Water Supply Assessment for Sandy Creek 08

Jackson County, Georgia

Prepared for:

Georgia State Soil and Water Conservation Commission

Prepared by:

Schnabel Engineering

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EXECUTIVE SUMMARY

The Georgia Soil and Water Conservation Commission (GSWCC), in partnership with the Natural Resources Conservation Service (NRCS) and the Georgia Environmental Protection Division (EPD) initiated a study to evaluate whether or not any of the existing watershed dams, designed and constructed under federal laws PL 544 and PL 566, could be modified to serve as water supply reservoirs. The evaluation process went through several iterations, the most recent of which can be found in the Finding Report dated December, 2007 on file with the GSWCC. The Finding Report identified 20 structures that had sufficient potential for relatively high yields with relatively small environmental and infrastructural impacts, when compared to the other projects evaluated. The selected twenty dams were further evaluated to identify project parameters. Eight additional structures were selected in 2008 for further evaluation.

The following report summarizes the evaluation of the Sandy Creek Structure Number 8, which is located in Jackson County, Georgia. For the purposes of this report, the existing normal pool will be raised to impound a water supply pool having a surface area of approximately 165 acres.

For convenience, the following summary lists the major findings of this evaluation. This summary should not be utilized as a separate document or in lieu of reading the entire report, including the Appendix.

- Approximately 324 acres of land will be impacted by the proposed reservoir and dam raising
- Approximately 18 structures will be impacted by the proposed reservoir and dam raising
- Seven county roads will be impacted.
- Approximately 3,500 feet of electric transmission lines will be affected.
- For the modeled conditions, the drought of record in the Sandy Creek 8 basin the current drought. For a water supply storage of approximately 870 million gallons and supplementation of natural reservoir inflow by pumped diversions (maximum 5 million gallons per day, mgd) from the nearby North Ocoee River, the safe yield of the reservoir is estimated to be 1.3 mgd.
- Approximately 19 acres of palustrine wetlands will be impacted by the proposed reservoir and dam raising
- Approximately 15 acres of lacustrine/palustrine open waters will be impacted by the proposed reservoir and dam raising
- Approximately 19,206 linear feet of lower perennial streams will be impacted by the proposed reservoir and dam raising
- Approximately 4,544 linear feet of intermittent streams will be impacted by the proposed reservoir and dam raising
- Review of existing cultural resources information did not indicate any identified cultural resources within the maximum reservoir pool limits of Sandy Creek 8.
- Review of available information did not indicate any primary or secondary trout streams or 303(d) / 305(b) listed streams occurring within the maximum reservoir pool limits of Sandy Creek 8.
- Review of existing threatened and endangered species information identified six federally and state protected species documented from Jackson County, Georgia
- Project cost is estimated in 2008 dollars at $49,000,000.

PREFACE

The results of the analyses presented herein are based upon United States Geological Survey (USGS) quadrangle maps and, therefore, should be utilized for planning purposes only. If the subject project is identified as having a possibility of progressing past this analysis, additional studies will be required. These studies will include but not be limited to detailed environmental evaluations, detailed yield analyses, preliminary engineering design, and detailed cost estimating. These additional studies will be required prior to beginning detailed design work and/or land acquisition. The level of study presented herein shall be considered as a screening tool to evaluate the proposed project relative to other projects. Until further studies are performed, actual yield and costs associated with the entire project cannot be readily determined.

TABLE OF CONTENTS

INTRODUCTION

The project team of Schnabel Engineering South, LLC (Schnabel) and Jordan Jones and Golding (JJ&G) were retained by the Georgia State Investment and Financing Commission as the agent for the Georgia Soil and Water Conservation Commission to evaluate 166 existing flood control structures. The subject structures were originally designed and constructed under Federal laws PL 544 and PL 566 to control storm water runoff (flooding) and collect sediment. The goal of this evaluation was to identify impoundments that could be enlarged to provide a relatively reliable water supply. The results of the evaluation were utilized to select twenty of the dams and reservoirs that had potential for relatively high yields with relatively small environmental and infrastructural impacts, when compared to the other projects evaluated. The selected twenty dams were further evaluated to identify project parameters. An additional eight structures were selected for further evaluation. The additional evaluation included the following:

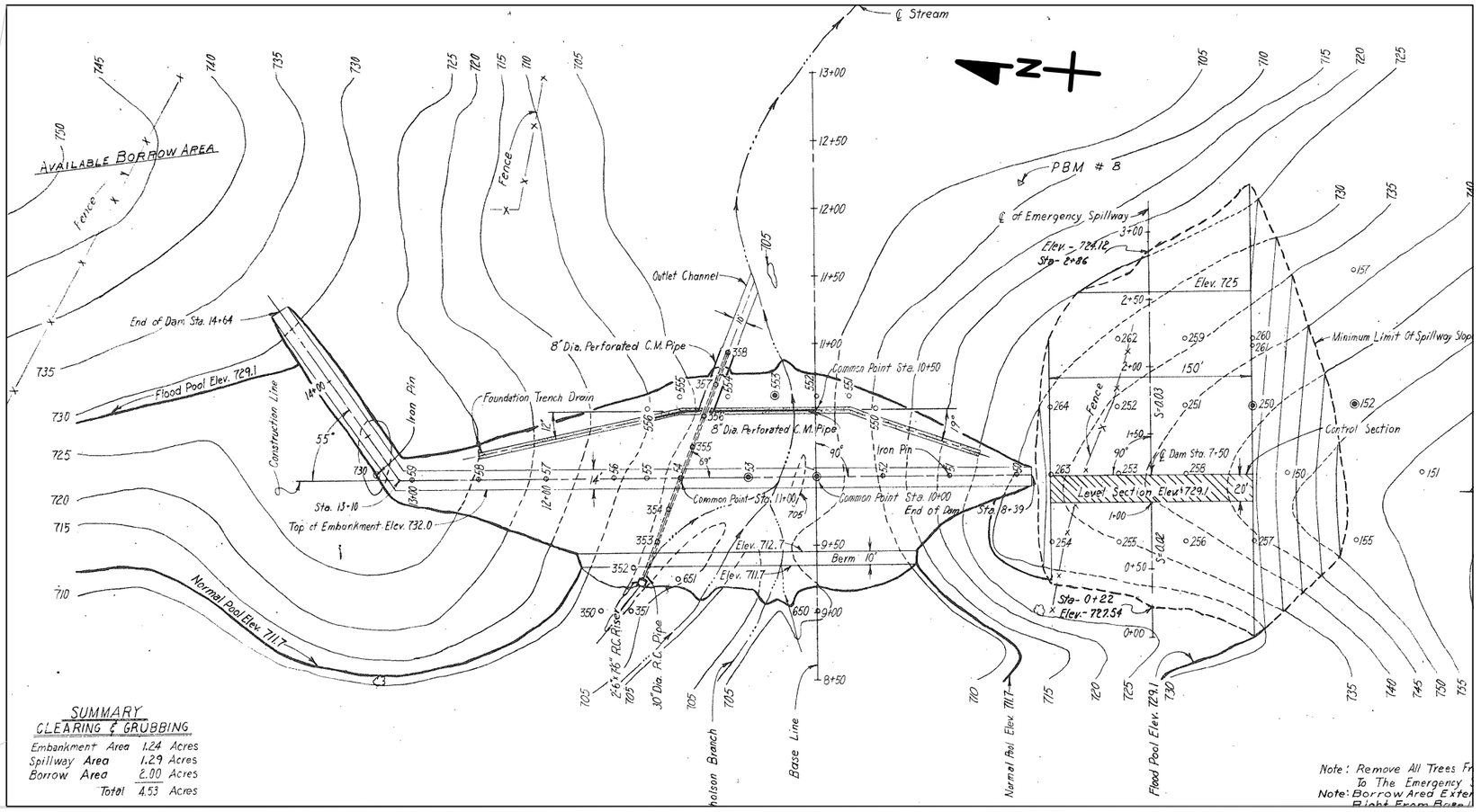
- More detailed yield analyses
- More detailed environmental evaluation
- Cost estimation of proposed modifications

The Sandy Creek Watershed Dam Number 8 in Jackson County, Georgia was one of the structures selected for further evaluation.

BACKGROUND

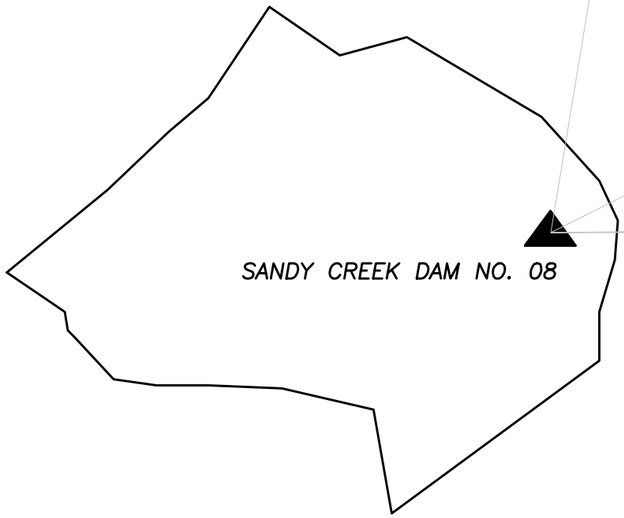
The subject dam, Sandy Creek Watershed Dam Number 8 (Sandy Creek Dam No. 8), is located approximately 6 miles northwest of Maysville, Georgia in Jackson County. More specifically, the dam is located on the Nicholson Branch tributary of Sandy Creek.

The existing dam was designed in 1962 and built in 1963. As designed, the dam had a crest elevation of 732 feet and impounded a reservoir that had a surface area of approximately 14.5 acres at a normal pool elevation of 711.7 feet. The crest of the emergency spillway was designed to be at elevation 729.1 feet. Figure 1 shows the location of the subject dam within the county as well as a plan view of the existing embankment and emergency spillway. According to the Soil Conservation Service (SCS), now known as the Natural Resources Conservation Service (NRCS), Dam Inventory sheet, the dam was originally designed and constructed as a Class ‘A’ or low-hazard dam. The state Safe Dams program has classified the dam as a Category II, or low-hazard structure. When designed, the emergency spillway (now referred to as an auxiliary spillway) had a four percent chance of operating in any given year. This results in the auxiliary spillway operating during storm events equal to and greater than the 25-year event. With the exception of engineering, land acquisition, and project administration, the dam was completed for a cost of approximately $23,600.



SUMMARY
CLEARING & GRUBBING

Embankment Area	1.24	Acres
Spillway Area	1.29	Acres
Borrow Area	2.00	Acres
Total	4.53	Acres



JACKSON COUNTY

N.T.S.

0 100 200

SCALE IN FEET

Schnabel Engineering

NRCS WATERSHED DAM ASSESSMENT
SANDY CREEK DAM NO. 08

TYPICAL SECTION

PROJECT NO. 07170033.05
FIGURE 1

Needs and Demand Evaluation

Population projections for Jackson County through the year 2015 were obtained from the Office of Planning and Budget's Georgia Population Projections (published in 2005). Projections to 2057 were extrapolated based on the average growth rate that was shown in the Projection publication. These projections can be seen in Table 1.

Table 1
Population Projection

Year	Population Projection
2000	41,589
2005	52,292
2010	59,781
2015	70,344
2020*	83,709
2025*	99,614
2030*	118,541
2035*	141,064
2040*	167,866
2045*	199,760
2050*	237,715
2055*	282,881
2057*	304,380

Data Source: from Georgia Population Projections by the Office of Planning and Budget
**Population Calculated based on yearly % growth from 2005-2015*

Water demand projections were calculated based on population projections and water withdrawal data for Jackson County in 2000. According to the US Census, the population of Jackson County was 41,589 in 2000, while the water withdrawal was 4.6 million gallons per day (MGD) based on the document "Water Use in Georgia by County for 2000", (Information Circular 106, Julia Fanning, USGS, Atlanta, 2003). Currently, Jackson County holds a 14.5 MGD share of the Upper Oconee Basin Water Authority surface water withdrawal permit for the Bear Creek Reservoir (total permit of 58 MGD). The City of Commerce holds a 4.2 MGD surface water permit for Grove Creek, while the City of Jefferson has a 1.75 MGD permit for Big Curry Creek. In addition to these surface water permits, the cities of Braselton and Hoschton hold groundwater withdrawal permits of 0.3 MGD and 0.15 MGD respectively. All totaled, water withdrawal permitted for public use in Jackson County is 20.9 MGD (all numbers are reported in permitted monthly average).

The overall usage in Jackson County was calculated to be 111 gallons per day (gpd) per person. This number was used as a constant through 2057 to create water withdrawal projections. The water withdrawal projection for 2057 was calculated to be approximately 34 MGD. This figure includes all unaccounted for water (UAW), and the assumption that industrial usage would increase with the increase in Jackson County population. Water withdrawal projections are shown in Table 2.

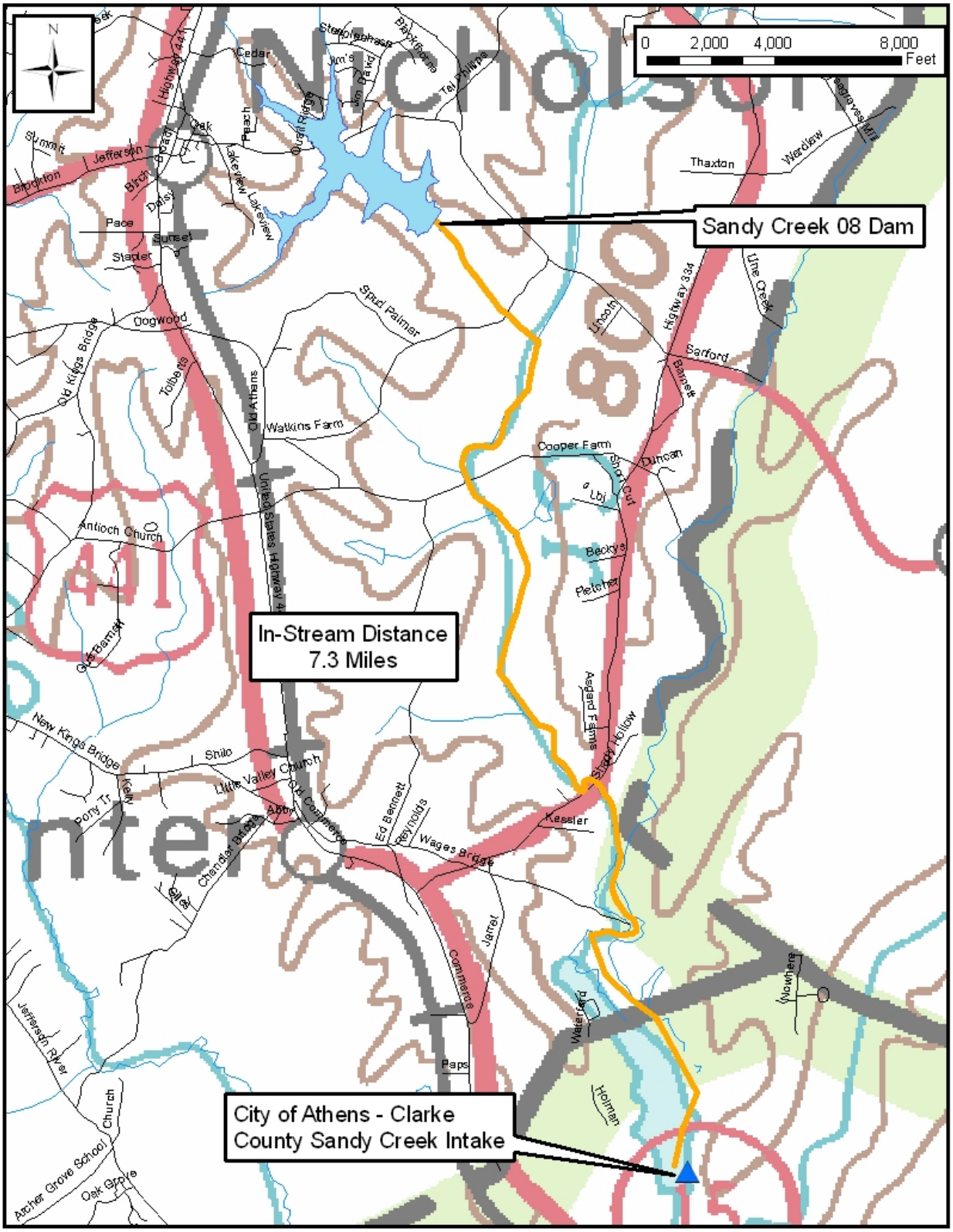
Table 2
Water Withdrawal Projection

Year	Water Withdrawal Projection (MGD)
2000	4.6
2005	5.8
2010	6.6
2015	7.8
2020	9.3
2025	11
2030	13
2035	16
2040	19
2045	22
2050	26
2055	31
2057	34

Proximity to Surface Water Intakes

Based on the GIS database developed for this project, the closest surface water intake structure is downstream of the dam on Sandy Creek. This structure is operated by the Unified Government of Athens-Clarke County. The stream distance to the intake is approximately 7.34 miles. This includes 0.96 miles from the dam along a small tributary to Sandy Creek to the confluence with Sandy Creek. The following figure illustrates the location of the nearest surface water intake to Sandy Creek 08.

