7	Mill	Boy Scout Road to Flint River	6	Biota Impacted	N
Barnetts Creek	8	Thomas/Grady	West Branch to Ochlockonee River, W. of Thomasville	9	Dissolved Oxygen	N
Little Ochlockonee River	9	Thomas	Big Cr. to Ochlockonee River near Ochlocknee	9	Dissolved Oxygen, Fecal Coliform Bacteria	N
Tired Creek	6	Grady	Turkey Cr. to Ochlockonee River	9	Fecal Coliform Bacteria	N
E. Br. Barnetts Creek	3	Thomas	Horse Cr. to Barnetts Cr. near Ochlocknee	9	Dissolved Oxygen	N
Ochlockonee River	33	Thomas/Grady	Oquina Creek to Stateline	9	Fish Consumption Guidance	N
Ochlockonee River	16	Thomas	Bridge Cr. to Oquina Creek	9	Dissolved Oxygen/Fish Consumption Guidance	N
Santa Fe River	NA	NA	Map 50	11	Dissolved Oxygen, Fecal Coliform	N
Ochlocknee River	NA	NA	Maps 9 and 88	10	Fecal Coliform, Nutrients, Turbidity, Mercury	N
Apalachicola River	NA	NA	Map 10	8	Turbidity	N
Chipola River	NA	NA	Map 1	2	Fecal Coliform, Mercury, Turbidity	N
Urban Runoff						
Dry Creek	12	Early	Headwaters, d/s Blakely, to Spring Creek	7	Dissolved Oxygen	N
Spring Creek	22	Early/Miller	SR62 near Arlington to Aycocks Creek	7	Dissolved Oxygen/Biota Impacted	N

RIVER	LENGTH (MILES)	COUNTY	LOCATION	CRITICAL HABITAT UNIT	IMPAIRMENTS	TMDL(S)
Kinchafoonee Creek	40	Terrell/Sumter/ Lee/Dougherty	Ga. Hwy. 45 to Lake Chehaw/Worth	6	Fish Consumption Guidance	Y
Flint River	9	Clayton/Fayette /Spalding	Road S1058/Woolsey Road to Horton Creek	5	Fecal Coliform, Bacteria	N
Whitewater Creek	13	Macon	Cedar Creek to Flint River	5	Fecal Coliform, Bacteria/PH	N

Note: Non-point sources of pollution may be associated with agriculture, however, the category is also used for unknown sources of pollution. Georgia Department of Natural Resources Environmental Protection Division, Data Source Code/Key for Abbreviations. Accessed at http://www.gaepd.org/Files_PDF/305b/Y2006_303d/Y2006_Data_Source_Code.pdf on May 16, 2007.

Sources:

Georgia Department of Natural Resources Environmental Protection Division, 2006 305(b)/303(d) Rivers/Streams Not Fully Supporting Designated Uses. Accessed at http://www.gaepd.org/Files_PDF/305b/Y2006_303d/Y2006_Streams.pdf on May 16, 2007.

U.S. Environmental Protection Agency, Total Maximum Daily Loads for Alabama, Florida, and Georgia. Accessed at http://www.epa.gov/owow/tmdl/ on May 16, 2007.

Georgia Department of Natural Resources Environmental Protection Division, Georgia 305(b)/303(d) GIS Databases and Map Revised July 2002. Accessed at http://www.gaepd.org/Documents/305b.html on May 16, 2007.

Florida Department of Environmental Protection, 303(d) 2002 Group1 Impaired Waters. Accessed at http://www.fgdl.org/metadata/fgdl_html/watqual303d_2002.htm on May 16, 2007.

5.3 AGRICULTURE

151. While agriculture is common throughout the proposed critical habitat, this analysis focuses on the Middle and Lower Flint River Basins, which includes a concentration of agricultural activity as well as a portion of the proposed critical habitat (Units 6 and 7).[167] The market value of agricultural output in the 14 counties in this region totaled about $521 million in 2002. Major products include cotton, peanuts, poultry, and hogs.[168]

152. Agricultural operations also exist around proposed critical habitat in Florida and Alabama. In particular, major livestock operations (e.g., dairy cattle, poultry) exist in Florida's Santa Fe River watershed (proposed Unit 11), with a value of approximately $83 million.[169] Likewise, some panhandle counties (e.g., Gadsden) account for major row crop harvests. However, the overall concentration of agriculture and proposed critical habitat in these areas is less than in southwest Georgia.

5.3.1 VOLUNTARY NATURAL RESOURCE MANAGEMENT PROJECTS

153. Conservation efforts for the seven mussels may be undertaken for agricultural operations that receive a loan or grant from the Federal Farm Service Agency (FSA) or a grant from the Natural Resources Conservation Service (NRCS). These sources frequently fund the implementation of voluntary BMPs, including water quality protection practices (e.g., through the Environmental Quality Incentives Program).

154. Georgia NRCS staff indicate that seven mussels conservation efforts have had little influence on their cost-sharing activities. First, most of the cost-sharing contracts in the Flint Basin have no water quality implications or affect water quality only indirectly. Since most of the area is cropland, the projects primarily fund conservation tillage, cover crops, or irrigation system improvements. Pastureland is limited and many of the rivers are too large for livestock watering, minimizing the number of near-stream projects such as watering ramps.[170] Furthermore, NRCS staff note that each project includes an "environmental evaluation" worksheet that explicitly flags endangered species issues. NRCS technical guidance instructs field staff to arrange consultations with the Service and relevant State officials when specific conditions are met. Thus far, this procedure has produced no mussel-related consultations.[171]

155. While the potential for impacts associated with seven mussels conservation appears limited, it is useful to consider the nature of potential effects. First, landowners and the

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[167] The focus on agriculture in Units 6 and 7 was also recommended by Georgia Environmental Protection Division, based on their water quality management experience. Personal communication with Liz Booth, Acting Director for the Watershed Program, Environmental Engineer, Kathy Methier, Unit Manager, Water Quality Monitoring, Cody D. Jones, Environmental Specialist, Channing St. Aubin, Environmental Specialist, Kevin Farrell, Program Manager for the Water Withdrawal Permitting Program, August 29, 2006.

[168] National Agricultural Statistics Service, 2002 Census of Agriculture.

[169] National Agricultural Statistics Service, Ibid.

[170] Personal communication with David Lamm, Assistant State Conservationist (Programs), NRCS, October 12, 2006.

[171] Personal communication with David Lamm, Assistant State Conservationist (Programs), NRCS, October 26, 2006.

NRCS may need to enter into more frequent and more formal consultations with the Service and State water quality officials prior to implementing projects, increasing the overall costs of achieving the desired water quality protection. Second, landowners may simply see the need for consultation as an unwanted complexity, and avoid participating in the BMP implementation programs altogether.[172] The result may be elimination of the projects or implementation of less efficient projects with other landowners. Ultimately, this outcome could lead to the loss of water quality benefits that accrue from the BMP programs.

5.3.2 NPDES PERMITTING OF LIVESTOCK OPERATIONS

156. A second aspect of agriculture that may be affected is permitting of water discharges from livestock operations. In Georgia, livestock operations are concentrated in northern and eastern regions of the State; the 14 counties in the Middle and Lower Flint Basins account for only about five percent of all market sales of livestock, with most of this total concentrated in the eight counties of the Lower Flint Basin (NASS, 2002).[173] Nonetheless, a number of operations are located in proposed critical habitat, as demonstrated in Exhibit 5-1. As noted, Florida's Santa Fe Basin (Unit 11) has a major concentration of livestock operations, particularly beef and dairy cattle as well as poultry; these are also summarized in Exhibit 5-1.

157. Livestock operations may affect the seven mussels and their habitat through discharge of animal waste and wastewater into streams, as a result of spills from waste storage systems, or as a result of runoff from land application of manure (for treatment rather than as crop fertilizer). The CWA designates many animal feeding operations as point sources that must obtain discharge permits under the NPDES program. While requirements vary by farm type, these permits typically require that permittees develop and implement nutrient management plans, assembling information on nutrient production, land application practices, an emergency response plan, and other facility details. Required nutrient management measures may include installation of approved waste retention structures, construction of vegetation buffers, and/or implementation of water quality monitoring procedures.

158. For several reasons, conservation efforts for the seven mussels are likely to have a modest effect on livestock operations. First, consistent with Federal guidelines, Georgia does not require permitting of smaller livestock operations. A cutoff of 300 animal units is used to define small operations. This cutoff translates into 300 beef cattle, 750 swine, or 9,000 to 37,500 poultry (depending upon the manure management system used).[174] The majority of livestock operations in the Lower Flint Basin qualify as small, and therefore are not

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[172] NRCS staff agreed that landowners may avoid participation when confronted with endangered species issues, although few projects would be affected. Personal communication with David Lamm, Assistant State Conservationist (Programs), NRCS, October 12, 2006.

[173] National Agricultural Statistics Service, Op cit.

[174] Georgia Cooperative Extension Service, "A Review of Georgia's Animal Feeding Operation Regulations," University of Georgia College of Agriculture and Environmental Sciences, February 2005.

required to apply for NPDES permits (see Exhibit 5-1).[175] Florida regulations apply similar cutoffs to define small animal feeding operations. As summarized in Exhibit 5-3, the livestock farms in Florida's Santa Fe Basin are largely small operations. While the regulations allow permitting of these operations if particular discharge methods are used, NPDES permits are not automatically required.[176]

EXHIBIT 5-3 NUMBER OF LIVESTOCK OPERATIONS IN LOWER FLINT AND SANTA FE RIVER BASIN COUNTIES

STATE	COUNTY	POULTRY*	CATTLE		HOGS	
			TOTAL	SMALL	TOTAL	SMALL
Georgia	Baker	10	59	48	23	22
	Calhoun	3	24	13	0	0
	Decatur	14	153	134	7	7
	Dougherty	1	41	39	10	10
	Early	9	151	137	22	22
	Miller	6	90	79	16	13
	Mitchell	32	189	166	20	14
	Terrell	1	39	39	5	5
Florida	Alachua	89	765	710	71	71
	Bradford	36	241	236	7	7
	Columbia	62	454	442	45	45
	Union	23	207	204	8	8

Source: NASS, 2002 Census of Agriculture.
* Includes layers and broilers. Information on poultry operation size generally withheld due to confidential business concerns related to the small number of operations per county.

159. Furthermore, all Georgia livestock operations are governed by a general permit that includes no specific requirements recognizing threatened and endangered species or their habitat. Georgia may eventually adopt a watershed-based permitting system whereby permits are tailored to specific conditions in the watershed. Potentially, this approach would allow permitters to require more stringent facility design and procedures for large and medium-sized operations. However, the current system is not structured to allow this kind of permit customization. In addition, it is unlikely that seven mussels conservation considerations would lead permitting officials to require NPDES permits of smaller facilities,[177] although Georgia law may allow such a decision.[178] To the extent that

[175] Note that the operation size data reported in the NASS survey do not correspond directly to the 300 animal unit equivalents. This analysis interprets the number of "small" operations conservatively. For example, small cattle operations are those reported as having 200 or fewer head; the number of operations below the 300-head regulatory cutoff is likely greater.

[176] "Agricultural Wastewater Program Definitions Related to Animal Feeding Operations," obtained online at http://www.dep.state.fl.us/water/wastewater/iw/agri_def.htm.

[177] Personal communication with Vernon Jones, Georgia Department of Agriculture, Livestock and Poultry Field Forces, October 10, 2006.

smaller facilities were required to obtain NPDES permits, the costs to operators would likely be modest. For example, development of a standard nutrient management plan is estimated to be several hundred dollars per farm.[179]

160. Overall, the prevalence of small facilities, generic nature of permit requirements, and minor cost of nutrient management plan development all suggest that the costs of conservation efforts for the seven mussels would be limited for livestock operations.

5.4 URBAN RUNOFF

161. The seven mussels may also be affected by pollutants associated with urban stormwater runoff. Under the NPDES program, permits are issued for stormwater discharges from municipal storm sewer systems and new construction sites (in addition to other activities). In Georgia, Florida, and Alabama, State water quality agencies are authorized to issue stormwater permits, although specific requirements vary from State to State.

162. The potential for stormwater runoff is greatest in urbanized areas as they then to have the greatest amount of impervious surface. This analysis, therefore, focuses on those that have experienced rapid growth. Analysis of Census population data highlights several counties with high growth rates in proposed critical habitat, where current and future stormwater discharges and permitting activity may be most extensive.[180] As shown in Exhibit 5-4, these areas are generally located around major municipalities in Georgia and Florida and are especially concentrated in the Upper Flint Basin.

[178] Georgia regulations stipulate that if evidence of pollution exists, DNR/EPD can designate small livestock operations for permitting. Georgia Cooperative Extension Service, "A Review of Georgia's Animal Feeding Operation Regulations," University of Georgia College of Agriculture and Environmental Sciences, February 2005.

[179] Personal communication with Vernon Jones, Georgia Department of Agriculture, Livestock and Poultry Field Forces, October 10, 2006.

[180] Counties highlighted are those with 1990-2003 growth rates that are more than double the national average of 17 percent.

EXHIBIT 5-4 HIGH-GROWTH COUNTIES ADJACENT TO PROPOSED CRITICAL HABITAT

STATE	COUNTY	NEARBY MUNICIPALITY	RIVER BASIN	CRITICAL HABITAT UNIT
Georgia	Fayette	Atlanta	Upper Flint	5
	Coweta	Atlanta	Upper Flint	5
	Pike	Atlanta	Upper Flint	5
	Crawford	Macon	Upper Flint	5
	Marion	Columbus	Middle Flint	6
	Lee	Albany	Middle Flint	6
Florida	Columbia	Gainesville	Santa Fe	11
	Union	Gainesville	Santa Fe	11
	Wakulla	Tallahassee	Lower Ochlockonee	10
Note: Counties listed are those with population growth rate from 1990 to 2003 exceeding 34 percent (twice the national average).				

163. Water quality characterizations suggest that urban runoff may be a source of impairment in some of the proposed critical habitat units, although the geographic scope of this contamination is likely limited. State 303(d) reports identify rivers and streams not fully supporting their designated uses. In Georgia, these reports also identify potential causes of the impairment. Exhibit 5-5 summarizes actions underway in the Georgia critical habitat units for which urban runoff is identified as a source of impairment. While the Florida 303(d) list does not include suspected sources of contamination, other data suggest that urban runoff is not a major water quality concern in the counties where critical habitat is proposed. For instance, the watershed vulnerability indicator "urban runoff potential" developed by the EPA suggest that none of the Florida counties in the study area have a high potential for urban runoff based on land uses and prevalence of impervious surface area.[181] Characteristics of Florida's impaired streams are provided above in Exhibit 5-2.

[181] Watershed vulnerability indicators obtained online at http://www.scorecard.org/env-releases/.

EXHIBIT 5-5 ACTIONS UNDERWAY FOR GEORGIA CRITICAL HABITAT RIVER REACHES REPORTED AS IMPAIRED BY URBAN RUNOFF

RIVER	CRITICAL HABITAT UNIT	ACTIONS UNDERWAY
Dry Creek	7	EPD will address urban runoff through a watershed protection strategy.
Flint River	5	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metro Atlanta.
Spring Creek	7	EPD will address urban runoff through a watershed protection strategy.
Whitewater Creek	5	EPD will address urban runoff through a watershed protection strategy.
Source: Georgia DNR/EPD, 2006 305(b)/303(d) Rivers/Streams Not Fully Supporting Designated Uses.		

164. Georgia and Florida are authorized to issue NPDES permits and these State-issued permits are treated as non-Federal actions. Stormwater permit development typically does not involve consultation between the Service and the State permitting agencies, although the Service can review permit applications to confirm that listed species are not adversely affected by water quality impacts. If the proposed permit does not appear to meet State water quality standards, the Service may object to issuance of the permit, and the State may ask the applicant to alter the permit to meet the standards.

165. State stormwater permitting experts indicate that collaboration with the Service is uncommon. The permits are broad in scope and do not include provisions to evaluate particular species (e.g., through a survey of mussel populations) or protect particular species.[182] Permitters have not conducted consultations in the past, nor did they foresee future consultation related to seven mussels conservation.[183]

166. While it is unlikely that seven mussels protection would directly trigger modifications to stormwater management projects, the Service or other entity could request that more stringent BMPs be implemented for systems or sites discharging to rivers with designated critical habitat. Such requirements could increase municipal expenditures on stormwater management or increase construction costs at new development sites. If the BMPs are costly, such requirements may preclude some construction projects. However, to the extent that any of these impacts are realized, it is through the broader process of establishing water quality standards, developing TMDLs, and modifying permits to achieve standards, rather than through direct consideration of seven mussels conservation in the permitting process.

[182] Based on U.S. EPA guidance, some states specify procedures for assessing the impact of stormwater discharges on listed species and critical habitat as a precondition for developing a general stormwater permit (i.e., for a permit that follows a general format and requires less customized information). The assessment findings determine whether use of a general permit is allowed and whether consultation with the Service is necessary. However, stormwater permitting experts in Georgia and Florida indicate that their states have not adopted these provisions in their programs. Therefore, these state permitting agencies do not require species and habitat impact assessment as a prerequisite to pursuing a general stormwater permit. Personal communication with Steven Kelly, Florida DEP, October 11, 2006, and Lyn Mickelson, Georgia DNR Environmental Protection Division, October 12, 2006.

[183] Personal communication with Lyn Mickelson, Georgia DNR Environmental Protection Division, October 3, 2006.

5.5 FORESTRY

167. Timber harvesting represents a potential source of sediment and other water pollutants detrimental to the seven mussels habitat. While Georgia has a major forestry sector, harvests generally are concentrated in the southeast portion of the State, outside of the proposed critical habitat units (see Exhibit 5-6). While some private timber harvest does occur in Unit 2, potential economic impacts from seven mussels conservation efforts are limited.[184] Of the counties bordering the proposed critical habitat units, none had annual total timber products removals exceeding 20 million cubic feet in 2002. Florida harvests are somewhat greater. In the panhandle, Bay and Jackson Counties both had harvests greater than 20 million cubic feet in 2002. Likewise, near the Santa Fe River Complex (Unit 11), Alachua and Columbia Counties both had 2002 harvests in excess of 20 million cubic feet.

168. Forestry-related water quality impacts are minimized through voluntary implementation of best management practices. State reports on implementation rates suggest that BMP use is high. Specifically, compliance with BMP recommendations in the major Florida counties identified above is estimated to be 100 percent.[185] Georgia's BMP survey results, while not available by county, suggest that compliance rates range from 88 to 100 percent in the relevant regions of the State. Compliance rates for small, private operations are at the low end of this range, while compliance rates for major forest industry operations and logging of public lands are at or near 100 percent.[186]

169. The potential for commercial forestry cost impacts is greatest for harvests on Federal lands. In these areas, seven mussels conservation efforts may include modifications to logging practices. However, harvests in Florida's Apalachicola National Forest (ANF) are minor relative to harvests on private lands. ANF staff indicate that annual removals total roughly 800,000 cubic feet per year,[187] about three percent of total removals in the counties of Gadsden, Liberty, and Wakulla. Furthermore, removals occur in upland areas, limiting the potential for water quality impacts.[188] Therefore, the potential for economic impacts from the seven mussels conservation efforts is limited.

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[184] In 2004, Houston County, Georgia (Unit 2) ranked 62 out of 67 for total stumpage revenue from sale of forest products by county. Alabama Forestry Commission. 2004. Forest Resource Report 2004. State of Alabama.

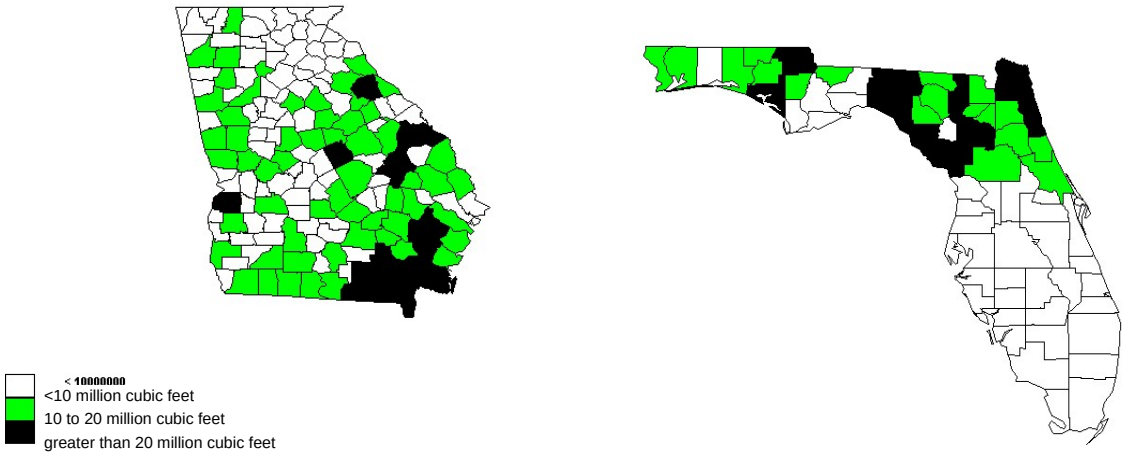
[185] Florida Division of Forestry, Silviculture Best Management Practices 2005 Implementation Survey Report, February 2006.

