SUPPLEMENTAL WATERSHED WORK PLAN NO. 3
AND ENVIRONMENTAL ASSESSMENT
FOR
PINE CREEK WATERSHED DAM NO. 4
FOR THE TOWN OF ONEIDA, TENNESSEE
(SCOTT COUNTY, TENNESSEE)

PREPARED BY
USDA NATURAL RESOURCES CONSERVATION SERVICE

IN COOPERATION WITH
TOWN OF ONEIDA, TENNESSEE

&

SCOTT COUNTY SOIL AND WATER CONSERVATION DISTRICT

April 2016

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SUPPLEMENTAL WATERSHED WORK PLAN NO. 3 AND ENVIRONMENTAL ASSESSMENT FOR PINE CREEK WATERSHED DAM NO. 4 FOR THE TOWN OF ONEIDA, TENNESSEE

(SCOTT COUNTY, TENNESSEE)

PREPARED BY:

United State Department of Agriculture,
Natural Resources Conservation Service

IN COOPERATION WITH:

Town of Oneida, Tennessee
Scott County Soil and Water Conservation District

PROJECT LOCATION:

Scott County, Tennessee

FOR MORE INFORMATION:

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ABSTRACT:

Supplemental Watershed Work Plan No. 3 and Environmental Assessment (EA) describes a plan to meet all applicable USDA-Natural Resources Conservation Service (NRCS) and State of Tennessee dam safety and performance standards, and to extend the useful life of Pine Creek Watershed Dam No. 4 beyond its original evaluated life expectancy. The dam was originally constructed in 1966 with a 50-year service life. The dam was designed and constructed as a Significant Hazard Class dam. NRCS recently classified Pine Creek Watershed Dam No. 4 as a High Hazard Class dam. The new life expectancy is 70 years. Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake, located on North Fork Pine Creek upstream from developed areas of Scott County, provide municipal water supply, flood control, and fish and wildlife development. The dam and reservoir are owned and operated by the Town of Oneida, Tennessee.

The purpose of the Project (Project Purpose) is to 1) maintain the current level of flood damage reduction provided by Pine Creek Watershed Dam No. 4 for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features, 2) improve the existing municipal water supply availability provided for the Town of Oneida, and 3) comply with applicable design, performance, and safety criteria for a High Hazard Class dam.

The need for this Project (Project Need) is to 1) continue providing flood damage reduction downstream from the dam, 2) address applicable NRCS and State of Tennessee standards and design criteria for public health and safety to reduce the risk of loss of human life, and 3) continue providing source water for public water supplies from Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake.

The Sponsor's primary objectives for this Project are to meet or exceed state and federal dam safety criteria; maintain the current level of flood protection; and improve the current level of availability of water supplies.

The no action, rehabilitation of the existing dam, and decommissioning with nonstructural measures alternatives were evaluated in detail. The other non-structural measures alternative, floodproofing, was not evaluated in detail. The recommended alternative is to rehabilitate the existing dam. This is also the National Economic Development (NED) alternative, which is the alternative that maximizes net national economic development benefits consistent with protecting the nation's environment.

Dam rehabilitation will include: 1) raising the top of dam elevation by 0.9 foot, 2) installing a Roller Compacted Concrete-(RCC-) armored overtopping of the entire dam that will serve as the auxiliary spillway, 3) filling the existing auxiliary spillway, 4) adding a stilling basin at the bottom of the RCC, 5) installing a sand diaphragm, 6) relocating the water supply pump station, 7) replacing the 30-inch diameter principal spillway riser structure and conduit with 48-inch diameter, and 8) increasing the elevation of the principal spillway riser inlet by 1.0 foot.

Economic benefits will exceed costs. Sponsor will incur at least 35% of the total rehabilitation Project cost. The planned action will bring Pine Creek Watershed Dam No. 4 into compliance with current, applicable NRCS and State of Tennessee dam safety and performance standards for High Hazard Class dams.

This plan is intended to document the requirements of the National Historic Preservation Act of 1966, the Endangered Species Act of 1973, and other applicable environmental laws and Executive Orders for this federal action. The plan documents the impacts on the relevant resource concerns for purposes of the National Environmental Policy Act of 1969.

COMMENTS AND INQUIRIES:

Comments and inquires must be received by June 30, 2016. Submit comments and inquiries to: Michelle Beasley, Economist, Michelle.Beasley@tn.usda.gov, USDA - Natural Resources Conservation Service, 675 U.S. Courthouse, 801 Broadway, Nashville, TN 37203, (615) 277-2558.

SUMMARY OF SUPPLEMENTAL WATERSHED WORK PLAN NO. 3

AND ENVIRONMENTAL ASSESSMENT

FOR THE

PINE CREEK WATERSHED DAM NO. 4

(SCOTT COUNTY, TENNESSEE)

Congressional Districts – TN: 3RD

(OFFICE OF MANAGEMENT AND BUDGET FACT SHEET)

SPONSORS OF PINE CREEK WATERSHED DAM NO. 4 PROJECT

Town of Oneida, Tennessee

ADDITIONAL SPONSORS OF PINE CREEK WATERSHED DAM NO. 4 PROJECT

Scott County Soil Conservation District

AUTHORITIES

Pine Creek Watershed Work Plan was completed and approved in June 1961, executed by the Sponsors and the USDA Soil Conservation Service (now USDA Natural Resources Conservation Service [NRCS]) and became effective in August 18, 1961 under the authority of Public Law (PL) 83-566, Watershed Protection and Flood Prevention Act (16 U.S.C.1001-1008).

Rehabilitation of PL 83-566-assisted dams has been authorized under the authority of Section 14 of Public Law 83-566, the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. Parts 1001-1008, 1010, and 1012). The responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to NRCS.

PROPOSED ACTION

The proposed action is the rehabilitation of Pine Creek Watershed Dam No. 4 to current design, performance, and safety criteria with a service life of 70 years.

PROJECT PURPOSE AND NEED

The purpose of the Project (Project Purpose) includes the following:

- Maintain the current level of flood damage reduction provided by Pine Creek Watershed Dam No. 4 for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features.
- Improve the existing municipal water supply availability provided for the Town of Oneida, Tennessee.
- Maintain the current level of wildlife habitat developed with Project.
- Comply with applicable design, performance, and safety criteria for a High Hazard Class dam.

The need for this supplemental watershed plan (Project Need) arises from the fact that Pine Creek Watershed Dam No. 4, designed and constructed as a Significant Hazard Class dam, does not meet current dam design and safety criteria for a High Hazard Class dam. The dam was originally constructed in 1966 with a 50-year service life. NRCS recently classified Pine Creek Dam No. 4 as a High Hazard Class dam. The current hazard classification is due to the presence of bridges, roads, and buildings existing in the downstream dam breach inundation zone. The Project Need includes the following:

- Continue providing flood damage reduction downstream from the dam and address applicable NRCS and State of Tennessee standards and design criteria for public health and safety to reduce the risk of loss of human life.
- Continue providing source water for public water supplies from Pine Creek Dam No. 4 and Howard H. Baker Senior Lake.
- Continue providing fish and wildlife habitat.

PREFERRED ALTERNATIVE

The Preferred Alternative is the National Economic Development (NED) Alternative, which is to rehabilitate Pine Creek Watershed Dam No. 4. This will:

- Rehabilitate the dam to current NRCS High Hazard Class dam design criteria.
- Extend the service life for 70 years.
- Comply with State of Tennessee Department of Environment and Conservation (TDEC) dam safety regulations.

The Preferred Alternative results in the following:

- Maintaining the axis of the dam at its present location.
- Raising the top of dam elevation by 0.9 foot.
- Adding a 350-foot-wide Roller Compacted Concrete-(RCC-) armoring to resist erosion during overtopping of the dam and serve as the auxiliary spillway.
- Filling the existing auxiliary spillway.
- Adding a stilling basin at the bottom of the RCC to direct flows into the downstream channel.
- Installing a sand diaphragm around the principal spillway conduit.
- Relocating the water supply pump station due to spatial conflicts with the stilling basin and to afford future access from the service road.
- Replacing the principal spillway riser structure and conduit to increase the principal spillway conduit size from 30-inch diameter to 48-inch diameter.
- Increasing the elevation of the riser inlet by one foot and adding 59 acre-feet of water supply storage.

PROJECT BENEFITS

The Preferred Alternative includes these benefits:

- Flood control
- Minimized risk of loss of human life
- Minimized risk of extensive damages
- Increased water supply storage
- Sediment storage
- Improved downstream water quality
- Maintained land values

ALTERNATIVE PLANS CONSIDERED

Several alternatives and variations of alternatives were considered. The National Economic Development (NED) Alternative is the alternative that reasonably maximizes net economic benefits consistent with protecting the Nation's environment.

Alternatives included structural and non-structural measures. The period of analysis for all alternatives was determined to be 73 years representing an implementation period of 3 years and a service life of 70 years. All alternatives used the same period of analysis so that they could be consistently compared. Table S-3 summarizes the primary alternatives considered for the Project.

RESOURCE INFORMATION

Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake, located on North Fork Pine Creek, in Scott County, were built in 1966 to provide municipal water supply, flood control, and fish and wildlife development. The dam and reservoir are owned and operated by the Town of Oneida. The property upstream from Pine Creek Watershed Dam No. 4 is predominantly private ownership.

Figure S-1 shows the location of Pine Creek Watershed Dam No. 4.

Pine Creek Watershed Dam No. 4 is a zoned-earth embankment flood control structure. The dam was designed and constructed as a Significant Hazard Class dam. The dam is currently classified by NRCS and the Tennessee Department of Environment and Conservation (TDEC) as a High Hazard Class dam.

The following resource information was obtained from the NRCS Field Office Technical Guide, Section II, Climate Data for Scott County, Tennessee.

Climate

- *Temperature*
  In winter, the average temperature is 34.1° Fahrenheit (F) and the average daily minimum temperature is 22.2° F. The lowest temperature on record, which occurred on January 21, 1985, was -26° F. In summer, the average temperature is 71.4° F and the average daily maximum temperature is 83.8° F. The highest recorded temperature, which occurred on July 17, 1980, was 102° F.
- *Precipitation*
  The total annual precipitation is approximately 54.7 inches. Approximately 50 percent of this (27 inches) typically falls between May and October. This period also includes the growing season for most crops. The heaviest 1-day rainfall during the period of record was 4.8 inches on September 3, 1982. Thunderstorms occur approximately 47 days each year with most occurring between May and August.
- *Snowfall*
  The average seasonal snowfall is about 11 inches. The greatest snow depth at any one time during the period of record was 9 inches. On the average, 3 days of the year have at least 1 inch of snow on the ground.
- *Humidity*
  The average relative humidity in midafternoon is about 59 percent. Humidity is higher at night, and the average at dawn is about 86 percent.
- *Sunshine*
  The sun shines approximately 64 percent of the time in summer and 42 percent in winter.

- *Wind*
  The prevailing wind is from the northeast. Average wind speed is highest, between 8 and 9 miles per hour, from January to April.
- *Topography and Drainage*
  Scott County lies entirely within the Cumberland Plateau and Mountains Major Area. The western part of Scott County is in the Cumberland Plateau portion, and the eastern part is in the Wartburg Basin of the Cumberland Mountains. The Cumberland Plateau consists of broad rolling flats dissected by dendritic drainage ways. The Cumberland Mountains area is comprised of steep, high mountains with narrow, uneven tops and narrow intermountain valleys. The soils of the Cumberland Plateau and Mountains are underlain by interbedded shale, siltstone, and sandstone of Pennsylvanian age. Scott County is drained to the north by the Big South Fork section of the Cumberland River and its tributaries.

Table S-1 provides relevant resource information and the planned land use conditions upstream from Pine Creek Watershed Dam No. 4.

Table S-1
Resource Information

Resource	Pine Creek Watershed Dam No. 4 Contributing Watershed
Location of Structure [1]	
Longitude	84°32'24.74"W
Latitude	36°30'27.75"N
Hydrologic Unit Code [2]	05130104
HUC Watershed Name [2]	South Fork Cumberland
Congressional District [3]	Tennessee U.S. Congressional District 3
Drainage Area upstream of dam (square miles)[4]	1.4
Land Use above dam (acres)[4]	Total – 898
Pasture/Hay	184.7
Deciduous Forest	419.4
Developed, Low Intensity	16.0
Developed, Open Space	66.9
Evergreen Forest	5.9
Mixed Forest	37.7
Grassland/Herbaceous	114.7
Water	52.7

[1] Google Earth 7.1.2.2041

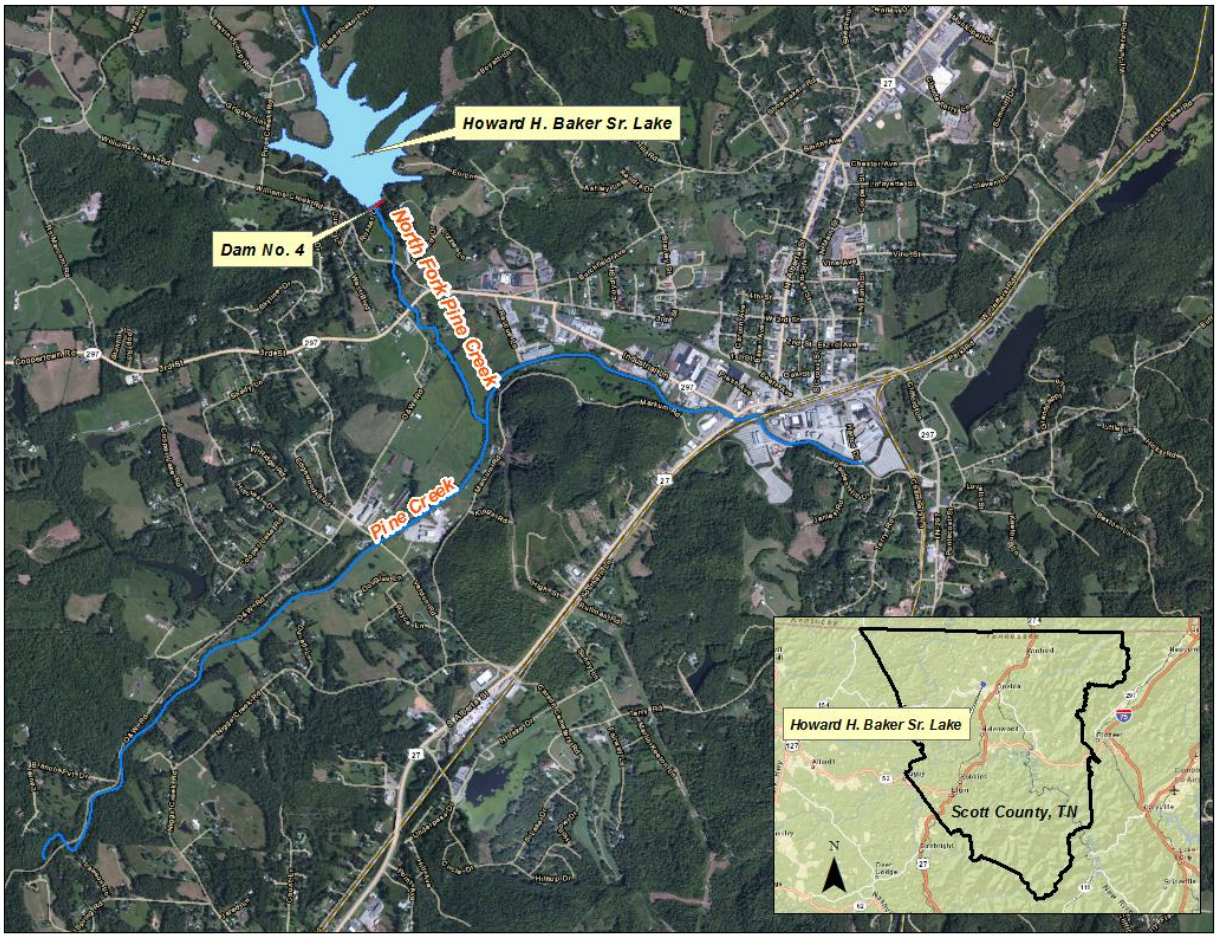
[2] http://cfpub.epa.gov/surf/huc.cfm?huc_code=05130104

[3] http://fleischmann.house.gov/our-district

[4] National Land Cover Database, 2006

The property upstream from Pine Creek Watershed Dam No. 4 is predominantly private ownership.