Figure 2
Distance to Nearest Intake



ENGINEERING FACTORS

Proposed Dam

The proposed dam, which will incorporate the existing dam, will have a crest elevation of 760 feet, an auxiliary spillway elevation of 750 feet, and a water supply pool elevation of 746 feet. The proposed dam will impound a reservoir that has a surface area of approximately 165 acres and storage volume of approximately 870 million gallons (MG) at the water supply pool elevation. A plan view of the proposed reservoir is shown in Figure 3.

Several engineering assumptions were made pertaining to spillway configuration. The spillway system for the proposed dam was assumed to consist of a principal spillway in the form of a 2'-6" by 7'-6" interior dimension reinforced concrete riser with a 30-inch diameter reinforced concrete low-level outlet pipe and an auxiliary spillway in the form of a 100-foot wide reinforced concrete chute spillway with ogee crest. The intent of the proposed principal spillway is to approximate the flows that are being discharged by the current spillway system during the two through 100-year storm events. The size of the auxiliary spillway was approximated by estimating the peak inflow that would occur during the Probable Maximum Precipitation (PMP) event and computing the spillway width that would be required to pass the estimated inflow with a given amount of hydraulic head. The available hydraulic head was determined by comparing the drainage basin area to lake surface area. The structures that had a drainage basin area to lake surface area ratio equal to or in excess of ten were allotted 15 feet of hydraulic head to pass the PMP inflows, while the structures that had a ratio of less than ten where allotted ten feet of hydraulic head to pass the PMP inflows. The assumption that the dam would be required to pass the inflow resulting from the PMP storm event is based on the history of the Georgia Department of Natural Resources Environmental Protection Division Safe Dams Program (Safe Dams) reviewing plans for water supply reservoir dams regardless of classification. As such, the dam would generally be required to comply with the engineering guidelines established by Safe Dams. The proposed dam would have a relatively high likelihood of being classified as high-hazard or Class 'C' by the NRCS, as well as Safe Dams. For this reason, it has been assumed that the dam will be required to pass the full PMP storm event.

The proposed dam and flood pool will:

- Impact 18 structures
- Require the purchase of 280 acres from 79 parcels
- Require the purchase of 44 acres of easement area for state required buffer
- Impact seven local/county roads
- Impact approximately 3,500 feet of transmission power lines

Figure 4 displays the proposed reservoir area as well as the buffer and affected parcels. The 18 affected structures were identified from aerial photographs. The types of structures were not identified on the ground and could be houses, barns, trailers, etc. A more detailed ground survey will be required to determine the type of each structure and the corresponding purchase price of each structure.

Figure 3
Proposed Reservoir Area Map

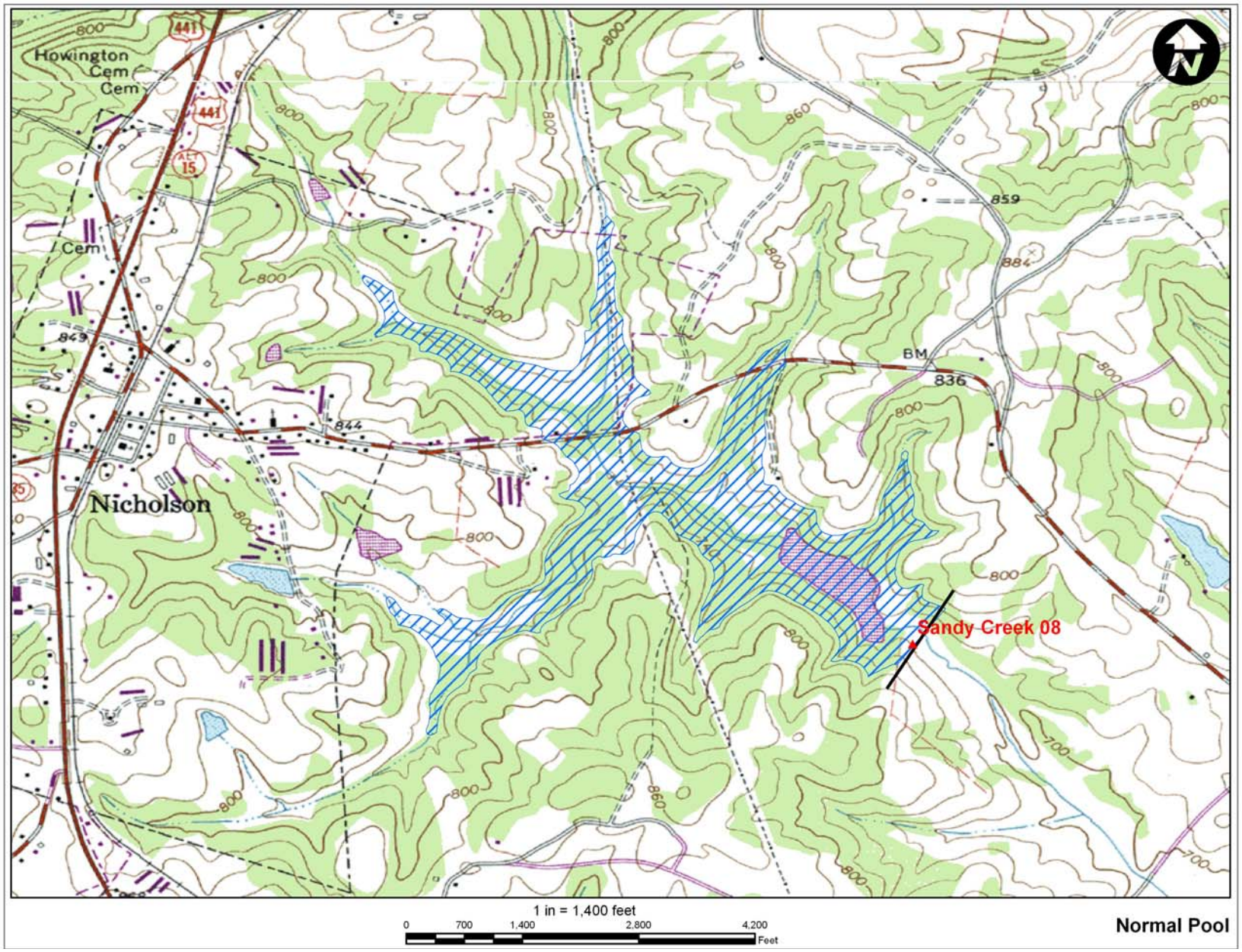
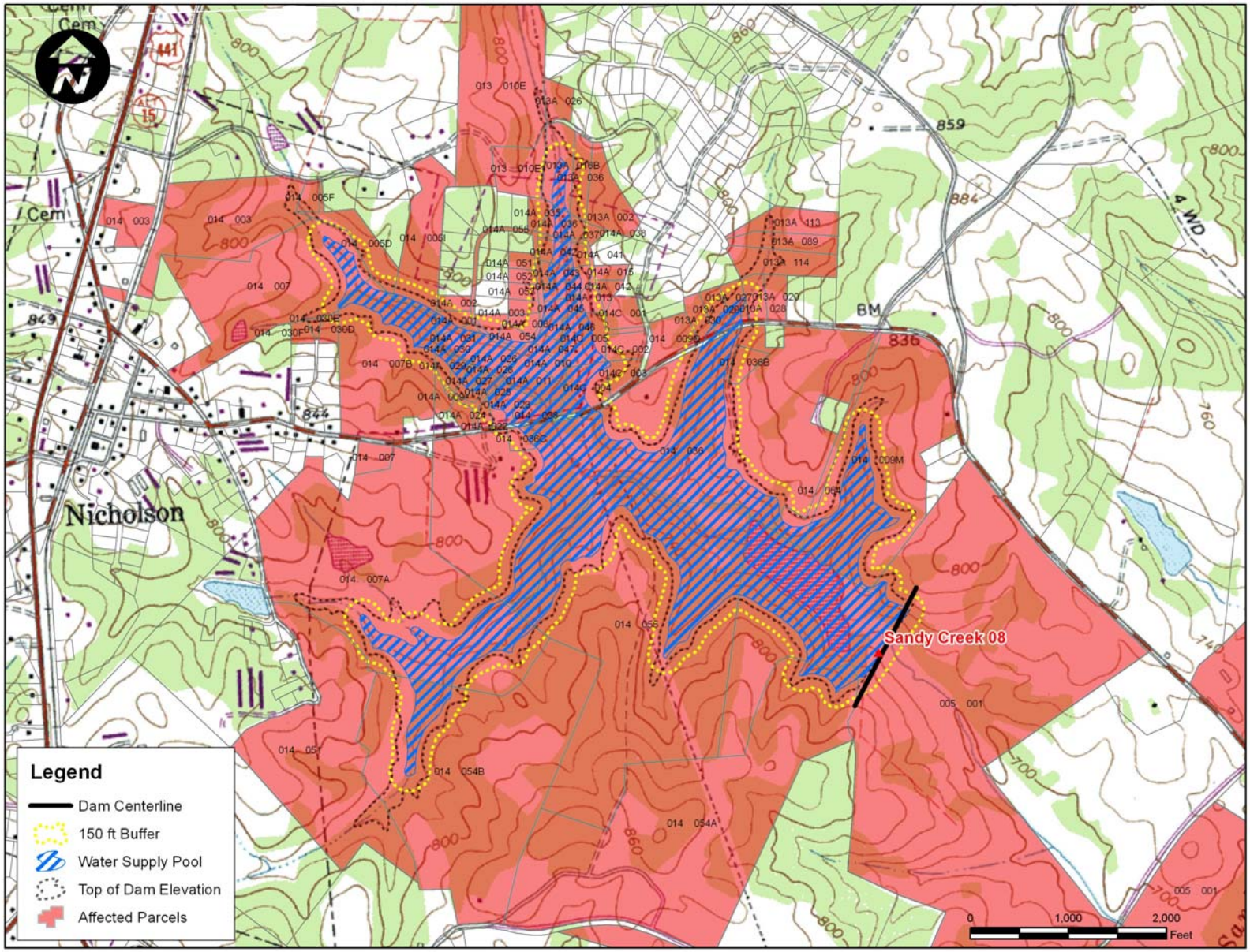


Figure 4
Land Acquisition and Buffer Areas



SAFE YIELD ANALYSIS

Definition

Reservoir safe yield is generally defined as the reliable withdrawal rate of water with acceptable quality that can be provided by reservoir storage through the critical drought period. The critical drought period in the State of Georgia is defined as the drought of record and in any given drainage basin can vary depending on reservoir size and other factors. The drought of record for the Oconee River basin is current drought; however the current drought does not yet exhibit recovery. Therefore the safe yield presented in this study was based on the current drought, extended with hypothetical flow data. Safe yield was simulated using a constant average annual demand. The justification for this is that while total water demands after declaration of a drought condition are usually less than normal, this situation is typically offset by higher than average demands prior to declaration of the drought condition. Safe yield is dependent upon the storage and hydrologic (rainfall/runoff/evaporation) characteristics of the source and source facilities, the selected critical drought, upstream and downstream permitted withdrawals, and the minimum in-stream flow (MIF) requirements.

The proposed reservoir is a "pumped-storage" reservoir, where natural inflow into the reservoir is supplemented with pumped diversions from a nearby larger stream or river. Water is pumped from a larger river when runoff is plentiful, and is stored in the reservoir for times of drought. Pumped diversions increase safe yield, and generally result in fewer environmental impacts compared with reservoirs on main-stem rivers.

Analysis Method

Two gages (first two in Table 3 below) with a combined record period of 71 years were used to simulate flow for the safe yield analysis.

Table 3
Gage Summary

USGS Gage	Gage Name	Record Period	Drainage Area (mi^2)	Notes
02217500	Middle Oconee River near Athens	10/01/1901 – 09/30/1902 01/01/1929 – 03/31/1932 05/01/1937 - Present	392	S
02217475	Middle Oconee River near Arcade	03/01/1987 -Present	332	S
02217900	North Oconee River at Athens	10/01/1928 – 03/31/1932 06/24/1944 – 12/31/1949	290	C

S – gage used in safe yield simulation
C – gage used for correlation only

Since the North Oconee River only has a combined 10 years of data, the first two gages noted above were used to simulate flow in the Sandy Creek and North Oconee River basins. To

confirm the applicability of the Middle Oconee River in simulating flow in the North Oconee River basin, a correlation of the North Oconee and Middle Oconee River gages (both at Athens) was performed. Based on this correlation, direct use of the Middle Oconee River unit discharges (cfs/mi^2) was considered reasonable (Figure A-1, Appendix). Where data was available from both Middle Oconee gages, preference was given to the Arcade gage (1987-present), given its location above (upstream of) withdrawals by the Upper Oconee Basin Authority and the City of Athens. For the period between about 1980 (when Athens intake became operational) and 1987, simulated flows are likely less than actual streamflows due to Athens' withdrawals; however, given that the mid-1980's drought is not the drought of record, this has negligible effects on the analysis results. To adjust the Arcade data for more recent upstream withdrawals, we obtained withdrawal records from the City of Winder (Mulberry River) and added their withdrawals to the gage data. The combined record from the two Middle Oconee gages was then used to simulate streamflows in the safe yield study for the combined 71 year record period.