[186] Georgia Forestry Commission, Results of Georgia's 2004 Silvicultural Best Management Practices Implementation and Compliance Survey, October 2005.

[187] Personal communication with Susan Fitzgerald, U.S. Forest Service, Apalachicola National Forest, October 10, 2006.

[188] Personal communication with Susan Fitzgerald, U.S. Forest Service, Apalachicola National Forest, July 25, 2006.

Exhibit 5-6
DISTRIBUTION OF TIMBER HARVEST IN GEORGIA AND FLORIDA



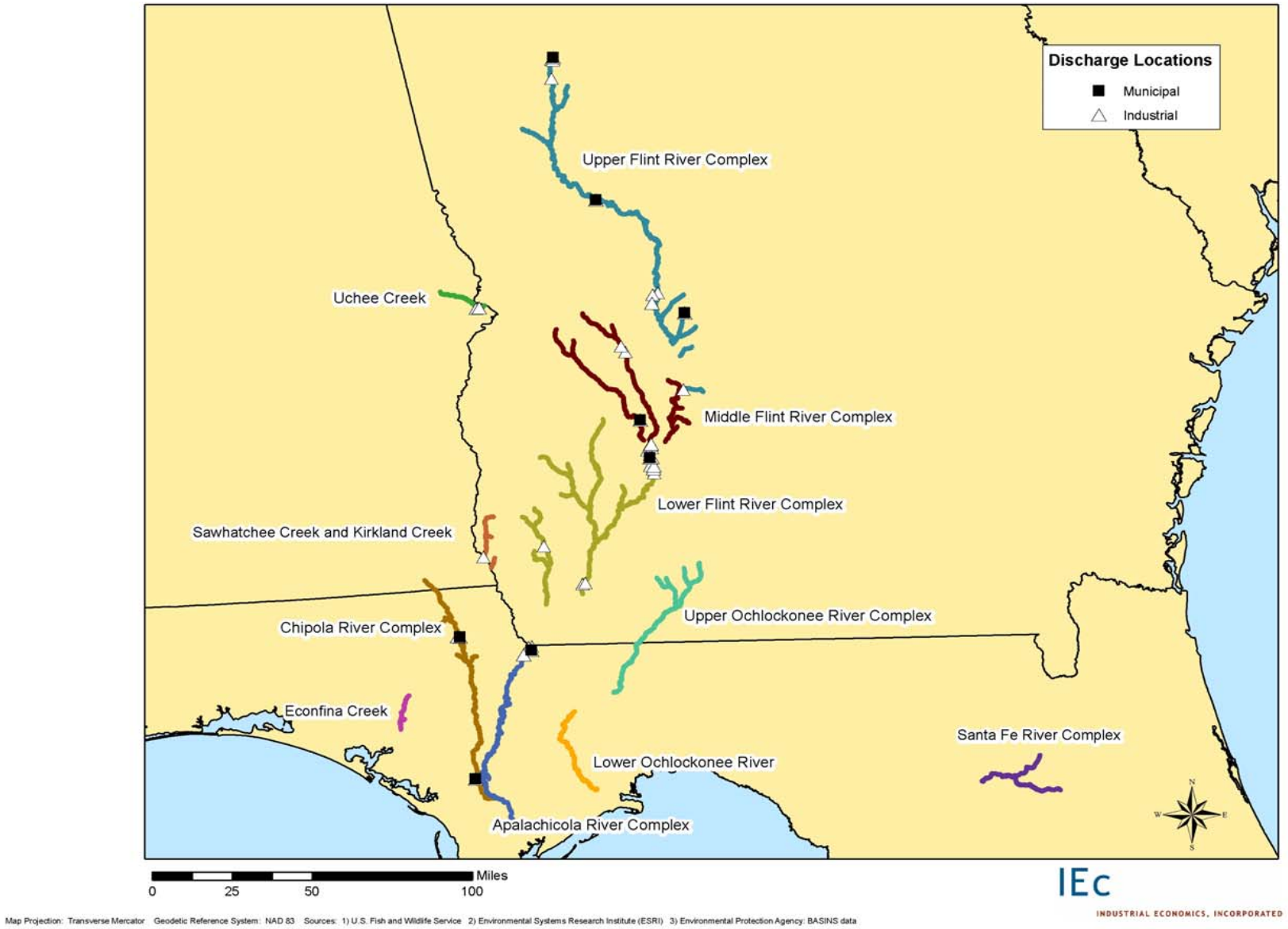
170. ANF staff have pursued no consultations specifically related to forestry impacts on seven mussels conservation. All threatened and endangered species consultations are conducted together, i.e., for all species as a group. Forestry is not among the activities that present water quality concerns (i.e., sedimentation); instead the focus is on bridge building and other in-stream projects. No projects (forestry or otherwise) have been modified for seven mussels conservation.[189]

5.6 INDUSTRIAL AND MUNICIPAL POINT SOURCES

171. Industrial facilities and municipal wastewater treatment plants may influence water quality in the proposed critical habitat rivers. Exhibit 5-7 shows the location of permitted dischargers located within one mile of proposed critical habitat rivers. In total, there area eight municipal and 57 industrial facilities, many of which are concentrated around Albany, Georgia.

[189] Personal communication with Susan Fitzgerald, U.S. Forest Service, Ibid.

EXHIBIT 5-7 PERMITTED NPDES DISCHARGERS WITHIN ONE MILE OF PROPOSED CRITICAL HABITAT RIVERS



172. Data from Georgia's 303(d) list suggest that point source dischargers are not a major source of impairment in proposed critical habitat. Of the 18 river reaches that are listed as impaired and which are part of proposed critical habitat, none include industrial or municipal discharges as a cause of impairment.[190] In Florida, portions of the Santa Fe, Apalachicola, Chipola, and Ochlockonee Rivers are characterized as impaired, primarily due to nutrients, dissolved oxygen, coliform, and turbidity suggesting non-point sources are the primary contributors.[191]

173. The Service reviews permit applications to confirm that listed species are not adversely affected by water quality impacts. If the proposed permit does not appear to meet State water quality standards, the Service may object to issuance of the permit, and the State may ask the applicant to alter the permit to meet the standards. The potential for such a scenario is limited by the requirements of the TMDL process, whereby hydrologic modeling and other analyses are used to develop effluent limits for all sources discharging to a selected waterbody, ensuring attainment of water quality standards.

174. Municipalities may bear additional costs due to limitations or restrictions placed on the quality or quantity of wastewater discharge associated with the seven mussels conservation efforts. In the case that water quality constraints were imposed, municipalities may bear additional treatment and filtration costs, whereas if restrictions are placed on the quantity of wastewater discharge, municipalities may incur fixed costs associated with unused infrastructure and/or limitations on municipal water consumption. However, additional biological information would be required to quantify these types of impacts, including the particular pollutants considered a threat to the seven mussels, and potential parameters on allowable discharges of these pollutants.

[190] Georgia DNR/EPD, 2006 305(b)/303(d) Rivers/Streams Not Fully Supporting Designated Uses, obtained online at http://www.gadnr.org/epd/Documents/305b.html.

[191] Florida DEP, 2002 Update to Florida's 303(d) List of Impaired Surface Waters, Verified List, obtained online at http://www.dep.state.fl.us/water/tmdl/2002_303d_update.htm.

SECTION 6 | ECONOMIC IMPACTS TO OTHER ACTIVITIES

175. Other activities identified in the proposed rule that may adversely affect the seven mussels or their habitat are transportation, deadhead logging, navigation dredging, snagging, sand and gravel mining projects, and possibly, the presence of non-native species. The proposed rule identifies these activities variously as potential sources of sedimentation, channel instability, and channelization, all of which are listed as threats to the seven mussels.[192] These activities and species management efforts designed to conserve the seven mussels are quantified in this Section.

176. The remainder of this Section first summarizes economic impacts to transportation, species management, deadhead logging, and navigation dredging projects. It then provides background information and the approach used for quantifying impacts to the aforementioned activities, followed by descriptions of impacts by project. It concludes with a qualitative discussion of potential impacts to seven mussels associated with sand and gravel mining, and presence of non-native species.

6.1 SUMMARY

6.1.1 PRE-DESIGNATION COSTS

177. Pre-designation costs of seven mussels conservation efforts related to other activities have resulted from surveying and monitoring for mussel species for transportation, and navigation dredging, and from species management projects, including the establishment of minimum flows and levels in Unit 11.[193] Exhibit 6-1 presents the total pre-designation costs to other activities by critical habitat unit. Total pre-designation impacts to other activities are estimated to be $1.12 million (discounted at three percent).

6.1.2 POST-DESIGNATION COSTS

178. Post-designation costs to other activities are estimated for transportation, species management (including development of a habitat conservation plan), and deadhead logging activities. Due to water quality and other permitting impediments unrelated to seven mussels conservation, that have precluded dredging since 2001, and the expectation expressed by the USACE is that navigation dredging is unlikely in the future in proposed critical habitat waters, post-designation navigation dredging costs are not estimated.

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[192] F.R. 71 32759 and F.R. 71 32749

[193] See Water Resource Associates, Inc. 2006. Draft Technical Report: MFL Establishment for the Upper Santa Fe River. Prepared for the Suwannee River Water Management District in association with SDII Global, Janicki Environmental and Intera, Inc. December 2006.

Exhibit 6-2 presents total post-designation impacts to other activities by proposed critical habitat unit. Total post-designation impacts to other activities are estimated to be up to $7.22 million (discounted at three percent). About half of the costs, 52 percent, result from transportation project activities.

6.2 TRANSPORTATION

6.2.1 BACKGROUND AND APPROACH

179. This analysis presents compliance costs for transportation projects within proposed critical habitat. It includes pre-designation costs obtained through interviews with State Departments of Transportation (DOTs), and forecasts post-designation costs by applying the past costs to an estimated number of future transportation projects. Compliance costs may result due to conservation efforts such as those that have occurred in the past. Specifically, past efforts have included surveys prior to projects, relocation of mussels away from project areas, and monitoring of water quality and mussel populations during and after project completion.[194] The Georgia and Florida DOTs anticipate undertaking transportation projects within proposed critical habitat, with similar per-project compliance costs.

- **Georgia Department of Transportation.** The Georgia DOT has developed a standard mussel survey protocol and suite of conservation measures that are employed in each project where mussels may be present. Depending on survey results, projects may require relocation of mussels. Based on the consultation history, an estimated one in seven projects will occur in the future that may require relocation of mussels and continued monitoring.[195]

[194] The majority of the past consultations (two formal and 36 informal) for transportation projects within proposed critical habitat were related to bridge projects. As such, this analysis accounts for future bridge projects consistent with new information from Georgia Department of Transportation.

[195] All but one of 14 Georgia consultations for transportation projects were in Unit 6. Past mussel relocation and monitoring efforts, have had an average cost of $76,700 (undiscounted). This cost is multiplied by the estimated four projects per year, and presented as impacts to Unit 6 in the post-designation impacts of this analysis.

EXHIBIT 6-1 TOTAL PRE-DESIGNATION IMPACTS TO OTHER ACTIVITIES

UNIT	UNDISCOUNTED	PRESENT VALUE	
		3%	7%
2 - Chipola River	$26,500	$27,900	$29,900
3 - Uchee Creek	$559	$575	$598
4 - Sawhatchee and Kirkland Creeks	$5,190	$5,430	$5,750
5 - Upper Flint River	$26,900	$28,400	$30,400
6 - Middle Flint River	$42,600	$44,600	$47,200
7 - Lower Flint River	$73,400	$81,300	$92,800
8 - Apalachicola River	$494,000	$577,000	$712,000
9 - Upper Ochlockonee	$12,000	$12,700	$13,600
11 - Santa Fe and New Rivers	$325,000	$345,000	$373,000
TOTAL	$1,010,000	$1,120,000	$1,300,000
Note: Totals may not sum due to rounding.			

EXHIBIT 6-2 TOTAL POST-DESIGNATION IMPACTS TO OTHER ACTIVITIES

UNIT	UNDISCOUNTED	PRESENT VALUE		ANNUALIZED	
		3%	7%	3%	7%
1- Econfina Creek	$127,000	$116,000	$107,000	$7,810	$10,100
2 - Chipola River	$622,000	$485,000	$367,000	$27,300	$24,200
3 - Uchee Creek	$643	$643	$643	$43	$61
4 - Sawhatchee and Kirkland Creeks	$161,000	$122,000	$88,700	$8,210	$8,370
5 - Upper Flint River	$2,720,000	$2,340,000	$1,980,000	$157,000	$187,000
6 - Middle Flint River	$1,040,000	$794,000	$586,000	$53,400	$55,300
7 - Lower Flint River	$495,000	$452,000	$414,000	$30,400	$39,100
8 - Apalachicola River	$3,310,000	$2,600,000	$2,000,000	$134,000	$108,000
9 - Upper Ochlockonee River	$204,000	$154,000	$111,000	$10,300	$10,500
10 - Lower Ochlockonee River	$82,300	$64,200	$48,200	$4,310	$4,550
11 - Santa Fe and New Rivers	$102,000	$91,700	$82,300	$6,160	$7,770
TOTAL	$8,860,000	$7,220,000	$5,790,000	$440,000	$455,000
Note: Totals may not sum due to rounding.					

- **Florida Department of Transportation.** The Florida DOT has recently adopted a similar expanded survey protocol, developed with the Service, and expects costs of implementation to be similar to those estimated by Georgia.[196] Costs are quantified for one bridge project that crosses proposed critical habitat identified in the Florida DOT five year adopted work program (2007-2011). Assuming the same level of conservation effort in the future, impacts to one project every five years are quantified.[197] Relocation costs are quantified for these forecast projects.[198] State Route 2 over Cowarts Creek in Florida is another known crossing in the Florida portion of Unit 2. No transportation projects are expected at this crossing.[199]
- **Alabama Department of Transportation.** In Alabama, surveys have been conducted by the Department of Transportation in Big Creek for Interstate 10 construction work that will connect Dothan, Alabama to Florida when complete. [200]

6.2.2 IMPACTS TO TRANSPORTATION PROJECTS

180. The following describes specific transportation projects.

6.2.2.1 Georgia Department of Transportation (Units 4, 5, 6, 7, 9)

181. Georgia DOT spent $314,000 (undiscounted) in 2005 on 40 surveys for the seven mussels in multiple locations. Of these, five occurred for projects within the proposed critical habitat. From 2005 through those planned in 2007 a total of 16 surveys occur within proposed critical habitat units.[201] Total pre-designation impacts resulting from survey and relocation efforts within proposed critical habitat are $156,000 (discounted at three percent). Continued conservation efforts are assumed to occur at the same level in each future year of the analysis, as Georgia DOT continues its schedule of surveying. That is, an average of four surveys per year within proposed critical habitat are forecast. In addition, the analysis assumes mussel relocation will be undertaken for one in seven projects, or 0.6 projects each year. Total post-designation impacts attributable to survey efforts, are estimated to be $634,000 (discounted at three percent), while total post-designation impacts attributable to relocation activities are $672,000.

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[196] Personal communication with John Smith, Florida Department of Transportation, on October 24, 2006.

[197] Florida Department of Transportation identified one project scheduled in the five year adopted workplan as within proposed critical habitat in Unit 1 that may result in seven mussels conservation efforts. Written communication from Natalie F. Kent, Environmental Specialist District Noise Specialist, Florida Department of Transportation on May 2, 2007.

[198] Note that although no relocations have been undertaken for the seven mussels for Florida Department of Transportation projects to date, one project is identified that is scheduled for 2007 and is likely to require relocation, as described in email received from the Service's Panama City Field Office on May 2, 2007.

[199] Personal communication from Mary Mittiga, Ecologist/Transportation Planning , U.S. Fish and Wildlife Service,. Panama City Field Office. July 2, 2007.

[200] Personal communication, John Shields, Alabama Department of Transportation, June 27, 2007.

[201] Most surveys conducted by Georgia Department of Transportation are through the Office of Environment/Location. The Office of Consultant Design also sometimes conducts mussel surveys. The estimate of an additional four projects from 2005-2007 is for surveys by the Office of Consultant Design.

6.2.2.2 Florida Department of Transportation (Units 1, 2, 8, 9, 10, 11)

182. Florida DOT has surveyed the upper Chipola River for a project designed to reduce scour in the river under a bridge crossing. Total impacts of that survey are $5,250 (discounted at three percent).[202] Post-designation impacts of surveys for the seven mussels are calculated based on the per-project survey costs in Georgia in 2005. The total post-designation impacts of surveying for transportation projects and potential mussel relocation efforts are forecast to be up to $275,000 (discounted at three percent).

6.2.2.3 Alabama Department of Transportation (Units 2 and 3)

183. Surveys for construction of Interstate 10 totaled approximately $10,300 (discounted at three percent). Subsequent project modifications may be undertaken, but information on any such efforts are not available at this time.[203]

6.2.2.4 Fayette County, Georgia (Unit 5)

184. Fayette County's Transportation Plan includes planned projects and recommended years of implementation for those projects. A total of 13 projects are planned in areas within proposed critical habitat, 11 of which are expected to require an initial survey for mussels at a cost of $125,000, that may be followed by annual mussel monitoring surveys, with a cost of $25,000 each.[204] These annual surveys may occur once after the initial $125,000 survey, or continue for five years. Post-designation costs to Fayette County may be up to $2.2 million (discounted at three percent).

6.3 SPECIES MANAGEMENT

6.3.1 BACKGROUND AND APPROACH

185. Species management efforts for the seven mussels within the units proposed for critical habitat include Habitat Conservation Plan (HCP) development, surveying, monitoring, and establishing minimum flows. The costs presented in this Section were obtained through stakeholder interviews, and represent past and likely future species management activities, independent of similar efforts that may occur for other activity types (e.g., see transportation survey costs quantified in this Section).

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[202] Thomas Hemphill, HDR Inc., Consultant to Florida Department of Transportation for mussel survey, provided by email November 6, 2006.

[203] Personal communication, John Shields, Alabama Department of Transportation, June 27, 2007.

[204] Fax from Bill McNally, McNally, Fox & Grant. Received October 25, 2006. Note that one of the projects was scheduled to occur in 2005, and is assigned to 2007 as Fayette County's fax indicated it has not yet occurred. Two projects listed by Fayette County did not appear in the Fayette County Transportation Plan with recommended construction dates, and are therefore assumed to occur after the scope of the Plan, and of this analysis.

6.3.2 IMPACTS TO SPECIES MANAGEMENT PROJECTS

186. This Section provides a summary of species management efforts and specific impacts by manager.

6.3.2.1 Alabama Department of Conservation and Natural Resources (Unit 2)

187. The Alabama Department of Conservation and Natural Resources conducted surveys for the seven mussels in Big Creek and Cowarts Creek in 2006 and will continue in 2007, with funding through a Section 6 grant. Note that Cowarts Creek was added to the proposed designation as published in the Federal Register on June 21, 2007. Total survey costs (undiscounted) are $12,000 (fiscal year 2006) and $8,000 (fiscal year 2007).[205] Pre-designation costs total $12,300 (discounted at three percent), and post-designation costs are estimated at $8,640 (discounted at three percent).

6.3.2.2 Alabama Geological Survey (Unit 3)

188. The Alabama Geological Survey is conducting mussel surveys in Uchee Creek, and twenty other Chattahoochee tributaries with Section 6 funding at a undiscounted cost of $12,000 (fiscal year 2006), and $14,000 (fiscal year 2007).[206] As for Unit 2, a proportional amount of the total survey costs are included in the calculated impacts for this unit totaling $600 (discounted at three percent).