Figure S-1
Project Location Map



PROJECT BENEFICIARY PROFILE

Table S-2 provides relevant information regarding the Project beneficiary profile.

Table S-2
Project Beneficiary Profile

Beneficiary	Town of Oneida[1]	Scott County[1]	Tennessee[1]	U.S.[1]
Population	3,771	22,191	6,346,105	308,745,538
Median Age	38.4 years	37.9 years	38.0 years	37.2 years
Per Capita Income	$17,255	$18,840	$24,678	$27,915
Median Household Income	$26,250	$29,294	$44,297	$52,762
Total Number of Households	1,599	8,439	2,493,552	114,761,359
Median Value of Housing Units	$86,500	$79,700	$138,400	$186,200
Percent of Families Living Below Poverty Level	24.4%	21.8%	13.3%	10.5%

[1] Source: United States Census Bureau, Census 2010
http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t&keepList=t#

The proposed action directly benefits 1,599 households in Oneida, Tennessee. Additionally the proposed action indirectly benefits the population of Scott County, Tennessee, which includes approximately 22,191 people.

Table S-3
Primary Alternative Plans Considered

Alternative	Summary of Alternative	Screening Method			Carried Forward for Detailed Study?
		Estimated Cost	Project Purpose Met	Project Need Met	
No Action/Future Without Federal Project	▪ Minimum constructed breach of the embankment to remove the storage function of the dam and restore the stream to a free-flowing state through the impoundment area and the footprint area of the dam. ▪ Acquire alternative sources for water supply.	$1,951,800			Yes
Rehabilitation to NRCS High Hazard Class Dam (NED Alternative)	▪ Federally-assisted rehabilitation of dam to NRCS High Hazard Class dam design criteria by raising the top of dam elevation, an RCC-armored overtopping dam that will serve as the auxiliary spillway, filling the existing auxiliary spillway, adding a stilling basin at the bottom of the RCC, installing a sand diaphragm, relocating the water supply pump station, replacing the principal spillway riser structure and conduit, and increasing the elevation of the riser inlet.	$2,891,500	✓	✓	Yes
Dam Decommissioning with Nonstructural measures	▪ Federally-assisted removal of the entire embankment and restoring the stream and 100-year floodplain to a free-flowing state through the impoundment area and the footprint area of the dam. ▪ Relocate existing residential and public structures in the downstream 100-year floodplain. ▪ Acquire alternative sources for water supply.	$3,138,000	✓	✓	Yes
Other Nonstructural Measures (Floodproofing)	▪ Maintain dam at current configuration. ▪ Demolish and relocate the inhabitants of 46 residential structures. ▪ Demolish and relocate the inhabitants of 21 commercial structures. ▪ Acquire alternative sources for water supply. ▪ Prevent development in breach inundation area.	>$8,891,000	✓	✓	No

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PROJECT COSTS

Table S-4 summarizes the allocation of Project costs for the Preferred Alternative. The calculated cost share amounts were obtained from a series of worksheets developed by NRCS to assist with the computation of cost-share amounts for the watershed agreement.

Funding will be requested annually until the Project is funded.

Table S-4
Estimated Project Costs

Works of Improvement	NRCS	Sponsors	Total
Cost-Sharable Items [1]			
Rehabilitation of dam (Construction Costs)	$ 1,391,000	$ 682,700	$ 2,073,700
Relocation [2]	$ -	$ -	$ -
Sponsor's Planning Costs	$ -	$ -	$ -
Sponsor's Engineering Costs	NA	$ -	$ -
Sponsor's Project Administration	NA	$ -	$ -
Land Rights Acquisition Cost [3]	NA	$ 66,300	$ 66,300
Subtotal: Cost-Share Costs	$ 1,391,000	$ 749,000	$ 2,140,000
Cost-Share Percentages	**65.0%**	**35.0%**	**100.0%**
Non Cost-Sharable Items			
NRCS Engineering & Project Administration	$ 749,000	NA	$ 749,000
Natural Resource Rights	NA	$ -	$ -
Federal, State and Local Permits	NA	$ 2,500	$ 2,500
Subtotal: Non Cost-Share Costs	$ 749,000	$ 2,500	$ 751,500

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1 Total eligible rehabilitation project costs for the purpose of cost sharing includes construction; land rights, easements, or rights-of-way; and all non- NRCS technical and engineering assistance for planning, design and Project administration. The Sponsor's share shall be paid with non-federal funds. In-kind contributions may be counted as specified in a separate Memorandum of Understanding between the Sponsor and NRCS.

2 Investigation of the watershed Project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost-shared in accordance with the percentages shown.

3 The Sponsor will acquire land rights with other than Watershed Protection and Flood Prevention Act funds, such real property as will be needed in connection with the works of improvement. The value of real property is eligible as in-kind contributions toward the Sponsor's share of the works of improvement costs. In no case will the amount of an in-kind contribution exceed the Sponsor's share of the cost for the works of improvement. The maximum cost eligible for in-kind credit is the same as that for cost sharing.

4 Price Base 2015.

Table S-5
Estimated Project Benefits

Rehabilitate to NRCS High Hazard Class Dam	Estimated Average Annual Monetary Benefits[1,3]
Flood Damage Reduction	
Residential, Commercial and Transportation	$ 304,500
Other Benefits	
Municipal Water Supply	$ 470,100
Avoided Cost[2]	$ 68,200
Total Monetary Benefits	$ 842,800

April-2016

1 Price base 2015

2 Per Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, 1.7.2 (b) (3) - the avoided cost of the most likely alternative to the planned action.

3 Amortized over 3 years construction and 70-year service life at 3.125%. Includes operation and maintenance.

Table S-6
Estimated Project Benefits and Costs

Item	Value [1]
Average Annual Benefits [2]	$ 842,800
Average Annual Costs [2]	$ 107,800
Net Annual Economic Benefits	$ 735,000
Benefit Cost Ratio	7.8:1
Period of Analysis	73 years
Project service life	70 years

April-2016

1 Price base 2015

2 Amortized over 3 years construction and 70-year service life at 3.125%. Includes Operation and Maintenance.

ENVIRONMENTAL CONSIDERATIONS AND EFFECTS

Table S-7 describes the resource concerns identified during Project scoping and summarizes the potential impacts related to the Preferred Alternative.

Table S-7
Summary of Relevant Resource Concerns and Effects of Rehabilitation

Relevant Resource Concern	Summary of Effects of Preferred Alternative
Cultural Resources	• No impacts to cultural resources are anticipated.
Endangered and Threatened Species	• Not likely to adversely affect Federal endangered or threatened species. • No impact on wildlife management areas or state-listed species.
Environmental Justice	• No disproportionate adverse effects are anticipated to any ethnically, racially, or socioeconomically-disadvantaged families or groups.
Erosion and Sedimentation	• Decrease downstream sedimentation. • The threat of property damage from dam failure would be reduced.
Fish and Wildlife	• Maintain existing fish and wildlife habitat. • Wildlife temporarily displaced during construction.
Floodplain Management	• The preferred alternative passes the 24-hour PMP without overtopping, meeting High Hazard Class dam criteria. • No impacts to FEMA floodplain limits are anticipated as the downstream receiving stream is not an effective FEMA floodplain.
Floodwater Damage	• No additional structures, utilities, or transportation features are shown to be inundated by the change in the100-year event floodplain downstream of the dam per recent aerial photography. • The 5-year recurrence interval flood event results in a maximum downstream increase of 0.72 foot compared to existing. The 100-year recurrence interval increase is 0.86 foot. • Change in 100-year floodplain downstream produces an increase in floodplain area of 4.6 acres.
Invasive Species	• Construction could potentially introduce invasive species.
Land Use	• Provide flood protection for existing development. • Result in minimal changes in land use and vegetation cover.
Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act	• Migratory birds and their nesting activities would be temporarily disturbed if construction takes place between April 1 and July 15.
Plants – Degraded Plant Condition	• Construction will permanently remove vegetation from the dam and auxiliary spillway.
Prime and Unique Farmlands	• Inundate farmland infrequently for short periods. • Continue to provide flood control to downstream prime farmlands.
Public Health and Safety	• Reduce the threat to human health and safety, by providing improved flood control.
Regional Water Resources Plans	• Improve the public water supply storage for the Town of Oneida.
Riparian Areas	• Maintain the shoreline riparian area.
Scenic Beauty	• Maintain the current aesthetic appeal of Howard H. Baker Senior Lake.

Relevant Resource Concern	Summary of Effects of Preferred Alternative
Social Issues	• Improve the current water supply storage at Howard H. Baker Senior Lake.
Water-Based Recreation	• Improve the current water-based recreation at Howard H. Baker Senior Lake.
Water Quality	• Temporary impacts to water quality, during construction.
Water Resources	• Provides improved water supply storage for the Town of Oneida by increasing the normal pool height by 1.0 foot resulting in 59 acre-feet of additional water supply storage.
Water – Excess/Insufficient Water	• Provides improved water supply storage for the Town of Oneida.
Waters of the United States/Clean Water Act	• Impacts to Waters of the United States will require a Section 404 permit from the USACE. • Downstream water quality would be protected by capturing and retaining sediment and pollutants in pool areas. • Temporary impacts to water quality associated with construction activities would be reduced through implementation of an SWPPP.
Wetlands	• Wetlands along the perimeter of the lake would be affected by a rise in pool elevation. • Additional wetlands (estimated <1 acre) could form along new shoreline following rise in pool elevation. • Loss of aquatic habitat within pool areas and the loss of hydrology and wetland habitat within fringe wetlands adjacent to pool areas.

Source: Amec Foster Wheeler (Amec), Resource Inventory-DRAFT, Howard H. Baker Sr. Lake/Dam No. 4 (February 2014)

MITIGATION

Required measures will be implemented to avoid and minimize any adverse impacts during construction and may include timing of work, sediment controls such as seeding, mulching and silt fences, and wetting construction areas to reduce dust. Additionally, best management practices identified during the permitting process will be incorporated into the Project to reduce potential impacts. Therefore, compensatory mitigation is not anticipated.

MAJOR CONCLUSIONS

The Preferred Alternative is to rehabilitate Pine Creek Watershed Dam No. 4 to current NRCS High Hazard Class dam design criteria for a service life of 70 years. This is also the National Economic Development Alternative.

AREAS OF CONTROVERSY

No areas of controversy were identified.

ISSUES TO BE RESOLVED

None identified.

EVIDENCE OF UNUSUAL CONGRESSIONAL OR LOCAL INTEREST

No evidence of unusual Congressional or local interests was identified.

COMPLIANCE CERTIFICATION

Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? Yes_X_ No___

1.0 PURPOSE AND NEED FOR ACTION

1.1 CHANGES REQUIRING PREPARATION OF A SUPPLEMENT

Pine Creek Watershed Dam No. 4 was designed and constructed as a Significant Hazard Class dam. This classification was recently changed to High Hazard Class dam due to the presence of homes in the downstream breach inundation zone. Pine Creek Watershed Dam No. 4 does not meet current NRCS dam design and safety criteria for a High Hazard Class dam.

1.2 INTRODUCTION

This Supplemental Watershed Work Plan No.3 and Environmental Assessment will formulate, evaluate, and resolve alternatives for the rehabilitation of Pine Creek Watershed Dam No. 4.

The Pine Creek Watershed Work Plan was completed and approved June 8, 1962. It has subsequently been supplemented two times. The following is a description of the Work Plan and each of the available Supplements used to formulate the Project benefits for the Pine Creek Dam No. 4:

- The Watershed Plan Agreement for Pine Creek Watershed, Scott County, Tennessee, executed by Sponsors named therein and NRCS (formerly Soil Conservation Service [SCS]), effective July 16, 1959.
- Supplemental Watershed Plan Agreement No. 1 for Pine Creek Watershed, Scott County, Tennessee, executed by Sponsors named therein and NRCS (formerly SCS), effective April 8, 1964.
- Supplemental Watershed Plan Agreement No. 2 for Pine Creek Watershed, Scott County, Tennessee, executed by Sponsors named therein and NRCS (formerly SCS), effective September 26, 1967.

NRCS completed a Rehabilitation Assessment Report which included an evaluation and estimated risk-based profile of the dam in December 2007. The evaluation indicated that the Pine Creek Watershed Dam No. 4 Risk Index was 82. NRCS reviewed the breach inundation zone downstream from the dam and determined that 15 homes, businesses, major buildings, U.S. Highway 27, State Highway 29, and the Southern Railroad were subject to flooding during a breach of the dam.

1.3 PROJECT PURPOSE

The purpose of the Project (Project Purpose) includes the following:

- Maintain the current level of flood damage reduction provided by Pine Creek Watershed Dam No. 4 for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features.
- Improve the existing municipal water supply availability provided for the Town of Oneida.
- Maintain the current level of wildlife habitat developed with Project.
- Comply with applicable design, performance, and safety criteria for a High Hazard Class dam.

1.4 PROJECT NEED

The need for this supplemental watershed plan (Project Need) arises from the fact that Pine Creek Dam No. 4, designed and constructed as a Significant Hazard Class dam, does not meet current dam design and safety criteria for a High Hazard Class dam. The dam was originally constructed in 1966 with a 50-year service life. NRCS recently classified Pine Creek Dam No. 4 as a High Hazard Class dam. The current hazard classification is due to the presence of bridges, roads and buildings existing in the downstream dam breach inundation zone. The Project Need includes the following:

- Continue providing the current level of flood damage reduction downstream from the dam and address applicable NRCS and State of Tennessee standards and design criteria for public health and safety to reduce the risk of loss of human life.
- Continue providing source water for public water supplies.
- Continue providing fish and wildlife habitat.