The combined gage record includes four major droughts (1954-56, 1986-88, 1999-2002, 2007 - present). Since there is insufficient data to model the full extent of the current drought, streamflow data was extended into the future (2009 – 2012) using data from 2001- 2004. Comparison of the 2008 flows have closely tracked those of 2000, thus extension of the flows beyond 2008 using the 2001-2004 data is considered reasonable. Therefore the estimated safe yield and pumping capacities presented in this study were based in part on the current drought, extended with hypothetical flow data.

The diversion pump station was assumed to be located below the confluence of Curry Creek with the North Oconee River. The straight line pipe distance between the dam and diversion location was estimated at 3.75 miles.

The following drainage areas were used in the analysis:

- Dam Site (Nicholson Branch, tributary to Sandy Creek): 3.14 mi^2
- Diversion (North Oconee River): 178 mi^2

The pumped diversion location and watershed are shown in Figure 5. The maximum estimated pool level at top of dam was selected to limit the number of structures impacted by the proposed reservoir. From that level, a freeboard allowance of 10 feet between the top of dam and the auxiliary spillway was incorporated to pass the spillway design flood (assumed to be the probable maximum flood). Additional depth to maintain existing flood storage volume (582 Ac-ft, or 190 MG) was subtracted from the auxiliary spillway elevation to compute the water supply pool elevation used in the analysis of safe yield. Note that more detailed topographic mapping would be needed to more closely approximate the safe yield of the proposed reservoir. Table 4 summarizes the various reservoir elevations and approximate storage volumes. Calculation of stage-area and stage-storage curves is presented as Figure A-2 in the Appendix. Figure 6 below is the stage-storage curve for the reservoir.

Figure 5
Watershed Location Map

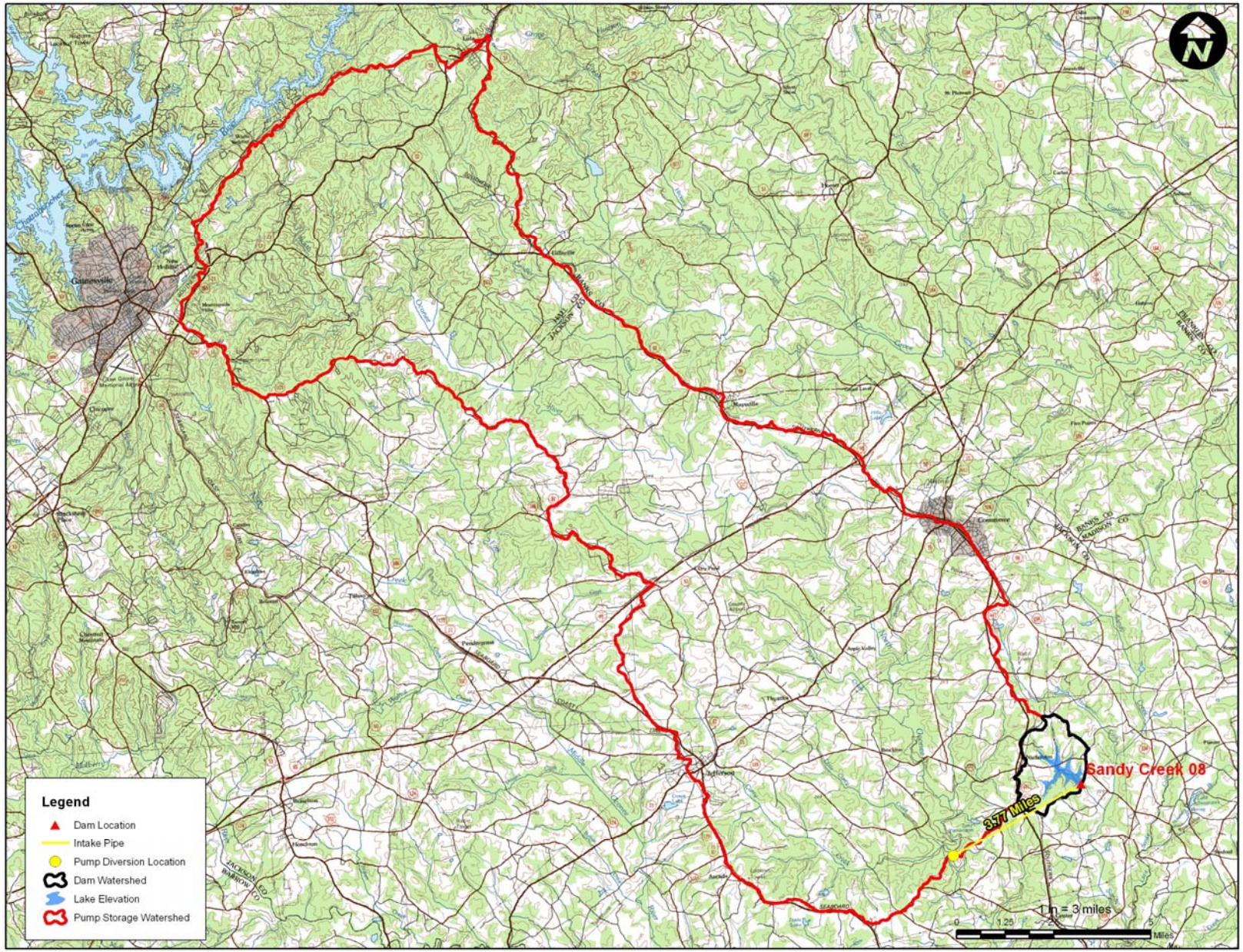
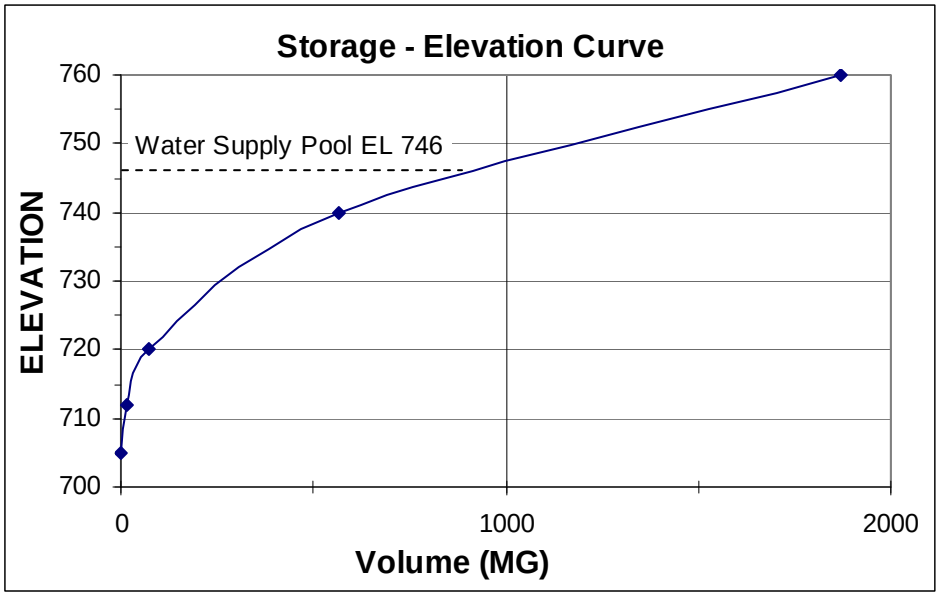


Table 4
Summary of Reservoir Data

Stage	Elevation	Volume (Million Gallons)
Maximum Pool (Top of Dam)	760	1,870
Flood Pool (Auxiliary Spillway Crest)	750	1,060
Water Supply Pool	746	870

Figure 6



A reservoir operations model was developed to incorporate daily gage data from the selected USGS gage and reservoir shape parameters for estimation of evaporation. The following assumptions were incorporated into the analysis for the estimation of safe yield:

Assumptions:

1. Dead storage of 20% of gross reservoir storage was incorporated to allow for sediment storage and poor water quality in lower reservoir strata.
2. Usable water supply storage was assumed to be the water supply pool storage (calculated as noted above) less dead storage.
3. Pump station diversions were assumed to be from the North Oconee River at the location previously described. Diversions were assumed to occur whenever the reservoir level fell below full water supply pool. Pumped diversions were assumed to be bounded by pumping capacity and by flow restrictions on North Oconee River (noted below).
4. A minimum in-stream flow (MIF) of 30% AAF at the diversion pump station (North Oconee River) was used.

5. Allowance for two downstream withdrawals by the City of Athens would increase release requirements at the proposed dam and diversion sites. In addition to the MIF, the model provided for a prorated let-by at the dam and proposed pump station (PS) with the following characteristics:

Permitee:	Athens (Sandy Cr.)	Athens (N. Oconee)
Downstream Withdrawal:	16 mgd	25.5 mgd
Drainage Area:	46.5 mi^2	275 mi^2
Prorated Let-by (Dam):	1.08 mgd	0.29 mgd
Prorated Let-by (PS):	N/A	16.5 mgd

6. Upstream withdrawals in the North Oconee River basin would reduce available flow in the diversion stream. Adjustments for the following upstream withdrawals were incorporated into the model:

Permittee	**Upstream Withdrawal**	**Drainage Area (mi^2)**	**MIF (mgd)**
Hall County (Cedar Cr. Res)	2.0	2.4	0.31
Hall County (N.Oconee PS)	20	40.6	7.15
Jefferson (Curry Cr)	1.75	10.6	0
Jefferson (Park Cr Res.)	4.6	2.5	0.19
Jefferson (N. Oconee PS)	4.0	103.3	17.4

7. For the dam site, minimum in-stream flow of 30/60/40 percent average annual flow (AAF) was used. This MIF applies as follows: 30% AAF for July through November; 60% AAF for January through April; and 40% AAF for May, June and December.
8. Return flow from wastewater discharges or septic systems was not considered in the analysis.
9. Evaporation loss was based upon net historical evaporation rates (one standard deviation above average monthly values) as recorded at the University of Georgia in Athens. Lake evaporation was assumed to be equal to 70% of pan evaporation during each month. Surface area was approximated by a regression equation relating storage to surface area (Figure A-3, Appendix).
10. Streamflow data from the USGS gages noted above was applied in direct proportion of drainage areas to simulate flow into the reservoir and at the diversion location.
11. Total seepage losses would be less than the MIF requirements and, therefore, did not need to be separately considered.
12. Safe yield is that quantity of water that can be provided to meet water demands during the critical drought period.

The attainable safe yield during the analyzed period was found by iteration of the daily mass balance equation:

Ending Storage = (Beginning Storage) + (Natural Inflow) + (Pumped Inflow) – (Water Supply) – (Evaporation) – (MIF)

The trial safe yield value was varied until the reservoir level just reached the dead storage value, and recovery of the reservoir was computed.

SAFE YIELD RESULTS

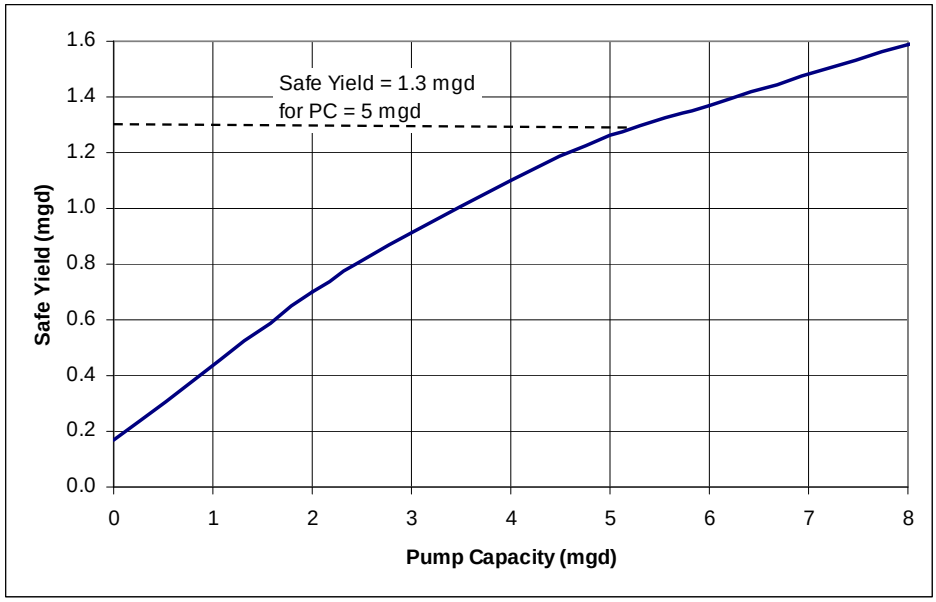
Incorporating the above assumptions, the estimated safe yield of the site was computed. The results of the safe yield analysis are presented in Table 5 and Figure 7. It should be noted that these estimated safe yield values are based on USGS topographic mapping. The estimates could vary significantly based on more detailed mapping, which would be required as part of a final safe yield analysis. In addition, the final safe yield analysis should incorporate the most recent stream flow data to more accurately reflect the effects of the current drought (drought of record) on project safe yield. The table below presents the estimated safe yield and refill time for a range of pump capacities. We have assumed a refill time of 4 to 5 years is the maximum refill duration for selection of pump capacity.