6.3.2.3 Georgia Department of Natural Resources (Unit 4, 5, 6, 7)

189. Georgia Department of Natural Resources (DNR), Wildlife Resources Division has conducted survey and monitoring efforts in Sawhatchee Creek (Unit 4), and in the Upper and Middle Flint River (Units 5 and 6). Costs of these efforts have totaled $15,700 (discounted at three percent). Future costs are expected to primarily relate to the development and implementation of a HCP for the mussels in the lower Flint.[207]

190. Georgia DNR, Wildlife Resources Division's development of a HCP for the seven mussels in the lower Flint River is based on concern related to agricultural withdrawals, and resultant flow issues as identified in the Flint River Basin Regional Water Development and Conservation Plan.[208] The HCP will be focused on conservation in the lower Flint River. Measures to conserve water may include efforts to improve agricultural irrigation efficiency, however, specific measures, timeframe, and associated costs of implementing the HCP are not known at this time. Section 2 of this analysis estimates the volume of water necessary to meet target flow in the Flint River basin, and Section 3 estimates the economic value of that water.

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[205] Written communication from Steve Rider, Alabama Department of Conservation and Natural Resources, Wildlife and Freshwater Fisheries Division. October 19, 2006.

[206] Written communication from Steve Rider, Alabama Department of Conservation and Natural Resources, Wildlife and Freshwater Fisheries Division, October 19, 2006.

[207] Personal communication with Jason Wisniewski, Aquatic Zoologist, Georgia Department of Natural Resources, January 31, 2007, and February 2, 2007.

[208] See Flint River Basin Plan. Personal communication with Mike Harris, Georgia Department of Natural Resources, Wildlife Resources Division, October 24, 2006.

191. Total State and Federal funding for the first year of HCP development has been obtained, totaling $186,000, and an estimated additional $133,000 will be needed for the second year (undiscounted). Total post-designation costs for the HCP (discounted at three percent) are $314,000.

6.3.2.4 Northwest Florida Water Management District (Unit 8)

192. Public lands and conservation areas constitute a majority of land use along the Apalachicola River. Private and State conservation lands line some of its northern length. The Northwest Florida Water Management District (NWFWMD) owns land managed for overall conservation along the river in Gulf and Calhoun Counties bordering the Apalachicola National Forest, and in its most southern reaches, the river flows through Tates Hell State Forest. NWFWMD is working to acquire more riparian lands north of the areas it already owns.[209] NWFWMD does not manage for individual species, therefore no costs are estimated here.

6.3.2.5 Florida Fish and Wildlife Conservation Commission (Unit 8)

193. The Florida Fish and Wildlife Conservation Commission (FWCC) conducted survey and monitoring efforts for the seven mussels in 2006 in the Apalachicola River and its tributaries. Estimated costs of the staff time required for these efforts are $12,400 (discounted at three percent). Estimates of potential future estimates are not available.[210]

6.3.2.6 U.S. Army Corps of Engineers (Units 2 and 8)

194. The USACE has undertaken conservation efforts for the seven mussels in the Apalachicola River for a variety of projects, including navigation dredging (dredge material disposal sites), relocation of mussels from the Jim Woodruff dam area, water management, and slough restoration efforts.[211] From 1998 to 2004, most mussel conservation-related expenses incurred by USACE were for dredging and navigation projects, and involved surveying and avoiding mussel habitat areas when designating dredge material disposal sites. Surveys were also conducted at proposed slough restoration sites, and relocation of mussels was conducted if necessary.[212] In 2005-2006, the expenses were for water management operations at Jim Woodruff Dam, related to releases from the dam to the Apalachicola River.[213] The costs of these past efforts total $564,000 (discounted at three percent).[214]

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[209] Northwest Florida Water Management District. 2006. "Land Acquisition Work Plan" Florida Forever. Program Development Series 2006-1.

[210] Personal communication with Ted Hoehn, Fish and Wildlife Conservation Commission, Division of Habitat and Species Conservation. January 30 - February 2, 2007.

[211] Personal communication with USACE Mobile District, various staff, August 25, 2006.

[212] Public Comment Letter from Curtis M. Flakes, Chief, Planning and Environmental Division, U.S. Army Corps of Engineers, Mobile District, dated August 6, 2007.

[213] Personal communication with Joanne Brandt, Biologist, USACE Mobile District, February 2, 2007.

[214] Costs provided by Brian Zettle, USACE Mobile District, in email to IEc on February 2, 2007, as calculated for annual reports on expenditures by USACE including per-species expenditures.

195. Beginning in 2007, USACE is undertaking species management efforts to comply with the reasonable and prudent measures in the September 5, 2006 Biological Opinion on operations at Jim Woodruff Dam. These include development of a long-term monitoring plan for the listed mussels in the Apalachicola River and the Chipola River below the Chipola Cutoff, evaluation of sediment dynamics and channel morphology in these areas as related to mussel habitat, and development of a drought provision for the listed mussels and the Gulf sturgeon in the Apalachicola River.[215] The reasonable and prudent measures are described in detail in the Biological Opinion. In 2007, $225,000 has been spent on the initial steps of the monitoring and geomorphology studies, and development of the drought provision. Costs are expected to be higher in 2008 (up to $450,000) for implementation of the studies, followed by annual costs of approximately $150,000 thereafter. Contingent on approval of the planned studies by the Service, costs are expected to be up to $2.66 million (discounted at three percent) over the next 20 years.[216] Administrative costs to USACE of section 7 consultation related to the Biological Opinion are captured in Appendix A.

6.3.2.7 Florida State Parks (Units 2 and 8)

196. Torreya State Park has conducted a survey for threatened and endangered mussel species, at an estimated cost of $272 (undiscounted), representing staff time requirements. Florida Caverns State Park may conduct a similar survey for the seven mussels.[217] Total pre-designation impacts to the Florida Park Service total $280 (discounted at three percent), and total post-designation impacts total $272 (discounted at three percent).

6.3.2.8 Apalachicola National Forest (Unit 10)

197. Apalachicola National Forest conducts section 7 consultations for its projects with the Service that include all listed species, including the seven mussels. To date, none have resulted in any conservation efforts for the seven mussels. Administrative costs of section 7 consultations are included in Appendix A.[218]

6.3.2.9 Suwannee River Water Management District (Unit 11)

198. Florida law requires that minimum flows and levels (MFLs) be established to protect the consumptive and non-consumptive uses of water resources from 'significant harm' by providing permitting criteria for consumptive, and environmental resource uses.[219] In accordance with these requirements, the Suwannee River Water Management District

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[215] Note that the U.S. Army Corps of Engineers estimated the portion of these costs attributable to work related to the mussels, and only this portion, approximately $75,000, is included in the estimated costs in 2007.

[216] Personal communication with Joanne Brandt and Brian Zettle, Inland Environment Team, Planning and Environmental Division, Mobile District, U.S. Army Corps of Engineers. September 4, 2007.

[217] Personal communication with Harold Mitchell, Biologist, Florida Department of Environmental Protection, Parks Division. October 18, 2006.

[218] The estimated number of consultations that will consider the mussels was provided by Susan Fitzgerald, Biologist, Apalachicola National Forest, U.S. Forest Service, via personal communication on July 25, 2006.

[219] MFL requirements established by: Florida Statutes, Subsection 373.042(2), State Comprehensive Plan, and the Florida Administrative Code (F.A.C.) water resources implementation rule Chapter 62-40.473.

(SRWMD) has drafted proposed MFLs for the Upper Santa Fe River basin, including the New River. SRWMD based these draft MFLs in part on ecological parameters estimated to be protective of Federal and State-listed endangered and threatened mussel species.[220] Specifically, one of the two ecological criteria for establishing MFLs with the appropriate level of essential habitat protection is:

- The maintenance and protection of suitable habitat for freshwater mussels, including the threatened and endangered species that occur or have occurred in the New River basin, and the putative host species for their parasitic developmental stages.[221]

The MFLs are scheduled to be implemented in 2007, and will result in the regulation of cumulative water use for all non-residential water use.[222]

199. Costs associated with development of MFLs to date are $345,000 (discounted at three percent). An additional cost of $60,000 (discounted at three percent), or an annualized cost of $4,000, is expected for completion of the peer review process of these draft MFLs. Further discussion of implementation of the MFLs is presented in Sections 2 and 3.

6.4 DEADHEAD LOGGING

6.4.1 DEADHEAD LOGGING IN FLORIDA AND GEORGIA

200. Deadhead logging involves reclamation of submerged timber from rivers and lakes. Many of the submerged logs are old-growth timber and can be valuable when sold to sawmills. As discussed below, Florida and Georgia both operate deadhead logging permit programs.

6.4.1.1 Florida

201. Initiated in the late 1990s, Florida's deadhead logging program is permitted by the State DEP's Bureau of Submerged Lands and Environmental Resources. Five-year permits are issued, allowing reclamation of logs from designated reaches of several rivers in the panhandle region of the State. Exhibit 6-3 summarizes the number of permits and total log harvests on critical habitat rivers.

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[220] Water Resource Associates, Inc. 2006. Draft Technical Report: MFL Establishment for the Upper Santa Fe River. Prepared for the Suwannee River Water Management District in association with SDII Global, Janicki Environmental and Intera, Inc. December 2006.

[221] Water Resource Associates, Inc. 2006. Draft Technical Report: MFL Establishment for the Upper Santa Fe River. Prepared for the Suwannee River Water Management District in association with SDII Global, Janicki Environmental and Intera, Inc. December 2006.

[222] Personal communication with Louis Mantini, Suwannee River Water Management District, October 30, 2006.

EXHIBIT 6-3 DEADHEAD LOGGING ON CRITICAL HABITAT RIVERS IN FLORIDA

RIVER	NUMBER OF ACTIVE PERMITS	ORIGINAL YEAR PERMITS ISSUED	TOTAL LOGS REMOVED	AVERAGE LOGS REMOVED PER YEAR
Chipola River	9	1999	747	107
Apalachicola River	14	1999	2,908	415
Lower Ochlockonee River	2	2002	157	39
TOTAL	**25**		**3,812**	**561**
Source: FLDEP, Bureau of Submerged Lands and Environmental Resources				

202. In issuing permits, some attention is given to avoiding impacts on mussel populations.[223] Specifically, maps with 1990s data from Service mussel surveys are consulted and logging is prohibited in certain areas.[224]

203. Three types of costs associated with seven mussel conservation are possible:

1) *Section 7 consultation for deadhead logging permit renewals.* The overall cost of consulting on the permits as they are renewed would likely be small since a total of 10 individuals are permitted to conduct deadhead logging on critical habitat rivers and permits are renewed every five years. Therefore, approximately 100 consultations could result over the next 20 years. However, this level of consultation is unlikely since consultations could be grouped and since log inventories are being depleted, meaning that permits will not be renewed.

2) *Mussel surveys resulting from consultation.* Mussel surveys potentially required as part of renewed deadhead logging permits would introduce a cost for permittees. While no systematic data exist, a mussel survey by a certified diver is estimated to cost roughly $5,000.[225] This cost would be realized once every five years when the permit is renewed. For existing permits in Florida, this results in a total of 40 permit renewals (25 permits at five year intervals) that are forecast to be impacted within the timeframe of this analysis.[226]

[223] DEP experts in charge of the deadhead logging program indicated consultations may have been conducted in the 1990s. A letter from the Service to FLDEP requested consultation on deadhead logging issues in 1999. See correspondence from Gail Carmody, U.S. FWS, Panama City Field Office, to Phil Coram, FLDEP, dated October 29, 1999.

[224] Florida Department of Environmental Protection officials indicate that the no-logging buffers are few in number and small in size, so loggers simply bypass the designated areas. Hence, little if any log recovery is precluded by the restrictions. Personal communication with Sara Merritt, FLDEP Bureau of Submerged Lands and Environmental Resources, October 10, 2006 and October 26, 2006.

[225] Personal communication with Adam Kaeser, Georgia Department of Natural Resources, Fisheries Management Office, October 4, 2006.

[226] Note that this assumes that there are still logs available in 2024.

3) *Limits on deadhead logging.* A separate category of potential costs would be realized to the extent that consultation and surveying preclude future deadhead logging (or, if permittees choose to forego the consultation process and not renew their permits). Based on discussions with sawmill operators, FLDEP officials roughly estimate the value of reclaimed logs to be $500 to $1,000 per log. Presenting these costs for a 20-year total introduces uncertainty, as submerged log resources have been depleted and future recovery will not equal past levels.[227]

Based on the above information and the uncertainty associated with how consultations would be conducted or the possibility of preclusion of future logging, economic impacts to deadhead logging are estimated for mussel surveys at the time of permit renewal only. Total post-designation impacts to deadhead logging activities are estimated to be $385,000 (discounted at three percent).

6.4.1.2 Georgia

204. Georgia DNR administers a program for recovery of submerged old growth logs from the Lower Flint and Altamaha Rivers. DNR began offering permits for participation in the program in January 2006, and the program is slated to continue until January 2008.

205. Discussions with DNR staff suggest that potential economic impacts associated with conservation efforts for the seven mussels are likely modest. No applications were filed during the initial permit period (from January to February 2006). Furthermore, DNR staff believe that the accumulation of recoverable logs is limited and that the likelihood of future applications is small.[228]

206. Should interested parties file applications in the future, the logging program is governed by policies designed to protect fish and wildlife species. Developed in consultation with the Service, the policy specifically states that "no recovery will be allowed in and adjacent to important fish or mussel habitat…"[229] Prior to recovery of logs, DNR would conduct a survey to assess risks to Federal and State endangered and threatened species, and may also ask the applicant to fund a mussel survey to be conducted by an approved professional diver. The policy states that "if listed mussel species are present in the immediate vicinity…of the logs to be recovered, then U.S. Fish and Wildlife Service guidelines for log removal will be followed." To the extent that deadhead logging permits are issued in the future, mussel conservation costs would include these surveys as well as any incremental costs associated with modified log removal procedures, or lost revenues from prohibitions on log removal. Because information is not available to characterize the available submerged log resources in proposed critical habitat rivers in Georgia, or to indicate any future estimate of permit issuance, this analysis does not include costs of mussel conservation associated with deadhead logging in Georgia.

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[227] Note that if seven mussels conservation precludes future logging, the consultation and survey costs described above would be eliminated. Hence, the consultation/survey costs and the lost revenue are not additive.

[228] Personal communication with Adam Kaeser, Georgia DNR, Fisheries Management Office, October 4, 2006.

[229] Georgia Department of Natural Resources, "Policy on Salvage Logging", January 30, 2006.

6.5 NAVIGATION DREDGING, SAND AND GRAVEL MINING, AND NON-NATIVE SPECIES

6.5.1 NAVIGATION DREDGING

207. Historically, the USACE maintained the ACF River System as a Federal navigation project, providing a link from the upper Chattachoochee and Flint River basins to the Gulf of Mexico at Apalachicola, Florida. The total waterway measured 290 miles with a lift of 190 feet accomplished by three locks and dams. Although the Federal navigation project is still authorized, various concerns have precluded navigation dredging activities since 2001.

208. USACE representatives indicate that use of the ACF System peaked in the mid-1980s, with total barge cargoes of roughly 1.2 million tons. Since then, drought and permitting impediments have virtually eliminated dredging and commercial navigation. Dredging last occurred in 2001 and water quality certification for additional dredging in Florida expired in 2004.[230] As described in the USACE public comment letter, Section 401 water quality certification, and Coastal Consistency Certification for the Apalachicola River have been denied by the State of Florida, and the alternative provisions provided with the denial are not currently permitted by Congress.[231] While some commercial and political interests favor restoration of the navigation channel, they have faced opposition from environmental and taxpayer groups that criticize the project as being too costly and ecologically unsound.[232]

209. USACE has undertaken species management efforts related to dredge material disposal for navigation projects. These actions typically included surveying and mussel relocation if warranted. See the above Species Management section for an estimate of the costs of these efforts. USACE representatives believe that mussel conservation efforts may reduce the likelihood of future dredging, but that the future of the ACF System was already highly uncertain as a result of broader economic and ecological concerns.

6.5.2 SAND AND GRAVEL MINING

210. Sand and gravel extraction from riverbeds was common in the ACF Basin, but ceased several years ago. When active, most of the operations were located on the upper Chattahoochee. The USACE (one of the permitting authorities for sand and gravel extraction) indicates that future operations are unlikely.[233]

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[230] Personal communication with Terrence Jangula, U.S. Army Corps of Engineers, Panama City Office, October 12, 2006.

[231] Public Comment Letter from Curtis M. Flakes, Chief, Planning and Environmental Division, U.S. Army Corps of Engineers, Mobile District, dated August 6, 2007.

[232] Public Comment Letter from Billy Houston, Executive Director, Tri-Rivers Waterway Development Association, dated August 3, 2007, and written copy of oral comments made at the public hearing in LaGrange, GA, on July 9, 2007; and "Apalachicola River Navigation: Highest Cost Per Mile in the South," obtained online at http://www.taxpayer.net/corpswatch/troubledwaters/projects/apalachicola.htm.

[233] Personal communication with Terrence Jangula, Panama City Office, Mobile District, U.S. Army Corps of Engineers. October 12, 2006.

6.5.3 NON-NATIVE SPECIES

211. The proposed rule highlights two non-native species that could pose a threat to the seven mussels:

- The Asian clam (*Corbicula fluminea*) is widespread throughout the range of the seven mussels. Some research suggests that the Asian clam may directly compete with mussels for food, nutrients, and habitat.
- The black carp (*Mylopharyngodon piceus*) is used in catfish aquaculture. Because it eats snails and mussels, its escape into the wild could be problematic, particularly if non-sterile individuals are allowed to reproduce.

Two factors limit the potential for conservation efforts for the seven mussels to cause economic impacts related to these non-native species. First, while the black carp is an input into catfish production, neither the carp nor the Asian clam is sold in commercial markets. Second, while the Lacey Act prohibits inter-state transport of certain injurious species, no such transport occurs for the black carp and Asian clam.

REFERENCES

5 U.S.C. § 601 *et seq.*

16 U.S.C. 1532; 16 U.S.C. 1533; 16 U.S.C. '1533(b)(2).

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APPENDIX A | ADMINISTRATIVE COSTS

1. This appendix presents administrative costs of actions taken under section 7 of the Act associated with the geographic area proposed as critical habitat for the seven mussels. First, this Appendix defines the types of administrative costs likely to be associated with the proposed habitat. Next, the Appendix presents estimates of the number of technical assistance efforts and consultations likely to result from the designation of critical habitat and/or the listing of the seven mussels, as well as the per-unit costs of each of these activities. Based on this analysis, estimates of past and future administrative costs are derived.

A.1 CATEGORIES OF ADMINISTRATIVE COSTS

2. The following section provides an overview of the categories of administrative cost impacts that arise due to the implementation of section 7 in the geographic area proposed as critical habitat for the seven mussels.

TECHNICAL ASSISTANCE

3. Frequently, the Service responds to requests for technical assistance from State agencies, local municipalities, and private landowners and developers who may have questions regarding whether specific activities may affect critical habitat. Technical assistance costs represent the estimated economic costs of informational conversations between these entities and the Service regarding the designation of critical habitat for the seven mussels. Most likely, such conversations will occur between municipal or private property owners and the Service regarding lands designated as critical habitat or lands adjacent to critical habitat. The Service's technical assistance activities are voluntary and generally occur in instances where a Federal nexus does not exist.

SECTION 7 CONSULTATIONS

4. Section 7(a)(2) of the Act requires Federal agencies (Action agencies) to consult with the Service whenever activities that they undertake, authorize, permit, or fund may affect a listed species or designated critical habitat. There are two scenarios under which the designation of critical habitat can result in section 7 consultations with the Service beyond those required by the listing. These include:

- New consultations, which can occur when activities involving a Federal nexus are proposed in critical habitat not thought to be currently occupied by the species; and

- Re-initiations of consultations, which result when consultations that previously occurred under the listing are re-initiated due to new information or circumstances generated by the designation.

In some cases, consultations will involve the Service and another Federal agency only, such as the U.S. Forest Service. More often, they will also include a third party involved in projects on non-Federal lands with a Federal nexus, such as state agencies and private landowners.

5. During a consultation, the Service, the Action agency, and the landowner manager applying for Federal funding or permitting (if applicable) communicate in an effort to minimize potential adverse effects to the species and/or to the proposed critical habitat. Communication between these parties may occur via written letters, phone calls, in-person meetings, or any combination of these. The duration and complexity of these interactions depends on a number of variables, including the type of consultation, the species, the activity of concern, and the potential effects to the species and designated critical habitat associated with the activity that has been proposed, the Federal agency, and whether there is a private applicant involved.