1.5 OPPORTUNITIES

The following opportunities will be recognized by implementing an alternative that addresses the Project purpose and need. Quantification of these opportunities will be provided in other sections of this report as necessary.

- Comply with dam design and safety criteria established by NRCS.
- Minimize the potential for loss of life associated with a dam failure.
- Reduce Sponsor liability associated with operation of noncompliant dam.
- Maintain the current level of flood protection for downstream agricultural land, houses, businesses, and infrastructure.
- Protect real estate values by providing flood protection for a 100-year, 24-hour flood event.

2.0 SCOPE OF THE PLAN

2.1 SCOPING PROCESS

A scoping process identified issues of economic, environmental, cultural, and social concerns related to the Project. Concerns of the Sponsor and local citizens were expressed at planning and at public meetings of the Town of Oneida. Factors that affect soil, water, air, plant, and animal resources were identified by engineers, biologists, economists, resource conservationists, water quality specialists, and others. The scoping process of the Environmental Assessment for the dam involved site investigations, public meetings, and consultations with jurisdictional agencies.

The scoping process identified (1) the objectives, needs, and primary concerns for the Sponsor, (2) the relevant issues, and (3) the environmental concerns associated with the Project.

2.2 IDENTIFIED RESOURCE CONCERNS

Table 2-1 identifies the primary Resource Concerns based on the National Watershed Program Manual, Part 501.24 and the additional Resource Concerns included in the Project Scope-of-Work. Relevancy to the proposed action was determined when sufficient rationale was provided. Irrelevant concerns are eliminated from further consideration. Relevant resource concerns were reviewed in detail for the alternatives comparison.

Table 2-1
Summary of Scoping

Resource Concern	Relevant to Proposed Action	Rationale
National Economic Development (NED)	Yes	• Pine Creek Watershed Dam No. 4 is one of 4 planned floodwater retarding dams in the Pine Creek Watershed designed to reduce floodwater damage. Keeping and maintaining Pine Creek Watershed Dam No. 4 provides positive impact to NED by serving to reduce flood damage. • Adverse NED effects result without the Project.
Air Quality/Clean Air Act	No	• The proposed action or alternatives are located within Scott County, Tennessee which is currently within attainment status. • There will be some temporary effects during construction (dust and exhaust).
Coastal Zone Management Areas	No	• Pine Creek Watershed Dam No. 4 is not located in an area subject to the Coastal Zone Management regulations.
Coral Reefs	No	• No coral reefs of associated water bodies (e.g. embayment areas) are present in or near the planning area.

Resource Concern	Relevant to Proposed Action	Rationale
Cultural Resources	Yes	• A Phase I Archaeological Review was completed for the Project Area of Potential Effect (APE). No archaeological resources were identified. • Cultural resources may be affected by some alternatives.
Ecological Critical Areas	No	• There are no critical habitat areas within the Project area. • Ecological Critical Areas would not be affected by proposed action or alternatives.
Endangered and Threatened Species	Yes	• Some alternatives have the potential to affect federally- or state-listed threatened or endangered species. • No federally-listed threatened or endangered species are known to occur within the Project area, but specific surveys have not been conducted as part of this study.
Environmental Justice	Yes	• The Project area does not contain a disproportionate population of minority individuals. • Approximately 20% of the residents in Census Tract 9751 are below the poverty level. • Some minority or low-income individuals could be directly or indirectly affected by some alternatives.
Erosion and Sedimentation	Yes	• Sedimentation accumulations have occurred behind the impoundment. • Potential erosion during construction could temporarily affect North Fork Pine Creek.
Essential Fish Habitat	No	• There are no essential fish habitats within the Project area.
Fish and Wildlife	Yes	• Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake provide habitat for fish and other wildlife.
Floodplain Management	Yes	• The breach inundation area includes portions of the 100-year floodplain downstream of Pine Creek Watershed Dam No. 4. • The dam is located within a FEMA-Zone X which is in an area outside of the 0.2-percent-annual-chance floodplain. • The purpose of Pine Creek Watershed Dam No. 4 is to reduce flooding losses in downstream communities.
Floodwater Damage	Yes	• The purpose of Pine Creek Watershed Dam No. 4 is to provide flood protection for residents, motorists, and other persons using downstream facilities, while minimizing the threat of loss of life or unsafe conditions from a dam failure.
Forest Resources	No	• It is not expected that the Project or alternatives would have an impact on forest resources.

Resource Concern	Relevant to Proposed Action	Rationale
Invasive Species	Yes	• Seventy-three exotic species are known to occur in Scott County, Tennessee. • It is likely that invasive species or possibly noxious weeds are within or adjacent to the Project area. • Construction activities have the potential to introduce invasive species.
Land Use	Yes	• Pine Creek Watershed Dam No. 4 was designed and constructed to prevent flood damage to downstream areas. • Land use has been planned under the premise that the dam would be retained. • Loss of the dam would significantly impact land use in the downstream benefit area.
Migratory Bird Treaty Act / Bald and Golden Eagle Protection Act	Yes	• Project area provides habitat for migratory birds. • Bald Eagles have been observed flying above the Project area.
Natural Areas	No	• The Project area is not situated within a designated Natural area.
Parklands	No	• Pine Creek Watershed Dam No. 4 and the immediate watershed area are not within a designated park area. • No effect to park land is expected.
Plants – Degraded Plant Condition	Yes	• Construction will permanently remove vegetation from the dam and auxiliary spillway.
Prime and Unique Farmlands	Yes	• Prime farmland is located within the Benefit area.
Public Health and Safety	Yes	• 46 residential and 21 commercial structures are subject to flooding during a breach of the dam. • The purpose of Pine Creek Watershed Dam No. 4 is to provide flood protection up to the 100-year flood to downstream residences, road networks, and other facilities.
Regional Water Resources Plans	Yes	• The Project site is located in the South Fork Cumberland River Watershed – Watershed Water Quality Management Plan.
Riparian Areas	Yes	• Riparian areas associated with Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake may be affected by the proposed action or alternatives.
Scenic Beauty	Yes	• The Project site is located in a region of Tennessee known for its scenic beauty. • The scenic quality of the general landscape may be affected by some of the alternatives.
Scientific Resources	No	• No scientific resources are known to be in or near the Project area.

Resource Concern	Relevant to Proposed Action	Rationale
Sole Source Aquifers	No	• The Project is not included in a sole source zone.
Social Issues	Yes	• The land surrounding Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake is privately owned small tracts. • The proposed action or alternatives could affect certain recreational activities of the adjacent land owners. • Other social issues that could be affected include public health and safety, and flood damage.
Soil – Soil Quality Degradation	No	• The Project or alternatives would not have an impact on soil quality.
Water-Based Recreation	Yes	• Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake provide water-based recreation in the form of fishing. • The proposed action or alternatives could affect the type and level of water-based recreation opportunities that are available at the site.
Water Quality	Yes	• Raising the lake level could decrease the distance between surface water and existing septic systems. • Downstream water quality could be affected during construction.
Water Resources	Yes	• Pine Creek Watershed Dam No. 4, Howard H. Baker Senior Lake, and the surrounding areas provide water resources. • Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake provide water source for the Town of Oneida, Tennessee.
Waters of the United States/Clean Water Act	Yes	• North Fork Pine Creek, as well as the lake and wetlands upstream of Pine Creek Watershed Dam No. 4, will likely be considered “Waters of the U.S.” and regulated under Sections 404 and 401 of the CWA. • Impacts to Waters of the U.S. require a permit from the USACE and a Water Quality Certification (WQC) from the State. • North Fork Pine Creek is listed on Tennessee’s 303 (d) list as impaired due to "not supporting" use designation. • Wetlands and surface water quality could be affected by some alternatives.
Wetlands	Yes	• Wetlands are present along portions of the perimeter of the lake and would be affected by Project alternatives. • The proposed action or alternatives could affect wetlands within the Project area.
Wild and Scenic Rivers	No	• Pine Creek is neither a federally-listed nor a state-listed Wild and Scenic River.

Source: Amec Foster Wheeler, Resource Inventory-DRAFT, Howard H. Baker Sr. Lake/Dam No. 4 (February 2014)

3.0 AFFECTED ENVIRONMENT

Information regarding the affected environment for Pine Creek Watershed Dam No. 4 was acquired from a report titled, Resource Inventory, Howard H. Baker Sr. Lake/Dam No. 4, Oneida, Scott County, TN, Amec Foster Wheeler (February 2014).

Unless otherwise noted in the following sections, future conditions are projected to remain unchanged.

Additional information regarding the affected environment of the Pine Creek Watershed can be found in the Pine Creek Watershed Work Plan. Conditions that have changed specific to Pine Creek Watershed Dam No. 4 are provided below.

3.1 PROJECT SETTING

Pine Creek Watershed Dam No. 4 is located in Scott County, Tennessee, on North Fork Pine Creek approximately 1.5 miles west northwest of Oneida, Tennessee. Its geographic coordinates are 36°30'27.75" North Latitude and 84°32'24.74" West Longitude (see Project Location Map in Appendix B). The dam is situated at approximately 1460 feet above mean sea level.

Scott County lies entirely within the Cumberland Plateau and Mountains Major Land Resource Area. The western part of Scott County is in the Cumberland Plateau portion, and the eastern part is in the Wartburg Basin of the Cumberland Mountains. The Cumberland Plateau consists of broad rolling flats dissected by dendritic drainageways. The Cumberland Mountains area is comprised of steep, high mountains with narrow, uneven tops and narrow intermountain valleys.

Pine Creek Watershed Dam No. 4 was designed and constructed under the supervision of the USDA Natural Resources Conservation Service (NRCS, formerly USDA Soil Conservation Service, SCS) in 1966. Pine Creek Watershed Dam No. 4 drainage area encompasses 1.40 square miles. Pine Creek Watershed Dam No. 4 has a length of 410 feet, is 34 feet high, and has created a 53-acre impoundment. The maximum depth of the impoundment is 26 feet. Pine Creek Watershed Dam No. 4 has a flood water storage capacity of approximately 407 acre-feet. The dam discharges into North Fork Pine Creek which subsequently flows into Pine Creek downstream from the dam. The purpose and objective for the construction of Pine Creek Watershed Dam No. 4 was to provide flood control for Pine Creek, municipal water supply for the Town of Oneida, and wildlife development.

3.2 SOILS

A current soil survey report obtained from the USDA NRCS Web Soil Survey indicates that there are five (5) soil map units within the defined study area. For the purposes of this resource (e.g. soils) the defined study area encompasses the watershed drainage area for Pine Creek Watershed Dam No. 4 and downstream along the North Fork Pine Creek to the confluence with Pine Creek. The predominant soils groups are the Allegheny-Cotaco-complex, Gilpin silt loam and Wernock silt loam. Table 3-1 summarizes the soil units present within the defined study area.

Table 3-1
Summary of Soil Units within Project Study Area

Soil Map Unit Name	Soil Map Unit Symbol	K Factor Erosion Potential*	Prime Farmland**	Hydric Soil
Allegheny-Cotaco complex, occasionally flooded	Ac	.32	All areas are Prime Farmland	2
Bethesda-Mines pit complex, 10 to 80 percent slopes	Bm	.28	Not Prime Farmland	0
Gilpin silt loam, 5 to 12 percent slopes	GnC	.37	No	No
Gilpin silt loam, 12 to 20 percent slopes	GnD	.37	No	No
Gilpin-Petros complex, 20 to 35 percent slopes	GpE	.32	No	No
Lily loam, 2 to 5 percent slopes	LbB	.28	PFL	No
Lily loam, 12 to 20 percent slopes	LbD	.28	No	No
Pope-Philo complex, frequently flooded	Pp	.37	PFL	Partial
Shelocta silt loam, 5 to 12 percent slopes	ShC	.32	No	No
Shelocta silt loam, 12 to 20 percent slopes	ShD	.32	No	No
Water	W		No	No
Wernock silt loam, 2 to 5 percent slopes	WrB	.37	PFL	No
Wernock silt loam, 5 to 12 percent slopes	WrC	.37	No	No

Notes: * K Factor Erosion Potential indicates the soil unit's susceptibility to sheet and rill erosion, K Factor < .39 = Not Susceptible to Erosion; K Factor > .39 = Susceptible to Erosion.
** PFL Indicates Prime Farmland

Source: USDA-NRCS Web Soil Survey, Custom Soil Report (October 2014)

3.3 Soil Erosion and Sedimentation

The sediment survey was initially conducted by Amec on February 27, 2014. The volume of measured accumulated sediment below the lower usable water supply intake elevation of 1452.6 feet, is 43.7 acre-feet, since the construction of the dam. From this estimate the average annual sedimentation rate over 48 years was calculated as 0.91 acre-foot per year. Therefore, at the current sedimentation rate, the remaining life of the lower water supply intake is 71 years.

The volume of measured accumulated sediment below the upper usable water supply intake elevation of 1457.6 feet is 76.7 acre-feet, since the construction of the dam which was calculated as having an average annual sedimentation rate of 1.6 acre-feet per year. Therefore, at the current sedimentation rate of 1.6 acre-feet per year, the remaining life of the upper water supply intake is 114 years.

As the lower water supply pool has been filled only 40% and the upper water supply pool has been filled only 30% with sediment in the 48 years since construction, the water supply intake structures are expected to have an extended period of life and sedimentation is not considered a major factor in the water supply intake ability of the Project. The sediment may accumulate up to the lower water supply intake in 71 years.

The majority of soils within the watershed are susceptible to erosion due to slope and erodibility. Land use in this area primarily includes undeveloped forests, grasslands and pastures, and low-density residential areas.

Given the nature of the watershed, it is assumed that a substantial portion of the sedimentation is a result of gully and streambank erosion, although there may be sheet and rill erosion within the watershed that is also a source of sediment. There are no current on-site sheet or rill erosion issues, and no current ephemeral gully erosion issues identified. The presence of Pine Creek Watershed Dam No. 4 reduces the amount of sediment loadings downstream and the cost of removal of sediment from downstream bridges and culverts. Additionally, there has been no reporting of scour as an issue related to clear water scour.

3.4 WATER RESOURCES

North Fork Pine Creek is listed as an impaired stream by the Tennessee Department of Environment and Conservation (TDEC) and included on the Tennessee 303(d) list. North Fork Pine Creek (TN05130104048_0200) is designated as "not supporting" use due to *Escherichia coli* caused by on-site treatment systems (septic systems and similar decentralized systems).

Howard H. Baker Senior Lake currently provides municipal water supply storage for the Town of Oneida. The water is treated by standard water treatment processes prior to distribution and consumption.