Table 5
Safe Yield Summary

Pump Capacity (mgd)	Estimated Safe Yield (mgd)	Refill Time* (years)
0	0.2	12
2	0.7	7
3	0.9	5
4	1.1	4
5	1.3	4
6	1.4	4
8	1.6	4

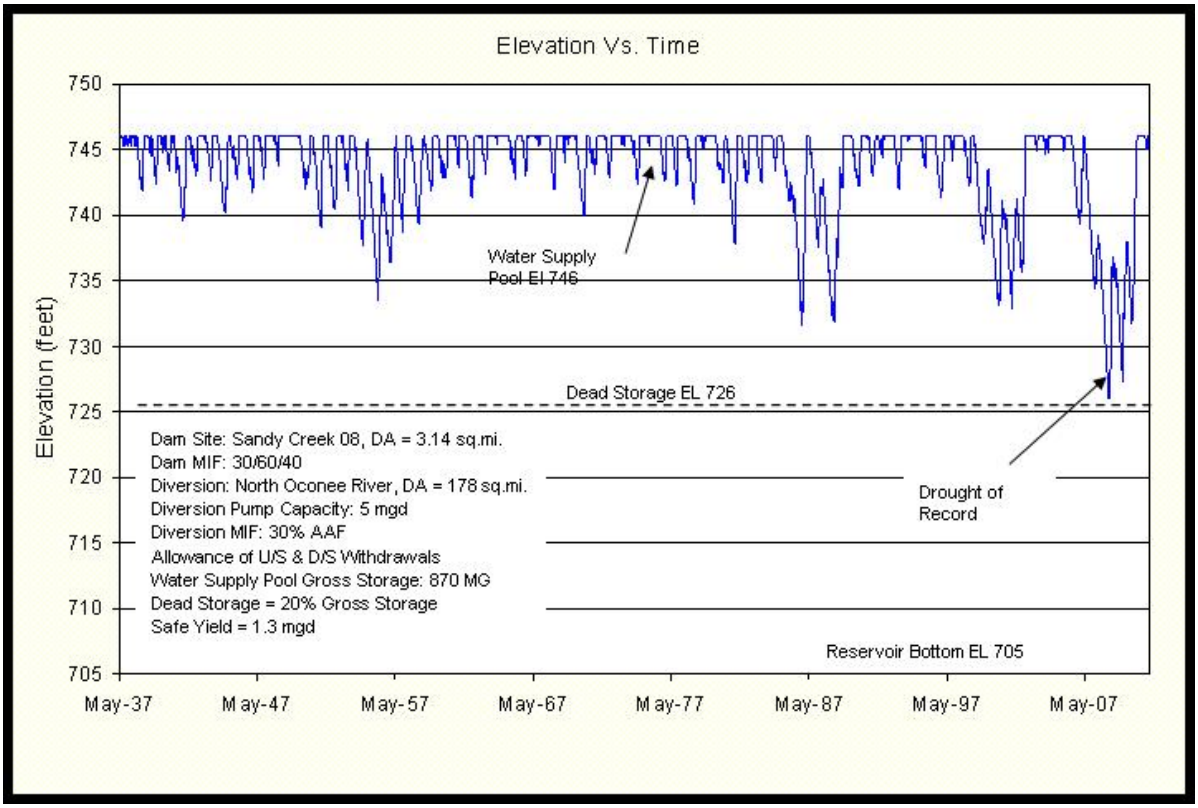
*Refill time is the time from start of drawdown until complete refill to water supply pool

Figure 7
Estimated Safe Yield vs Pump Capacity



As presented in Figure 7, there is diminishing return (safe yield) with increasing pump capacity (reflecting pump station and pipeline cost). For the purposes of this analysis, an estimated economical safe yield and pump capacity combination were selected from the above graph. The estimated safe yield for this project is approximately 1.3 mgd for a pump capacity of 5 mgd. These values were used to size and cost out the diversion facilities detailed later in this report. The variation of reservoir elevation over time for the above assumed safe yield and pump capacity is reflected in Figure 8.

Figure 8
Reservoir Elevation vs.Time


Elevation Vs. Time
Elevation (feet)
750
745
740
735
730
725
720
715
710
705
May-37
May-47
May-57
May-67
May-77
May-87
May-97
May-07
Water Supply
Pool El 746
Dead Storage EL 726
Drought of
Record
Dam Site: Sandy Creek 08, DA = 3.14 sq.mi.
Dam MIF: 30/60/40
Diversion: North Oconee River, DA = 178 sq.mi.
Diversion Pump Capacity: 5 mgd
Diversion MIF: 30% AAF
Allowance of U/S & D/S Withdrawals
Water Supply Pool Gross Storage: 870 MG
Dead Storage = 20% Gross Storage
Safe Yield = 1.3 mgd
Reservoir Bottom EL 705

ENVIRONMENTAL CONSIDERATIONS

Preliminary Studies

To evaluate the potential environmental impacts, permitting and compensatory mitigation associated with Sandy Creek 8, preliminary ecological studies were conducted by JJG ecologists. These studies consisted of a desktop survey to estimate wetlands, streams, and open waters (i.e. jurisdictional waters) occurring within the project area. All estimates of jurisdictional waters, permitting requirements, and compensatory mitigation requirements/cost estimates presented herein are very general and preliminary in nature. Detailed field studies would be necessary to definitively determine the number of jurisdictional waters and permitting requirements.

Desktop evaluations were performed with available data resources including the U.S. Geological Survey (USGS) 7.5-minute topographic maps and U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps. In addition, current aerial maps were used to identify jurisdictional resources not indicated in any USGS or NWI data. Observations made during the desktop survey were then transcribed into an ArcView GIS database for analysis. Preliminary estimates of jurisdictional waters occurring within the Sandy Creek 8 project area are provided below.

Wetlands

The *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin Classification System) defines the Palustrine System as all nontidal wetlands dominated by trees, shrubs, persistent emergent vegetation, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity is less than 0.5 percent. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: 1) area less than 20-acres; 2) the lack of active wave-formed or bedrock shoreline; 3) water depth in the deepest part of basin less than 6.6 feet at low water; and 4) salinity due to ocean-derived salts less than 0.5 percent.

The Lacustrine System includes wetlands and deepwater habitats with all of the following characteristics: 1) situated in a topographic depression or a dammed river channel; 2) lacking trees, shrubs, persistent emergent vegetation, emergent mosses or lichens with greater than 30-percent areal coverage; and 3) total area exceeds 20 acres. Wetlands and deepwater habitats less than 20-acres are also included in this system if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 6.6 feet at low water.

Office reviews determined that approximately 19 acres of palustrine wetlands and approximately 15 acres of lacustrine/palustrine open waters exist within the Sandy Creek 8 project area. These systems are primarily associated with several unnamed tributaries to Sandy Creek within the proposed reservoir pool limits. Cowardin classifications of the wetland systems range from palustrine forested to palustrine emergent with hydrologic regimes ranging from saturated to seasonally flooded.

Streams

The Cowardin Classification System defines lower perennial streams as low gradient streams with slow water velocities and substrates comprised mainly of sand and mud. Intermittent streams are defined as streams flowing for only part of the year. When water is not flowing, it may remain in isolated pools or surface water may be absent. Ephemeral streams flow only in direct response to precipitation and do not receive groundwater contributions.

Office reviews indicate that approximately 19,206 linear feet of lower perennial streams and approximately 4,544 linear feet of intermittent streams are located within the maximum reservoir pool limits of Sandy Creek 8. Ephemeral streams were not identified due to the preliminary nature of the studies. Refer to Figure 9 for locations of these jurisdictional features.

Cultural Resources

Review of existing cultural resources information did not indicate any identified cultural resources within the maximum reservoir pool limits of Sandy Creek 8. The Sandy Creek Structure 8 dam is listed; however, based on existing GIS database resources, this feature is not identified within the maximum reservoir pool limits. It should be noted that the absence of recorded cultural resources does not mean that they do not exist; in fact, a Phase I Cultural Resources Survey (conducted to the standards of Section 106 of the National Historic Preservation Act) would be required to determine the presence or absence of Cultural Resources as part of permitting for any proposed reservoir project.

Threatened and Endangered Species

Review of existing threatened and endangered species information identified six federally and state protected species documented from Jackson County, Georgia. These species consist of two faunal species and four floral species. The Georgia Department of Natural Resources – Non-game Conservation Section does not list the occurrence of any federally and state protected species within the maximum reservoir pool limits of Sandy Creek 8. Specialized aquatic surveys would be required to definitively determine the presence/absence of the Altamaha shiner within the project area. Refer to Table 6 for a summary of protected species located in Jackson County and potential habitat for these species within the maximum reservoir pool limits.

Figure 9
Jurisdictional Areas Location Map

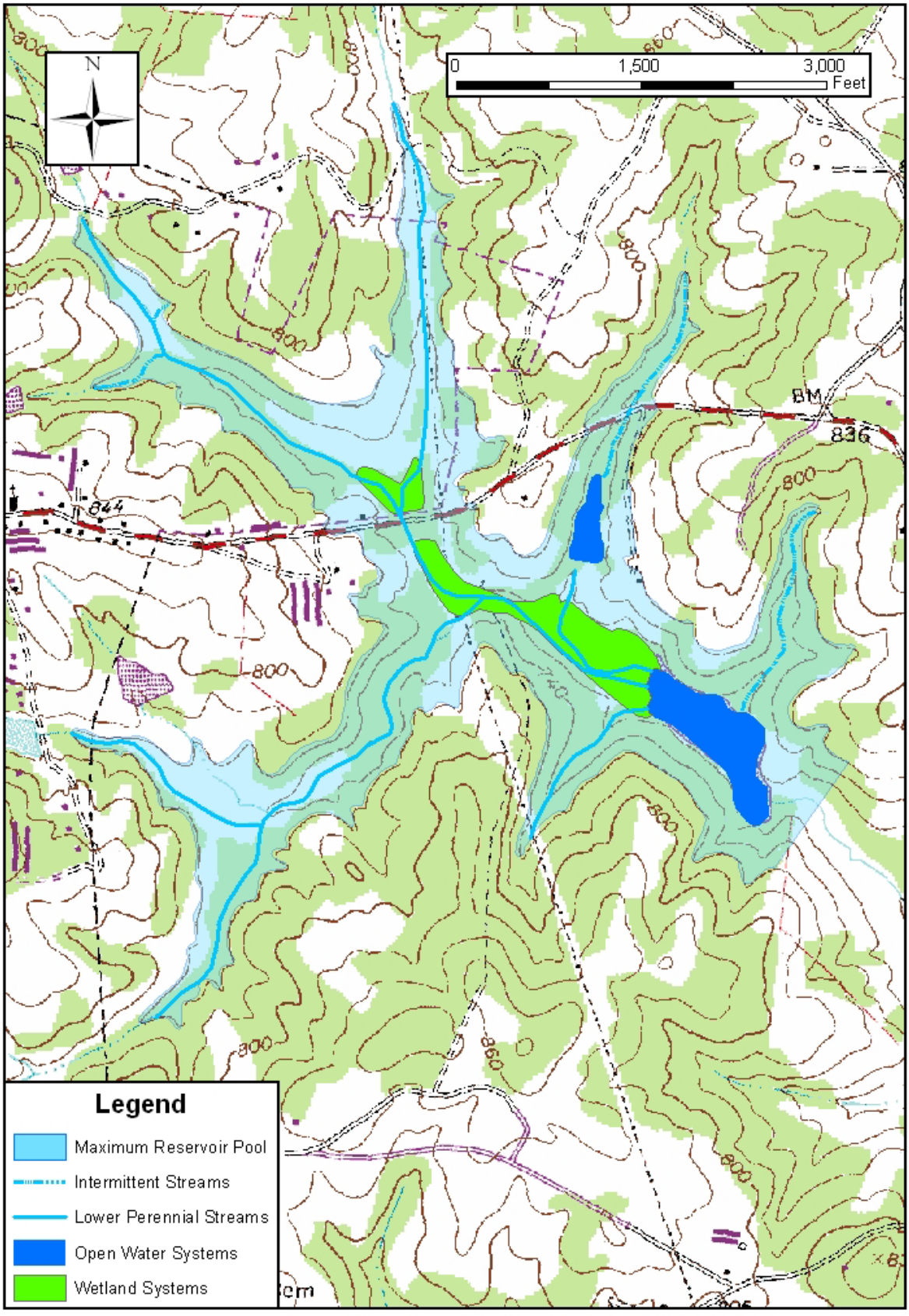


Table 6
Summary of Protected Species for Jackson County, Georgia

Scientific Name	Vernacular Name	Federal Status	State Status	Habitat Present (Yes/No)	Preferred Habitat
Faunal					
Cyprinella xaenura	Altamaha shiner	NA	T	No	small tributaries and rivers in pools with rocky to sandy substrates; Upper Altamaha river drainage
Haliaeetus leucocephalus	bald eagle	DL	T	Yes	forages along rivers, estuaries, and impoundments
Floral					
Amphianthus pusillus	pool sprite	T	T	No	shallow pools (>1 feet deep) on granite outcrops, where water collects after a rain
Isoetes melanospora	black-spored quillwort	E	E	No	shallow pools (>1 feet deep) on granite outcrops, where water collects after a rain
Isoetes tegetiformans	mat-forming quillwort	E	E	No	vernal pools on granite outcrops; shallow, flat-bottomed pools that form in depressions granite outcrops
Veratrum woodii	Ozark bunchflower	NA	R	Yes	moist, hardwood dominated woods; usually in clumps along streams

T= threatened, E= endangered, DL= delisted, R= rare, NA= not applicable

Trout Streams

Review of available resources indicated no primary or secondary trout streams are located within the maximum reservoir pool limits of Sandy Creek 8.

303(d) and 305(b) Listed Streams

Review of available resources did not indicate any 303(d) or 305(b) listed streams within the maximum reservoir pool limits of Sandy Creek 8.

Section 404/401 Permitting

The U.S. Army Corps of Engineers (USACE) regulates the discharge of dredged or fill material into the Nation's Waters under Section 404 of the Clean Water Act. Construction of an impoundment and flooding jurisdictional streams and wetlands is regulated by the USACE. Two types of permits are available through the USACE: Nationwide and Individual Permits. Nationwide Permits (NWP) have been established previously by the Chief of Engineers for projects that have minimal cumulative impacts to the Nation's Waters. Examples of the most commonly used NWPs include site development, minor road crossings, maintenance activities, and utility line discharges. Specific criteria and conditions were established that must be satisfied prior to obtaining authorization of a NWP from the USACE. In addition, the USACE, Savannah District issued Regional Conditions effective May 11, 2007.

Individual Permits (IP) are required for projects having more than minimal cumulative adverse impacts on the Nation's waters. The development of a water supply reservoir would typically require an IP. IPs involve significantly more information, documentation, and coordination with regulatory agencies and are considerably more difficult to acquire than a NWP. Prior to coordination with the USACE regarding the construction of an impoundment, required information would consist of, but not be limited to, the following information:

- Justification of Purpose and Need for the project
- Alternatives analysis of other water supply options evaluated to meet the need
- Wetland delineation with surveyed boundaries of USACE jurisdictional waters
- Phase I cultural resources and protected species surveys
- Detailed description of proposed project and proposed impacts to jurisdictional waters
- Detailed analysis of flow releases documented with population analysis and system modeling
- Avoidance and minimization of jurisdictional waters analysis
- Identification of adjacent property owners
- Development of a conceptual compensatory mitigation plan

Following completion of these items, a complex project meeting would typically be scheduled with the USACE Northern Area Section Office (Morrow, GA) to present the proposed project. Subsequent to the meeting, and if a project is tentatively accepted by the regulatory agencies, preparation of an IP would begin along with the preparation of a formal application. Following submittal of an IP, the application must be advertised for public comment. The USACE prepares the public notice, which includes detailed applicant information such as site location, proposed impacts, cultural resources, protected species, and proposed mitigation. The public notice would be advertised for 30 days and is also submitted to regulatory agencies including the Environmental Protection Agency (EPA) and the USFWS, adjacent property owners, and to the

USACE general mailing list. Applicants will be required to respond to inquiries received during the public notice process. Public hearings could be required if substantial adverse comments are received from the coordinating agencies or the public. Additional information and permitting required would consist of a Section 401 Water Quality Certification from the Georgia Environmental Protection Division (EPD). This certification must be issued for an IP to be valid. Depending on the level of impacts associated with the proposed reservoir, an Environmental Assessment or Environmental Impact Statement could be required by the USACE as well. Based on previous project experience, the level of controversy and environmental issues raised during agency and public review, a typical new reservoir project may require permitting times of five years or more.

The expansion of an existing reservoir could potentially facilitate the Section 404 permitting process when compared to the construction of a new impoundment. This is especially true for issues such as alternatives analysis, avoidance and minimization, and aquatic organism passage in that many or most potential impacts have already occurred. However, the steps of the overall Section 404 permitting process would still need to be followed, and historically reservoirs have encountered significant regulatory and public challenges, regardless of the presence/absence of an existing impoundment.