6. Section 7 consultations with the Service may be either informal or formal. *Informal consultations* consist of discussion between the Service, the Action agency, and the applicant concerning an action that may affect a listed species or its designated critical habitat. The process is designed to identify and resolve potential concerns at an early stage in the planning process. By contrast, a *formal consultation* is required if the Action agency determines that its proposed action may or will adversely affect the listed species or designated critical habitat in ways that cannot be resolved through informal consultation. The formal consultation process results in the Service's determination in its Biological Opinion of whether the action is likely to jeopardize a species or adversely modify critical habitat, and recommendations to minimize those impacts. Regardless of the type of consultation or proposed project, section 7 consultations can require substantial administrative effort on the part of all participants.

A.2 ESTIMATED COSTS OF CONSULTATIONS AND TECHNICAL ASSISTANCE

7. Estimates of the cost of an individual consultation and technical assistance request were developed from a review and analysis of historical section 7 files from a number of Service field offices around the country conducted in 2002. These files addressed consultations conducted for both listings and critical habitat designations. Cost figures were based on an average level of effort of low, medium, or high complexity, multiplied by the appropriate labor rates for staff from the Service and other Federal agencies.

8. The administrative costs estimates presented in this section take into consideration the level of effort of the Service, the Action agency, and the applicant, as well as the varying complexity of the consultation or the technical assistance request. Costs associated with these consultations include the administrative costs associated with conducting the consultations, such as the costs of time spent in meetings, preparing letters, and the development of a biological opinion. Exhibit A-1 provides a summary of the estimated

administrative costs of consultations and technical assistance requests. Note that for consultation (past and expected) related to the Modified Interim Operation Plan (Modified IOP), and to water supply and water control plan coordination, costs are higher than the estimates provided in Exhibit A-1. The Modified IOP consultation is estimated to have cost the Service $48,000, and a similar annual level of effort by the Service is expected for the next five years, with subsequent compliance review efforts each year at a cost of approximately $10,000 each. These estimates are included in the "Formal" category for Unit 8 in the exhibits below. Administrative costs of developing the Habitat Conservation Plan for the lower Flint River, as discussed in Section 6, are also expected to be higher than an average formal consultation. This analysis uses twice the estimated total consultation cost for a formal consultation based on communication with the Service.[1]

EXHIBIT A-1 ESTIMATED ADMINISTRATIVE COSTS OF CONSULTATION AND TECHNICAL ASSISTANCE EFFORTS (PER EFFORT)

CONSULTATION TYPE	SERVICE	ACTION AGENCY	THIRD PARTY	TOTAL
Technical Assistance	$520	n/a	$1,050	$1,500
Informal Consultation	$2,250	$2,900	$2,050	$7,500
Formal Consultation	$5,050	$5,750	$3,500	$14,500

Source: IEc analysis based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2002, a review of consultation records from several Service field offices across the country. Confirmed by local Action agencies.
Note: Estimates primarily reflect staff wages and time involvement.

A.3 SUMMARY OF PAST ADMINISTRATIVE COSTS

9. Since the listing of the seven mussels in 1998, there have been ten formal, 102 informal, and ten technical assistance section 7 consultations in the geographic area proposed as critical habitat for the seven mussels.

10. As shown in Exhibit A-2, past administrative costs are estimated at $959,000. Administrative costs resulting from past formal consultations are estimated to have been $179,000 while informal consultations are estimated to have cost $765,000 and technical assistance requests $15,000 since the listing of the species.

A.4 SUMMARY OF FUTURE ADMINISTRATIVE COSTS

11. This analysis includes costs of consultation for the activities as indicated by action agencies. As shown in Exhibit A-4, future administrative costs are estimated at $3.41 million assuming a three percent discount rate over twenty years, or $170,000 annually (discounted at three percent).

[1] Written communication from the Service received on May 22, 2007, and personal communication with the Service on August 18, 2007.

A.5 CAVEATS

12. The number of consultations and technical assistance efforts to be undertaken in the future for activities within a given complex is highly uncertain. The frequency of such efforts will be related to the level of economic activity, the presence of HCPs or other regional plans that obviate the need for consultation, and the extent to which economic activity overlaps with critical habitat. To the extent that this analysis over or underestimates the number of these efforts in the future, estimated costs will be over or understated.

EXHIBIT A-2 PAST ADMINISTRATIVE COSTS BY RIVER SEGMENT AND BY ACTIVITY, 1998-2006, $2006

UNIT	TYPE OF CONSULTATION	WATER PROJECTS (HYDROPOWER, WATER SUPPLY, UTILITIES)	WATER QUALITY	MUNICIPAL, AGRICULTURE, RECREATION	OTHER ACTIVITIES (TRANSPORTATION, SPECIES MANAGEMENT, DREDGING/DEADHEAD LOGGING, SAND & GRAVEL MINING)	TOTAL NUMBER	TOTAL COSTS
Unit 1	Formal					0	$0
	Informal				2.00	2	$19,000
	Technical Assistance					0	$0
	Subtotal					**2**	**$19,000**
Unit 2	Formal					0	$0
	Informal	1.00	2.00	1.00	13.00	17	$128,000
	Technical Assistance				1.00	1	$1,500
	Subtotal					**18**	**$130,000**
Unit 3	Formal					0	$0
	Informal	1.00	1.00			2	$15,000
	Technical Assistance					0	$0
	Subtotal					**2**	**$15,000**
Unit 4	Formal					0	$0
	Informal	1.00				1	$7,500
	Technical Assistance					0	$0
	Subtotal					**1**	**$7,500**
Unit 5	Formal	3.00				3	$43,500
	Informal	1.50			2.33	4	$28,700
	Technical Assistance					0	$0
	Subtotal					**6.83**	**$72,200**
Unit 6	Formal	1.00			1.00	2	$29,000
	Informal				6.33	6	$47,500
	Technical Assistance					0	$0
	Subtotal					**8.33**	**$76,500**

UNIT	TYPE OF CONSULTATION	WATER PROJECTS (HYDROPOWER, WATER SUPPLY, UTILITIES)	WATER QUALITY	MUNICIPAL, AGRICULTURE, RECREATION	OTHER ACTIVITIES (TRANSPORTATION, SPECIES MANAGEMENT, DREDGING/DEADHEAD LOGGING, SAND & GRAVEL MINING)	TOTAL NUMBER	TOTAL COSTS
Unit 7	Formal				3.00	3	$43,500
	Informal	1.50			0.33	2	$13,700
	Technical Assistance					0	$0
	Subtotal					**4.83**	**$57,200**
Unit 8	Formal	2.00				2	$62,500
	Informal	0.50			7.00	8	$56,300
	Technical Assistance				4.00	4	$6,000
	Subtotal					**14**	**$124,800**
Unit 9	Formal					0	$0
	Informal	4.50		5.00	2.50	12	$90,000
	Technical Assistance					0	$0
	Subtotal					**12**	**$90,000**
Unit 10	Formal					0	$0
	Informal	2.00	1.00		2.50	6	$41,300
	Technical Assistance					0	$0
	Subtotal					**6**	**$41,300**
Unit 11	Formal					0	$0
	Informal			1.00		1	$7,500
	Technical Assistance					0	$0
	Subtotal					**1**	**$7,500**
Unknown Unit	Formal					0	$0
	Informal	3.00		4.00	35.00	42	$315,000
	Technical Assistance	1.00			4.00	5	$7,500
	Subtotal					**47**	**$323,000**

UNIT	TYPE OF CONSULTATION	WATER PROJECTS (HYDROPOWER, WATER SUPPLY, UTILITIES)	WATER QUALITY	MUNICIPAL, AGRICULTURE, RECREATION	OTHER ACTIVITIES (TRANSPORTATION, SPECIES MANAGEMENT, DREDGING/DEADHEAD LOGGING, SAND & GRAVEL MINING)	TOTAL NUMBER	TOTAL COSTS
Proposed CHD	**Formal**	**6.00**	**0.00**	**0.00**	**4.00**	10	$179,000
	Informal	**16.00**	**4.00**	**11.00**	**70.99**	102	$765,000
	Technical Assistance	**1.00**	**0.00**	**0.00**	**9.00**	10	$15,000
					Subtotal	**122**	**$959,000**
TOTAL COSTS		**$242,000**	**$30,000**	**$82,500**	**$604,000**		**$959,000**

Note: totals may not sum due to rounding. Consultations may be undertaken for activities that span more than one unit; thus, some numbers of consultations totals show fractions (e.g., three units may show a third, .33, of the costs of a given consultation).

EXHIBIT A-3 FUTURE ADMINISTRATIVE COSTS BY REACH AND BY ACTIVITY (2007-2026),$2006

UNIT	TYPE OF CONSULT	WATER PROJECTS (HYDROPOWER, WATER SUPPLY, UTILITIES)	OTHER ACTIVITIES (TRANSPORTATION, SPECIES MANAGEMENT, DREDGING/DEADHEAD LOGGING, SAND & GRAVEL MINING)	TOTAL NUMBER	TOTAL COSTS
	Formals			0	$0
	Informals		1.50	2	$11,300
	Technical Assistance			0	$0
Unit 1			**Subtotal**	**2**	**$11,300**
	Formals			0	$0
	Informals		36.50	37	$274,000
	Technical Assistance			0	$0
Unit 2			**Subtotal**	**37**	**$274,000**
	Formals			0	$0
	Informals			0	$0
	Technical Assistance			0	$0
Unit 3			**Subtotal**	**0**	**$0**
	Formals			0	$0
	Informals		20.53	1	$154,000
	Technical Assistance			0	$0
Unit 4			**Subtotal**	**21**	**$154,000**
	Formals	3.00[1]		3	$44,000
	Informals	48.50	21.53	70	$525,000
	Technical Assistance			0	$0
Unit 5			**Subtotal**	**73**	**$569,000**
	Formals			0	$0
	Informals	51.50	20.53	72	$540,000
	Technical Assistance			0	$0
Unit 6			**Subtotal**	**72**	**$540,000**
	Formals		1.00	1	$29,000
	Informals		22.53	23	$169,000
	Technical Assistance			0	$0
Unit 7			**Subtotal**	**24**	**$198,000**
Unit 8	Formals	20		20	$390,000
	Informals		56.50	57	$424,000
	Technical Assistance			0	$0

UNIT	TYPE OF CONSULT	WATER PROJECTS (HYDROPOWER, WATER SUPPLY, UTILITIES)	OTHER ACTIVITIES (TRANSPORTATION, SPECIES MANAGEMENT, DREDGING/DEADHEAD LOGGING, SAND & GRAVEL MINING)	TOTAL NUMBER	TOTAL COSTS
			Subtotal	**77**	**$814,000**
	Formals	1.00		1	$14,500
	Informals		21.03	21	$158,000
	Technical Assistance			0	$0
Unit 9			**Subtotal**	**22**	**$172,500**
	Formals			0	$0
	Informals		9.50	10	$71,300
	Technical Assistance		400.00	400	$600,000
Unit 10			**Subtotal**	**410**	**$671,000**
	Formals			0	$0
	Informals		0.5	1	$3,750
	Technical Assistance			0	$0
Unit 11			**Subtotal**	**1**	**$3,750**
	Formals	24.00	1.00	25	$477,000
	Informals	100.00	209.67	311	$2,330,000
Proposed	Technical Assistance	0	400.00	400	$600,000
CHD			**Subtotal**	**736**	**$3,407,000**
	Formals	**24**	**1**		
Total Number per activity	Informals	**100**	**210**		
	Technical Assistance	**0**	**400**		
TOTAL COSTS		**$1,200,000**	**$2,210,000**		**$3,410,000**

Note: Totals may not sum due to rounding.

1. These consultations may be re-initiated due to designation of critical habitat. Refer to Appendix B for more detail.

EXHIBIT A-4 TOTAL FUTURE ADMINISTRATIVE COSTS, 2007-2026

UNIT	UNDISCOUNTED DOLLARS	PRESENT VALUE		ANNUALIZED	
		3%	7%	3%	7%
1 - Econfina Creek	$11,300	$8,000	$6,000	$538	$566
2 - Chipola River	$274,000	$204,000	$145,000	$13,700	$13,700
3 - Uchee Creek	$0	$0	$0	$0	$0
4 - Sawhatchee and Kirkland Creeks	$154,000	$115,000	$82,000	$7,730	$7,740
5 - Upper Flint River	$569,000	$423,000	$301,000	$28,400	$28,400
6 - Middle Flint River	$540,000	$402,000	$286,000	$27,000	$27,000
7 - Lower Flint River	$198,000	$147,000	$105,000	$9,880	$9,910
8 - Apalachicola River	$814,000	$606,000	$431,000	$40,700	$40,700
9 - Upper Ochlockonee River	$173,000	$128,000	$91,000	$8,600	$8,590
10 - Lower Ochlockonee River	$671,000	$499,000	$356,000	$33,500	$33,600
11 - Santa Fe and New Rivers	$3,750	$3,000	$2,000	$202	$189
Total	**$3,410,000**	**$2,530,000**	**$1,810,000**	**$170,000**	**$170,000**

Note: Totals may not sum due to rounding.

APPENDIX B | INCREMENTAL ANALYSIS OF CRITICAL HABITAT DESIGNATION FOR THE SEVEN MUSSELS

1. This appendix estimates the potential incremental impacts of critical habitat designation for the seven mussel species ("seven mussels"). It does so by attempting to isolate those direct and indirect impacts discussed in this report that are expected to be triggered specifically by the critical habitat designation. That is, the incremental conservation efforts and associated impacts included in this appendix would not be expected to occur absent the designation of critical habitat for the seven mussels.

2. As described in detail in Section B.3 of this appendix, the incremental impacts of critical habitat designation for the seven mussels are forecast to be $501,000 (present value at a three percent discount rate). These incremental impacts are associated with administrative costs of consultation above and beyond those impacts expected to occur due to the listing of the species. All remaining impacts quantified in Sections 3 through 6 of this report are forecast to occur regardless of critical habitat designation for the seven mussels.

B.1 BACKGROUND

3. The U.S. Office of Management and Budget's (OMB) guidelines for conducting economic analysis of regulations direct Federal agencies to measure the costs of a regulatory action against a baseline, which it defines as the "best assessment of the way the world would look absent the proposed action."[1] In other words, the baseline includes the existing regulatory and socio-economic burden imposed on landowners, managers, or other resource users potentially affected by the designation of critical habitat. Costs that are incremental to that baseline (i.e., occurring over and above existing constraints) are attributable to the proposed regulation. Significant debate has occurred regarding whether assessing the costs of the Service's proposed regulations using this baseline approach is appropriate in the context of critical habitat designations.

4. In 2001, the U.S. Tenth Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed critical habitat, regardless of whether those impacts are attributable coextensively to other causes.[2] Specifically, the court stated

[1] OMB, "Circular A-4," September 17, 2003.

[2] *New Mexico Cattle Growers Assn v. United States Fish and Wildlife Service*, 248 F.3d 1277 (10th Cir. 2001).

> "The statutory language is plain in requiring some kind of consideration of economic impact in the CHD phase. Although 50 C.F.R. 402.02 is not at issue here, the regulation's definition of the jeopardy standard as fully encompassing the adverse modification standard renders any purported economic analysis done utilizing the baseline approach virtually meaningless. We are compelled by the canons of statutory interpretation to give some effect to the congressional directive that economic impacts be considered at the time of critical habitat designation…. Because economic analysis done using the FWS's baseline model is rendered essentially without meaning by 50 C.F.R. § 402.02, we conclude Congress intended that the FWS conduct a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes. Thus, we hold the baseline approach to economic analysis is not in accord with the language or intent of the ESA."[3]

5. Since that decision, however, courts in other cases have held that an incremental analysis of impacts stemming solely from the critical habitat rulemaking is proper.[4] For example, In the March 2006 court order ruling that the August 2004 critical habitat rule for the Peirson's milk-vetch was arbitrary and capricious, the United States District Court for the Northern District of California stated,

> "The Court is not persuaded by the reasoning of *New Mexico Cattle Growers*, and instead agrees with the reasoning and holding of *Cape Hatteras Access Preservation Alliance v. U.S. Dep't of the Interior*, 344 F. Supp 2d 108 (D.D.C. 2004). That case also involved a challenge to the Service's baseline approach and the court held that the baseline approach was both consistent with the language and purpose of the ESA and that it was a reasonable method for assessing the actual costs of a particular critical habitat designation *Id* at 130. 'To find the true cost of a designation, the world with the designation must be compared to the world without it.'"[5]

6. In order to address the divergent opinions of the courts and provide the most complete information to decision-makers, this economic analysis reports both: a) the fully co-extensive impacts associated with the proposed critical habitat designation (in Sections 3 through 6 of the report); and b) the subset of these impacts that are identified as incremental to the rulemaking, precipitated specifically by the designation of critical habitat for the seven mussels (in this appendix).

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[3] *New Mexico Cattle GrowersAssn v. United States Fish and Wildlife Service*, 248 F.3d 1277 (10th Cir. 2001).

[4] *Cape Hatteras Access Preservation Alliance v. Department of Interior*, 344 F. Supp. 2d 108 (D.D.C.); CBD v. BLM, 422 F. Supp/. 2d 1115 (N.D. Cal. 2006).

[5] Center for Biological Diversity et al, Plaintiffs, v. Bureau of Land Management et. al, Defendants and American Sand Association, et al, Defendant Intervenors. Order re: Cross Motions for Summary Judgment. Case 3:03-cv-02509 Document 174 Filed 03/14/2006. Pages 44-45.

7. Until a new regulation is adopted to define "destruction or adverse modification," incremental effects of critical habitat designation are determined using the Service's December 9, 2004 interim guidance on "Application of the 'Destruction or Adverse Modification' Standard Under Section 7(a)(2) of the Endangered Species Act" and information from the Service regarding what potential consultations and project modifications would be imposed as a result of critical habitat designation over and above those associated with the listing.[6] The following section describes the methods employed to identify incremental impacts anticipated to result from the designation of critical habitat.

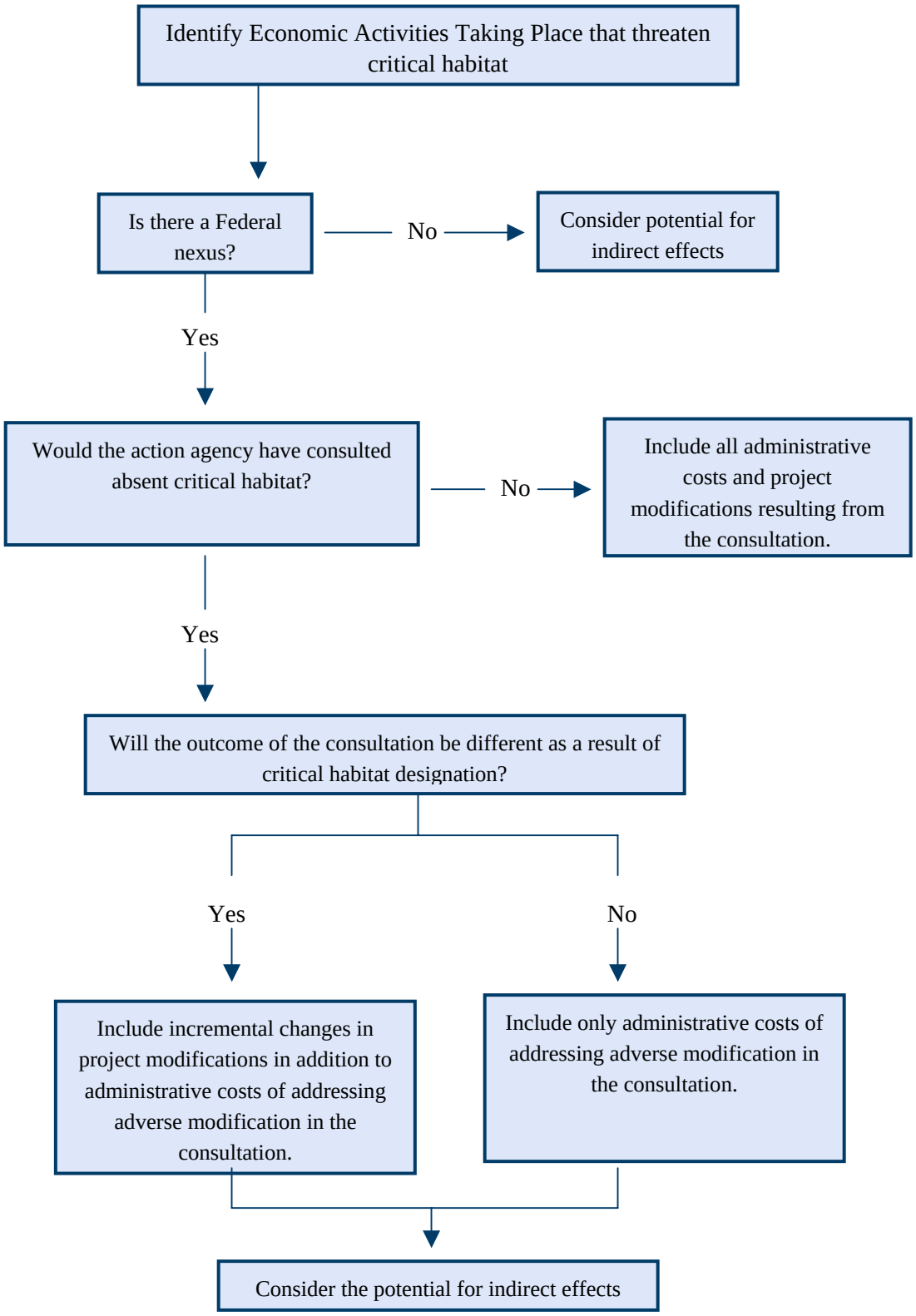
B.2 FRAMEWORK FOR THE INCREMENTAL ANALYSIS

8. This section provides a description of the methodology used to determine potential economic impacts stemming from the proposed designation of critical habitat for the seven mussels. The analysis evaluates impacts in a "with critical habitat designation" versus a "without critical habitat designation" framework, measuring the net change in economic activity. The "without critical habitat designation" scenario, which represents the baseline for this incremental analysis, includes all protection already afforded the seven mussels under State, local, and Federal laws, existing conservation plans, and the listing of the species under the Act. The focus of this incremental analysis is to determine the impacts on land uses and activities from the designation of critical habitat that are above and beyond those impacts due to existing required or voluntary conservation efforts being undertaken due to other Federal, State, and local regulations or guidelines.