Elevated Manganese levels in the reservoir cause detrimental effects on operation of the Town of Oneida water treatment plant. The elevated levels have been observed after reservoir inversions, which often occur in the fall of each year. Elevated levels reduce the flow rate through filtration processes and increase chemical demand (potassium permanganate) to oxidize the Manganese.

The Embankment and Geotechnical Evaluation, completed by Amec Foster Wheeler (Amec), documents the current water resources related to the dam.

Excessive Subsurface Water. The Project Team conducted a geotechnical investigation of the auxiliary spillway in March 2014. Five soil borings were advanced as part of the geotechnical investigation. Each of the borings was dry upon boring completion. Groundwater was encountered in one of the borings (B-1) after completing the coring at a depth of approximately 5.2 feet below ground surface. Based on this data, there does not appear to be an excessive subsurface water issue at Pine Creek Watershed Dam No. 4.

Excessive Seepage. The Project Team conducted seepage analyses as part of the geotechnical evaluation of the dam. The seepage analysis indicated that the phreatic surface does not reach the ground surface and does not produce exit gradients at the toe of the dam. This condition was consistent with on-site observations. Based on this data, there does not appear to be an excessive seepage issue at Pine Creek Watershed Dam No. 4.

Excessive Runoff, Flooding or Ponding. Pine Creek Watershed Dam No. 4 was constructed in 1966 as a multi-purpose dam to reduce flooding losses in the downstream communities. Currently, the dam controls runoff from a 1.4 square mile area up to the 100-year storm, and mitigates flood flows greater than that return period.

The Hydrologic Study, completed by Amec, documents the stream discharge with and without the Project. The peak in the stream reach downstream from the Pine Creek Watershed Dam No. 4 during the 100-year storm is 850 cfs. According to the current analysis of the existing dam, the peak flow from the principal spillway during the 100-year storm is 119.3 cfs and is contained in the channel just downstream of the dam. This means the presence of Pine Creek Watershed Dam No. 4 reduces the peak flow rate by 730 cfs, an 86% reduction.

A dam breach analysis was completed and evaluated the Probable Maximum Flood. A breach would impact several communities, including the Town of Oneida downstream from the dam site. Pine Creek Watershed Dam No. 4 is currently classified as a High Hazard Class dam, which is due to the presence of bridges, roads, and buildings existing in the downstream dam breach inundation zone.

Groundwater. Groundwater in Scott County is derived primarily from fractured rock aquifers and some unconsolidated deposits that are recharged locally from precipitation. No groundwater was encountered during subsurface explorations at the site.

Groundwater Quality. No specific information concerning the groundwater quality in the immediate location of Pine Creek Watershed Dam No. 4 is available. There is no available information regarding groundwater monitoring wells at the specific dam location.

Water Supply. The current Howard H. Baker Senior Lake and Pine Creek Watershed Dam No. 4 reservoir supplies approximately 54 percent of the water for the Town of Oneida for the 7-year period of record provided. This reservoir supplies approximately 1.1 million gallons of raw water per day. Future demand for water supply is not expected to significantly increase due to the population increases projected through 2030.

3.5 BIOLOGICAL RESOURCES

Plant Conditions. Vegetation across the Project area is healthy, in general, and not in a degraded condition. Vegetation along the Pine Creek Watershed Dam No. 4 embankment and auxiliary spillway is maintained grass which transitions into brush vegetation before giving over to the tree line. No degraded plant conditions were observed.

The Project area also includes riparian areas along the border of the lake as well as along North Fork Pine Creek and tributaries flowing into the lake. Based on the site reconnaissance on January 30, 2014, the lake is primarily surrounded by a combination of upland pine forests, upland mixed forests, upland deciduous forests, and grassland, including maintained lawns. Tree species observed along the perimeter of the lake include: Virginia pine (*Pinus virginiana*), Eastern white pine (*Pinus strobus*), American holly (*Ilex opaca*), American beech (*Fagus grandifolia*), sassafras (*Sassafras albidum*), sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and various oaks, including white oak (*Quercus alba*) and chestnut oak (*Quercus montana*). As discussed above, there are a few areas of herbaceous and scrub-shrub wetlands along the portions of the perimeter of the lake which were dominated by willow, alder, buttonbush, and various sedges and rushes. Forests surrounding the lake provide habitat for various terrestrial wildlife species common to the area.

Fish and Wildlife. The Project area provides habitat for migratory birds. During the site reconnaissance on January 30, 2014, a bald eagle was observed flying over the lake, but no nests were observed. Coordination with United States Fish and Wildlife Service (USFWS) will ensure that the Project will not negatively affect bald eagles.

Fish and wildlife resources include native or naturalized plants and animals, and the habitats in which they occur. The Project footprint and adjacent areas generally consist of previously disturbed lands associated with the dam, open fields, and woodlands. As a result, nearby vegetation communities comprise a mix of native and non-native plant species.

Howard H. Baker Senior Lake and surrounding areas provide habitat for a variety of fish and wildlife, including a warm-water fishery (including but not limited to bluegill, largemouth bass and other sunfish species, and catfish), waterfowl and other migratory birds, and common terrestrial wildlife such as deer, turkey, quail, rabbit, and squirrel. Additionally, the presence of the dam allows for the augmentation of stream flow to downstream portions of North Fork Pine Creek during dry conditions. Although a species survey was not conducted, species observed on the lake during the site reconnaissance on January 30, 2014 include: great blue heron (*Ardea herodias*), redhead (*Aythya americana*), and American coot (*Fulica americana*).

The lake may also be used for recreational fishing and non-consumptive uses such as bird watching.

3.6 ENERGY

Pine Creek Watershed Dam No. 4 is neither used for energy production nor do operations there require the consumption of energy other than the occasional mowing maintenance activities. This resource area is not applicable for this Project.

3.7 HUMAN, ECONOMIC, AND SOCIAL CONSIDERATIONS

Social Conditions. The Project site is located in a rural area of Scott County, Tennessee. The land use in the Project drainage area is primarily rural residential and undeveloped forests. Table 3-2 provides relevant information regarding the social and economic conditions in the study area.

Table 3-2
Social and Economic Profile

Beneficiary	Town of Oneida[1]	Scott County[1]	Tennessee[1]	U.S.[1]
Population	3,771	22,191	6,346,105	308,745,538
Median Age	38.4 years	37.9 years	38.0 years	37.2 years
Per Capita Income	$17,255	$18,840	$24,678	$27,915
Median Household Income	$26,250	$29,294	$44,297	$52,762
Total Number of Households	1,599	8,439	2,493,552	114,761,359
Median Value of Housing Units	$86,500	$79,700	$138,400	$186,200
Percent of Families Living Below Poverty Level	24.4%	21.8%	13.3%	10.5%

[1] Source: United States Census Bureau, Census 2010
http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t&keepList=t#

Land Use and Land Cover. The land use in the watershed is predominantly forest and grassland.

Public Health and Safety. Pine Creek Watershed Dam No. 4 was designed in 1964 and construction was completed in 1966. The Town of Oneida is the Sponsor for this dam and is responsible for the operation and maintenance of the facility.

Pine Creek Watershed Dam No. 4 has been maintained in accordance with the O&M agreement. During the dam inspection in 2008 and the site walk conducted on May 9, 2014, it was determined that the structure was in satisfactory condition with no additional maintenance actions required on the part of the Sponsor.

46 residential and 21 commercial structures are within the breach inundation area. Additionally, the dam currently reduces flooding downstream for high frequency events up to and including the 100-year storm.

Labor. There will be differences in labor requirements for alternatives as related to O&M and perhaps flood recovery. The labor needed to maintain the dam and reservoir is estimated as the equivalent of 1 full-time staff, which includes grounds maintenance, and other miscellaneous maintenance services.

Management Level. There are differences in management requirements between alternatives. The dam owner has sufficient education and experience to manage and maintain the dam and reservoir; in its current configuration. However, a consulting firm has been engaged for professional engineering services. The effort to provide management is estimated at 0.5 full-time staff for the current configuration and operation.

3.8 SPECIAL ENVIRONMENTAL CONCERNS

Clean Air Act. The Project is not located in a "nonattainment" area for any of the criteria pollutants (http://www.epa.gov/oaqps001/greenbk/ancl.html). Scott County, Tennessee is in “attainment” for all criteria pollutants. Additionally, the Project area is not within a “Class I Area” as identified in 40 CFR Part 81.

Clean Water Act/Waters of the United States. Based on maps in the Watershed Work Plan for the Pine Creek Watershed (1961), Dam No. 4 was constructed across North Fork Pine Creek. According to the United States Geological Survey (USGS) topographic map (Oneida North, 2013), Cotton Creek, North Fork Pine Creek, and an additional unnamed tributary flow into Howard H. Baker Senior Lake. North Fork Pine Creek flows from the dam southeast to its confluence with Pine Creek, which continues in a southwesterly direction. Refer to Figure B-3 – Project Site Map.

Howard H. Baker Senior Lake, and the contributing stream (North Fork Pine Creek), are likely jurisdictional "Waters of the United States." Additionally, any wetlands adjacent to these features would be considered jurisdictional "Waters of the United States." The National Wetlands Inventory (NWI) map identifies Howard H. Baker Senior Lake as L1UBHh (Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded) with PEM wetlands (Palustrine Emergent wetlands) located at the tips of the fingers of the lake.

North Fork Pine Creek (TN05130104048_0200) is designated as "not supporting" use due to Escherichia coli caused by on-site treatment systems (septic systems and similar decentralized systems).

***Coastal Zone Management*.** The Pine Creek Watershed Dam No. 4 is not located in an area subject to Coastal Zone Management regulations.

Coral Reefs. The Pine Creek Watershed Dam No. 4 is not located in an area subject to coral reef protection regulations.

Cultural Resources/Historic Properties. In January 2014, the Project Team conducted a Phase I archaeological survey for the proposed improvements on Pine Creek Watershed Dam No. 4. This survey was conducted to assess the potential impact on archaeological resources by the proposed activities. The Area of Potential Effect (APE) for the archaeological survey consisted of four impact areas adjacent to the dam including the auxiliary spillway, the toe slope immediately south of the dam, and a 19.68-foot buffer surrounding the current pool level of Howard H. Baker Senior Lake. The entire APE encompasses approximately 11.57 acres. Pedestrian reconnaissance, coupled with shovel test probe (STP) excavation, was used to investigate the APE following federal and state guidelines. No archaeological sites or cultural remains were identified during the survey. No further archaeological work is recommended in association with the proposed undertaking.

Endangered and Threatened Species. The Project Team conducted a review of the potential presence of threatened or endangered plant species and/or special concern species within the study area. The species of concern potentially within Scott County, Tennessee are listed on Table 3-3. Specific surveys were not completed for the Project area; however, potential Indiana bat and Northern long-eared bat habitat (i.e., snags) was observed along the perimeter of the lake during the field reconnaissance on January 30, 2014. No federally-designated critical habitat is present within the Project footprint.

Table 3-3
Federally- and State-listed Species Listed for Scott County, Tennessee

Scientific Name	Common Name	Federal Status	State Status	Habitat
Plants				
Ageratina luciae-brauniae	Lucy Braun's White Snakeroot	--	T	Rockhouses
Berberis canadensis	American Barberry	--	S	Rocky woods and river bars
Botrychium jenmanii	Alabama Grapefern	--	T	Pine woods
Bryoxiphium norvegicum	Sword Moss	--	T	Sandstone rockhouses and shaded outcroppings
Calamovilfa arcuata	Cumberland Sand-Grass	--	T	Rocky and sandy river bars
Cardamine rotundifolia	Round-leaf Watercress	--	S	Mucky wetlands and seeps
Carex echinata ssp. echinata	Little Prickly Sedge	--	S	Swamps and bogs
Chrysogonum virginianum	Green-and-gold	--	T	Dry woods and openings
Comptonia peregrina	Sweet-fern	--	E	Rocky, sandy stream-sides
Conradina verticillata	Cumberland Rosemary	LT	T	Sandy, rocky river banks and bars
Corallorhiza maculata	Spotted Coralroot	--	T	Shady, moist woods
Corydalis sempervirens	Pale Corydalis	--	E	Dry or rocky woods
Cypripedium kentuckiense	Southern Lady's-slipper	--	E	Riparian forests
Eriophorum virginicum	Tawny Cotton-grass	--	E	Bogs
Eurybia saxicastellii	Rockcastle Aster	--	E	Rocky river bars
Fothergilla major	Mountain Witch-alder	--	T	Rocky slopes and river banks
Helenium brevifolium	Shortleaf Sneezeweed	--	E	Rocky, sandy streamsides
Hexastylis virginica	Virginia Heartleaf	--	S	Sandy or rocky woods
Hydrocotyle americana	American Water-pennywort	--	E	Wet soils and pools

Scientific Name	Common Name	Federal Status	State Status	Habitat
Hymenophyllum tayloriae	Taylor's Filmy Fern	--	S	Moist rockhouses
Hypericum nudiflorum	Early St. Johnswort	--	S	Acidic wet and/or open areas
Juglans cinerea	Butternut	--	T	Rich woods and hollows
Lejeunea blomquistii	Blomquist Leafy Liverwort	--	S	Mid elev. Gorges on rock or bark
Lilium philadelphicum	Wood Lily	--	E	Dry openings, powerlines
Marshallia grandiflora	Large-fl. Barbara's-buttons	--	E	Rocky river bars
Microlejeunea globosa	Cardot's Lejeunea	--	S	Creekside edge of rockhouse
Minuartia cumberlandensis	Cumberland Sandwort	LE	E	Rockhouses
Monotropsis odorata	Sweet pinsap	--	T	Piney woods
Panax quinquefolius	American Ginseng	--	S/CE	Rich woods
Pellia appalachiana	A Liverwort	--	S	Wet soil, barrens
Phemeranthus teretifolius	Roundleaf Fameflower	--	T	Dry sandy rock outcrops
Platanthera cristata	Yellow Crested Orchid	--	S	Acidic seeps and stream heads
Platanthera integrilabia	White Fringeless Orchid	C	E	Acidic seeps and stream heads
Potamogeton tennesseensis	Tennessee Pondweed	--	T	Slow acidic streams
Rhynchospora harveyi	Harvey's Beakrush	--	T	Barrens and other open areas
Solidago arenicola	Southern racemose goldenrod	--	S	Rocky river bars
Spiraea virginiana	Virginia Spiraea	LT	E	Stream bars and ledges
Stenanthium diffusum	Cumberland featherbells	--	E	Rockhouses
Thuja occidentalis	Northern White Cedar	--	S	Calcareous rocky seeps, cliffs
Trichomanes boschianum	Bristle-fern	--	T	Rocky seeps

Scientific Name	Common Name	Federal Status	State Status	Habitat
Birds				
Dendroica cerulea	Cerulean Warbler	--	D	Mature deciduous forest, particularly in floodplains or mesic conditions.
Limnothlypis swainsonii	Swainson's Warbler	--	D	Mature, rich, damp, deciduous floodplain and swamp forests.
Vermivora chrysoptera	Golden-winged Warbler	--	D	Early successional habitats in foothill regions of Appalachians.
Mammals				
Myotis septentrionalis	Northern Long-eared bat	LT	--	Hibernates in caves; spring/summer maternity roosts are normally under the bark of standing trees or in cavities or crevices.
Myotis sodalis	Indiana bat	LE	E	Hibernates in caves; spring/summer maternity roosts are normally under the bark of standing trees.
Neotoma magister	Allegheny Woodrat	--	D	Outcrops, cliffs, talus slopes, crevices, sinkholes, caves and karst.
Reptiles				
Ophisaurus attenuatus longicaudus	Eastern Slender Glass Lizard	--	D	Dry upland areas including brushy, cut-over woodlands and grassy fields; nearly statewide but obscure; fossorial.
Amphibians				
Desmognathus welteri	Black Mountain Salamander	--	D	Spring runs and permanent streams in wooded mountainous terrain; northern Cumberlands.
Hemidactylium scutatum	Four-toed Salamander	--	D	Woodland swamps, shallow depressions, & sphagnum mats on acidic soils; middle and east Tennessee.
Fish				
Chrosomus cumberlandensis	Blackside Dace	LT	T	Small upland tributaries with sand, sandstone, and shale substrates in unsilted conditions; upper Cumberland River Watershed.
Chrosomus saylori	Laurel Dace	LE	E	Cool 1st-2nd order streams with slabrock and rubble substrate; Walden Ridge of the Cumberland Plateau; Tennessee River watershed.