Compensatory Mitigation

To determine the amount mitigation potentially required for jurisdictional impacts within the Sandy Creek 8, the USACE's Standard Operating Procedure (SOP) for Compensatory Mitigation (March 2004) was utilized. The SOP uses a series of factors such as location, type, existing condition, type of impact, etc. to generate a multiplying "factor." That factor is then multiplied by the impact area (acreage or linear footage) to calculate the required mitigation credits. An "average" factor for jurisdictional areas associated with Sandy Creek 8 was utilized. *However, it is imperative to note that this document only serves as a guideline if impacts <u>do not</u> exceed 5,000 linear feet of stream or ten acres of wetland impacts.* Potential impacts for the Sandy Creek 8 would significantly exceed this threshold and actual compensatory mitigation requirements would likely be substantially different from SOP estimates. Currently, the USACE Savannah District Office is developing a new SOP for large-scale projects focused on reservoirs.

Utilizing the 2004 SOP and the approximated acreage and linear feet of jurisdictional waters located within the Sandy Creek 8 project area, an estimate of compensatory mitigation credits can be determined. Multiplying factors used for this analysis include: 6.7 for wetland systems, 5.7 for open waters, 12.7 for lower perennial streams, and 7.6 for intermittent streams. This factor was then multiplied by the acreage/ linear footage to determine an estimated number of mitigation credits required. The number of credits was then multiplied by an average credit price to estimate the final estimated compensatory mitigation cost associated with the Sandy Creek 8. Refer to Table 7 for estimated impacts to jurisdictional waters and an estimate of mitigation credits required and associated costs.

Stream Buffer Variance

The Georgia Erosion and Sedimentation Act of 1975 (GESA), as amended, requires that a 25-foot vegetated buffer be maintained along all state waters. Any land disturbing activities within the buffer would require obtaining a stream buffer variance from the EPD. The local issuing authority is responsible for determining if state waters are on-site and is responsible for determining if a stream buffer variance is required.

The GESA has a number of activities that are considered for stream buffer variances, including public water system reservoirs. Based on current regulations, reservoir construction would likely qualify for a variance. Attendant features such as pipelines and roadways, would likely be exempt from GESA regulations if stream crossings are constructed nearly perpendicular.

EPD Water Withdrawal Permit

Georgia EPD requires a permit for withdrawal of 100,000 gallons per day or more of either surface water or ground water. In addition to justification of water needs for up to 50 years in the future, water withdrawal permits typically require the preparation of water conservation, drought contingency, water supply/watershed protection, and reservoir management plans. A public hearing may be required as part of the withdrawal permitting process. EPD requires that its comments on the component plans be addressed before moving forward with issuing the water withdrawal permit. Based on previous permitting experience, a water withdrawal permit can be obtained within 5 to 7 months, depending on EPD's review time and the extent of their comments.

Source Water Protection Plan

Amendments to the Federal Safe Drinking Water Act (SDWA) have brought about a new approach for ensuring clean and safe drinking water served by public water supplies in the United States. Management of a drinking water source now requires a Source Water Protection Plan. This plan basically defines watershed management strategies for ensuring that the water supply is not compromised by potential pollutant sources. Typically these sources are unmanaged development, but they can also include industrial sources that can potentially contaminate the water supply. The entity that operates this reservoir for water supply would be required to produce and implement the Plan. The Plan should also address any source water from outside the reservoir watershed that would be used to fill the reservoir, i.e., pumped/storage sources. The cost and schedule for producing a Source Water Assessment and the corresponding Source Water Protection Plan have not been included in the estimates presented in the report.

PROJECT CONSTRUCTION COST ESTIMATE NARRATIVE

Dam and Reservoir

The construction cost estimate for the proposed dam was based upon the general description provided in the background section of the report. Additionally, the following assumptions were made regarding the geometry of the dam.

- Upstream slope of 3H to 1V
- Downstream slope of 3H to 1V
- Upstream slope wave action protection in the form of riprap from 30 feet below the crest of the dam to 5 feet below the crest of the dam. Riprap supported by a berm located 30 feet below top of dam.
- Downstream slope having nearly horizontal 12-foot wide berms at 30-foot vertical intervals to control surface water runoff and erosion
- Crest of dam having a width of 25-feet

In addition to the above geometric considerations, the following internal drainage configurations were also considered in the estimation of construction costs.

- Chimney drain located at the downstream edge of the crest
- Trench drain located at 1/3 the distance from the downstream toe to the crest

A plan view and cross section of the proposed dam is provided in Figures 10 and 11.

Contained below are the items estimated to develop the construction cost estimate. We caution that the quantities and associated prices are based upon limited engineering evaluation and will likely change as the project proceeds into detailed evaluation and design.

Mobilization and Demobilization

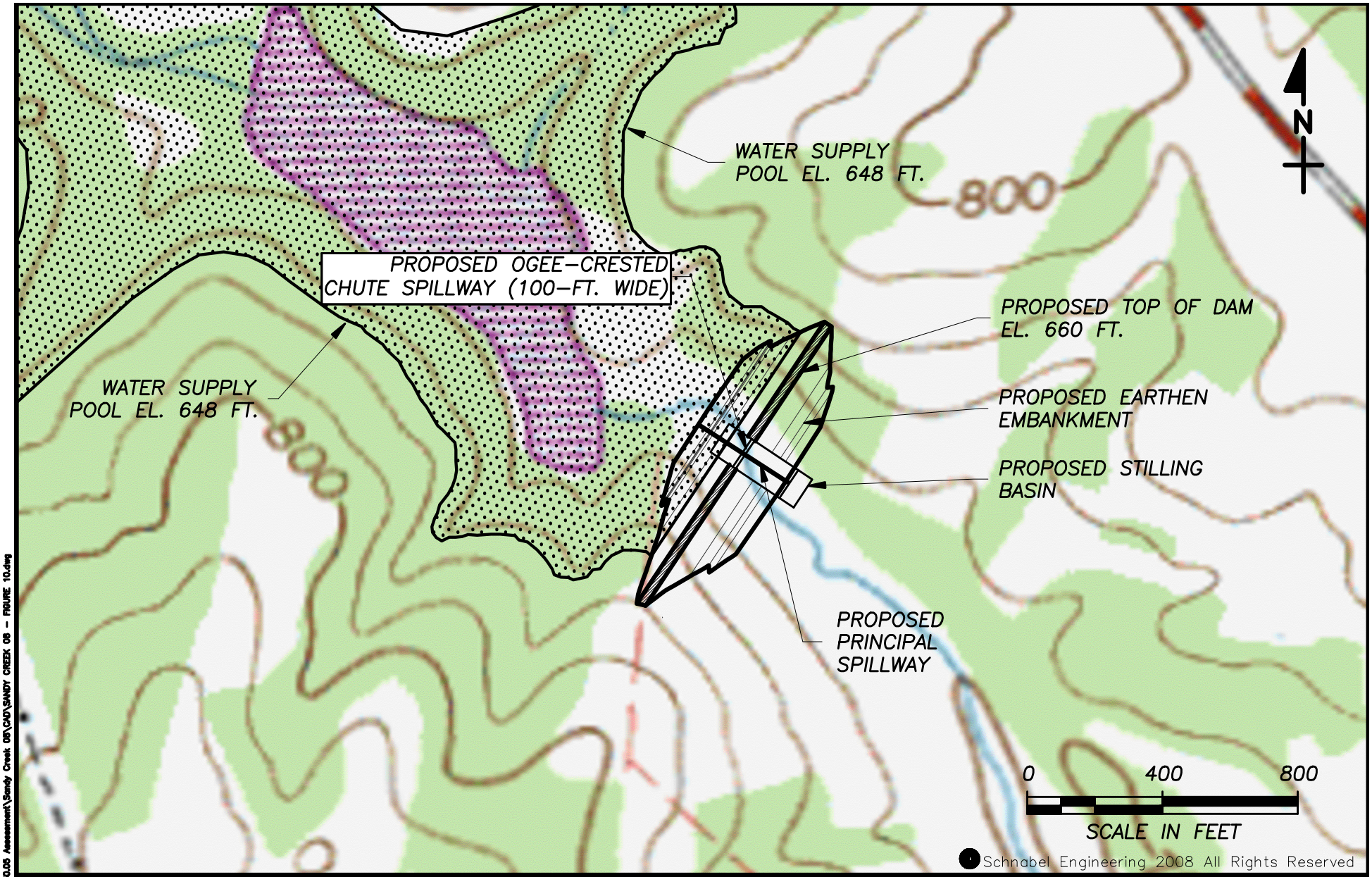
Mobilization and demobilization is a lump sum item estimated at 6 percent of the unit rate sum of the construction items.

Erosion and Sedimentation Control

Erosion and sedimentation control is a lump sum item estimated at 2 percent of the sum of unit rate construction items.

Control of Water

Control of water is a lump sum item estimated at 3 percent of the sum of unit rate construction items. This item includes the control of both surface water and groundwater and will likely consist of stream diversion, cofferdam construction and maintenance, pumping, and well points, as well as any other means of controlling water during construction.



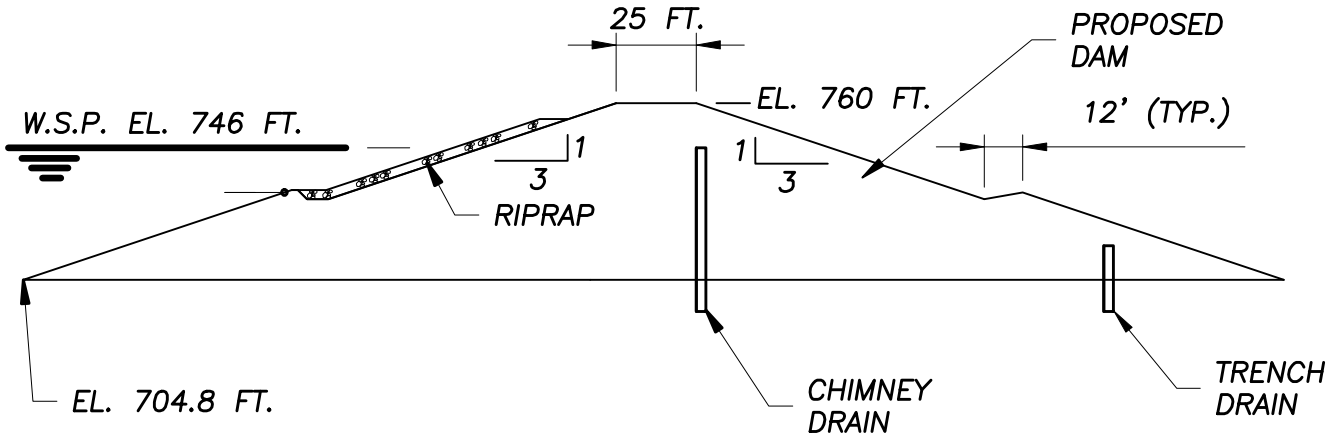
G:\2007 Jobs\07170030.05 Assessment\Sandy Creek 05\CAD\SANDY CREEK 05 - FIGURE 10.dwg

Schnabel Engineering

NRCS WATERSHED DAM ASSESSMENT
SANDY CREEK DAM NO. 9

PROPOSED PLAN VIEW

PROJECT NO. 07170030.05
FIGURE 10



0 60 120

SCALE IN FEET

Schnabel Engineering

NRCS WATERSHED DAM ASSESSMENT
SANDY CREEK DAM NO. 05

TYPICAL SECTION

PROJECT NO. 07170030.05
FIGURE 11

Clearing

Clearing is a unit rate item measured in acres associated with the removal of trees and other vegetation from the reservoir. The estimated area of clearing was assumed to be equal to the surface area of the reservoir at the normal pool elevation.

Clearing and Grubbing

Clearing and grubbing is a unit rate item measured in acres associated with the removal of trees, other vegetation, and associated root mats in the areas to receive structural fill or concrete. The estimated area of clearing and grubbing was assumed to be equal to the footprint of the proposed dam plus an additional 50-foot perimeter around the proposed dam.

Earth Fill

Earth Fill is a unit rate item measured in cubic yards. The computed volume of earth fill represents the estimated quantity required to construct the dam as described herein. The estimated quantity was computed using an AutoCad Civil 3D computer model based on the proposed grading and existing topography. In addition to the proposed embankment earth fill, foundation excavation backfill was calculated (see Excavation, Common for details) and added to the embankment earth fill to determine the total quantity of earth fill.

Drain Fill

Drain Fill is a unit rate item measured in cubic yards. The computed volume of drain fill represents the estimated quantity of fine and coarse-grained drain material required to construct the internal drainage system as described herein. For the purposes of this study, no differentiation was made between fine and coarse drain fill. In addition, the quantity for the trench drain was assumed to be equal to half of the chimney drain quantity. The chimney drain was assumed to have a top elevation equal to the proposed normal pool elevation and a bottom elevation approximated at the limits of the foundation excavation. The chimney drain was assumed to have a width of three feet and run the length of the dam from one abutment, into the floodplain, and up the other abutment tying into residual soils.

Excavation, Common

Excavation, Common is a unit rate item measured in cubic yards associated with the removal of unsuitable material (soils) within and adjacent to the footprint of the proposed dam. The volume of common excavation was calculated by approximating the surface area of the floodplain within the limits of clearing and grubbing as well as the depth of excavation within the same area. The surface area of the floodplain was approximated using available topographic maps. The depth of excavation was estimated from the boring data included in the design plans for the existing dam.

Riprap

Riprap is a unit rate item measured in tons. The computed weight of riprap represents the estimated quantity required to construct the wave-action berm as described herein. Riprap was assumed to be placed on the upstream slope of the dam. The section of riprap was assumed to extend 30 vertical feet, have a thickness of about 2-¾ feet, and traverse the length of the proposed dam.

Permanent Turf Establishment

Permanent Turf Establishment is a unit rate item measured in acres associated with the establishment of a permanent turf at the conclusion of construction activities for the proposed dam. The estimated area of permanent turf establishment was assumed to be equal to the estimated area of clearing and grubbing.

Concrete, Class 4000

Concrete, Class 4000 is a unit rate item measured in cubic yards associated with the construction of the reinforced concrete auxiliary chute spillway. The volume of concrete was estimated by comparing the proposed auxiliary spillway drop in elevation and width to the drops in elevation and widths of constructed reinforced concrete chute spillways. A relationship was developed between the drop in elevation and width of the constructed spillways and the required quantity of concrete. This relationship was applied to the proposed dam to estimate the quantity of concrete.

Principal Spillway Reinforced Concrete Pressure Pipe

Reinforced Concrete Pressure Pipe (RCPP) is a unit rate item measured in feet. The computed length of RCPP represents the estimated quantity required to construct the principal spillway conduit described herein. The RCPP was assumed to be placed through the base of the proposed dam from the upstream toe to the downstream toe. The diameter of the pipe was assumed to be equal to the diameter of the pipe in the existing dam.