9. Exhibit B-1 depicts the decision analysis regarding whether an impact should be considered incremental. The following sections describe this decision tree in detail.

[6] Director, U.S. Fish and Wildlife Service, Memorandum to Regional Directors and Manager of the California-Nevada Operations Office, Subject: Application of the "Destruction or Adverse Modification" Standard under Section 7(a)(2) of the Endangered Species Act, dated December 9, 2004.

EXHIBIT B-1 IDENTIFYING INCREMENTAL IMPACTS OF CRITICAL HABITAT DESIGNATION



B.2.1 DEFINING THE BASELINE

10. The baseline for this incremental analysis is the existing state of regulation, prior to the designation of critical habitat, that provides protection to the species under the Act, as well as under other Federal, State and local laws. Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species. The administrative costs of consultations under the jeopardy standard, along with the impacts of project modifications resulting from these consultations, are considered baseline impacts.

11. In addition to impacts associated with section 7 of the Act, the baseline includes impacts of compliance with other Sections of the Act, as well as other Federal, State, and local laws that protect the species in the absence of critical habitat designation. If the Clean Water Act, for example, protects wetland habitat for the species, relevant impacts of Clean Water Act compliance are considered part of the baseline.

12. The baseline represents the best estimate of the "world without critical habitat," and therefore considers a wide range of additional factors beyond the compliance costs of regulations that provide protection to the listed species. As recommended by OMB, the baseline incorporates, as appropriate, trends in market conditions, implementation of other regulations and policies by the Service and other government entities, and trends in other factors that have the potential to affect economic costs and benefits, such as the rate of regional economic growth in potentially affected industries.

13. When critical habitat is designated, section 7 requires Federal agencies to ensure that their actions will not result in the destruction or adverse modification of critical habitat (in addition to considering whether the actions are likely to jeopardize the continued existence of the species). The added administrative costs of including consideration of critical habitat in section 7 consultations, and the additional impacts of implementing project modifications resulting from the protection of critical habitat are the direct compliance costs of designating critical habitat. These costs are not in the baseline, and are considered incremental impacts of the rulemaking.

B.2.2 QUANTIFYING INCREMENTAL ECONOMIC IMPACTS

14. The incremental impacts of the proposed critical habitat designation are a subset of the co-extensive economic impacts quantified in Sections 3 through 6 of this analysis. Incremental impacts may be the direct compliance costs associated with additional effort for forecast consultations, reinitiated consultations, new consultations occurring specifically because of the designation, and additional project modifications that would not have been required under the jeopardy standard. Additionally, incremental impacts may include indirect impacts resulting from reaction to the potential designation of critical habitat (e.g., developing habitat conservation plans (HCPs) specifically to avoid designation of critical habitat), triggering of additional requirements under State or local

laws intended to protect sensitive habitat, and uncertainty and perceptional effects on markets.

Direct Impacts

15. The direct, incremental impacts of critical habitat designation stem from the consideration of the potential for destruction or adverse modification of critical habitat during section 7 consultations. The two categories of direct, incremental impacts of critical habitat designation are: 1) the administrative costs of conducting section 7 consultation; and 2) implementation of any project modifications requested by the Service through section 7 consultation to avoid, compensate for, or mitigate potential destruction or adverse modification of critical habitat.

Administrative Section 7 Consultation Costs

16. Parties involved in section 7 consultations include the Service, a Federal "action agency," and in some cases, a private entity involved in the project or land use activity. The action agency (i.e., the Federal nexus necessitating the consultation) serves as the liaison with the Service. While consultations are required for activities that involve a Federal nexus and may jeopardize the continued existence of the species regardless of whether critical habitat is designated, the designation may increase the effort for consultations in the case that the project or activity in question may adversely modify critical habitat.

17. In general, three different scenarios associated with the designation of critical habitat may trigger incremental administrative consultation costs:

    1. **Additional effort to address adverse modification in a new consultation -** New consultations taking place after critical habitat designation may require additional effort to address critical habitat issues above and beyond the listing issues. In this case, only the additional administrative effort required to consider critical habitat is considered an incremental impact of the designation.

    2. **Re-initiation of consultation to address adverse modification -** Consultations that have already been completed on a project or activity may require re-initiation to address critical habitat. In this case, the costs of re-initiating the consultation, including all associated administrative and project modification costs are considered incremental impacts of the designation.

    3. **Incremental consultation resulting entirely from critical habitat designation -** Critical habitat designation may trigger additional consultations that may not occur absent the designation (e.g., for an activity for which adverse modification may be an issue, while jeopardy is not, or consultations resulting from the new information about the potential presence of the species provided by the designation). Such consultations may, for example, be triggered in critical habitat areas that are not occupied by the species. All associated administrative and project modification costs

of incremental consultations are considered incremental impacts of the designation.

18. The administrative costs of these consultations vary depending on the specifics of the project. One way to address this variability is to show a range of possible costs of consultation as it may not be possible to predict the outcome of each future consultation in terms of level of effort. Review of consultation records and discussions with Service field offices resulted in an estimated range of administrative costs of consultation as highlighted in Exhibit B-2.

EXHIBIT B-2 RANGE OF ADMINISTRATIVE CONSULTATIONS COSTS, 2006$

CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT
Informal	$1,100 - $3,400	$1,500 - $4,300	$1,200 - $2,900	$0 - $4,000
Formal	$3,400 - $6,700	$4,300 - $7,200	$2,900 - $4,100	$4,000 - $5,600

Source: IEc analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2006, and a review of consultation records from several Service field offices across the country conducted in 2002.
Note: Estimates reflect average hourly time required by staff.

19. The above ranges in consultation costs represent effort required for all types of consultation, including those that considered both adverse modification and jeopardy and are therefore not representative of the incremental administrative costs of consultation triggered specifically by critical habitat designation. To estimate the fraction of the administrative costs associated with consultation the following assumptions were applied.

- The costs of an incremental consultation (one only occurring because of the designation of critical habitat) are the greatest, as all costs associated with this consultation are included.
- Re-initiation of a consultation is assumed to require approximately half the level of effort of the incremental consultation. This assumes that re-initiations are less time-consuming as the groundwork for the project has already been considered in terms of its effect on the species.
- Efficiencies exist with considering both jeopardy and adverse modification at the same time (e.g., in staff time saved for project review and report writing), and therefore incremental administrative costs of considering adverse modification in consultations that will already be required to consider jeopardy result in the least incremental effort of these three consultation categories, roughly half that of a re-initiation.

20. The cost model in Exhibit B-3 presents the estimated incremental costs of consultation for each of the three categories of consultation described above. Importantly, the

estimated costs represent the midpoint of the ranges in Exhibit B-2 to account for variability regarding levels of effect of specific consultation.[7]

EXHIBIT B-3 ESTIMATED ADMINISTRATIVE COSTS OF CONSULTATION (PER EFFORT), 2006$

CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT
INCREMENTAL CONSULTATION RESULTING ENTIRELY FROM CRITICAL HABITAT DESGINATION				
Informal	$2,250	$2,900	$2,050	$2,000
Formal	$5,050	$5,750	$3,500	$4,800
RE-INITIATION OF CONSULTATION TO ADDRESS ADVERSE MODIFICATION				
Informal	$1,120	$1,450	$1,020	$1,000
Formal	$2,520	$2,870	$1,750	$2,400
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION				
Informal	$560	$725	$510	$500
Formal	$1,260	$1,430	$875	$1,200

Source: IEc analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2006, and a review of consultation records from several Service field offices across the country conducted in 2002.
Notes:
1. Estimates reflect average hourly time required by staff.
2. Biological Assessment costs are not included in this report based on review of the consultation history indicating that they have been uncommon for the seven mussels in the past.

Section 7 Project Modification Impacts

21. Section 7 consultation considering critical habitat may also result in additional project modification recommendations specifically addressing potential destruction or adverse modification of critical habitat. For forecast consultations considering jeopardy and adverse modification, and for re-initiations of past consultations to consider critical habitat, economic impacts of project modifications undertaken to avoid, compensate for, or mitigate adverse modification are considered incremental impacts of critical habitat designation. For consultations that are forecast to occur specifically because of the designation (incremental consultations), impacts of all associated project modifications are assumed to be incremental impacts of the designation. This is summarized below.

1. **Additional effort to address adverse modification in a new consultation** - Only project modifications associated solely with avoiding, compensating for, or mitigating adverse modification are considered incremental.

[7] Absent specific information on the probability that a consultation will be closer to the low or high end of the range, presenting the midpoint effectively assumes there is an even distribution of the consultation falling at any given point on the spectrum between the low-end cost and high-end cost.

2. **Re-initiation of consultation to address adverse modification -** Only project modifications associated solely with avoiding, compensating for, or mitigating adverse modification are considered incremental.

3. **Incremental consultation resulting entirely from critical habitat designation -** Impacts of all project modifications are considered incremental.

Indirect Impacts

22. The designation of critical habitat may, under certain circumstances, affect actions that do not have a Federal nexus and thus are not subject to the provisions of section 7 under the Act. Indirect impacts are those unintended changes economic behavior that may occur outside of the Act, through other Federal, State, or local actions, that are caused by the designation of critical habitat. This section identifies common types of indirect impacts that may be associated with the designation of critical habitat. This analysis does not expect any of these impacts to be associated with the critical habitat designation for the seven mussels.

Habitat Conservation Plans

23. Under section 10(a)(1)(B) of the Act, a non-Federal entity (i.e., a landowner or local government) may develop an HCP for an endangered animal species in order to meet the conditions for issuance of an incidental take permit in connection with the development and management of a property. The HCP intends to counterbalance potential harmful effects that a proposed activity may have on a species, while allowing the otherwise lawful activity to proceed. As such, the purpose of the habitat conservation planning process is to ensure that the effects of incidental take are adequately minimized and mitigated. Thus, HCPs are developed to ensure compliance with section 9 of the Act and to meet the requirements of section 10 of the Act.

24. HCPs are not required or necessarily recommended by a critical habitat designation. Some landowners, however, may voluntarily complete a HCP in response to the prospect of having their land designated as critical habitat. In this case, the effort involved in creating the HCP and undertaking associated conservation actions are considered an incremental effect of designation.

Other State and Local Laws

25. Under certain circumstances, critical habitat designation may provide new information to a community about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other State or local laws. In cases where these impacts would not have been triggered absent critical habitat designation, they are considered indirect, incremental impacts of the designation.

26. The California Environmental Quality Act (CEQA), for example, requires that lead agencies, public agencies responsible for project approval, consider the environmental effects of proposed projects that are considered discretionary in nature and not categorically or statutorily exempt. In some instances, critical habitat designation may

trigger CEQA-related requirements. This is most likely to occur in areas where the critical habitat designation provides clearer information on the importance of particular areas as habitat for a listed species. In addition, applicants who were "categorically exempt" from preparing an Environmental Impact Report under CEQA may no longer be exempt once critical habitat is designated. In cases where the designation triggers the CEQA significance test or results in a reduction of categorically exempt activities, associated impacts are considered to be an indirect, incremental effect of the designation.

Additional Indirect Impacts

27. In addition to the indirect effects of compliance with other laws or triggered by the designation, project proponents, land managers and landowners may face additional indirect impacts, including the following:

- **Time Delays -** Both public and private entities may experience incremental time delays for projects and other activities due to requirements associated with the need to reinitiate the Section 7 consultation process and/or compliance with other laws triggered by the designation. To the extent that delays result from the designation, they are considered indirect, incremental impacts of the designation.
- **Regulatory Uncertainty -** The Service conducts each section 7 consultation on a case-by-case basis and issues a biological opinion on formal consultations based on species-specific and site-specific information. As a result, government agencies and affiliated private parties who consult with the Service under section 7 may face uncertainty concerning whether project modifications will be recommended by the Service and what the nature of these modifications will be. This uncertainty may diminish as consultations are completed and additional information becomes available on the effects of critical habitat on specific activities. Where information suggests that this type of regulatory uncertainty stemming from the designation may affect a project or economic behavior, associated impacts are considered indirect, incremental impacts of the designation.
- **Stigma -** In some cases, the public may perceive that critical habitat designation may result in limitations on private property uses above and beyond those associated with anticipated project modifications and regulatory uncertainty described above. Public attitudes about the limits or restrictions that critical habitat may impose can cause real economic effects to property owners, regardless of whether such limits are actually imposed. All else equal, a property that is designated as critical habitat may have a lower market value than an identical property that is not within the boundaries of critical habitat due to perceived limitations or restrictions. As the public becomes aware of the true regulatory burden imposed by critical habitat, the impact of the designation on property markets may decrease. To the extent that potential stigma effects on markets are probable and identifiable, these impacts are considered indirect, incremental impacts of the designation.

B.3 INCREMENTAL ANALYSIS OF CRITICAL HABITAT FOR THE SEVEN MUSSELS

28. Exhibit B-4 summarizes the co-extensive impacts quantified in Sections 3 through 6 of this analysis, and details whether, according to the framework described above, each impact is considered to be a baseline or incremental impact. Total baseline impacts of seven mussels conservation are forecast to be $61,800,000 to $100,000,000 (present value at a three percent discount rate). Importantly, these baseline impacts are not expected to be affected by decisions made regarding the final critical habitat designation for the seven mussels; they are expected occur absent any critical habitat designation for the species. Total incremental impacts of critical habitat designation are forecast to be $501,000 (present value at a three percent discount rate).

29. Exhibit B-4 highlights that, aside from a subset of administrative costs of section 7 consultation, all of the economic impacts quantified in Sections 3 through 6 of this analysis are expected to be baseline costs of the seven mussel species associated with their listing status. In other words, although critical habitat designation for the seven mussels is not expected to require modifications to land uses and activities above and beyond modifications that are already required under the listing, direct costs of critical habitat exist associated with the value of time and effort of conducting section 7 consultations beyond those associated with the listing of the seven mussels.

30. Exhibit B-5 distributes the estimated incremental impacts across the proposed critical habitat units for the seven mussels. Designation of all Units except for Unit 3 are expected to generate incremental impacts above and beyond those associated with the listing of the species. The designation of critical habitat Unit 8 is expected to trigger the greatest incremental impacts, 26 percent of total forecast incremental impacts.

EXHIBIT B-4 INCREMENTAL IMPACTS OF CRITICAL HABITAT DESIGNATION FOR THE SEVEN MUSSELS

DESCRIPTION OF IMPACT QUANTIFIED IN CO-EXTENSIVE ANALYSIS (SECTIONS 3 THROUGH 6)	BASELINE IMPACT (PV, 3%)	INCREMENTAL IMPACT (PV, 3%)	REASON
AGRICULTURE (SECTION 3.2)			
Reduction in irrigated agriculture in the Flint River Basin (Units 7 and 5) associated with converting to dryland farming.	$21,700,000 - $33,500,000	$0	Irrigation reductions in the Lower Flint River Basin are associated with the Flint River Drought Protection Act (2000). Mechanisms to reduce irrigated agriculture were put in place during times of severe drought in the past and are likely to continue regardless of designation of critical habitat for the seven mussels.
Administrative costs of consultation	$0	$0	No consultations are forecast for agricultural water use.
RECREATION (SECTION 3.3)			
Reduction in recreational boating trips in the future due to lower water levels in reservoirs on the Chattahoochee River.	$27,700,000 - $54,100,000	$0	The Modified Interim Operations Plan (Modified IOP) that governs the USACE operations of the Chattahoochee River Federal reservoirs contains measures to support the listed mussels in the Apalachicola River downstream of Jim Woodruff Dam. The Modified IOP was developed prior to the proposed critical habitat designation, and its implementation and associated impacts to recreational boaters are expected to occur regardless of critical habitat designation.
Administrative costs of consultation	$0	$0	No consultations are forecast for recreational use.
WATER MANAGEMENT (SECTION 4)			
Surveying and monitoring efforts at completed or planned reservoirs.	$609,000	$0	Surveying and monitoring were recommended in section 7 consultations in consideration of jeopardy, and are expected to be recommended even absent critical habitat designation for water management projects.
Surveying efforts associated with FERC relicensing efforts for Lake Blackshear and Lake Talquin.	$145,000	$0	
Surveying and monitoring efforts associated with new off-stream withdrawal projects.	$2,360,000	$0	

DESCRIPTION OF IMPACT QUANTIFIED IN CO-EXTENSIVE ANALYSIS (SECTIONS 3 THROUGH 6)	BASELINE IMPACT (PV, 3%)	INCREMENTAL IMPACT (PV, 3%)	REASON
Administrative costs of consultation	$686,000	$205,000	Incremental administrative consultation costs are associated with 3 forecast re-initiations of consultations for the FERC-licensed dams and 101 forecast new consultations for FERC relicensing (one) and for new off-stream water withdrawal projects (100) that are expected to require additional effort for consideration of potential impacts to critical habitat.
TRANSPORTATION (SECTION 6.2)			
Mussel surveying and potential relocation.	$3,790,000	$0	Surveying and monitoring were recommended in section 7 consultations in consideration of jeopardy, and are expected to be recommended even absent critical habitat designation for transportation projects.
Administrative costs of consultation	$465,000	$146,000	Incremental administrative consultation costs are associated with 110 forecast new consultations on transportation projects that are expected to require additional effort for consideration of potential impacts to critical habitat.
SPECIES MANAGEMENT (SECTION 6.3)			
Development of Georgia Department of Natural Resources HCP.	$314,000	$0	Georgia EPD has indicated it will pursue the HCP regardless of critical habitat.
Surveying and monitoring efforts by management agencies for the mussels independent of planned projects.	$2,670,000	$0	These impacts are associated with species management undertaken by agencies in the past associated with the listing of species. These efforts are expected to continue regardless of the designation of critical habitat.
The Suwannee River Water Management District has developed minimum flows and levels (MFLs) for the Upper Santa Fe River Basin.	$60,000	$0	The forecast implementation of MFLs is associated with Florida law (Florida Statutes, Subsection 373.042(2), State Comprehensive Plan, and the Florida Administrative Code (F.A.C.) water resources implementation rule Chapter 62-40.473); impacts of implementation are therefore expect to occur absent critical habitat designation. This analysis does not forecast changes in MFLs as a result of critical habitat.