Scientific Name	Common Name	Federal Status	State Status	Habitat
Erimonax monachus	Spotfin chub	LT	T	Clear upland rivers with swift currents and boulder substrates; portions of the Tennessee River Watershed.
Etheostoma baileyi	Emerald Darter	--	D	Creeks and small rivers with riffles containing gravel or rubble; upper Cumberland drainage.
Etheostoma cinereum	Ashy Darter	--	T	Small to medium upland rivers with bedrock or gravel substrate and boulders.
Etheostoma lemniscatum	Tuxedo Darter	LE	E	Gently flowing, silt-free pools or runs immediately upstream of riffles with cobble, boulders, and slabrock; Big South Fork Cumberland River.
Etheostoma sagitta	Arrow Darter	C	D	Smaller streams of northern Cumberland Plateau & Cumberland Mountains; Cumberland River watershed.
Etheostoma susanae	Cumberland Darter	LE	E	Creeks in the upper Cumberland River watershed of the Cumberland Mountains; extremely rare.
Etheostoma tippecanoe	Tippecanoe Darter	--	D	Medium to large rivers in shallow riffle areas containing fine cherty gravel; Cumberland River watershed.
Ethostoma percnurum	Duskytail Darter	LE	E	Gently flowing pools near riffles; larger creeks and medium size rivers; Tennessee and Cumberland River drainages.
Notropis rubellus	Rosyface Shiner	--	D	Clear, swift, large creeks with bottoms of clean gravel or rubble; tributaries to Cumberland River upstream Cumberland Falls.
Percina squamata	Olive Darter	--	D	Small-medium rivers; in strong flowing chutes with rubble/boulders in high-gradient streams; portions of upper Tennessee and Cumberland river systems.
Mollusks				
Alasmidonta atropurpurea	Cumberland Elktoe	LE	E	Small creeks to medium-sized rivers with slow current, sand substrates, and large cobble; upper Cumberland River watershed.

Scientific Name	Common Name	Federal Status	State Status	Habitat
Epioblasma brevidens	Cumberlandian Combshell	LE	E	Large creeks to large rivers, in coarse sand or mixtures of gravel, cobble, or rocks; Tennessee and Cumberland river systems.
Epioblasma florentina walkeri	Tan Riffleshell	LE	E	Found in river headwaters, in riffles and shoals in sand and gravel substrates; Tennessee and Cumberland river systems.
Fusconaia cuneolus	Finerayed Pigtoe	LE	E	Riffles of fords and shoals of mod gradient streams In firm cobble and gravel substrates; Middle and Upper Tennessee River watershed.
Lampsis virescens	Alabama Lampmussel	LE	E	Found in sand and gravel substrates in shoal areas of small-medium size rivers; middle and upper Tennessee River system; poss extirpated in Tennessee.
Pegias fabula	Littlewing Pearlymussel	LE	E	Cool, clear, high-gradient streams in sand, gravel, and cobble substrates, riffles; portions of Cumberland and Upper Tennessee River systems.
Villosa perpurpurea	Purple bean	LE	E	Creeks to medium-sized rivers, headwaters, in riffles with coarse sand and gravel & some silt; Upper Tennessee River watershed.
Villosa trabalis	Cumberland Bean	LE	E	Riffle areas of small rivers & streams in sand, gravel, and cobble substrates with swift current; Upper Cumberland and Upper Tennessee River systems.
Crustaceans				
Cambarus bouchardi	Big South Fork Crayfish	--	E	Small to medium sized streams under rock cover; Roaring Paunch Creek & tributaries (Big South Fork watershed); tertiary burrower.

KEY:	
FEDERAL STATUS	
CODE	**DESCRIPTION**
LE – Listed Endangered	Taxon is threatened by extinction throughout all or a significant portion of its range.
LT – Listed Threatened	Taxon is likely to become an endangered species in the foreseeable future.
C – Candidate species***	Taxon for which the USFWS has sufficient information to support proposals to list the species as threatened or endangered, and for which the Service anticipates a listing proposal.
STATE STATUS	
CODE	**DESCRIPTION**
D – Deemed in Need of Management	Any species or subspecies of nongame wildlife which the executive director of the TWRA believes should be investigated in order to develop information relating to populations, distribution, habitat needs, limiting factors, and other biological and ecological data to determine management measures necessary for their continued ability to sustain themselves successfully. This category is analogous to Special Concern.
E – Endangered	Any species or subspecies whose prospects of survival or recruitment within the state are in jeopardy or are likely to become so within the foreseeable future.
T – Threatened	Any species or subspecies that is likely to become an endangered species within the foreseeable future.
S – Special Concern	Any species or subspecies of plant that is uncommon in Tennessee, or has unique or highly specific habitat requirements or scientific value and therefore requires careful monitoring of its status.
CE – Commercially Exploited	Due to large numbers of plants being taken from the wild and propagation or cultivation insufficient to meet market demand. These plants are of long-term conservation concern, but the Division of Natural Heritage does not recommend they be included in the normal environmental review process.
Sources: Tennessee Department of Environment & Conservation, Natural Heritage Program (http://www.tn.gov/environment/article/na-environmental-reviews), accessed: August 31, 2015; U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC) report (JNNM4-TXREN-EBRL4-KRF7W-MLNRRU, generated August 31, 2015)	

Environmental Justice. Based on the U.S. Environmental Protection Agency's (USEPA's) EJView (2010 Census data), formerly known as the Environmental Justice Geographic Assessment Tool, the Project area contains a relatively low minority population (0 – 10%). The Project area is located in Census Tract 9751 and has a minority population of approximately 2% according to 2010 US Census data. Approximately 20% of the residents in Census Tract 9751 are below the poverty level. As a comparison, Scott County has a minority population of approximately 2% and approximately 25% of its residents are below the poverty level.

Essential Fish Habitat. There are no Essential Fish Habitats in the Pine Creek Watershed Dam No. 4 drainage area.

Floodplain Management. The drainage area of the dam, the Project footprint and the floodplain immediately downstream of the dam are located within a Zone X, which is an area determined to be outside of the 0.2-percent-annual-chance floodplain as shown on the FEMA Flood Insurance Rate Map No. 47151C0070C, Effective September 28, 2007. Approximately 3,000 feet downstream of the dam the floodplain is designated as Zone A (an area designated as a Special Flood Hazard Area subject to flooding by the 1-percent-annual-chance flood, with no base flood elevations determined). A copy of the pertinent area of the FIRM is contained in Appendix B and can be found at the web address: http://msc.fema.gov/portal/search?AddressQuery=Oneida%2C%20TN

One of the primary purposes of the existing dam is flood control. The floodplain area below the dam includes approximately 229 acres, with approximately 134 acres of developed property being most susceptible to flood damage. The remaining area is pasture/hay land. These areas currently benefit from flood control provided by Pine Creek Watershed Dam No. 4.

***Invasive Species*.** Seventy-three exotic species are known to occur in Scott County, Tennessee. It is likely that invasive species or possibly noxious weeds are within or adjacent to the Project area; however, a specific survey has not been conducted.

Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act. Tennessee lies within the bird migratory route known as the Mississippi Flyway. Hundreds of bird species travel within this migration route. Birds protected under the Migratory Bird Treaty Act (MBTA) include common songbirds, raptors, waterfowl, shorebirds, seabirds and wading birds. The existing pool and adjacent areas upstream from the dam provide nesting, feeding, and resting habitat for migratory birds.

Although bald eagles are no longer protected by the Endangered Species Act (ESA), they are protected by the Bald and Golden Eagle Protection Act. No bald eagle nests were observed in the Project footprint; however, during the site reconnaissance on January 30, 2014, a bald eagle was observed flying over the lake.

Prime and Unique Farmlands. Based on USDA Scott County Soil Survey Maps, approximately 225 acres (~99%) within the benefit area are considered Prime Farmland (See Figure B-4 – Prime Farmland Map in Appendix B).

Riparian Areas. The Project area includes riparian areas along the border of Howard H. Baker Senior Lake, as well as along North Fork Pine Creek and tributaries flowing into the lake. Based on the site reconnaissance on January 30, 2014, the lake primarily is surrounded by a combination of upland pine forests, upland mixed forests, upland deciduous forests, and grassland, including maintained lawns. Tree species observed along the perimeter of the lake include: Virginia pine (*Pinus virginiana*), Eastern white pine (*Pinus strobus*), American holly (*Ilex opaca*), American beech (*Fagus grandifolia*), sassafras (*Sassafras albidum*), sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and various oaks, including white oak (*Quercus alba*) and chestnut oak (*Quercus montana*). As discussed above, there are a few areas of herbaceous and scrub-shrub wetlands along the portions of the perimeter of the lake which were dominated by willow, alder, buttonbush, and various sedges and rushes. Forests surrounding the lake provide habitat for various terrestrial wildlife species common to the area.

Howard H. Baker Senior Lake provides habitat for fish, waterfowl, and other wildlife. Although a species survey was not conducted, species observed on the lake during the site reconnaissance on January 30, 2014 include: great blue heron (*Ardea herodias*), redhead (*Aythya americana*), and American coot (*Fulica americana*).

Scenic Beauty. The Project site is located in a region of Tennessee known for its scenic beauty. Scott County is situated atop the Cumberland Plateau and the western foothills of the Appalachian Mountains. Howard H. Baker Senior Lake is nestled within a primarily rural landscape surrounded by a combination of forested slopes, open fields, and scattered homes.

Wetlands. The attached NWI map identifies Howard H. Baker Senior Lake as L1UBHh (Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded) with PEM wetlands (Palustrine Emergent wetlands) located at the tips of the fingers of the lake. The presence of wetlands was verified during the January 30, 2014 site reconnaissance, but wetland boundaries were not field-delineated. Based on site reconnaissance, the wetlands appear to be a mixture of PEM wetlands and PSS (palustrine scrub-shrub) wetlands. The following species were noted in wetland areas: willow (*Salix sp.*), hazel alder (*Alnus serrulata*), and buttonbush (*Cephalanthus occidentalis*), as well as various grasses, sedges, and rushes. No wetlands were observed in the immediate vicinity of the dam itself. Wetland and surface water boundaries are estimated and have not been field verified or approved by the United States Army Corps of Engineers (USACE).

***Wild and Scenic Rivers*.** Pine Creek is neither a federally-listed nor a state-Listed Wild and Scenic River.

3.9 OTHER CONCERNS

Recreation. The land at Pine Creek Watershed Dam No. 4 and the upgradient watershed area is owned by private individuals. Pine Creek Watershed Dam No. 4 is used for fishing by adjacent land owners. There is no public land in the watershed and no public access to Howard H. Baker Senior Lake.

A non-exclusive list of concerns is itemized in NRCS' Scope of Work for Architect and Engineering Services, Attachment 4 – NWPM 501.24 Public Participation, Section B. Scoping (August, 28, 2013) for the Pine Creek Watershed Dam No. 4 Project. The following resource concerns were determined as not relevant to the proposed action:

- Air Quality/Clean Air Act
- Coastal Zone Management
- Coral Reefs
- Ecological Critical Areas
- Energy – Inefficient Energy Use
- Essential Fish Habitat
- Forest Resources
- Natural Areas
- Parklands
- Scientific Resources
- Sole Source Aquifers
- Soil – Soil Quality Degradation
- Wild and Scenic Rivers

3.10 BACKGROUND AND STATUS OF DAM

Pine Creek Watershed Dam No. 4 is located within the Pine Creek Watershed on North Fork Pine Creek, which is a tributary to Pine Creek (See Figure 1). The dam was built in 1966 to provide flood protection, and water supply for the Town of Oneida, and fish and wildlife development. The dam consists of an earthen embankment with crest elevations between about 1473.1 feet and 1474.6 feet (both NAVD88 converted from NGVD29). The dam is about 450 feet long and up to 35 feet tall. The As-Built Drawings (USDA, 1966) indicate that the dam embankment was designed with a 14-foot-wide crest and 3H:1V (horizontal:vertical) upstream slopes and 3.5H:1V downstream slopes.

The principal spillway for the dam consists of a 30-inch reinforced concrete pipe that penetrates the dam. A concrete riser box is located at the upstream end of the pipe, and the box has a high stage inlet of elevation 1466.6 feet (NAVD88) with a notch on each side at elevation 1465.5 feet (NAVD88) which controls the current normal pool. The box has a low stage inlet of 1463.64 feet (NAVD88) which is currently closed. The principal spillway has a capacity of 105 cfs at the auxiliary spillway crest. The pipe drains through the dam embankment into a 200-foot-long outlet channel leading to the natural channel of North Fork Pine Creek downstream of the dam. The auxiliary spillway is located along the east abutment of the dam and directs flow towards the outlet channel downstream of the dam. The As-Built Drawings for Pine Creek Watershed Dam No. 4 indicate that construction of the embankment included a keyway and an interval of zoned fill. The keyway is located along the dam centerline and extends to varying depths within the bedrock. The bottom of the keyway is 12 feet wide and the side slopes are at a 2H:1V inclination. The zoned fill section consists of rock fill and is located beneath the landside slope of the dam. This section is 12 feet wide and inclined at a 3H:1V inclination. A foundation trench drain is located beneath the zoned fill section. The trench drain consists of a four-foot-wide trench that is up to five feet deep and was backfilled with sand. A collector pipe is located within the drain, and the pipe drains to the outlet channel for the primary spillway.