Concrete, Class 3000 (mass)

Concrete, Class 3000 is a unit rate item measured in cubic yards associated with the construction of the concrete cradle beneath the principal spillway pipe. The concrete cradle was assumed to be designed as a Soil Conservation Service Type A2 cradle and run the length of the principal spillway pipe minus ten feet.

Reinforced Concrete Riser

The Reinforced Concrete Riser is a lump sum item associated with the construction of the reinforced concrete principal spillway structure. The cost was estimated by comparing the proposed principal spillway riser height to the heights of constructed reinforced concrete riser structures. A relationship was developed between the height of the constructed spillways and the

cost to construct them. This relationship was utilized to estimate the cost of the proposed riser structure.

Land Acquisition

The costs associated with land acquisitions are unit rate items based upon the number of acres that will need to be purchased at the top-of-dam elevation, the number of acres that will need to be managed for a 150-foot buffer around the normal pool, and the number of houses that will need to be purchased. For the purposes of the buffer management, only the portions of the buffer above top-of-dam elevation were considered. The costs to purchase the land were estimated based upon available records of recent land sales. The cost to manage the buffer was assumed to be 60 percent of the land purchase cost. The cost of each structure impacted was assumed to be $200,000.

Roadway Relocation

To construct the proposed project, seven roads will be impacted. These roads may need to be raised, relocated, or modified to accommodate the new reservoir; however, no consideration was given to the relocation of the roads in this study. A more detailed evaluation would need to be performed to evaluate the impact on existing roadways and the associated cost.

Utility Relocation

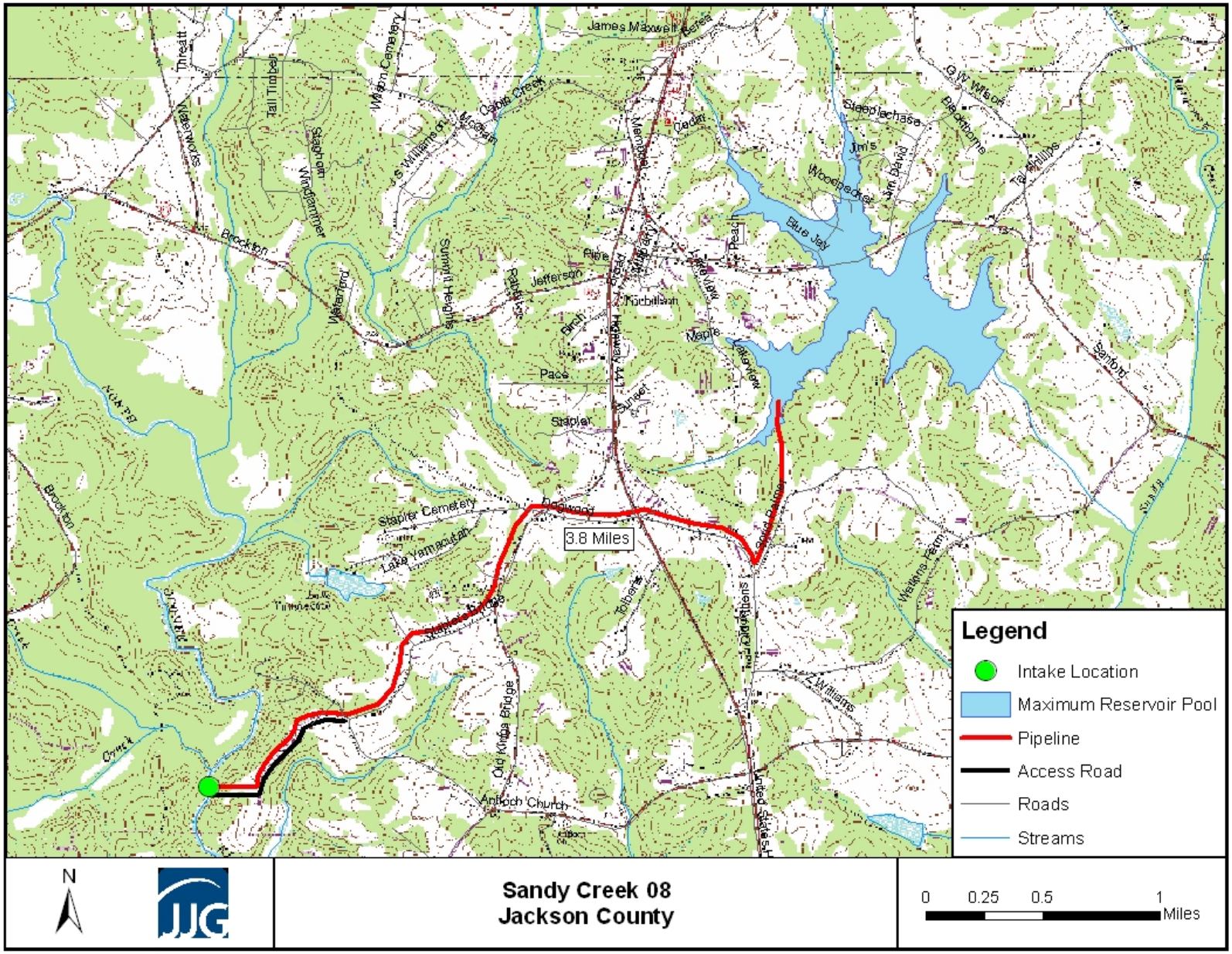
To construct the proposed project an electric transmission line will be impacted; however, no consideration was given to the impact this will have. A more detailed evaluation would need to be performed to evaluate the impact and cost associated with this transmission line.

Pump Station and Pipeline Cost Estimation

The pump storage location for Sandy Creek Reservoir 08 is located on the North Oconee River just downstream of its confluence with Curry Creek as shown in Figure 12. The reservoir is located approximately 3.5 miles northeast on Sandy Creek. With a normal pool elevation of 746 feet, Reservoir 08 has an average day yield of approximately 1.3 MGD. An 18-inch pipeline was selected to carry water from the pump storage location to the reservoir. This pipeline is approximately 3.8 miles in length and will pump water from the storage location elevation of 740 feet, to the 746 feet height of the reservoir water surface. A cascading structure will need to be constructed where the pipe comes into the reservoir to provide aeration and erosion control.

Three 2.5-MGD pumps were selected at the pump storage location to pump water to the reservoir, giving a firm pumping capacity of 5-MGD. An access road will need to be constructed in order to construct and maintain the pumping station on the Hudson River. This road, shown on Figure 12, will run approximately 0.7 miles from Staplers Bridge Road. The cost opinion for these components is found in the appendix.

Figure 12
Project Location Map



Compensatory Mitigation

The simplest mitigation option is typically purchasing credits from a bank. Compensatory mitigation credits may be purchased from an approved mitigation bank or through the Georgia Land Trust Service Center if a bank is not available within the project area. Based on recent projects, wetland credits range from $7,000-$10,000 per credit and stream credits range from $70-$110 per credit. An option to purchasing credits is to obtain credits by conducting on-site restoration or preservation of jurisdictional waters.

Table 7
Sandy Creek 8 Estimated Impacts and Overall Mitigation Banking Cost Analysis

Impact Type	Estimated Impact Acres/Linear Feet	Projected Credits Needed	Projected Cost* $90/stream credit $7,500/wetland credit
Wetland	19.26 A	129	$967,500
Intermittent Stream	4,544 l.f.	34,534	$3,108,060
Lower Perennial Stream	19,206 l.f.	243,916	$21,952,440
Open Water	15.11 A	86	$645,000
Total	**34.37 acres / 23,750 lf**	**215 wetland / 278,450 stream****	**$26,673,000**

*Cost is based on recent quotes from banks within the Upper Oconee River Basin. Actual banking price may be higher or lower than estimated depending on the date of purchase and credit availability. **Total required credits calculated using the March 2004 Standard Operating Procedure mitigation guidelines established by the US Army Corps of Engineers.

Estimated Project Construction Cost

The total project cost is estimated at $49,000,000. Table A-5, located in the appendix, shows an itemized breakdown of the costs associated with enlarging the existing dam and reservoir. These costs are estimates and are based on multiple assumptions.

APPENDIX

FIGURES

TABLES

Figure A-1

North Oconee River at Athens (USGS 02217900) vs
Middle Oconee River near Athens (02217500)

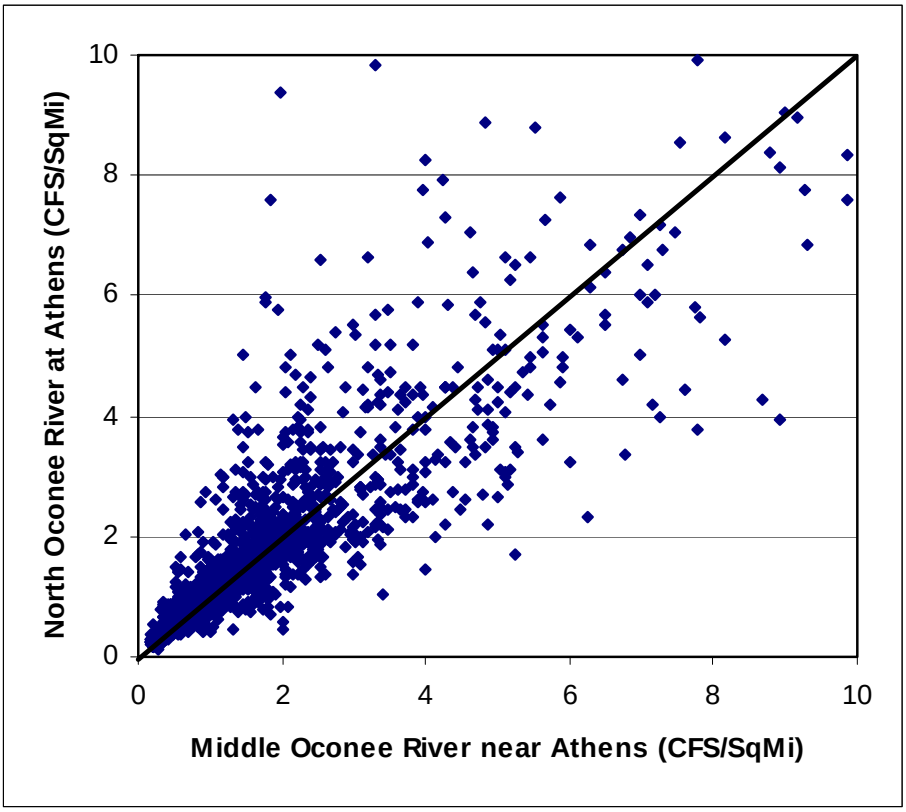
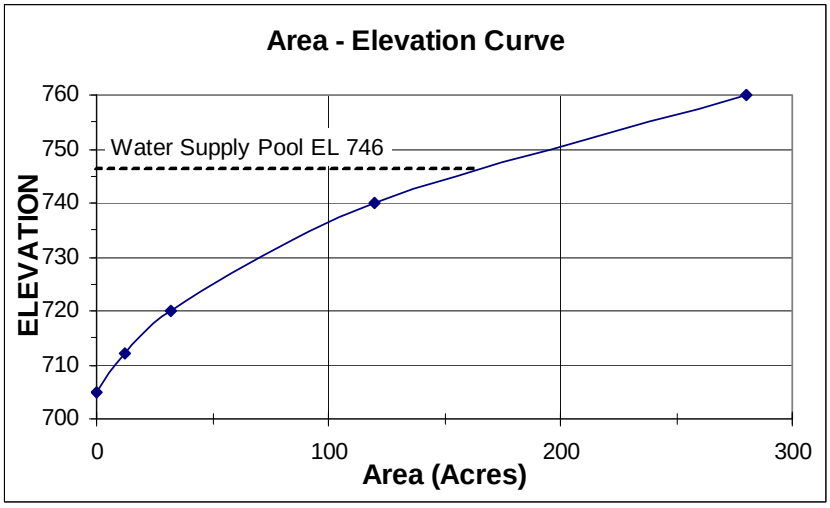
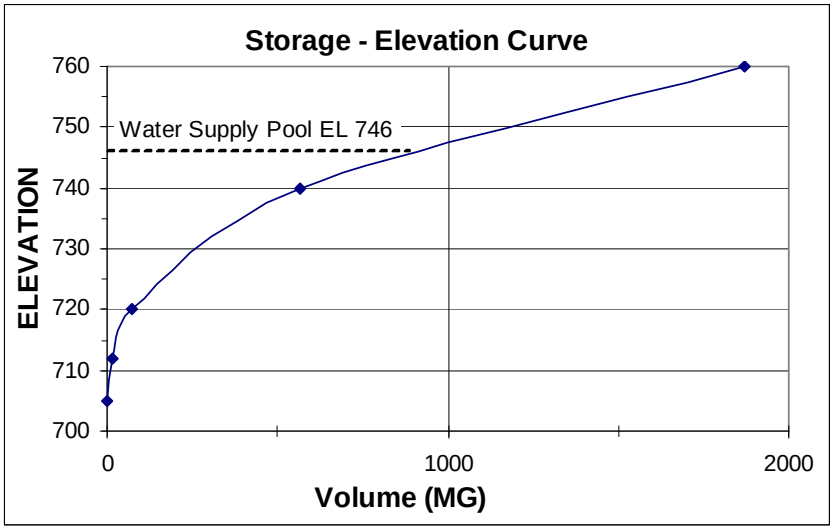