DESCRIPTION OF IMPACT QUANTIFIED IN CO-EXTENSIVE ANALYSIS (SECTIONS 3 THROUGH 6)	BASELINE IMPACT (PV, 3%)	INCREMENTAL IMPACT (PV, 3%)	REASON
Administrative costs of consultation	$457,000	$10,800	Incremental administrative consultation costs are associated with one forecast new consultation including internal consultation on the Georgia Department of Natural Resources HCP, that are expected to require additional effort for consideration of potential impacts to critical habitat.
DEADHEAD LOGGING (SECTION 6.4)			
Mussel surveys and limits on deadhead logging.	$385,000	$0	The Florida Department of Environmental Protection (DEP) permits deadhead logging activity, and has required mussel surveys associated with the listing of the species. This is expected to continue regardless of the designation of critical habitat.
Administrative costs of consultation	$424,000	$134,000	Incremental administrative consultation costs are associated with 100 forecast new consultations for future deadhead logging activities that are expected to require additional effort for consideration of potential impacts to critical habitat.
WATER QUALITY (SECTION 5)			
Qualitative discussion of potential impacts to activities affecting water quality.	unknown	unknown	
Administrative costs of consultation	$223	$5,360	Incremental administrative consultation costs are associated with one forecast informal consultation stemming from concerns about water quality as it affects the seven mussels habitat downstream of Lake Talquin. This consultation is expected to occur solely because of the designation of critical habitat.*
TOTALS	**$61,800,000 - $100,000,000**	**$501,000**	

* Personal communication with Athens, Georgia and Panama City, Florida, U.S. Fish and Wildlife Service Field Offices, August 18, 2007.

EXHIBIT B-5 INCREMENTAL IMPACTS OF CRITICAL HABITAT BY UNIT

UNIT	WATER MANAGEMENT	TRANSPORTATION	SPECIES MANAGEMENT	DEADHEAD LOGGING	WATER QUALITY	TOTAL
1- Econfina Creek	$0	$2,000	$0	$0	$0	$2,000
2 Chipola River	$0	$668	$0	$48,100	$0	$48,700
3 Uchee Creek	$0	$0	$0	$0	$0	$0
4 Sawhatchee and Kirkland Creeks	$0	$27,400	$0	$0	$0	$27,400
5 Upper Flint River	$80,700	$28,800	$0	$0	$0	$109,000
6 Middle Flint River	$68,800	$27,400	$0	$0	$0	$96,200
7 Lower Flint River	$0	$30,100	$10,800	$0	$0	$40,900
8 Apalachicola River	$53,000	$668	$0	$74,800	$0	$128,000
9 Upper Ochlockonee River	$2,650	$28,100	$0	$0	$0	$30,700
10 Lower Ochlockonee River	$0	$668	$0	$10,700	$5,360	$16,700
11 Santa Fe and New Rivers	$0	$668	$0	$0	$0	$668
Total	**$205,000**	**$146,000**	**$10,800**	**$134,000**	**$5,360**	**$501,000**

APPENDIX C| FINAL REGULATORY FLEXIBILITY ANALYSIS AND ENERGY IMPACTS ANALYSIS

1. This appendix considers the extent to which the incremental impacts analysis described in Appendix B could be borne by small entities and the energy industry. The analysis presented in Section C.1 is conducted pursuant to the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) in 1996, and meets the requirements of a Final Regulatory Flexibility Analysis (FRFA). Information for this analysis was gathered from the Small Business Administration (SBA), U.S. Census Bureau, and the Risk Management Association (RMA). The energy analysis in Section C.2 is conducted pursuant to Executive Order No. 13211.

2. The analyses of impacts to small entities and the energy industry rely on the estimated incremental impacts associated with the proposed critical habitat designation (see Appendix B), and not the fully co-extensive impacts of seven mussels conservation. The incremental impacts of the rulemaking are considered most relevant for the small business and energy impacts analyses as they are expected to stem from the critical habitat designation, and are therefore not expected to occur in the case that critical habitat is not designated for the seven mussels. The co-extensive impacts associated with the listing of the seven mussels, as quantified in Sections 3 through 6 of this report, are expected to occur regardless of the outcome of this rulemaking and are therefore not considered in terms of their impacts on small businesses and the energy industry.

C.1 SBREFA ANALYSIS

3. When a Federal agency proposes regulations, the RFA requires the agency to prepare and make available for public comment an IRFA that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions).[1]

4. If a proposed rule is not expected to have a significant impact on a substantial number of small entities, the RFA allows an agency to so certify, in lieu of preparing an IRFA.[2] In the case of the proposed critical habitat for the seven mussels, uncertainty exists regarding both the numbers of entities that will be subject to the proposed rule

[1] 5 U.S.C. 601 et seq.

[2] Thus, for a regulatory flexibility analysis to be required, impacts must exceed a threshold for "significant impact" and a threshold for a "substantial number of small entities." 5 U.S.C. 605(b).

and the degree of impact on particular entities. In particular, the nature of impacts that may be experienced as a result of seven mussels conservation efforts, and the distribution of these costs across the potentially affected industries is uncertain.

5. To ensure broad consideration of impacts on small entities, the Service has prepared this small business analysis without first making the threshold determination whether the proposed critical habitat designation could be certified as not having a significant economic impact on a substantial number of small entities.

C.1.1 SUMMARY OF IMPACTS ON SMALL ENTITIES

6. This FRFA concludes that, of the land use activities considered in Sections 3 to 6 of this analysis, incremental impacts of critical habitat designation to the following activities may be borne by small entities:

- Water management; and
- Deadhead logging.

7. Exhibit C-1 summarizes the estimated impacts to small entities described in detail in the remainder of this appendix.

EXHIBIT C-1 SUMMARY OF IMPACTS TO SMALL ENTITIES

ACTIVITY	TOTAL NUMBER OF AFFECTED SMALL ENTITIES	PERCENTAGE OF TOTAL SMALL ENTITIES THAT ARE EXPECTED TO BE AFFECTED	ESTIMATED IMPACT PER SMALL ENTITY (OVER 20 YEARS, PRESENT VALUE, 3% DISCOUNT RATE)	IMPACTS AS A PERCENT OF AVERAGE REVENUES
Water supply, hydropower, and other impoundments	1 hydropower operation	100%	$1,020	Unknown
Deadhead logging	10 logging businesses	100%	$3,790	0.05% - 0.09%

8. As discussed in Appendix B, the only incremental impacts associated with this rulemaking are administrative costs associated with section 7 consultation to address adverse modification. The following activities are expected to experience incremental, administrative consultation costs that may be borne by small businesses:

- **Water management (Federal Energy Regulatory Commission dam relicensing and water withdrawals) -** Incremental administrative impacts may be borne by small businesses involved in consultation, including hydropower dam operators.

- **Deadhead logging -** Incremental administrative impacts may be borne by ten small deadhead logging operations.

9. The following activities are expected to experience incremental, administrative consultation costs that are not expected to be borne by small businesses:

   - **Transportation -** Incremental administrative impacts are not expected to be borne by small business as the parties involved in consultation include State and county agencies, and not businesses.
   - **Species management activities -** Forecast incremental administrative impacts are expected to be borne by the Georgia Department of Natural Resources, and not small businesses.
   - **Water quality -** Incremental administrative impacts are expected to result from one consultation between the Service, Federal Energy Regulatory Commission (FERC) and the City of Tallahassee. No impacts are expected to small businesses.

C.1.2 FRFA

10. This FRFA is intended to improve the Service's understanding of the potential effects of the proposed rule on small entities, and to identify opportunities to minimize these impacts in the final rulemaking. Exhibit C-2 describes the components of an FRFA. The remainder of this section addresses each of these FRFA requirements.

EXHIBIT C-2 ELEMENTS OF A FIRFA

ELEMENTS OF A FINAL REGULATORY FLEXIBILITY ANALYSIS
1. A succinct statement of the need for, and objectives of, the rule.
2. A summary of the significant issues raised by the public comments in response to the IRFA, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments.
3. A description and an estimate of the number of small entities to which the rule will apply.
4. A description of the projected reporting, recordkeeping, and other compliance requirements of the rule, including an estimate of the classes of small entities that will be subject to the requirement and the types of professional skills necessary for the preparation of the report or record.
5. A description of steps the agency has taken to minimize the significant adverse economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each of the other significant alternatives to the rule considered by the agency was rejected.
Source: Small Business Administration, Office of Advocacy. May 2003. A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act. pg. 49.

Reasons for Considering the Proposed Action

11. Section 4(a)(3) of the Endangered Species Act (Act) requires the Service to designate critical habitat for threatened and endangered species to the maximum extent prudent and determinable.[3] Given that the seven mussels are Federally-listed variously as threatened and endangered under the Act, the Service finds that consideration of critical habitat designation is required.

12. The benefits of critical habitat designation derive from section 7 of the Act, which requires that Federal agencies, in consultation with the Service, ensure that actions they carry out, permit, or fund are not likely to destroy or adversely modify critical habitat.

Objectives and Legal Basis of the Proposed Rule

13. The purpose of the proposed rule is to designate critical habitat for the seven mussels pursuant to the Act.

14. As noted above, the Act requires the Service to designate critical habitat for threatened and endangered species to the maximum extent prudent and determinable. Section 4(b)(2) of the Act requires that the Service designate critical habitat "on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impacts, of specifying any particular area as critical habitat." This section grants the Secretary [of Interior] to exclude any area from critical habitat if (s)he determines "the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat." The Secretary's discretion is limited, as (s)he may not exclude areas if so doing "will result in the extinction of the species."

Description and Types and Number of Small Entities to which the Rule will Apply and Description of the Projected Compliance Requirements of the Proposed Rule

15. Three types of small entities are defined in the RFA:

- Small Business - Section 601(3) of the RFA defines a small business as having the same meaning as small business concern under section 3 of the Small Business Act. This includes any firm that is independently owned and operated and is not dominant in its field of operation. The U.S. Small Business Administration (SBA) has developed size standards to carry out the purposes of the Small Business Act, and those size standards can be found in 13 CFR 121.201. The size standards are matched to North American Industry Classification System (NAICS) industries. The SBA definition of a small business applies to a firm's parent company and all affiliates as a single entity.

[3] 16 U.S.C. Sections 1531-1544.

- Small Governmental Jurisdiction - Section 601(5) defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with a population of less than 50,000. Special districts may include those servicing irrigation, ports, parks and recreation, sanitation, drainage, soil and water conservation, road assessment, etc. When counties have populations greater than 50,000, those municipalities of fewer than 50,000 can be identified using population reports. Other types of small government entities are not as easily identified under this standard, as they are not typically classified by population.
- Small Organization - Section 601(4) defines a small organization as any not-for-profit enterprise that is independently owned and operated and not dominant in its field. Small organizations may include private hospitals, educational institutions, irrigation districts, public utilities, agricultural co-ops, etc. Depending upon State laws, it may be difficult to distinguish whether a small entity is a government or non-profit entity. For example, a water supply entity may be a cooperative owned by its members in one case and in another a publicly chartered small government with the assets owned publicly and officers elected at the same elections as other public officials.

16. The courts have held that the RFA/SBREFA requires federal agencies to perform a regulatory flexibility analysis of forecast impacts to small entities that are directly regulated. In the case of *Mid-Tex Electric Cooperative, Inc., v. Federal Energy Regulatory Commission (FERC),* FERC proposed regulations affecting the manner in which generating utilities incorporated construction work in progress in their rates. The generating utilities that expected to be regulated were large businesses; however, their customers -- transmitting utilities such as electric cooperatives -- included numerous small entities. In this case, the court agreed that FERC simply authorized large electric generators to pass these costs through to their transmitting and retail utility customers, and FERC could therefore certify that small entities were not directly impacted within the definition of the RFA.[4]

17. Similarly, *American Trucking Associations, Inc. v. Environmental Protection Agency* (EPA) addressed a rulemaking in which EPA established a primary national ambient air quality standard for ozone and particulate matter.[5] The basis of EPA's RFA/SBREFA certification was that this standard did not directly regulate small entities; instead, small entities were indirectly regulated through the implementation of state plans that incorporated the standards. The court found that, while EPA imposed regulation on states, it did not have authority under this rule to impose regulations directly on small entities and therefore small entities were not directly impacted within the definition of the RFA.

[4] 773 F. 2d 327 (D.C. Cir. 1985).

[5] 175 F. 3d 1027, 1044 (D.C. Cir. 1999).

18. The Small Business Administration (SBA) in its guidance on how to comply with the RFA recognizes that consideration of indirectly affected small entities is not required by the RFA, but encourages agencies to perform a regulatory flexibility analysis even when the impacts of its regulation are indirect.[6] "If an agency can accomplish its statutory mission in a more cost-effective manner, the Office of Advocacy [of the SBA] believes that it is good public policy to do so. The only way an agency can determine this is if it does not certify regulations that it knows will have a significant impact on small entities even if the small entities are regulated by a delegation of authority from the federal agency to some other governing body."[7]

19. The regulatory mechanism through which critical habitat protections are enforced is section 7 of the Act, which directly regulates only those activities carried out, funded, or permitted by a Federal agency. By definition, Federal agencies are not considered small entities, although the activities they may fund or permit, may be proposed or carried out by small entities. Given the SBA guidance described above, this analysis considers the extent to which this designation could potentially affect small entities, regardless of whether these entities would be directly regulated by the Service through the proposed rule or by a delegation of impact from the directly regulated entity.

20. This FRFA focuses on small entities that may bear the incremental impacts of this rulemaking quantified in Appendix B of this economic analysis. Although indirectly affected businesses are considered, this analysis considers only those entities whose impact would not be measurably diluted. Of the affected activities discussed in the economic analysis this FRFA concludes that incremental impacts may only affect small entities associated with the following land use activities:

- **Water management (hydropower and water withdrawals) -** small hydropower operations.
- **Deadhead logging –** small businesses that conduct deadhead logging in the region.

Estimate of the Number of Small Entities to which the Proposed Rule will Apply

21. This FRFA estimates that one hydropower producer, and ten deadhead loggers in the region may experience incremental impacts of the critical habitat designation for the seven mussels as proposed.

Water Supply, Hydropower, and Other Impoundments

22. Section 4 of this analysis estimates impacts to water supply, hydropower, and other impoundments. As highlighted in Exhibit C-3, of the affected projects, only Crisp

[6] Small Business Administration, Office of Advocacy. May 2003. A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act. pg. 20.

[7] *Ibid.*, pg. 21.

County Power commission is considered a small entity. The Commission is expected to incur incremental impacts of critical habitat designation in the form of additional administrative costs associated with a re-initiation of consultation regarding its FERC-permitted facility. Incremental impacts to the Commission are forecast to be $1,020.[8] Appendix B also describes potential additional consultation costs for permitted water withdrawals. No information exists, however, on the entities that are withdrawing water associated with these permits, and therefore their small business status is unknown.

EXHIBIT C-3 CHARACTERISTICS OF WATER SUPPLY, HYDROPOWER, AND OTHER IMPOUNDMENTS POTENTIALLY AFFECTED BY SEVEN MUSSELS CONSERVATION EFFORTS

PROJECT	ENTITY UNDERTAKING PROJECT	POPULATION SERVED	SMALL ENTITY [1]
Griffin Still Branch Reservoir	City of Griffin, Georgia	60,000[2]	No
Lake McIntosh	Fayette County, Georgia	98,400[3]	No
Lake Blackshear	Crisp County Power Commission	23,000[4]	Yes
USACE Reservoirs	USACE	13,000,000[5]	No
Lake Talquin	City of Tallahassee, Florida	158,500[6]	No

1. The Small Business Administration defines a "small governmental jurisdiction" as governments of counties with a population of less than fifty thousand." U.S.C. § 601.
2. City of Griffin, Georgia, Water and Wastewater Department. About Us. Accessed at http://www.griffinstorm.com/WWW/AboutUs.htm on November 14, 2006.
3. Fayette County, Georgia, Official Website. Fayette County Facts. http://www.admin.co.fayette.ga.us/information/fay_facts.htm on November 14, 2006.
4. Crisp County Power Commission. Welcome. Accessed at http://www.crispcountypower.com/ on November 14, 2006.
5. USACE's reservoirs are part of Southeastern's 10-dam system that combined serve more than 13 million consumers. SEPA, Quick Facts, Accessed at http://www.sepa.doe.gov/Files/QuickFacts.pdf on May 17, 2007.
6. U.S. Census Bureau. American Fact Finder. Tallahassee Florida Population 2005. Accessed at http://factfinder.census.gov on November 13, 2006.

Deadhead Logging

23. As discussed in Section 6 of this analysis, currently ten individuals are permitted to conduct deadhead logging on rivers proposed for designation. Average annual revenues for these individuals are estimated to range from $28,000 to $56,000, and each of these individuals are assumed to be small businesses for the purpose of this FRFA. Incremental impacts of critical habitat designation to these deadhead logging operations are the additional administrative costs of considering critical habitat in future section 7 consultations. Total incremental impacts to these small businesses are expected to be $37,900 (present value applying a three percent discount rate) over

[8] This assumes the re-initiation of consultation would occur this year, and incremental impacts to the Commission would be $1,020 (see Exhibit B-2 in Appendix B).

the next 20 years.[9] This equates to an average $3,790 per business, or 0.05 percent to 0.09 of the present value average per business revenues over the 20 year time period.

A Description of Alternatives to the Proposed Rule Which Accomplish the Objectives and Which Minimize Impacts on Small Entities

24. The Service identified 11 units as proposed critical habitat for the seven mussels. An alternative to the Proposed Rule (designating the stream reaches of the 11 proposed units for critical habitat) is the designation of fraction of these units or portions of each unit. Section 4(b)(2) of the Act allows the Service to exclude areas proposed for designation based on economic impact and other relevant impacts. As a result, the designation of multiple combinations of units are also available to the Service as alternatives.

25. A reduction in the size of critical habitat will reduce the number of small businesses potentially affected. The extent to which the economic impact to small entities is reduced depends on how many, and which, subunits or portions of subunits of critical habitat are excluded.

C.2 POTENTIAL IMPACTS TO THE ENERGY INDUSTRY

26. Pursuant to Executive Order No. 13211, "Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use," issued May 18, 2001, Federal agencies must prepare and submit a "Statement of Energy Effects" for all "significant energy actions." The purpose of this requirement is to ensure that all Federal agencies "appropriately weigh and consider the effects of the Federal Government's regulations on the supply, distribution, and use of energy."[10]

27. The Office of Management and Budget provides guidance for implementing this Executive Order, outlining nine outcomes that may constitute "a significant adverse effect" when compared with the regulatory action under consideration:

- Reductions in crude oil supply in excess of 10,000 barrels per day (bbls);
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;
- Reductions in natural gas production in excess of 25 million Mcf per year;
- Reductions in electricity production in excess of 1 billion kilowatts-hours per year or in excess of 500 megawatts of installed capacity;

[9] Incremental impacts to third parties (the deadhead logging operations, in this case) for these consultations is $510 per consultation (see Exhibit B-2 in Appendix B). The estimated $37,900 represents the administrative costs of 100 forecast consultations discounted at three percent over 20 years.

[10] Memorandum For Heads of Executive Department Agencies, and Independent Regulatory Agencies, Guidance For Implementing E.O. 13211, M-01-27, Office of Management and Budget, July 13, 2001, http://www.whitehouse.gov/omb/memoranda/m01-27.html.

- Increases in energy use required by the regulatory action that exceed the thresholds above;
- Increases in the cost of energy production in excess of one percent;
- Increases in the cost of energy distribution in excess of one percent; or
- Other similarly adverse outcomes.[11]

28. As discussed in Section 4 of this analysis, operational change recommendations for the seven mussels may include maintenance of flows, including timing and duration of releases, or maximum fall rates. Appendix B of this analysis describes that no incremental impacts are forecast associated specifically with this rulemaking on the production, distribution, or use of energy. That is, all forecast impacts are expected to occur associated with the listing of the seven mussels, regardless of the designation of critical habitat.

[11] Ibid.