The dam was originally designed as a Significant Hazard Class dam with a 50-year service life and to meet the design standards in place at that time. NRCS recently classified Pine Creek Watershed Dam No. 4 as a High Hazard Class dam. This hazard classification is based on the presence of population, bridges, roads, and buildings located within the downstream dam breach inundation zone. Dam safety design standards are more stringent for high hazard class dams than those for significant hazard class dams, and have higher spillway capacity requirements.

The Town of Oneida requested and is receiving watershed rehabilitation assistance from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) for Pine Creek Watershed Dam No. 4 through the NRCS Watershed Rehabilitation Program. This Planning Study began in November 2013 and is anticipated to be completed by April 2016.

Table 3-4 contains As-Built and existing data for Pine Creek Watershed Dam No. 4.

Table 3-4
As-Built and Existing Project Features

Feature	Pine Creek Watershed Dam No. 4 As-Built Condition [1]	Pine Creek Watershed Dam No. 4 Existing Condition
Statistics		
Year Completed	1966	1966
Actual Construction Cost	Unknown	Unknown
Purposes	Flood Control, Water Supply and Wildlife Development	Flood Control, Water Supply and Wildlife Development
NRCS Hazard Class	Significant	High
Drainage Area Controlled	1.4 Square Miles	1.4 Square Miles
AMC II Runoff Curve Number	73	70
Key design elevations [2]		
Crest of dam (embankment)	1473.1 feet	1473.1 feet
Crest of auxiliary spillway	1469.6 feet	1469.6 feet
Crest of the principal spillway	1465.5 feet	1465.5 feet
Crest of low stage inlet (principal spillway, closed as noted in As-Built drawings)	1463.6 feet	1463.6 feet
Embankment		
Dam height	36 feet	36 feet
Dam length	400 feet	400 feet
Embankment volume	43,648 cubic yards	43,648 cubic yards
Upstream side slopes	3.5H:1V	3.5H:1V
Downstream side slopes	3H:1V	3H:1V
Top width	14 feet	14 feet
Auxiliary spillway		
Type	Vegetated earth	Vegetated earth
Bottom width	40 feet	40 feet
Design capacity	2,298 cfs	2,298 cfs

Feature	Pine Creek Watershed Dam No. 4 As-Built Condition [1]	Pine Creek Watershed Dam No. 4 Existing Condition
Principal spillway		
Type	Reinforced Concrete Pipe	Reinforced Concrete Pipe
Diameter	30-inch	30-inch
Capacity (at auxiliary spillway)	105 cfs	105 cfs
Storage capacities		
Total storage (at auxiliary	892 acre-feet	780 acre-feet
Flood detention storage	407 acre-feet	359 acre-feet
Water supply storage	485 acre-feet	421 acre-feet

[1] Source: Pine Creek Watershed Dam No. 4 As-Built Plans and Design Folder.
[2] Vertical Datum NAVD88

3.11 CURRENT CONDITION OF DAM

The Embankment and Geotechnical Evaluation, completed by Amec Foster Wheeler (Amec), documents the current condition of the dam.

Amec conducted a visual survey of the site on May 9, 2014. They observed that the ground surface of the dam embankment was vegetated with turf-type grass. They also observed some bedrock outcrops along the auxiliary spillway. Amec stated that the surface drainage of the embankment was good (crest surface slopes slightly downward from centerline); and did not observe wet areas, puddles, or water-stained depressions on the dam during the exploration.

The Evaluation identified no indications of through-seepage or under-seepage exiting the ground surface along the downstream face of the dam. They did observe minor erosion of the dam's upstream slope between the existing lake level and the auxiliary spillway elevation. Amec Foster Wheeler noted that field observations were consistent with the design geometry shown on the As-Built Drawings.

3.12 PRINCIPAL SPILLWAY ASSESSMENT

The Pine Creek Dam Spillway Pipe Assessment Video Inspection, submitted by Amec Foster Wheeler, documents the principal spillway assessment.

The Project Team conducted a video (TV) inspection of the principal spillway as part of the documentation of the current conditions of Pine Creek Watershed Dam No. 4 on October 3, 2014.

Based on the visual inspection, the inlet and outlet of the principal spillway pipe are functioning properly. No cracks or corrosion were found. Slight evidence of abrasion was observed along the bottom of the pipe, and was consistent among all segments.

Using the on-board laser measurement device on the TV crawler, Amec measured the joint gaps of each of the 16 joints where visible. Overall, the joint measurements ranged from 0 mm (0 inches) to 2.80 mm (~1/10 inch), which is less than the maximum tolerable gap of ¼ inch.

The video inspection was evaluated using the procedure outlined in Evaluation of the Condition of Principal Spillway Conduits, J.K. Koelliker, A.N. Lin, C.H. Best. The procedure provides a visual rating system as a guide for the general evaluation of the existing condition of the conduit. The rating system evaluates four aspects of a pipe: cracking, corrosion, lining condition, and joint condition. Each aspect is rated on a scale of 0 (poorest) to 9 (best). The principal spillway conduit was given a rating of 8 out of 9 with an Estimate of Remaining Life (ERL) of 90 years and a Time To Next Inspection (TTNI) of 20 years.

However, since the pipe is 48 years old, it is recommended that the outlet works system be replaced in order to upgrade the anti-seepage collars to a current-industry-standard drainage diaphragm. This upgrade can only be accomplished by excavating the dam down to the principal spillway outlet pipe grade.

3.13 Seepage Analysis

The Embankment and Geotechnical Evaluation, completed by Amec, documents the seepage analysis of the dam.

The seepage analyses at the two critical sections were performed based on finite element methods using Seep/W software in general accordance with Corps of Engineers documents Seepage Analysis and Control for Dams.

The seepage analysis at each critical section indicates that the phreatic surface does not reach the ground surface and does not produce exit gradients at the toe of the dam. This condition is consistent with our on-site observations. Therefore, each of the modeled sections produced a factor of safety with regard to seepage exit gradients greater than 5, as required.

3.14 Slope Stability

The Embankment and Geotechnical Evaluation, documents the slope stability of the dam.

The Project Team estimated the slope stability of the existing dam by numerically modeling a two-dimensional section through the embankment and subgrade using Geo-Slope International's Geo-Studio 2012 software entitled SLOPE/W and SEEP/W.

Three general cases were analyzed:

- Case A represents the condition of the dam with the lake level at the auxiliary spillway elevation in a steady state condition.
- Case B represents the same condition as Case A, but also includes applying a horizontal seismic force. The seismic force consists of a horizontal acceleration that is typically ⅓ to ½ of the PGA. We applied a horizontal seismic coefficient of 0.05g as recommended in Figure 4-1 of Earth Dams and Reservoirs. This seismic coefficient corresponds to about 40% of the PGA for the site (0.120g).
- Case C represents sudden drawdown of the lake from the auxiliary spillway elevation to the low stage inlet elevation of the principal spillway. To analyze a sudden drawdown condition, the Staged Undrained Strength Method proposed by Duncan, Wright, and Wong per Geo-Slope's built-in procedure was used.

The slope stability analyses indicate that the dam exceeds the required minimum factor of safety at the critical sections.

3.15 Status of Operation and Maintenance

The NRCS State Conservationist must verify that operation and maintenance is current prior to construction of the planned rehabilitation measures. The Sponsor is responsible for keeping the structure free of brush and trees, burrowing animals and recreational vehicle traffic.

There were no post-construction changes to the structure that influence the safety of the dam. No road cuts, quarries or mining activities were observed in the vicinity of the dam or reservoir. At the time of the site walk on May 9, 2014, the dam and associated structures were found to be functional and operation and maintenance current.

3.16 Breach Analysis and Hazard Classification

NRCS completed a dam assessment, hazard classification, and risk assessment for Pine Creek Watershed Dam No. 4 in December 2007. The hazard classification was based on results of a breach routing completed by NRCS in a separate study. Due to potentially habitable structures downstream, Pine Creek Watershed Dam No. 4 is classified as a High Hazard Class dam. Detailed discussions on the analyses, a presentation of results, and the inundation maps can be found in the stand-alone Breach Inundation Study and Assessment Report.

A dam breach analysis was performed to predict the extent of flooding from a catastrophic breach of Pine Creek Watershed Dam No. 4. The study utilized NRCS Technical Release 60 (TR-60) to produce a breach hydrograph. For the purposes of this study, the breach was assumed to occur with the water surface behind the dam equal to the maximum embankment height. The study illustrates the areas downstream of the dam that have the potential to flood in the event of a dam failure. The Breach Inundation Map is included in Figure C-1. The inundation area includes many residential and commercial properties in the inundation area, in addition to transportation infrastructure.

Pine Creek Watershed Dam No. 4 is currently classified as a High Hazard Class dam for NRCS purposes in that failure of this structure may cause loss of life, serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads. For the purposes of the State of Tennessee Safe Dams Act, the structure is considered a Small, Category 1 dam where failure would probably result in any of the following: loss of human life; excessive economic loss due to damage of downstream properties; excessive economic loss, public hazard, or public inconvenience due to loss of impoundment and/or damage to roads or any public or private utilities.

3.17 Potential Dam Failure Modes

The Project Team examined five potential modes of dam failure during the planning study. These include failure due to sedimentation, insufficient hydrologic capacity, seepage, seismic activity, and material deterioration, which are described below.

Sedimentation – No Risk. Sedimentation can fill the designed sediment pool, but will not encroach on the detention capacity. The Sedimentation Report, completed by Amec Foster Wheeler (April 2014) evaluates the current condition of sediment accumulation, the available flood storage and water supply capability, the future sediment accumulation rates, the future flood storage and the future water supply capability in the pool area. The report indicates that approximately 71 years of functional life remain for the sediment pool. Additionally, it will take approximately 114 years for submerged sediment to reach the upper water supply intake before starting to encroach on the flood detention pool. Consequently, sedimentation presents a minor risk failure mode for the dam.

Insufficient Hydrologic Capacity – High Risk. An auxiliary spillway breach or overtopping of the existing dam during a storm event can cause hydrologic failure. The integrity and stability of the auxiliary spillway is dependent upon depth, velocity, and duration of flow, the vegetative cover, and the embankment's resistance to erosion.

The dam was designed as a Significant Hazard Class dam and is currently classified as a High Hazard Class dam; consequently, the auxiliary spillway does not have adequate discharge capacity to prevent overtopping and may have limited resistance to erosion during the design storm event as evaluated by the SITES model. The principal spillways and auxiliary spillways may be considered inadequate according to current High Hazard Class dam design criteria. This deficiency, resulting from the upgraded design criteria, poses a high risk for hydrologic failure of the dam during extreme runoff events.

Seepage and Slope Stability – Low Risk. The Project Team analyzed the dam for slope stability using soil seepage and strength parameters from laboratory analysis in conjunction with published correlations and experience with similar soil types. Based upon the analysis, the slope stability and seepage analyses appear to indicate that the drainage system is operating properly. Based on the review of the available data, seepage and slope stability pose a low risk for failure of the dam.

Seismic Activity – Very Low Risk. The integrity and stability of an earthen embankment during seismic activity are dependent on the magnitude of the activity and the presence of unstable embankment or foundation material. Foundation movement through consolidation, compression, or lateral movement can create weak zones within the embankment where voids can form. This can cause conduit joint failure or collapse of the embankment.

Oneida is located within a relatively stable geological setting located west of the seismically active Appalachian Mountain region. The site is near Latitude 36.507791° north, Longitude 84.540128° west. Using the United States Geologic Service (USGS) web application and 2009 NEHRP Recommended Seismic Provisions, the peak ground acceleration (PGA) is 0.120g at the Project site.

The Watershed Work Plan for the Pine Creek Watershed (April 1961) indicates that the Pine Creek fault is located within the watershed. According to the Work Plan, the fault begins near the upstream end of the Pine Creek gorge and extends to the northeast about four miles to Oneida. The bedrock on the southeast side of the fault is dropped relative to the bedrock on the northwest side. Amec reviewed the previously referenced geologic map and observed a mapped unnamed fault that corresponds to the one mentioned in the Work Plan.

Material Deterioration – Low Risk. Based on the visual inspection, the inlet and outlet of the principal spillway pipe are functioning and there are no reported observations of cracking or deterioration of the conduits. Material deterioration poses a low risk of dam failure.

3.18 Consequences of Dam Failure

Inundation due to dam failure potentially has the following consequences.

Loss of Life. The breach inundation study indicates that a dam failure may result in inundation of residential structures and transportation facilities. The estimated Population at Risk for the dam is 5 and the associated Risk Index is 82.

Loss of Municipal Water Supply. Dam failure may result in loss of the storage function of the dam which provides water supply storage for the Town of Oneida.

Release of Harmful Materials. Large volumes of sediment and eroded embankment material released to the stream would harm water quality, degrade aquatic habitat and reduce downstream channel capacity. Further, the inundation area includes commercial and industrial land uses that may store hazardous materials.

Agricultural Damage. Flood damage and sedimentation may cause reduced productivity of agricultural land downstream from the structure.

Infrastructure Destruction. Residential dwellings, public buildings, fences, roads, bridges, public utilities, and farm equipment may be damaged or destroyed.

4.0 ALTERNATIVES

4.1 FORMULATION PROCESS

The following alternatives were considered in the development of this plan:

- ***No Action/Future Without Federal Project (FWOP)***
  The FWOP Alternative describes the most likely future condition that could be expected if NRCS takes no action. It describes what is most likely to happen in the absence of any developed federal alternative or changes in law or public policy.

  The FWOP is used to compare other alternatives to determine the magnitude of benefits and adverse effects. Clearly describing the FWOP condition provides the reference necessary to evaluate changes caused by the alternatives. The FWOP may or may not meet the purpose and need for federal action.

- ***Rehabilitation to NRCS High Hazard Class Dam***
  Rehabilitation Alternative includes federally-assisted upgrading of the existing dam to the most restrictive criteria of either the State of Tennessee or NRCS. Rehabilitation alternatives were evaluated to extend Project service life for an additional 70 years.

- ***Decommissioning of Dam***
  The Decommissioning Alternative includes federally-assisted removal of the dam and stabilizing the site.

- ***Decommissioning of Dam with Nonstructural Measures***
  In addition to the federally-assisted removal of the entire dam and stabilizing the site, this alternative includes acquisition and demolition of existing residential and public structures in the downstream 100-year floodplain.

- ***Relocation or Floodproofing of At-Risk Dwellings in the Breach Inundation Area***
  This alternative includes acquisition and demolition, relocation and/or flood protection of structures in the breach inundation area so that the hazard class can be lowered and less stringent dam safety standards can be evaluated.

- ***Other Nonstructural Measures***
  This alternative includes floodproofing, floodplain regulations, and other nonstructural measures so the hazard class can be maintained or lowered and less stringent dam safety standards can be applied.

- ***National Economic Development (NED) Alternative***
  The NED Alternative is not an independent option. It is the alternative, or combination of alternatives, that reduces the off-site or public problem and maximizes net national economic development benefits.