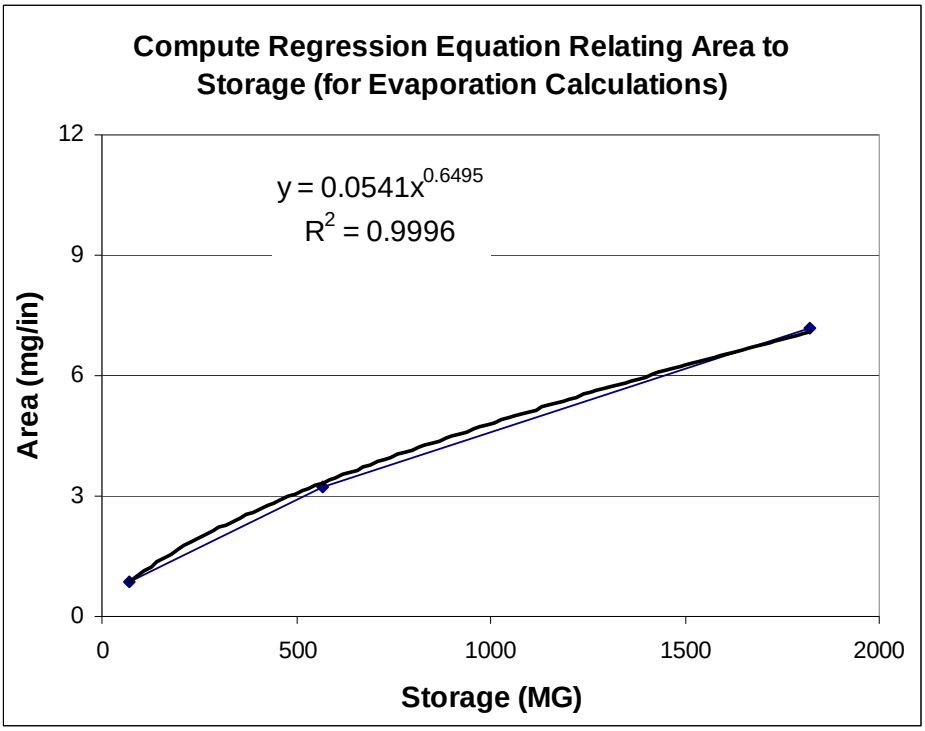
Figure A-2

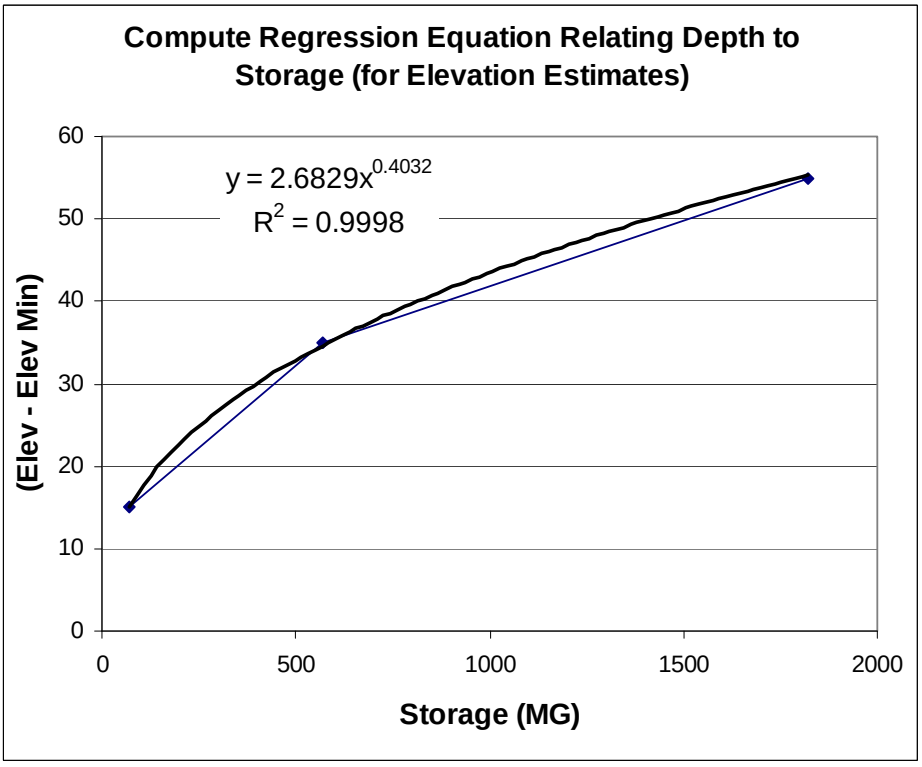
Sandy Creek 08
Area and Storage Curves

Elev.	Area Acres	Area mg/in	Inc. Vol. A-FT	Cumulative Vol A-FT	Cumulative Vol M Gal.
705	0.0	0	0	0	0
712	12.2	0	43	43	14
720	32.4	1	178	221	72
740	119.7	3	1521	1742	568
760	279.9	8	3996	5738	1870

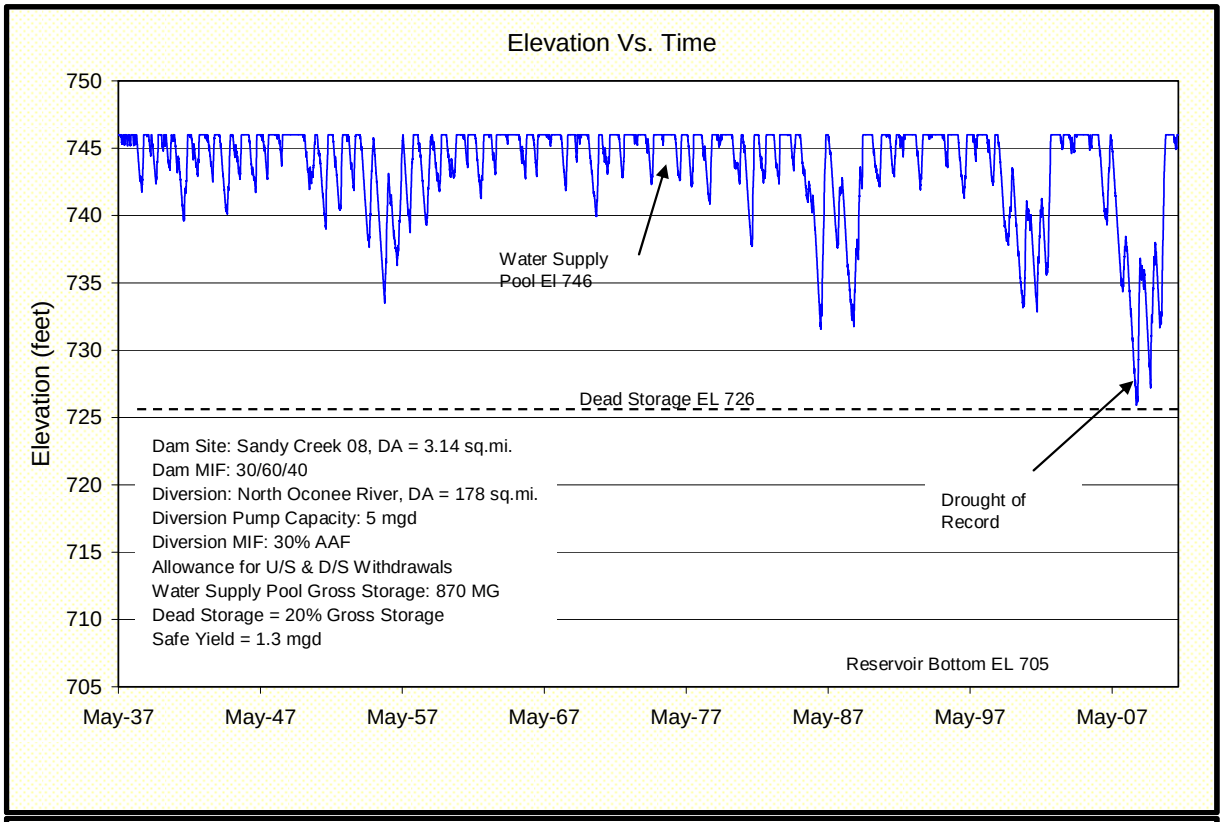


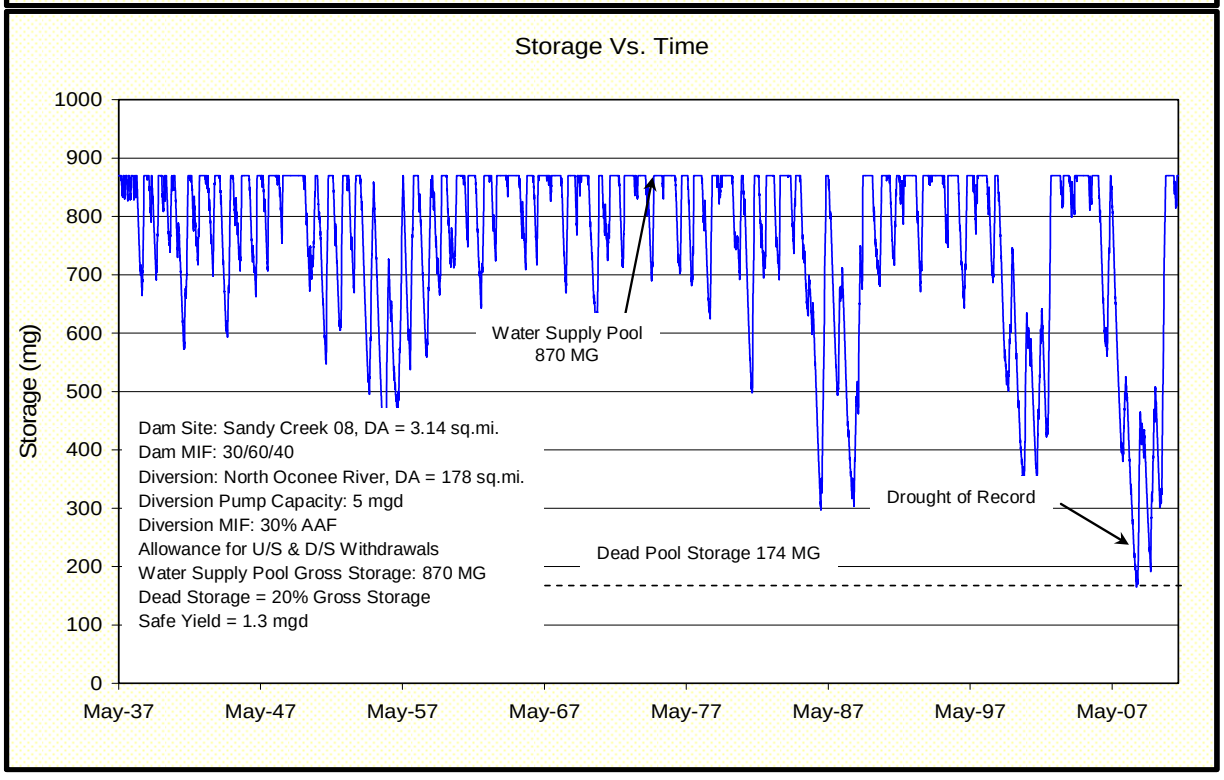



Compute Regression Equation Relating Area to Storage (for Evaporation Calculations)
y = 0.0541x^0.6495
R^2 = 0.9996
Area (mg/in)
Storage (MG)
0
3
6
9
12
0
500
1000
1500
2000


Compute Regression Equation Relating Depth to Storage (for Elevation Estimates)
y = 2.6829x^0.4032
R^2 = 0.9998
(Elev - Elev Min)
Storage (MG)
0
10
20
30
40
50
60
0
500
1000
1500
2000

Sandy Creek 08 Figure A-4





WATERSHED DAM ASSESSMENT - SANDY CREEK 08

Jackson County, Georgia (7194-002)

OPINION OF PROBABLE CONSTRUCTION COST ESTIMATE - CONCEPTUAL LEVEL

Summary by Division

Table A-1

Division	01 - Intake and Pump Station and Access Road	02 - 18 - inch Raw Water Force Main and Venturi Vault	03 - Reservoir Inlet Structure	TOTAL	% of Total
1	$0.71	$0.23	$0.06	$1.01	8.49%
2	$1.43	$0.54	$0.04	$2.01	16.99%
3	$0.75	$0.02	$0.29	$1.05	8.87%
4	$0.11	$0.00	$0.00	$0.11	0.90%
5	$0.02	$0.00	$0.00	$0.02	0.19%
6	$0.00	$0.00	$0.00	$0.00	0.00%
7	$0.02	$0.00	$0.00	$0.02	0.18%
8	$0.03	$0.00	$0.00	$0.03	0.25%
9	$0.05	$0.00	$0.00	$0.05	0.42%
10	$0.00	$0.00	$0.00	$0.00	0.00%
11	$1.11	$0.00	$0.03	$1.14	9.59%
12	$0.00	$0.00	$0.00	$0.00	0.00%
13	$0.00	$0.00	$0.00	$0.00	0.00%
14	$0.12	$0.00	$0.00	$0.12	0.98%
15	$0.34	$1.72	$0.02	$2.08	17.54%
16	$1.12	$0.07	$0.06	$1.25	10.54%
17	$0.22	$0.03	$0.03	$0.27	2.30%
Structure Contingency	$0.91	$0.13	$0.03	$1.06	8.95%
Markup	$1.09	$0.44	$0.11	$1.64	13.80%
Structure Total (without Contingency)	$8.03	$3.16	$0.66	$11.85	100.00%
Project Contingency	**$2.41**	**$0.95**	**$0.20**	**$3.56**	**30.00%**
Structure Total (with Contingency)	**$10.44**	**$4.11**	**$0.86**		

All Figures are in Millions

PROJECT TOTAL $15.41 M

SANDY CREEK 08

Maximum Reservoir Safe Yield:

1.26 MGD

RWPS Firm Pumping Capacity:

5.0 MGD

RWFM Pipe Diameter: 18-inches

WATERSHED DAM ASSESSMENT - (7194-002)
SANDY CREEK 08
OPINION OF PROBABLE CONSTRUCTION COST ESTIMATE - CONCEPTUAL LEVEL

01
DECEMBER 2008
Table A-2

No.	Spec. Sect.	Description	Unit	Qty	Labor $$		Material $$		Equipment $$		Subcontractor $$		Total
					Unit	Total	Unit	Total	Unit	Total	Unit	Total	
01 - Sandy Creek 08: River Intake and Pump Station					**3 - Channel Intake Pump Station**				**Pump Station Firm Capacity is 5.0 MGD**				
		Div 1											
1	1000	General Conditions	LS	1		$255,000		$202,200		$255,400		$0	$712,600
		Div 2											
2	2200	Earth Work	LS	1	$18,000.00	$18,000	$10,900.00	$10,900	$13,055.00	$13,060	$298,300.00	$298,300	$340,260
3		Access Road	LF	3850		$0		$0		$0	$110.00	$423,500	$423,500
4	2831	10' Galv. Chain Link Fence	LF	15595		$0		$0		$0	$30.00	$467,850	$467,850
5	2831	Dewatering / Pre-Excavation Preparation	LS	1	$50,000.00	$50,000	$20,000.00	$20,000	$100,000.00	$100,000	$30,000.00	$30,000	$200,000
		Div 3											
6	3250	Water Stop	LF	500	$1.25	$630	$2.00	$1,000		$0		$0	$1,630
7	3300	Concrete Bridge	SF		$2.00	$0		$0	$3.50	$0	$20.00	$0	$0
8	3300	Concrete	LS	1	$228,927.00	$228,930	$445,530.00	$445,530	$71,000.00	$71,000	$0.00	$0	$745,460
		Div 4											
9	4210	Brick Veneer	SF	3760		$0		$0		$0	$17.50	$65,800	$65,800
10	4220	Concrete Masonry Unit - Reinforced	SF	3760		$0		$0		$0	$11.00	$41,360	$41,360
		Div 5											
9	5524	Aluminum Handrail	LF	200	$6.00	$1,200	$35.00	$7,000	$2.90	$580		$0	$8,780
10		Ladder	VF	20	$50.00	$1,000	$150.00	$3,000	$15.00	$300		$0	$4,300
11	5530	Aluminum Grating Landing	SF	64	$10.00	$640	$45.00	$2,880	$10.00	$640		$0	$4,160
12	5530	Aluminum Grating	SF	160	$10.00	$1,600	$20.00	$3,200		$0		$0	$4,800
		Div 6											
		Div 7											
13		Membrane Roofing	SF	1260		$0		$0		$0	$10.00	$12,600	$12,600
14		Dampproofing - Walls	SF	3760		$0		$0		$0	$0.56	$2,110	$2,110
15		1" Rigid Insulation - Walls	SF	3760		$0		$0		$0	$1.07	$4,020	$4,020
16	7210	Walls - Core Fill Foam Insulation (12" CMU)	SF	3760		$0		$0		$0	$0.61	$2,290	$2,290
		Div 8											
17	8120	Hollow Metal Doors, Hardware, and Frames - Single	EA	10	$150.00	$1,500	$400.00	$4,000		$0		$0	$5,500
18	8120	Hollow Metal Doors, Hardware, and Frames - Double	EA	2	$150.00	$300	$800.00	$1,600		$0		$0	$1,900
19		Windows	LS	1	$3,000.00	$3,000	$8,000.00	$8,000	$1,000.00	$1,000		$0	$12,000
20	8331	Roll Up Aluminum Door (10'x12')	EA	2	$800.00	$1,600	$4,500.00	$9,000	$50.00	$100		$0	$10,700
		Div 9											
21	9900	Painting	LS	1		$0		$0		$0	$50,000.00	$50,000	$50,000
		Div 10											
		Div 11											
22		Screens / Spray Water System and Strainer	EA	3	$3,500.00	$10,500	$237,500.00	$712,500	$500.00	$1,500		$0	$724,500
23		Eductors	EA	18	$200.00	$3,600	$3,500.00	$63,000	$50.00	$900		$0	$67,500
24		Pumps (2.5 MGD, 220 Feet TDH)	EA	3	$9,500.00	$28,500	$95,000.00	$285,000	$1,000.00	$3,000		$0	$316,500
		Div 12											
		Div 13											
		Div 14											
25		Bridge Crane	LS	1	$5,000.00	$5,000	$110,000.00	$110,000	$1,500.00	$1,500		$0	$116,500
		Div 15											
26	15062	Ductile Iron Pipe	LS	1	$9,676.00	$9,680	$149,709.40	$149,710	$3,050.00	$3,050	$0.00	$0	$162,440
27		PVC Piping	LS	1	$1,250.00	$1,250	$8,000.00	$8,000	$750.00	$750		$0	$10,000
28		Valves	LS	1	$8,600.00	$8,600	$87,600.00	$87,600	$5,200.00	$5,200	$0.00	$0	$101,400
29		HVAC and Plumbing	LS	1		$0		$0		$0	$70,000.00	$70,000	$70,000
		Div 16											
30	16000	Electrical	LS	1		$0		$0		$0	$650,000.00	$650,000	$650,000