APPENDIX D
DETAILED UNIT BY UNIT IMPACTS

APPENDIX D-1 DETAILED IMPACTS TO ALL ACTIVITIES

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$138,000	$138,000	$124,000	$124,000	$113,000	$113,000	$8,350	$8,350	$10,700	$10,700
2 - Chipola River	$156,000	$156,000	$157,000	$157,000	$159,000	$159,000	$896,000	$896,000	$689,000	$689,000	$512,000	$512,000	$41,000	$41,000	$37,900	$37,900
3 - Uchee Creek	$15,600	$15,600	$15,600	$15,600	$15,600	$15,600	$643	$643	$643	$643	$643	$643	$43	$43	$61	$61
4 - Sawhatchee and Kirkland Creeks	$12,200	$12,200	$12,400	$12,400	$12,700	$12,700	$315,000	$315,000	$237,000	$237,000	$171,000	$171,000	$15,900	$15,900	$16,100	$16,100
5 - Upper Flint River	$193,000	$193,000	$200,000	$200,000	$210,000	$210,000	$7,500,000	$11,200,000	$6,030,000	$8,750,000	$4,790,000	$6,730,000	$396,000	$579,000	$428,000	$611,000
6 - Middle Flint River	$200,000	$200,000	$209,000	$209,000	$221,000	$221,000	$3,500,000	$3,500,000	$2,760,000	$2,760,000	$2,130,000	$2,130,000	$186,000	$186,000	$201,000	$201,000
7 - Lower Flint River	$131,000	$131,000	$138,000	$138,000	$150,000	$150,000	$27,500,000	$39,700,000	$20,600,000	$29,600,000	$14,700,000	$21,200,000	$1,380,000	$1,990,000	$1,390,000	$2,000,000
8 - Apalachicola River	$619,000	$619,000	$702,000	$702,000	$837,000	$837,000	$41,900,000	$78,100,000	$30,900,000	$57,300,000	$21,800,000	$40,200,000	$2,040,000	$3,810,000	$1,970,000	$3,710,000
9 - Upper Ochlockonee River	$102,000	$102,000	$103,000	$103,000	$104,000	$104,000	$376,000	$376,000	$282,000	$282,000	$202,000	$202,000	$18,900	$18,900	$19,100	$19,100
10 - Lower Ochlockonee River	$41,300	$41,300	$41,300	$41,300	$41,300	$41,300	$835,000	$835,000	$621,000	$621,000	$442,000	$442,000	$40,800	$40,800	$40,000	$40,000
11 - Santa Fe and New Rivers	$333,000	$333,000	$352,000	$352,000	$380,000	$380,000	$106,000	$106,000	$94,700	$94,700	$84,300	$84,300	$6,360	$6,360	$7,960	$7,960
TOTAL	$2,140,000	$2,140,000	$2,270,000	$2,270,000	$2,470,000	$2,470,000	$83,100,000	$135,000,000	$62,300,000	$101,000,000	$45,000,000	$71,700,000	$4,130,000	$6,700,000	$4,130,000	$6,660,000

APPENDIX D-2 DETAILED IMPACTS TO AGRICULTURE

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2 - Chipola River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3 - Uchee Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - Sawhatchee and Kirkland Creeks	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5 - Upper Flint River	$0	$0	$0	$0	$0	$0	$2,380,000	$6,040,000	$1,770,000	$4,490,000	$1,260,000	$3,200,000	$119,000	$302,000	$119,000	$302,000
6 - Middle Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7 - Lower Flint River	$0	$0	$0	$0	$0	$0	$26,800,000	$39,000,000	$20,000,000	$29,000,000	$14,200,000	$20,700,000	$1,340,000	$1,950,000	$1,340,000	$1,950,000
8 - Apalachicola River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9 - Upper Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10 - Lower Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11 - Santa Fe and New Rivers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL	$0	$0	$0	$0	$0	$0	$29,200,000	$45,100,000	$21,700,000	$33,500,000	$15,500,000	$23,900,000	$1,460,000	$2,250,000	$1,460,000	$2,250,000

APPENDIX D-3 DETAILED IMPACTS TO RECREATION

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2 - Chipola River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3 - Uchee Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - Sawhatchee and Kirkland Creeks	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5 - Upper Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6 - Middle Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7 - Lower Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8 - Apalachicola River	$0	$0	$0	$0	$0	$0	$37,800,000	$73,900,000	$27,700,000	$54,100,000	$19,300,000	$37,800,000	$1,860,000	$3,640,000	$1,830,000	$3,560,000
9 - Upper Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10 - Lower Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11 - Santa Fe and New Rivers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL	$0	$0	$0	$0	$0	$0	$37,800,000	$73,900,000	$27,700,000	$54,100,000	$19,300,000	$37,800,000	$1,860,000	$3,640,000	$1,830,000	$3,560,000

APPENDIX D-4 DETAILED IMPACTS TO WATER SUPPLY, HYDROPOWER, AND OTHER IMPOUNDMENTS

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2 - Chipola River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3 - Uchee Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - Sawhatchee and Kirkland Creeks	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5 - Upper Flint River	$93,900	$93,900	$99,300	$99,300	$107,000	$107,000	$1,830,000	$1,830,000	$1,490,000	$1,490,000	$1,250,000	$1,250,000	$91,700	$91,700	$93,300	$93,300
6 - Middle Flint River	$81,000	$81,000	$87,800	$87,800	$97,600	$97,600	$1,920,000	$1,920,000	$1,570,000	$1,570,000	$1,250,000	$1,250,000	$105,000	$105,000	$118,000	$118,000
7 - Lower Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8 - Apalachicola River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9 - Upper Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10 - Lower Ochlockonee River	$0	$0	$0	$0	$0	$0	$81,000	$81,000	$58,000	$58,000	$37,800	$37,800	$2,900	$2,900	$1,890	$1,890
11 - Santa Fe and New Rivers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL	$175,000	$175,000	$187,000	$187,000	$205,000	$205,000	$3,830,000	$3,830,000	$3,120,000	$3,120,000	$2,540,000	$2,540,000	$200,000	$200,000	$214,000	$214,000

APPENDIX D-5 DETAILED IMPACTS TO TRANSPORTATION

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$0	$0	$0	$0	$0	$0	$127,000	$127,000	$116,000	$116,000	$107,000	$107,000	$7,810	$7,810	$10,100	$10,100
2 - Chipola River	$14,500	$14,500	$15,600	$15,600	$17,100	$17,100	$42,300	$42,300	$31,700	$31,700	$22,300	$22,300	$2,130	$2,130	$2,110	$2,110
3 - Uchee Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - Sawhatchee and Kirkland Creeks	$4,190	$4,190	$4,380	$4,380	$4,640	$4,640	$161,000	$161,000	$122,000	$122,000	$88,700	$88,700	$8,210	$8,210	$8,370	$8,370
5 - Upper Flint River	$19,900	$19,900	$20,800	$20,800	$22,000	$22,000	$2,720,000	$2,720,000	$2,340,000	$2,340,000	$1,980,000	$1,980,000	$157,000	$157,000	$187,000	$187,000
6 - Middle Flint River	$35,600	$35,600	$37,000	$37,000	$38,800	$38,800	$1,040,000	$1,040,000	$794,000	$794,000	$586,000	$586,000	$53,400	$53,400	$55,300	$55,300
7 - Lower Flint River	$73,400	$73,400	$81,300	$81,300	$92,800	$92,800	$177,000	$177,000	$138,000	$138,000	$104,000	$104,000	$9,260	$9,260	$9,850	$9,850
8 - Apalachicola River	$0	$0	$0	$0	$0	$0	$42,300	$42,300	$31,700	$31,700	$22,300	$22,300	$2,130	$2,130	$2,110	$2,110
9 - Upper Ochlockonee River	$12,000	$12,000	$12,700	$12,700	$13,600	$13,600	$204,000	$204,000	$154,000	$154,000	$111,000	$111,000	$10,300	$10,300	$10,500	$10,500
10 - Lower Ochlockonee River	$0	$0	$0	$0	$0	$0	$42,300	$42,300	$31,700	$31,700	$22,300	$22,300	$2,130	$2,130	$2,110	$2,110
11 - Santa Fe and New Rivers	$0	$0	$0	$0	$0	$0	$42,300	$42,300	$31,700	$31,700	$22,300	$22,300	$2,130	$2,130	$2,110	$2,110
TOTAL	$160,000	$160,000	$172,000	$172,000	$189,000	$189,000	$4,590,000	$4,590,000	$3,790,000	$3,790,000	$3,070,000	$3,070,000	$255,000	$255,000	$290,000	$290,000

APPENDIX D-6 DETAILED IMPACTS TO DEADHEAD LOGGING

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2 - Chipola River	$0	$0	$0	$0	$0	$0	$180,000	$180,000	$138,000	$138,000	$102,000	$102,000	$9,260	$9,260	$9,590	$9,590
3 - Uchee Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - Sawhatchee and Kirkland Creeks	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5 - Upper Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6 - Middle Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7 - Lower Flint River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
8 - Apalachicola River	$0	$0	$0	$0	$0	$0	$280,000	$280,000	$214,000	$214,000	$158,000	$158,000	$14,400	$14,400	$14,900	$14,900
9 - Upper Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10 - Lower Ochlockonee River	$0	$0	$0	$0	$0	$0	$40,000	$40,000	$32,500	$32,500	$25,800	$25,800	$2,180	$2,180	$2,440	$2,440
11 - Santa Fe and New Rivers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL	$0	$0	$0	$0	$0	$0	$500,000	$500,000	$385,000	$385,000	$285,000	$285,000	$25,900	$25,900	$26,900	$26,900

APPENDIX D-7 DETAILED IMPACTS TO SPECIES MANAGEMENT

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2 - Chipola River	$12,000	$12,000	$12,400	$12,400	$12,800	$12,800	$400,000	$400,000	$316,000	$316,000	$243,000	$243,000	$15,900	$15,900	$12,500	$12,500
3 - Uchee Creek	$559	$559	$575	$575	$598	$598	$643	$643	$643	$643	$643	$643	$43	$43	$61	$61
4 - Sawhatchee and Kirkland Creeks	$500	$500	$523	$523	$554	$554	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5 - Upper Flint River	$7,000	$7,000	$7,570	$7,570	$8,380	$8,380	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
6 - Middle Flint River	$7,000	$7,000	$7,570	$7,570	$8,380	$8,380	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7 - Lower Flint River	$0	$0	$0	$0	$0	$0	$318,000	$318,000	$314,000	$314,000	$310,000	$310,000	$21,100	$21,100	$29,200	$29,200
8 - Apalachicola River	$494,000	$494,000	$577,000	$577,000	$712,000	$712,000	$2,980,000	$2,980,000	$2,360,000	$2,360,000	$1,820,000	$1,820,000	$118,000	$118,000	$91,000	$91,000
9 - Upper Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10 - Lower Ochlockonee River	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11 - Santa Fe and New Rivers	$325,000	$325,000	$345,000	$345,000	$373,000	$373,000	$60,000	$60,000	$60,000	$60,000	$60,000	$60,000	$4,030	$4,030	$5,660	$5,660
TOTAL	$846,000	$846,000	$950,000	$950,000	$1,120,000	$1,120,000	$3,760,000	$3,760,000	$3,050,000	$3,050,000	$2,430,000	$2,430,000	$159,000	$159,000	$139,000	$139,000

APPENDIX D-8 DETAILED ADMINISTRATIVE COSTS OF SECTION 7 CONSULTATION

UNIT	PAST (CONSTANT DOLLARS)		PAST PRESENT VALUE (3%)		PAST PRESENT VALUE (7%)		FUTURE (CONSTANT DOLLARS)		FUTURE PRESENT VALUE (3%)		FUTURE PRESENT VALUE (7%)		ANNUALIZED (3%)		ANNUALIZED (7%)	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1- Econfina Creek	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$11,300	$11,300	$8,000	$8,000	$6,000	$6,000	$538	$538	$566	$566
2 - Chipola River	$130,000	$130,000	$130,000	$130,000	$130,000	$130,000	$274,000	$274,000	$204,000	$204,000	$145,000	$145,000	$13,700	$13,700	$13,700	$13,700
3 - Uchee Creek	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4 - Sawhatchee and Kirkland Creeks	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$154,000	$154,000	$115,000	$115,000	$82,000	$82,000	$7,730	$7,730	$7,740	$7,740
5 - Upper Flint River	$72,200	$72,200	$72,200	$72,200	$72,200	$72,200	$569,000	$569,000	$423,000	$423,000	$301,000	$301,000	$28,400	$28,400	$28,400	$28,400
6 - Middle Flint River	$76,500	$76,500	$76,500	$76,500	$76,500	$76,500	$540,000	$540,000	$402,000	$402,000	$286,000	$286,000	$27,000	$27,000	$27,000	$27,000
7 - Lower Flint River	$57,200	$57,200	$57,200	$57,200	$57,200	$57,200	$198,000	$198,000	$147,000	$147,000	$105,000	$105,000	$9,880	$9,880	$9,910	$9,910
8 - Apalachicola River	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$814,000	$814,000	$606,000	$606,000	$431,000	$431,000	$40,700	$40,700	$40,700	$40,700
9 - Upper Ochlockonee River	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000	$173,000	$173,000	$128,000	$128,000	$91,000	$91,000	$8,600	$8,600	$8,590	$8,590
10 - Lower Ochlockonee River	$41,300	$41,300	$41,300	$41,300	$41,300	$41,300	$671,000	$671,000	$499,000	$499,000	$356,000	$356,000	$33,500	$33,500	$33,600	$33,600
11 - Santa Fe and New Rivers	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$3,750	$3,750	$3,000	$3,000	$2,000	$2,000	$202	$202	$189	$189
TOTAL	$959,000	$959,000	$959,000	$959,000	$959,000	$959,000	$3,410,000	$3,410,000	$2,530,000	$2,530,000	$1,810,000	$1,810,000	$170,000	$170,000	$170,000	$170,000

APPENDIX E

COTTON, PEANUTS, AND CORN ACREAGES IN GEORGIA'S CRITICAL HABITAT COUNTIES

COUNTY	TOTAL IRRIGATED ACREAGE	PEANUTS		COTTON		CORN		OTHER	
		ACRES	%	ACRES	%	ACRES	%	ACRES	%
Baker	20,398	7,825	38%	7,442	36%	4,494	22%	637	3%
Crawford	3,957	0	0	(D)	-	(D)	-	(D)	-
Decatur	47,316	12,060	25%	21,965	46%	3,084	7%	10,207	22%
Dooly	30,159	4,169	14%	22,103	73%	736	2%	3,151	10%
Dougherty	16,080	2,211	14%	4,235	26%	1,242	8%	8,392	52%
Fayette	(D)	0	0	0	0	0	0	(D)	100%
Macon	16,434	864	5%	1,977	12%	4,461	27%	9,132	56%
Meriwether	689	0	0	0	0	0	0	689	100%
Miller	35,472	12,543	35%	16,021	45%	6,378	18%	530	1%
Mitchell	44,037	9,651	22%	17,268	39%	7,698	17%	9,420	21%
Peach	6,430	0	0	(D)	-	0	0	(D)	-
Pike	(D)	0	0	0	0	(D)	-	(D)	-
Seminole	19,898	4,873	24%	6,949	35%	5,003	25%	3,073	15%
Spalding	(D)	0	0	0	0	(D)	-	(D)	-
Sumter	27,408	5,615	20%	8,909	33%	3,202	12%	9,682	35%
Talbot	(D)	0	0	0	0	(D)	-	(D)	-
Taylor	(D)	(D)	-	504	-	235	-	(D)	-
Upson	771	0	0	0	0	420	54%	351	46%
TOTALS	**269,049**	**59,811**	**22%**	**107,373**	**40%**	**36,953**	**14%**	**55,264**	**21%**

Note: (D) indicates "withheld to avoid disclosing data for individual farms."
Source: National Agricultural Statistics Service. 2002 Census of Agriculture, Table 23, Accessed on May 10, 2007. Available at: http://www.nass.usda.gov/

APPENDIX F SUMMARY OF AGRICULTURAL, MUNICIPAL, AND RECREATIONAL WATER VALUATION STUDIES

CITATION	PURPOSE	LOCATION	METHODS	RESULTS	RECOMMENDATIONS AND COMMENTS
AGRICULTURAL WATER VALUATION					
Conradie, B.L. and D.L. Hoag. 2004. A review of mathematical programming models of irrigation water values. *Water SA*. 30:3. 287-292.	Assess the range of irrigation water values from math programming models	Worldwide	Literature Review	$5.18-$234/acre-foot	Each region needs to produce its own model that is updated regularly. Full journal title is Water South Africa
Cummings, R.G., C.A. Holt, S.K. Laury. 2004. Using Laboratory Experiments for Policymaking: An Example from the Georgia Irrigation Reduction Auction. *Journal of Policy Analysis and Management*. 22: 2. 341-363.	Describe a study involving the experimental economics of auctions as applied to seasonal Georgia water permit sales	Flint River basin, Georgia	Experimental Economics	$135/acre	Average bid in actual auction: $135 per acre for a total of 33,006 acres. How this converts to a per-acre-foot metric depends entirely on the quantity of water applied to/consumed by each acre. If we assume 0.7 to 1.1 acre-feet per acre, this number is much higher than Taylor forthcoming ($35)
Jaeger, W.K. and Mikesell, R. 2002. Increasing streamflow to sustain salmon and other native fish in the pacific northwest. *Contemporary Economic Policy*. 20:4. 366-380.	Assess the economic feasibility of enhancing streamflow given available sources	Pacific Northwest	Literature Review	$23-$57/acre-foot from markets; $9-$44/acre-foot from hedonics; $20-$172/acre-foot for economic models	Water sales in OR: $9 (annualized). Leases in OR: $23. Leases in WA: $57. Hedonic analyses: $9 for lowest, $19 for median, $44 for highest (Faux and Perry 1999). Economic model results: $20/acre-foot for hops and alfalfa, $62/acre-foot for corn, $104/acre-foot for wheat, $156/acre-foot for pears, $172/acre-foot for apples (Gibbons, 1986) in Washington (and adjusted 2000 dollars)
Petrie, R.A. and L.O. Taylor, Forthcoming. Estimating the Value of Water Use Permits: A Hedonic Approach Applied to Farmland in the Southeastern U.S. *Land Economics*.	Apply hedonic analysis to assess the water value to agriculture in the Flint River Basin.	Dooly County, Georgia	Hedonic model	$35.38/acre-foot	For agriculture in this part of Georgia. This compares to an average of $24 per acre-foot in TX and $45 per acre foot in AZ and CA

CITATION	PURPOSE	LOCATION	METHODS	RESULTS	RECOMMENDATIONS AND COMMENTS
Scheierling, S.M., J.B. Loomis, and R.A. Young. 2006. Irrigation Water Demand: A Meta-Analysis of Price Elasticities. *Water Resources Research*. 42.	Investigate whether there are any systematic causes behind differences observed between price elasticities.	Western U.S	Meta-analysis	-0.48 short run mean elasticity	Confirms suspicions that major differences exist between values calculated based upon site and methodology. Recommend that studies using these elasticities be aware of how they were calculated
MUNICIPAL WATER VALUATION					
Arbues, F., M.A. Garcia-Valinas, and R. Martinez-Espineira. 2003. Estimation of residential water demand: a state-of-the-art review. *Journal of Socioeconomics*. 32, 81-102.	Survey the main issues in the literature on residential water demand.	Varies – Locations of studies not provided	Literature Review	-0.03 to –3.33 elasticity range	Price elasticities in these studies vary from –0.03 to –3.33. Reference paper for specific papers. Water price, income and household composition are crucial determinants of residential consumption. When designing demand management strategies, authors recommend complementing policies with other instruments, such as adoption of water-saving technologies
Cummings, R. and M.B. Walker. 2006. Conservation Pricing of Household Water Use in Rural Communities. Georgia State University Water Policy Working Paper 2006-001. Available from: http://www.h2opolicycenter.org/pdf_documents/water_workingpapers/WP2006-001.pdf	Assess the price elasticities of water demand in small communities (<100,000 population) in order to gain insight into the response to conservation pricing	Six small communities in Georgia	Linear and double log models	$915/acre-foot -0.31 elasticity	Marginal value of water in these small towns: $0.0028/gal. Elasticity: 0.31. Price elasticity varies significantly based on price. When price becomes $3.45 per 1000 gallons, demand becomes elastic.
Espey, M., J. Espey, W.D. Shaw. 1997. Price elasticity of residential demand for water: A meta-analysis. *Water Resources Research*. 33:6. 1369-1374.	Explain the differences between elasticity results in different studies	50 sites in the west, 53 in the east. 20 sites in both	Meta analysis	-0.48 average elasticity	Average elasticity: -0.48 (short run -0.38, long run -0.68). 90% of values are 0 to –0.90. ET, rainfall, pricing structure and season are the most important determinants. How demand is specified and the choice of model are also critical.