Alternative plans, including the NED Alternative, were formulated with consideration to completeness, effectiveness, efficiency, and acceptability (as required by the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, March 10, 1983.) These criteria are described below.

- ***Completeness.*** Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to the realization of the contributions to the objective.
- ***Effectiveness.*** Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.
- ***Efficiency.*** Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.
- ***Acceptability.*** Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and to compatibility with existing laws, regulations, and public policies.

Table 4-1 summarizes the alternatives considered and the results of the screening process.

Table 4-1
Range of Alternatives and Determination for Detailed Study

Alternative	Screening Criteria [1]				Carried Forward for Detailed Study
	Completeness	Effectiveness	Efficiency	Acceptability	
No Action/Future Without Federal Project (FWOP)	• Does not meet Project Purpose and Need.	• Does not meet Project Purpose of providing flood protection to agricultural land, rural transportation facilities, and rural residential structures. • Does not meet the Project Purpose of maintaining the existing municipal water supply availability. Municipal water supply would be acquired from an alternate source. • Addresses current risk of loss of human life resulting from dam failure through compliance with State regulations.	• Benefit/Costs of the FWOP were evaluated only for comparison of federal alternatives. • Sponsor financial resources may limit timely implementation of FWOP alternative. • Estimated cost equal to $1,951,800.	• Consistent with state and local laws, regulations, and policies. • Not consistent with public interest of maintaining the existing municipal water supply availability.	Yes
Rehabilitation to NRCS High Hazard Class Dam/NED Alternative	• Technically reliable. • Meets Project Purpose and Need. • Accounts for planned effects including NED, EQ[2], and OSE[2].	• Meets Project Purpose by providing flood protection. • Meets the Project Purpose of maintaining the existing municipal water supply availability. • Minimizes risk of loss of human life resulting from dam failure.	• Most cost-effective federal alternative. • Estimated cost equal to $2,891,500.	• Consistent with state and local laws, regulations, and policies. • Consistent with public interest of maintaining the existing municipal water supply availability.	Yes
Decommissioning	• Does not meet Project Purpose and Need because removing the dam eliminates benefits of flood control and municipal water supply. • Does not account for all EQ effects due to reduced water quality from loss of existing sedimentation trapping and storage capacity. • NED Account was not evaluated.	• Does not provide flood protection to agricultural land, rural transportation facilities, and rural residential structures. • Does not meet the Project Purpose of maintaining the existing municipal water supply availability. Municipal water supply would be acquired from an alternate source. • Results in increased flooding and sedimentation. • Addresses current risk of loss of human life resulting from dam failure. • Reconnects the stream. • Reduces future operation and maintenance costs.	• Detailed planning was not conducted because alternative does not meet the purpose and need for flood protection. • Estimated cost equal to $3,010,000.	• Consistent with state and local laws, regulations, and policies. • Not consistent with public interest of maintaining the existing municipal water supply availability.	No

Alternative	Screening Criteria [1]				Carried Forward for Detailed Study
	Completeness	Effectiveness	Efficiency	Acceptability	
Decommissioning with Nonstructural Measures	• Meets Project Purpose and Need. • Does not account for all EQ effects due to reduced water quality from loss of existing sedimentation trapping and storage capacity.	• Meets Project Purpose by providing flood protection. • Does not meet the Project Purpose of maintaining the existing municipal water supply availability. Municipal water supply would be acquired from an alternate source. • Results in increased flooding and sedimentation. • Addresses current risk of loss of human life resulting from dam failure. • Reconnects the stream. • Reduces future operation and maintenance costs.	• Determined to be marginally cost-effective. • Detailed planning was conducted. • Estimated cost equal to $3,138,000.	• Consistent with state and local laws, regulations, and policies. • Not consistent with public interest of maintaining the existing municipal water supply availability.	Yes
Acquisition or Relocation of At-Risk Structures	• Technically reliable and provides for all accounts. • NED, EQ, and OSE Accounts were not evaluated. • Would require upgrading existing dam to Significant Hazard Class dam criteria to maintain water supply component.	• Meets Project Purpose by providing flood protection. • Meets the Project Purpose of maintaining the existing municipal water supply availability. • Minimizes risk of loss of human life resulting from dam failure.	• Detailed planning was not conducted due to the exorbitant cost of the alternative. • Estimated cost greater than $8,891,000.	• Consistent with local laws, regulations, and policies. • Requires special restrictions on future development in breach inundation area. • Consistent with public interest of maintaining the existing municipal water supply availability.	No

[1] Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G), Section V. — Alternative Plans - 1.6.1 (c)

[2] P&G Accounts – Environmental Quality and Other Social Effects. See Section 4.5 for full description.

4.2 SPONSOR'S RATIONALE FOR CONDITIONS OF FUTURE WITHOUT FEDERAL PROJECT

Pine Creek Watershed Dam No. 4, designed and constructed as a Significant Hazard Class dam in 1964 and 1966, respectively, does not meet current dam design and safety criteria, as required in United States Department of Agriculture, Natural Resources Conservation Service, Technical Release 60, Earth Dams and Reservoirs, for High Hazard Class dams.

Tennessee Department of Environment and Conservation (TDEC), commensurate with TDEC Chapter 0400-45-07 (January 2013), will likely issue an administrative order requiring that the Sponsor upgrade the dam to current state standards; remove and/or relocate the hazards; or remove the hazard by removing the storage function of the reservoir. If the Sponsor does not comply with the administrative order, TDEC would likely breach the structure to remove the storage functions and bill the Sponsor for the work.

An evaluation of the Sponsor's options for meeting a potential TDEC administrative order, in the absence of NRCS technical and financial assistance, indicated that the likely Sponsor response would be to remove the storage function of the reservoir by constructing a breach, as directed by TDEC.

4.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Decommissioning of Pine Creek Watershed Dam No. 4. The Decommissioning Alternative was evaluated to include the removal of the entire dam, removal of the principal spillway structure, release of the impoundment, and stabilization/restoration of stream and 100-year floodplain functions.

Approximately 6,620 linear feet of the stream channel and floodplain restoration could be required. The stream channel would be approximately 15 feet wide, to reflect the natural channel width just upstream of the existing impoundment. The associated floodplain would be approximately 100 feet wide, and would merge upstream with the existing Zone AE 100-year floodplain. Based on the Virginia Stream Restoration & Stabilization Best Management Practices Guide, a rural watershed requiring priority one or two relocation (construct new floodplain and channel) would incur construction costs up to $100 per linear foot of stream restoration. This assumes no constraints to constructing the new channel, and readily available materials are nearby. The areas of the impoundment outside of the floodplain would also require additional stabilization against erosion from runoff.

The Decommissioning Alternative would eliminate flood storage and protection provided by the dam, which would expose downstream properties to an increased risk of flooding, property damage, and loss of life. As a result, the Decommissioning Alternative alone would not meet the objective to maintain the downstream flood damage reductions provided by the existing Project. To meet this objective, the Decommissioning Alternative would have to be supplemented by other measures such as floodproofing or relocation of structures located within the 100-year floodplain.

After decommissioning, there is no impounded water or sediment storage provided by the dam. The principal spillway system would be removed and disposed of in a suitable manner. If the dam was decommissioned, it would cause the following impacts:

- *Periodic Flooding, Sedimentation, and Other Damage*
  The existing dam provides sediment storage capacity, flood protection and flood-damage reduction to landowners, residents, motorists, and others using the Project benefit area. Without the dam, periodic flood events would result in flood damages, sedimentation damage and other associated damages at or in excess of pre-Project levels.

- *Increased Flood Zone*
  The existing downstream structures are currently protected from damage resulting from the 100-year storm events because the presence of the dam regulates the release of the water. Decommissioning induces flooding downstream. NRCS requires that induced damages be mitigated.
- *Loss of Municipal Water Supply Storage*
  Pine Creek Watershed Dam No. 4 currently provides municipal water supply storage for the Town of Oneida. Decommissioning would result in the loss of water supply storage.

The total estimated cost of dam decommissioning, including the construction of a restored main channel and removal of the dam is $3,010,000. The Decommissioning Alternative was eliminated from the detailed study because it does not meet the Project Purpose and Need of maintaining flood damage reduction.

Acquisition or Relocation of At-Risk Structures. This alternative removes the downstream hazard and allows Pine Creek Watershed Dam No. 4 to be reclassified as a Significant Hazard Class dam. Land use restrictions would need to be implemented to prevent future upgrades to High Hazard Class dam due to downstream development within the breach inundation area. The threat to human life from sudden dam failure would be reduced by relocating the residential and commercial structures and raising and/or relocating the roadways within the potential breach inundation.

An evaluation determined that the current dam did not meet TR-60 Design Criteria for a Significant Hazard Class dam. The existing dam as it is operated would meet detention storage requirements and the auxiliary spillway crest is 0.2 foot higher than what would be required by TR-60 for a Significant Hazard Class dam. However, the crest of the dam does not meet TR-60 criteria for capacity or integrity. Therefore, the existing dam would have to be raised at least 1.5 feet and the auxiliary spillway would have to be armored. In order to meet the dam owner's expectations and the TR-60 criteria, the riser would be converted to a single stage riser and the auxiliary spillway would be lowered to Elevation 1496.1 feet NAVD88 and widened to a 165-foot bottom width. The estimated cost for these improvements is $1,091,000.

The dam breach inundation zone and affected structures were based on the Breach Inundation Study completed by Amec. According to the results of this study, 46 residential and 21 commercial structures are predicted to be inundated by a breach of Pine Creek Watershed Dam No. 4. The 46 residences would have to be relocated outside the breach inundation zone. The median home value for the Town of Oneida provides a conservative cost estimate for this planning level evaluation. Based on available data from the United States Census Bureau, the median value of owner-occupied housing units for years 2009 to 2013 in Oneida, Tennessee is approximately $81,500. Additional cost would be incurred for demolition of existing houses and restoration of the site (i.e., filling in a basement, grading, landscaping, and disconnection and capping of utility lines). The costs for demolition vary greatly; however, using an estimate of $25,000 per house based on average demolition prices for similar projects in Nashville, Tennessee (Metro Nashville Home Buyout Program), the total cost for relocation of the remaining 46 residences is $4,669,000.

Acquisition in this alternative would not be voluntary and would result in additional costs not calculated, such as temporary housing and moving costs for displaced persons. Many of the commercial properties which lie within the breach inundation zone are already within the Pine Creek 100-year floodplain. After evaluating the tax assessor data an average value of $150,000 per structure was estimated to be the average. This estimate does not include the cost of site restoration, grading, landscaping and disconnection and capping of utility lines. The estimated cost of acquisition and relocation of Commercial Structures is $3,138,000.

The Project Team considered the use of levees to mitigate risks from a dam breach; however, due to the close proximity of structures in relation to North Fork Pine Creek and Pine Creek the structures would need to be relocated adding to the cost of this alternative. Additionally taking into account the changes in river hydraulics a levee system may not provide significant benefit where the breach inundation area is very close to or less than the 100-year floodplain on Pine Creek.

Howard H. Baker Senior Lake is the primary water supply for the Town of Oneida. Removal of this dam would remove approximately 1/2 of the water supply annually. At the current wholesale water rate from the neighboring Huntsville Utility District, the Town of Oneida would incur a cost of approximately $470,000 per year if use (1.3MGD) and rate ($1.98 per 1,000 gallons of treated water) are constant. The pipe infrastructure to deliver the water from Huntsville Utility District to the Town of Oneida is currently in place and is assumed to not incur a cost.

The total cost of this alternative is estimated to be greater than $8,891,000. The cost of acquisition of residential and commercial structures alone is not economically feasible and, therefore, costs for acquisition of other structures were not provided due to the complexity associated with estimation of these costs. The excessive cost of this alternative and social disruption caused by this approach is considered unreasonable and, therefore, Acquisition or Relocation of At-Risk Structures was eliminated from detailed study.

Variations of Rehabilitation Alternative. The following rehabilitation alternatives were considered and eliminated from detailed evaluation in consultation with the Sponsor and based on effectiveness, efficiency, constructability and compatibility with the purpose and need for the Project and in consideration of identifying the National Economic Development Alternative:

- Salvage the existing Principal Spillway works, but modify the riser to a single stage, increase the Auxiliary Spillway width, raise the top of dam elevation (5-7 feet), and move the water supply pump house to the west side of the channel. Increase Principal Spillway height for improved water supply.
- Salvage the existing Principal Spillway works, but modify the riser to a single stage, raise the top of dam elevation (5-7 feet), extend the embankment across the existing Auxiliary Spillway, and construct a concrete Auxiliary Spillway in the middle of the embankment. Increase Principal Spillway height for improved water supply.

The variations of the Rehabilitation Alternative noted were eliminated due to age of the Principal Spillway, and requirement to last an additional 70 years.

4.4 DESCRIPTION OF ALTERNATIVE PLANS

Future Without Federal Project. The Future Without Federal Project (FWOP) condition is the baseline from which all other alternatives are measured. It reflects the most likely future conditions expected to exist over the life of the Project without the potential federal funding identified in this plan.

The Sponsor has indicated that a minimum level breach of the dam, such as the removal of a portion of the earthen embankment, as directed by TDEC, would be the Future Without Federal Project approach conducted by the Town of Oneida. See Figure C-6 – Future Without Federal Project Alternative in Appendix C.

The FWOP (no-action) Alternative involves a minimum level of breach of the dam by the Sponsor, removal of the dam and reconnection, restoration and stabilization of the stream and 100-year floodplain functions. Typically, the entire footprint of the dam is removed; however, a portion of the embankment can be removed as long as the floodplain functions are restored. FWOP also requires the removal and disposal of the principal spillway and water supply structures.

For this planning level study, the FWOP Alternative was evaluated to include the partial removal of the dam, release of the impoundment, and minimal stream stabilization of stream and floodplain areas.

Using the National Hydrography Dataset stream lines, Amec estimated 6,620 linear feet of the stream channel and riparian area restoration would likely be required. However, additional hydraulic analysis would have to be performed during the design stage to determine the most adequate stream channel and geometry. The stream channel within the existing impoundment would be approximately 15 feet wide, to reflect the natural channel width based on the as-built drawings. The associated floodplain would be approximately 100 feet wide. A minimal level of stream channel definition would be performed and a

riparian zone would be vegetated for North Fork Pine Creek and two tributaries, Cotton Creek and an unnamed tributary within the reservoir footprint.

Based on the Virginia Stream Restoration & Stabilization Best Management Practices Guide, a minimal amount of channel restoration, riparian planting and monitoring would incur costs up to $50 per linear foot of restored stream. This assumes no constraints to constructing the new channels, and readily available materials are nearby. The areas of the impoundment outside of the floodplain would also require additional stabilization against erosion from runoff.

Howard H. Baker Senior Lake is the primary water supply for the Town of Oneida. Removal of this dam would remove approximately 1/2 of the water supply annually. At the current wholesale water rate from the neighboring Huntsville Utility District, the Town of Oneida would incur a cost of approximately $470,000 per year if use (1.3MGD) and rate ($1.98 per 1,000 Gallons) of treated water are constant. The pipe infrastructure to deliver the water from Huntsville Utility District to the Town of Oneida is currently in place and is assumed to not incur a cost.