WATERSHED DAM ASSESSMENT - (7194-002)
SANDY CREEK 08
OPINION OF PROBABLE CONSTRUCTION COST ESTIMATE - CONCEPTUAL LEVEL

No.	Spec. Sect.	Description	Unit	Qty	Labor $$		Material $$		Equipment $$		Subcontractor $$		Total
					Unit	Total	Unit	Total	Unit	Total	Unit	Total	
01 - Sandy Creek 08: River Intake and Pump Station					**3 - Channel Intake Pump Station**				**Pump Station Firm Capacity is 5.0 MGD**				
31		CCTV Allowance	LS	0		$0		$0		$0		$0	$0
32		Ductbank	LF	3950		$0		$0		$0	$120.00	$474,000	$474,000
		Div 17											
33	17000	Instrumentation	LS	1		$0		$0		$0	$220,000.00	$220,000	$220,000
		Contingency	LS	15%		$95,000		$320,000		$69,000		$422,000	$906,000
		Subtotals				$725,530		$2,454,120		$526,980		$3,233,830	$6,940,460

Sales Tax @	**7.0%**	$171,800
Labor Burden @	**30.0%**	$217,700
Bonds On Subs @	**1.5%**	$48,500
Subtotal		$7,378,460
Fee @	**7.0%**	$516,500
Insurance & Bonds @	**1.7%**	$134,200
Estimated Construction Cost		**$8,030,000**

Assumptions:

Assumes that EPD will allow withdrawal from this source
15 foot wide Asphalt access road with 10-foot high fence
Pump Station firm capacitty is 5MGD
Pump Station has a 3 channel intake
Pump Station footprint is approximately 100 feet by 40 feet
Pump Station main building footprint is approximately 35 feet by 35 feet
Pump Station main building also houses the electrical room and is made of brick and block
A Transformer is being provided by the Utility Company at the access road entrance
Estimate DOES NOT include easements acquisitions, land acquisitions, withdrawal permits or mitigations required to build the pump station

WATERSHED DAM ASSESSMENT - (7194-002)
SANDY CREEK 08
OPINION OF PROBABLE CONSTRUCTION COST - CONCEPTUAL

Table A-3

No.	Spec. Sect.	Description	Unit	Qty	Labor $$		Material $$		Equipment $$		Subcontractor $$		Total
					Unit	Total	Unit	Total	Unit	Total	Unit	Total	
02 - 18-inch Raw Water Line with Venturi Vault													
		Div 1											
1	1000	General Conditions	LS	1		$85,000		$61,500		$85,100		$0	$231,600
		Div 2											
2	2125	Erosion and Sedimentation Control Maintenance	LS	1		$0		$0		$0	$286,900.00	$286,900	$286,900
3		Bore and Jack Road Crossing (30")	LF	300		$0		$0		$0	$350.00	$105,000	$105,000
4	2510	Asphalt Concrete Pavement (5% of length)	LS	1		$0		$0		$0	$104,400.00	$104,400	$104,400
5	2523	Driveway Replacement (12 total)	LS	1		$0		$0		$0	$42,000.00	$42,000	$42,000
		Div 3											
6	3300	Miscellaneous Concrete (Venturi Vault)	LS	1	$1,500.00	$1,500	$12,500.00	$12,500	$1,000.00	$1,000	$0.00	$0	$15,000
		Div 4											
		Div 5											
		Div 6											
		Div 7											
		Div 8											
		Div 9											
		Div 10											
		Div 11											
		Div 12											
		Div 13											
		Div 14											
		Div 15											
7		**18" DIP**	**Depth**	**6**		**Depth of Cover**	**4**						
8		18" Pipe Excavation - Earth (compacted volume)	CY	13794	$0.75	$10,346		$0	$3.00	$41,382		$0	$51,728
9		18" Pipe Excavation - Trench Rock (compacted volume)	CY	4598		$0		$0		$0	$35.00	$160,930	$160,930
10		Trench Box	LF	20064		$0	$1.00	$20,064		$0		$0	$20,064
11		18" DIP Pressure Class 350	LF	16064	$4.67	$74,955	$53.04	$852,035	$2.50	$40,160		$0	$967,149
12		18" DIP Pressure Class 350 RJ	LF	4000	$4.67	$18,664	$68.06	$272,240	$2.50	$10,000		$0	$300,904
13		18" Pipe Bedding (compacted volume)	CY	3344	$1.00	$3,344	$17.00	$56,848	$1.00	$3,344		$0	$63,536
14		18" Pipe Backfill (compacted volume)	CY	13735	$1.00	$13,735		$0	$4.00	$54,939		$0	$68,674
15		Import Backfill Materials (loose volume, assume 10% swell)	CY	0		$0	$13.00	$0		$0		$0	$0
16		Haul off Rock (assume 15% swell) - with Trench Rock	CY	5288		$0		$0		$0		$0	$0
17		18" 90-degree Bend	EA	5	$98.20	$491	$2,304.72	$11,524	$50.00	$250		$0	$12,265
18		18" 45-degree Bend	EA	5	$98.20	$491	$2,159.46	$10,797	$50.00	$250		$0	$11,538
19		18" 22.5-degree Bend	EA	5	$98.20	$491	$2,393.82	$11,969	$50.00	$250		$0	$12,710
20		18" 11.25-degree Bend	EA	5	$98.20	$491	$2,393.00	$11,965	$50.00	$250		$0	$12,706
21												$0	
22		Earthwork Calculations				$0		$0		$0		$0	$0
23		Pipe Excavation - Total Compacted Volume	CY	18392		$0		$0		$0		$0	$0
24		Rock - Total Compacted Volume (assume 25%)	CY	4598		$0		$0		$0		$0	$0
25		Pipe Bedding - Total Compacted Volume	CY	3344		$0		$0		$0		$0	$0
26		Pipe Backfill - Total Compacted Volume Needed	CY	13735		$0		$0		$0		$0	$0
27		On-Site Backfill Material Available - Compacted Volume	CY	13794		$0		$0		$0		$0	$0
28		Materials for Disposal - Compacted Volume	CY	59	$5.00	$296		$0	$5.00	$296		$0	$592
29													
30		Air Release Valve and Manhole (4 each)	LS	1	$1,700.00	$1,700	$33,000.00	$33,000	$1,100.00	$1,100	$0.00	$0	$35,800
31													
		Div 16											
32	16000	Electrical	LS	1		$0		$0		$0	$65,000.00	$65,000	$65,000
		Div 17											
33	17000	Venturi Meter	LS	1	$1,250.00	$1,250	$18,000.00	$18,000	$500.00	$500		$0	$19,750

WATERSHED DAM ASSESSMENT - (7194-002)
SANDY CREEK 08
OPINION OF PROBABLE CONSTRUCTION COST - CONCEPTUAL

No.	Spec. Sect.	Description	Unit	Qty	Labor $$ Unit	Labor $$ Total	Material $$ Unit	Material $$ Total	Equipment $$ Unit	Equipment $$ Total	Subcontractor $$ Unit	Subcontractor $$ Total	Total
02 - 18-inch Raw Water Line with Venturi Vault													
34	17000	Instrumentation	LS	1		$0		$0		$0	$7,500.00	$7,500	$7,500
		Contingency	LS	5%		$11,000		$68,000		$12,000		$38,000	$129,000
		Subtotals				$223,753		$1,440,442		$250,821		$809,730	$2,724,746
		Sales Tax @		**7.0%**		$100,800							
		Labor Burden @		**30.0%**		$67,100							
		Bonds On Subs @		**1.5%**		$12,100							
		Subtotal				$2,904,746							
		Fee @		**7.0%**		$203,300							
		Insurance & Bonds @		**1.7%**		$52,800							
		Estimated Construction Cost				**$3,160,000**							

Assumptions:

DOES NOT include easements acquisitions, land acquisitions or mitigations required to construct the raw water transmission main

Assumed 25% of the excavated material is rock

$105 per LF (pipe only)
$157 per LF (total cost)

WATERSHED DAM ASSESSMENT - (7194-002)
SANDY CREEK 08
OPINION OF PROBABLE CONSTRUCTION COST - CONCEPTUAL LEVEL

03
DECEMBER 2008
Table A-4

No.	Spec. Sect.	Description	Unit	Qty	Labor $$		Material $$		Equipment $$		Subcontractor $$		Total
					Unit	Total	Unit	Total	Unit	Total	Unit	Total	
03 - Reservoir Inlet Structure													
		Div 1											
1	1000	General Conditions	LS	1		$22,000		$17,600		$22,200		$0	$61,800
		Div 2											
2	2200	Earth Work	LS	1	$5,000.00	$5,000	$2,600.00	$2,600	$4,926.00	$4,930	$31,300.00	$31,300	$43,830
		Div 3											
3	3250	Water Stop	LF	500	$1.25	$630	$2.00	$1,000		$0		$0	$1,630
4	3300	Concrete	LS	1	$91,809.00	$91,810	$167,738.00	$167,740	$28,300.00	$28,300	$0.00	$0	$287,850
		Div 4											
		Div 5											
		Div 6											
		Div 7											
		Div 8											
		Div 9											
		Div 10											
		Div 11											
5		Sluice Gates and Operators	EA	1	$2,500.00	$2,500	$25,000.00	$25,000	$1,000.00	$1,000		$0	$28,500
		Div 12											
		Div 13											
		Div 14											
		Div 15											
6	15062	Ductile Iron Pipe	LS	1	$810.60	$810	$14,385.35	$14,390	$435.00	$440	$0.00	$0	$15,640
		Div 16											
7	16000	Electrical	LS	1		$0		$0		$0	$60,000.00	$60,000	$60,000
		Div 17											
8	17000	Instrumentation	LS	1		$0		$0		$0	$25,000.00	$25,000	$25,000
		Contingency	LS	5%		$6,000		$11,000		$3,000		$6,000	$26,000
		Subtotals				$128,750		$239,330		$59,870		$122,300	$550,250

Sales Tax @	**7.0%**	$16,800
Labor Burden @	**30.0%**	$38,600
Bonds On Subs @	**1.5%**	$1,800
Subtotal		$607,450
Fee @	**7.0%**	$42,500
Insurance & Bonds @	**1.7%**	$11,000
Estimated Construction Cost		**$660,000**

Table A-5

Sandy Creek 08

TOTAL PROJECT OPINION OF COST

Item . No.	Description of Work	Estimated Quantity	Unit	Unit Price	Amount
1.	Mobilization and Demobilization	1	Job	Lump Sum	$307,321
2.	Erosion & Sediment Control	1	Job	Lump Sum	$102,440
3.	Control of Water	1	Job	Lump Sum	$153,660
4.	Clearing	165	Ac	2,500.00	$412,500
5.	Clearing & Grubbing	8	Ac	$5,000.00	$40,000
6.	Earth Fill	168,781	Cu-Yd	$2.50	$421,953
7.	Drain Fill	3,166	Cu-Yd	$75.00	$237,450
8.	Excavation, Common	16,510	Cu-Yd	$3.25	$53,658
9.	Riprap	7,300	Ton	$75.00	$547,500
10.	Permanent Turf Establishment	8	Ac	$2,000.00	$16,000
11.	Concrete, Class 4000 (reinforced)	3,695	Cu-Yd	$850.00	$3,140,750
12.	Concrete, Class 3000 (mass)	58	Cu-Yd	$400.00	$23,200
13.	30-Inch RCP	315	Feet	$400.00	$126,000
14.	Principal Spillway Riser	1	Lump Sum	$103,000.00	$103,000
	Dam Construction Cost Estimate				**$5,685,431**
15.	18-Inch Pipeline	1	Lump Sum	$3,160,000.00	$3,160,000
16.	Cascading Structure	1	Lump Sum	$660,000.00	$660,000

17.	Pumping Station (Including Raw Water Pumps and Access Road)	1	Lump Sum	$8,030,000.00	$8,030,000
	Pump Station and Pipeline Cost Estimate				**$11,850,000**
18.	Land Acquisition	280	Ac	$5,000.00	$1,400,000
19.	Easement Acquisition	44	Ac	$3,000.00	$132,000
20.	Building Acquisition	18	Buildings	$200,000	$3,600,000
	Land Acquisition Cost Estimate				**$5,132,000**
21.	Wetland	129	Credits	$7,500.00	$967,500
22.	Intermittent Stream	34,534	Credits	$90.00	$3,108,060
23.	Lower Perennial Stream	243,916	Credits	$90.00	$21,952,440
24.	Open Water	86	Credits	$7,500.00	$645,000
	Impacts and Overall Mitigation Cost Estimate				**$26,673,000**
	Construction, Land Acquisition, Mitigation Estimate				**$49,340,431**
	Suggested Project Estimate				**$49,000,000**

The above suggested project cost estimate does not include contingencies or professional services.
Professional services should be considered at not less than 15 percent of the suggested project cost estimate
Cost contigencies should be considered at not less than 25 percent of the suggest projet cost estimate
Prices are in 2008 U.S. Dollars