CITATION	PURPOSE	LOCATION	METHODS	RESULTS	RECOMMENDATIONS AND COMMENTS
Renwick, M.E. and R.D. Green. 2000. Do residential water demand side management policies measure up? An analysis of eight California Water Agencies. *Journal of Environmental Economics and Management*. 40, 37-55.	Assess the potential of price and alternative demand side management policies as an urban water resource management too	California	Econometric model of residential demand.	$213 -$1647/ acre-foot. -0.16 average elasticity	Average marginal prices ranged from $0.49 to $3.78 per hundred cubic feet (hcf). Average own price elasticity –0.16. –0.20 for the summer months. Other studies estimated from –0.22 to –0.37 in urban areas of California. These studies typically used much larger ranges of prices. The –0.16 value is only applicable in the region of observed marginal prices $0.47 to $4.25 per hcf
RECREATIONAL WATER VALUATION					
Eiswerth, M.E., J. Englin, E. Fadali, D. Shaw. 2000. The Value of Water Levels in Water-Based Recreation: A Pooled Revealed Preference/Contingent Behavior Model. *Water Resources Research*. 36:4. 1079-1086.	Assess the value of water to recreation in a remote Nevada reservoir.	Walker Lake, Nevada	Stated preference and revealed preference using a Poisson log likelihood function	$333,000-$499,500/foot of lake $10-$20/acre-foot	$12 to $18 per foot per person for use values, and an extra $0.6 to $0.9 per foot for option values. If the lake levels increased 20 feet, there are a minimum of 20,000 visitors per year and 155,000 non-visitors who have option values. Total value ranges from between $7 million and $14 million. This is then compared to the opportunity cost to agriculture of $12 to $45 per acre-foot * 700,000 acre-feet = $8.4 to $31.5 million. This volume of water implies that the lake is roughly 35,000 acre-feet per foot, further implying that each acre-foot of the lake is equal to roughly $10 to $20 per acre-foot for recreation
Fadali, E. and D. Shaw. 1998. Can Recreation Values for a Lake Constitute a Market for Banked Agricultural Water? *Contemporary Economic Policy*. 16. 433-441.	Investigate the willingness to pay to maintain lake levels that will preserve the Walker Lake fishery	Walker Lake, Nevada	Repeated nested multinomial logit model of recreation choice demand.	$80/acre-foot	$148 per person who uses the lake, $8 per person for option value. Overall, $12 to $45 per acre foot for agriculture, coming to $0.6 to $2.25 million needed for the 50,000 acre feet to save the lake. The WTP for recreation at Walker is $4 million, translating to $80 per acre foot

CITATION	PURPOSE	LOCATION	METHODS	RESULTS	RECOMMENDATIONS AND COMMENTS
Huszar, E. W.D. Shaw, J. Englin. 1999. Recreational Damages from reservoir storage level changes. *Water Resources Research*. 35:11. 3489-3494.	Use a single site, joint model of fish catch and recreation demand to estimate the value of changes in a Nevada reservoir.	Rye Patch Reservoir, Nevada	Time series single site recreation demand model.	<$0.50/acre-foot	$20,000 impact when reservoir goes from 0 to 45,000 acre-feet. This is less than $0.50 per acre-foot. Measured in consumers' surplus.
Jakus, P.M., P. Dowell, M.N. Murray. 2000. The Effect of Fluctuating Water Levels on Reservoir Fishing. *Journal of Agricultural and Resource Economics*. 25:2. 520-532.	Evaluate the impact of Tennessee Valley Authority reservoir levels on recreational fishing. This study investigates the benefits of maintaining a full pool for an additional month	13 reservoirs in the Tennessee Valley	Double hurdle/multinomial site choice model. Travel cost/count trips model	$450,000 for all 13 reservoirs. Uncertain but insignificant value per acre-foot	Aggregate impact is roughly $450,000, unknown acre-feet relationship. This is roughly an additional 1/3 of a trip per recreator, for a total of an additional 87,000 trips. $1.82 per person
McMahon, G.F., W.W. Wade, B. Roach, M.C. Farmer, and A.J. Friedrich. 2004. Lake Lanier National Economic Development Update: Evaluation of Water Supply, Hydropower, and Recreation Benefits, *Atlanta Regional Commission*. February.	Estimate the potential benefits to water supply, hydropower, and recreation from adjusting Lake Lanier management priorities.	Lake Lanier, Georgia	Random utility model using travel cost data from a USACE 1995 study	$0.14 per kilogallon	This result is based on the following: 15,128 fewer visitors per 1 percent reduction in surface area,

APPENDIX G| U.S. ARMY CORPS OF ENGINEERS LETTER TO GEORGIA DEPARTMENT OF NATURAL RESOURCES' ENVIRONMENTAL PROTECTION DIVISION

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

APR 30 2007

REPLY TO
ATTENTION OF

Inland Environment Team
Planning and Environmental Division

Dr. Carol Couch, Director
Environmental Protection Division
Georgia Department of Natural Resources
2 Martin Luther King Jr. Drive
Suite 1152, East Tower
Atlanta, Georgia 30334

Dear Dr. Couch:

This is in response to your letter dated April 9, 2007. As you are aware, in March 2006 we initiated formal Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) to determine the impacts of our existing operations at Jim Woodruff Dam and releases to the Apalachicola River in support of several federally-listed species. As you note, we received comments from the State of Georgia, as well as other stakeholders in the basin, during the consultation process. We also specifically solicited input from the States and stakeholders during two technical workshops held on May 24-25, 2006, and July 12, 2006, to ensure that the appropriate modeling tools and other information were used during our evaluation of the proposed operations in support of endangered and threatened species. We considered the comments submitted by you and your staff, as well as comments received from other stakeholders, in developing a revised interim operations plan (IOP), which was submitted on June 12, 2006, for consideration by the USFWS. This revision was developed to provide lower flow thresholds for the non-spawn season, and to provide for volumetric balancing of releases in order to minimize over-releases due to controlled ramping down of flows to minimize standing and/or exposure of listed species or host fish for listed mussels. Additional information, including recent monitoring data on the Gulf sturgeon and listed mussels was considered by Mobile District and the USFWS in completing the formal consultation and issuance of the Biological Opinion (BO) by USFWS on September 5, 2006.

The BO contains five reasonable and prudent measures (RPMs) and mandatory terms and conditions for implementing the BO in order to minimize and reduce the impacts to the listed species. RPM3 recognized that during most periods, a higher flow than the 5,000 cfs minimum flow prescribed in the Apalachicola, Chattahoochee, Flint Rivers ACF water control plan can be maintained in support of the listed mussel species. However, RPM3 also recognized that during periods of sustained drought, it would not be reasonable or prudent to maintain the higher flows.

A drought provision was developed to identify those climatic and hydrologic conditions, based on the impacts to composite storage within the basin, when reversion to the lower 5,000 cfs required minimum flow would be "triggered." An additional technical workshop was held with the States and stakeholders on December 13, 2006, in order to consider the proposed concept for a drought provision operation, and to solicit additional comments/information. Several comments and alternative concepts were submitted for consideration, including your letter dated January 9, 2007. These comments and suggestions were considered in finalizing a revised IOP operation pursuant to RPM3. The revised IOP operation was approved by the USFWS on February 28, 2007, and we are currently operating in accordance with this plan. The RPM3 drought provision operation was determined to be supportive of Gulf sturgeon, critical habitat for Gulf sturgeon, the mussel species, and host fish for the listed mussel species, using evaluation criteria similar, if not identical, to that used in the BO.

We share your concerns that we could be entering a multi-year drought and could experience sustained low flows in the upcoming months. We would note, however, that the reservoirs in the ACF basin are primarily impacted by the sustained low basin inflows, rather than discretionary water management actions that might be taken by the U.S. Army Corps of Engineers (Corps).

Even during sustained drought conditions, we must continue to operate Corps reservoirs to serve multiple water resources purposes in the basin in a balanced manner, including the demands necessary to support the federally-listed endangered and threatened species. The Corps operates the system in a manner that maximizes storage in the reservoirs consistent with meeting the needs of all the authorized project purposes. Results from our modeling and our experience during previous drought conditions, as in 1998-2001, demonstrate that some project purposes, such as navigation and hydropower, may be adversely impacted as we manage for drought; however, the public health and safety, water supply, and environmental demands, including releases for water quality, and fish and wildlife resources are still met.

Although conditions in the basin are abnormally dry this year, the reservoirs on the ACF system, other than Lake Lanier, are operating close to their "top of conservation" levels. The IOP has not impacted our ability to reach these levels at West Point Lake, Walter F. George Lake, and Lake Seminole. Lake Lanier is currently approximately two feet below where it would normally be at this time of year.

The IOP makes allowance for drought conditions by requiring that only the basin inflow be released as inflows continue to fall until the minimum flow thresholds in the currently approved IOP operation are reached. Once flows reach as low as 6,500 cfs, we will attempt to sustain that flow as long as possible provided storage in the upstream reservoirs is not significantly affected, as determined by tracking the composite storage in the basin. The approved drought provision in the IOP provides for a more conservative operation once the composite storage falls below Zone 2. At that point, releases would be drawn from storage, as necessary, to maintain the required 5,000 cfs minimum flow, which was also the required

minimum flow in 2000 before the IOP was developed. Should this occur, a significant drawdown of the reservoirs could result during a sustained drought.

In order to evaluate the possible impacts of continuing drought conditions on the ACF basin we modeled the IOP operations incorporating the current IOP drought provision, using projected flows similar to the 2000-2001 hydrologic conditions, and using essentially the same assumptions that Dr. Zeng used, except for the estimated agricultural water use in the Flint Basin. A presentation of our modeling results is enclosed. Our analysis indicates that the lakes would drop, but not as severely as Dr. Zeng's analysis suggests. Our modeling shows that Lake Lanier remains above elevations observed in 2000 (elevation 1056.5 feet, 13.5 feet below elevation 1070 feet), West Point Lake remains 2 feet above the bottom of conservation pool and in this range (2 to 3 above the bottom) for 15 days or 2 percent of time; Walter F. George Lake remains 1 foot above the bottom of conservation pool and in this range (1 to 2 feet above the bottom) for 32 days or 5 percent of time. The year 2000 is the most severe drought year during the 65-year model simulation, and 1999 to 2001 is the most severe 3-year period. By imposing these severe hydrologic conditions on the ACF system, the reservoirs will be drawn down even under the most conservative operating scheme. It is important to note that our modeling indicates that the reservoirs remain above the lowest historical pool levels, despite using the most severe hydrologic period conditions.

We believe the differences in our modeling results stem from different assumptions about estimated agricultural water use in the Flint Basin. Comparison of the models provided by Mobile District and Georgia at the July 2006 workshop identified that the difference in net demands for Jim Woodruff and the Flint River are mostly attributed to differences in agricultural demands. As you may recall, basin inflow is a computed value based on measured changes in reservoir pool levels together with streamflow gage measurements. Accordingly, computed basin inflow decreases as withdrawals increase because the withdrawals are implicitly reflected in reservoir and stream gage data. Consequently, the Jim Woodruff required discharge is reduced, because it is a function of the basin inflow. However, in the HEC-5 modeling effort, if the basin inflow is not recomputed to compensate for the Flint River irrigation withdrawals, then the HEC-5 model meets the Jim Woodruff discharge requirement by drawing on storage thereby over-compensating for the agricultural withdrawals. When the basin inflow falls below 5,000 cfs, we must maintain the minimum flow of 5,000 cfs as required by the current Water Control Plan. The greatest impact of the failure to adjust for the agricultural withdrawals occurs in this situation.

We have reviewed your latest recommendations, and also note that we have considered the recommendations you presented in your January 9, 2007 letter (a copy of this letter is enclosed for your reference). Below is a summary of your recommended changes to the IOP, our considerations of your recommendations, and how they were addressed in our consultation with USFWS to develop a drought provision operation under the IOP.

1. Establish Flow Thresholds of 10,000 cfs – 11,000 cfs March – May. As described in the supporting documents for the IOP, the March-May basin inflow thresholds and

associated releases from Jim Woodruff Dam were established to provide support not only for Gulf sturgeon spawning, but also to provide for sufficient floodplain habitat inundation for species identified as host fish for the listed mussel species. As described in the BO, "These productive areas (floodplain habitats) most likely serve as spawning and rearing habitats for one or more of the host fishes of the purple bankclimber and fat threeridge" (USFWS 2006). Although flows in the range of 10,000 cfs – 11,000 cfs might provide an adequate amount of Gulf sturgeon spawning habitat, our consultation history with the USFWS suggests that these flows could potentially result in significant impacts to the amount of floodplain habitat inundated for use by the listed mussel host fishes. You may recall that the proposed drought provision concept we presented at the Drought Provision Workshop on December 13, 2006 included a proposed reduction of the upper and lower basin inflow thresholds for the spawning period. However, as described in the Biological Assessment for RPM3 submitted to the USFWS on February 16, 2007, we determined that the proposed reductions in the thresholds for spring releases would potentially result in adverse effects to the listed mussels by negatively impacting flow regime characteristics relevant to host fishes (specifically the amount and duration of connected floodplain habitat). This determination was derived by modeling the proposed changes and evaluating impacts utilizing the same statistical and effects analyses as prepared by the USFWS in the BO, and led to the development of a revised concept for the drought provision that identified a lower basin inflow threshold of 18,000 cfs. It is reasonable to assume, based on the analysis of modeling conducted in development of an RPM3 drought provision operation that spring flow thresholds in 10,000 cfs -11,000 cfs range could also result in adverse impacts to listed mussels and their host fish.

Based on our consultation history with the USFWS, we also believe your proposed reduction in spring releases may adversely impact estuarine feeding habitat for juvenile and adult Gulf sturgeon. In order to evaluate the effects of the IOP on sturgeon estuarine feeding habitats, the USFWS considered flow regime alterations (specifically the maximum number of consecutive days per year of flow less than 16,000 cfs). As described in the BO, "Floodplain inundation is also critical to the movement of organic matter and nutrients into the riverine feeding habitats of both the mussels and juvenile sturgeon, and into the estuarine feeding habitats of juvenile and adult sturgeon" (USFWS 2006). Again, it is reasonable to assume, based on our other analyses, that limiting spring releases to your proposed values during dry conditions will increase the maximum number of consecutive days per year of flow less than 16,000 cfs as compared to the Baseline and Run of River values. In the BO, the USFWS determined that actions resulting in a substantial flow regime feature alteration could adversely impact important estuarine feeding habitat for Gulf sturgeon in Apalachicola Bay.

The reduction to spring flow thresholds prescribed by the RPM3 drought provision modifications to the IOP, as approved by the USFWS, were based on the best available scientific data, relating to Gulf Sturgeon and listed mussels and their host fish habitat needs, and allows additional opportunities for storage compared to the original IOP.

2. Specific Adjustments to Flow Thresholds under the IOP. The three specific adjustments you suggest appear to have been developed to allow for more storage than

the current IOP allows. These suggestions were also included in your January 9, 2007 letter and were considered during the development of the modifications to the IOP as required by RPM3 of the BO. The current approved IOP includes greater opportunities for storage as compared to the original IOP. Although the spring thresholds in the current IOP are not as low as your suggested 10,000 cfs – 11,000 cfs, modifications to the original IOP were made that allow for storage of up to 30 percent of the basin inflow when flows are between 35,800 cfs and 18,000 cfs during the Gulf sturgeon spawning period. At flows greater than 35,800 cfs no limit on storage occurs as long as at least 25,000 cfs is being released from Jim Woodruff Dam. During dry springs, these rules will likely result in operational releases that are comparable to your recommendation of avoiding releases above 23,000 cfs except when necessary for flood control operations. Although no additional opportunities for storage were made for the June – February time frame as compared to the original IOP, the use of composite storage to determine when flows greater than 5,000 cfs can be sustained helps to ensure that maintenance of the higher desired 6,500 cfs minimum flow will not significantly impact our ability to meet other authorized project purposes. This technique is consistent with your recommendation to utilize reservoir levels to determine when minimum flows greater than 5,000 cfs can be sustained during dry periods.

3. Loosen Rampdown Rate Restrictions. The ramping rate schedule prescribed by the current IOP was developed based on the needs of the federally listed species occurring in the Apalachicola River and on an attempt to replicate natural fall rates. Lower flows are assigned more gradual fall rates, and higher flows are assigned higher fall rates. The intent of the IOP maximum fall rate schedule is to limit the potential for stranding aquatic organisms, including listed species and host fish for listed mussels, in areas that may become exposed or become disconnected from the main channel during periods of declining flow. The more gradual fall rates prescribed when flows are less than 20,000 cfs may require the use of stored water from the reservoirs. The current IOP includes several measures to prevent or offset loss of storage due to ramping. By using a 7-day moving average basin inflow calculation to determine the minimum daily release from Jim Woodruff Dam, daily fluctuations in basin inflow are dampened and less extreme day-to-day changes in the required minimum release are experienced. As described in the BO, this dampening should generally, but not always, yield a required minimum release that is also consistent with the ramping rate schedule without the release of additional water from storage. However, since the use of storage will be required to meet the gradual ramping rates a portion of the time, volumetric balancing is used to prevent a substantial drawdown of storage while following declining basin inflow. Volumetric balancing tracks the volume of basin inflow and releases. When the volume of releases required for ramping exceeds the volume of basin inflow during a given period, subsequent releases are adjusted to replenish the storage that was used for down ramping. We believe this approach addresses your concerns that over releases due to gradual ramping rates be avoided.

4. Determine Reservoir Releases Based on Remaining System Storage. We understand your concern with the Corps' ability to refill reservoirs (especially Lake Lanier, due to its large size and limited drainage area) during extended drought periods under the IOP. However, we believe that most of the delays in refill are attributable to the lack of precipitation in the upper basin and not to the IOP. Therefore, the slower refill at Lake Lanier this year appears to be due to the abnormally dry conditions. If the current dry conditions continue or worsen, we would continue to make releases that approximate basin inflows as basin inflows decline. The IOP would not require any substantial releases to be made from storage until the basin inflows fall below 6,500 cfs, as described in the RPM3 drought provision operation. At that time, the IOP provides for the use of storage to augment basin inflow to sustain the higher desired minimum flow of at least 6,500 cfs, as long as the composite storage is not significantly impacted (i.e., composite storage remains in Zones 1 or 2). Once the composite storage falls into Zone 3, the required minimum release is reduced to 5,000 cfs until the composite storage within the basin recovers to Zone 1. As previously noted, the 5,000 cfs minimum flow is required by the current Water Control Plan operations. As such, storage used to augment basin inflow to meet the 5,000 cfs minimum flow would be required regardless of whether or not the IOP was in place.

5. Avoid Releases in Excess of Flow Thresholds. As described in the supporting documents for the IOP, the IOP rules prescribe minimum requirements for releases and generally releases will be higher than those prescribed during normal flow conditions. During a given month and basin inflow rate, releases will generally be greater than the IOP minimum releases, consistent with the maximum fall rate schedule, due to releases made for other project purposes such as hydropower operations, flood control operations, balancing of reservoir levels, etc. During wet periods, releases may substantially exceed the minimum release values, but during dry periods, releases will more closely match the minimum release values, as the Corps operates to conserve reservoir storage for authorized project purposes and future endangered and threatened species augmentation flow needs. During dry periods water managers do limit releases in excess of the flow thresholds to the extent practicable. Additionally, during dry periods the use of volumetric balancing offsets the loss of storage due to down ramping releases that require greater flows than prescribed by the basin inflow value.

It should be noted that RPM1 of the BO provides for adaptive management as new information becomes available or as conditions change. We will continue to gather information that can improve our operations in support of the listed species. We are also continuing to gather more information to assist in determining the status of the federally-listed species and critical habitat for the species, which will assist in possible future adaptive modifications to our operations, as necessary, and to assist in future consultations related to water management and water supply needs in the basin. This summer we will conduct a sedimentation/river morphology evaluation pursuant to RPM4 and initiate work toward a long-term mussel monitoring plan pursuant to RPM5. We also intend to continue to consider technical information from the States and stakeholder groups to assist in improving our water management operations and protection of the endangered and threatened species.

Sustained dry conditions and increasing competition for dwindling water resources emphasizes to all parties the importance of reaching a resolution toward the equitable sharing of water resources in the basin. I would encourage you and the other States to continue working toward this end. As always, the Mobile District stands ready to assist in this effort wherever possible.

Sincerely,

Peter F. Taylor, Jr.
Colonel, Corps of Engineers
District Commander

Enclosures