The total estimated cost of dam removal with a Sponsor breach is $1,951,800. This estimate does not include annual water supply costs incurred by the community of approximately $470,000 per year. A summary of the estimated costs associated with the FWOP (no-action) Alternative are provided in the attached “Engineer’s Construction Cost Estimate Breakdown.

If Pine Creek Watershed Dam No. 4 was breached by the Sponsor, it would cause the following impacts:

- *Periodic Flooding, Sedimentation, and Other Damage*
  The existing dam provides sediment storage capacity, flood protection and flood-damage reduction to landowners, residents, motorists, and others using the Project benefit area. Without the dam, periodic flood events would result in increased flood damages, sedimentation damage and other associated damages at or in excess of pre-Project levels.
- *Increased Flood Zone*
  The existing downstream structures are currently protected from damage resulting from the 100-year storm events because the presence of the dam regulates the release of the water. The Future Without Federal Project condition induces flooding downstream.
- *Loss of Municipal Water Supply Storage*
  Pine Creek Watershed Dam No. 4 currently provides municipal water supply storage for the Town of Oneida. The Future Without Federal Project condition would result in the loss of water supply storage.

Rehabilitation to NRCS High Hazard Class Dam. Pine Creek Watershed Dam No. 4 would be rehabilitated to meet current NRCS and TDEC High Hazard Class dam design and safety criteria. The service life would be 70 years. See the Project Site Map in Appendix B.

The alternative to rehabilitate Pine Creek Watershed Dam No. 4 to meet NRCS and State of Tennessee High Hazard Class dam criteria would require construction and modification in three locations of the dam: the auxiliary spillway, the upstream face, and the downstream toe of the dam.

Auxiliary Spillway – The embankment will be armored with 350 feet of Roller Compacted Concrete (RCC) to serve as the auxiliary spillway. The Auxiliary Spillway Crest Elevation will be lowered from Elevation 1469.60 feet to Elevation 1460.00 feet. The embankment will be extended across the existing auxiliary spillway. The top of dam elevation will be increased from Elevation 1473.1 feet (NAVD88) to Elevation 1474.0 feet (NAVD88).

Upstream Face – Replacement of the principal spillway riser and conduit structures will first require construction of a coffer dam and installation of a water diversion to dewater the construction area adjacent to the riser structure. The dewatering plan will be developed during the construction phase. Options for the coffer dam will be evaluated during the design phase. Dewatering methods that may be considered include pumping, installation of a siphon, or installation of pipe extending upstream to divert flow directly through the principal spillway conduit and around the riser structure.

Replacement of the riser structure will include demolition of the existing riser structure, replacement of unsuitable material, installation of the foundation, and installation of the new riser structure. The crest elevation of the principal spillway riser (single stage) will be increased from Elevation 1465.5 feet (NAVD88) to Elevation 1466.5 feet (NAVD88) and subsequently adding 59 acre-feet of water supply storage capacity and increasing the normal pool by 1 foot.

Replacement of the principal spillway conduit will include excavation of the embankment, demolition of the existing conduit and cutoff collars, removal of the unsuitable material, installation of the foundation, conduit placement, filter diaphragm installation, and embankment backfill. The principal spillway conduit diameter will be increased from the existing 30-inch diameter reinforced concrete pipe to a 48-inch diameter reinforced concrete pipe.

Downstream Toe – The existing foundation drain trench near the downstream toe of the dam will be replaced with filter material along the downstream slope of the embankment. Additionally, the existing cutoff collars will be replaced with a filter diaphragm surrounding the principal spillway conduit. Construction techniques of the filter diaphragm will be evaluated in the design phase. The filter diaphragm construction will consist of excavation, subgrade preparation, installation of aggregate material and geotextile, and backfill with suitable material.

The water supply pump station will be relocated to the west side of the stream due to spatial conflicts with the stilling basin and to provide future access from the service road.

The construction will be conducted to minimize erosion and sedimentation, including the development of an erosion and sediment control plan as part of the permitting process. The construction site will be seeded and mulched immediately as phases of work are completed to establish vegetation immediately following construction on all land disturbed by construction activities. Appropriate plants for erosion control and wildlife habitat will be selected based upon the installation season, soils, surrounding vegetation, and Sponsor's preference.

The total estimated cost of this alternative is $2,891,500 resulting in an average annual cost of $107,800. The average annual benefit of this alternative is $842,800. Rehabilitation is a feasible alternative due to its low cost compared to the other alternatives and limited disturbance to surrounding land and communities.

Rehabilitation to NRCS High Hazard Class dam is the National Economic Development (NED) Alternative and is also the Preferred Alternative for the following reasons:

- It fulfills the Project Purpose and Need, which were defined by the Sponsor and public.
- It has positive impacts on human resources and minimal impacts on natural resources.
- It has the highest benefit to cost ratio of the federally-assisted alternatives considered.
- It maximizes net economic benefits consistent with protecting the nation's environment.

Detailed information for the Rehabilitation to NRCS High Hazard Class dam alternative is provided in Table 4-2.

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Table 4-2
Rehabilitation to Current High Hazard Class Dam Criteria

Project Feature	Original As-Built Conditions	Rehabilitation to NRCS High Hazard Class Dam
Principal Spillway Crest Elevation	1465.50 feet	1466.50 feet
Principal Spillway Conduit	30-inch diameter RCP	48-inch diameter RCP
Auxiliary Spillway Crest Elevation	1469.60 feet	1469.00 feet
Auxiliary Spillway Bottom Width	40 feet	350 feet
Top of Dam Elevation	1473.10 feet	1474.00 feet

Decommissioning with Nonstructural Measures. The Decommissioning with Nonstructural Measures Alternative would consist of removing the dam and stabilizing the site and reservoir in addition to floodproofing the areas currently protected from flooding downstream from the dams. Floodproofing, relocation, and other non-structural measures (NWPM Section 505.35 B) can be implemented to protect downstream development, but flooding of agricultural property, in the absence of the existing structures, would result in damages and loss of agricultural production.

The Decommissioning with Nonstructural Measures Alternative would include measures to stabilize the sediment accumulations and reconnect the stream channels at the dam site. The dam would be breached during decommissioning. Grade stabilization structures would be installed to provide stabilization for the 25-year, 24-hour storm runoff from the drainage area. The size of the opening through the dam is designed and constructed large enough to safely pass the discharges from the 100-year, 24-hour storm runoff. Embankment material removed from the dam would be placed in the auxiliary spillway and pool area, compacted for stabilization, and vegetated. The accumulated sediment in the pool area is removed or stabilized and the stream channel is restored through the Project area. After decommissioning, there is no impounded water or sediment storage provided by the dam. The principal spillway system would be removed and disposed of in a suitable manner. If the dam were decommissioned, it would cause the following impacts:

- *Periodic Flooding, Sedimentation, and Other Damage*
  The existing dam provides sediment storage capacity, flood protection and flood-damage reduction to landowners, residents, motorists, and others using the Project benefit area. Without the dam, periodic flood events would result in flood damages, sedimentation damage and other associated damages at or in excess of pre-Project levels.
- *Increased Flood Zone*
  The existing downstream structures are currently protected from damage resulting from the 100-year storm events because the presence of the dam regulates the release of the water. The reach immediately downstream of the dam does not have a FEMA study for the specific stream. However, it is protected from the 100-year storm event in that structures are not impacted and transportation infrastructure is not overtopped with the dam in place. Decommissioning induces flooding downstream. NRCS requires that induced damages be mitigated. Consequently, damages to the roads, bridges, and utilities within the 100-year floodplain must be mitigated.
- *Loss of Municipal Water Supply Storage*
  Pine Creek Watershed Dam No. 4 currently provides municipal water supply storage for the Town of Oneida. Decommissioning would result in the loss of water supply storage.

The cost associated with Decommissioning with Nonstructural Measures, along with the necessary costs of fulfilling the Project Purpose and Need and addressing the subsequent impacts is estimated to be significantly greater than the cost of rehabilitating the dam to meet NRCS High Hazard Class dam standards.

A combination of structural measures and implementation of land use restrictions would be required to implement the Decommissioning with Nonstructural Measures Alternative.

The construction activities associated with decommissioning of the dam includes the following:

- Excavate openings through the dam to approximately the stream channel elevations to safely pass the 100-year, 24-hour storm event at a non-erosive velocity.
- Construct a reinforced concrete grade stabilization structure to safely pass the 25-year, 24-hour storm event.
- Vegetate accumulated sediment in the reservoirs.
- Remove the principal spillway structures and conduits.
- Vegetate disturbed areas for erosion control.

The Project Team considered the use of levees to mitigate risks from 100-year, 24-hour storm events; however, due to only one structure being impacted, the option to construct a levee was eliminated.

Floodproofing would likely require elevating of the structure above the 100-year flood elevation to protect the structure from inundation and hydrodynamic loading associated with the flood wave. Based on similar NRCS projects, the average cost to elevate structures above the 100-year floodplain is approximately $80 per square foot of the footprint (NRCS communication). The structure in the floodplain has an approximate footprint of 1,600 square feet. The estimated cost of elevating the structure in the 100-year floodplain is as follows:

Estimated Cost of Floodproofing = 1 residence x 1,600 square feet x $80 per square foot = $128,000

Howard H. Baker Senior Lake is the primary water supply for the Town of Oneida. Decommissioning of this dam would remove approximately 1/2 of the water supply annually. At the current wholesale water rate from the neighboring Huntsville Utility District, the Town of Oneida would incur a cost of approximately $470,100 per year if use (1.3MGD) and rate ($1.98 per 1,000 gallons of treated water) are constant. The pipe infrastructure to deliver the water from Huntsville Utility District to the Town of Oneida is currently in place and is assumed to not incur a cost.

The cost associated with Decommissioning with Nonstructural Measures along with the necessary costs of fulfilling the Project Purpose and Need and addressing the subsequent impacts is estimated to be approximately $3,138,000.

4.5 COMPARISON OF ALTERNATIVE PLANS

Table 2-1
Summary of Scoping identifies the primary resource concerns and NRCS planning requirements for the Project. Table 4-4 compares the alternatives with respect to these relevant resource concerns and NRCS planning requirements. Additionally, the table shows in parentheses the applicable Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) Account for each resource concern. These P&G Accounts are the following:

- *Environmental Quality (EQ)*
  The EQ account measures the ecological, cultural, and aesthetic attributes of significant natural and cultural resources. Measurements may be in numeric units or non-numeric terms.
- *Other Social Effects (OSE)*
  The OSE account communicates other relevant effects that are not reflected in other P&G accounts, including urban and community impacts and effects on life, health, and safety.
- *Regional Economic Development (RED)*
  The RED account communicates the effects on rural development, including employment, income, and economic activities. The RED account effects were not included in the study because they were not identified as issues during the scoping process.

- *National Economic Development (NED)*
  The NED account includes the estimates of Project benefits and costs used to calculate net economic benefits. The NED account included in Table 4-3 shows these effects on the national economy.

Table 4-3
NED Account Summary and Comparison of Alternative Plans

Item	Alternative[1]		
	No Action/Future Without Federal Project (Sponsor Breach)	Rehabilitate to NRCS High Hazard Class Dam	Decommissioning with Downstream Relocation and Acquisition in Floodplain
Total Investment	$ 1,951,800	$ 2,891,500	$ 3,010,000
PL 83-566 Funds	$ -	$ 2,140,000	$ 2,228,000
Other Funds	$ 1,951,800	$ 751,500	$ 782,000
Average Annual Benefits [2]	$ -	$ 842,800	$ 372,800
Average Annual Costs [2]	$ 68,200	$ 107,800	$ 109,700
Net Beneficial	$ (68,200)	$ 735,000	$ 263,100
Average Annual O&M Costs	$ -	$ 6,800	$ -
Average Annual Remaining Flood Damages	$ 286,900	$ 1,300	$ 1,300

April-2016

[1] Price base 2015.

[2] Amortized over 3 years construction and 70-year service life at a discount rate of 3.125%. Based on total economic benefits and costs of alternatives as compared to existing conditions.

Table 4-4
Summary and Comparison of Alternative Plans

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Project Purpose is to provide flood protection in a manner that minimizes the risk of loss of human life.	• Threat to human health and safety from dam failure would be eliminated. • A constructed breach of the dam would effectively eliminate the ability to store floodwater and sediments. • Flood protection to downstream populations would not be provided, which could increase the risk of loss of human life due to flooding.	• Threat to human health and safety from dam failure would be reduced. • Rehabilitation would bring the dam into compliance with federal and state criteria. • Threat of dam failure during large storms, and the threat of loss of life or unsafe conditions from dam failure would be reduced.	• Threat to human health and safety from dam failure would be reduced. • Rehabilitation would bring the dam into compliance with federal and state criteria. • Threat of dam failure during large storms, and the threat of loss of life or unsafe conditions from dam failure would be reduced.
Project Purpose is to improve municipal water supply storage.	• Loss of 1.1 million gallons of raw water per day for the Town of Oneida. • Lost Municipal water supply would be acquired from an alternate source.	• Increase the public water supply storage by approximately 19 million gallons for the Town of Oneida.	• Loss of 1.1 million gallons of raw water per day for the Town of Oneida. • Lost Municipal water supply would be acquired from an alternate source.
Project Purpose is to maintain wildlife development.	• Developed fish and wildlife habitat would be lost.	• Developed fish and wildlife habitat would be maintained.	• Developed fish and wildlife habitat would be lost.

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Erosion and Sedimentation (EQ)	• A constructed breach of the dam would effectively eliminate the ability to store floodwater and sediments. • Threat of dam failure during large storms, and the threat of property damage from erosion and sedimentation from dam failure would be eliminated. • Downstream erosion and sedimentation would increase.	• Sediment storage would be extended to 70 years.	• Dam would not retain existing sediment storage and related downstream water quality benefits.
Cultural Resources (EQ)	• No impacts to cultural resources are anticipated and no mitigation measures would be required. • Although no cultural resources were identified in the Project footprint, the downstream area, which could be impacted due to future catastrophic flooding, has not been surveyed. Flooding in the downstream area could impact known and undiscovered cultural resources.	• No impacts to cultural resources are anticipated and no mitigation measures would be required. • A finding of No Historic Properties Affected was recommended by NRCS and concurred by the SHPO.	• No impacts to cultural resources are anticipated and no mitigation measures would be required. • Although no cultural resources were identified in the Project footprint, increased flooding in the benefit area could impact known and undiscovered cultural resources.
Endangered and Threatened Species (EQ)	• Not likely to adversely affect.	• Not likely to adversely affect.	• No effect on Endangered or Threatened species.
Environmental Justice (EQ)	• No disproportionate adverse effects are anticipated to any ethnically-, racially-, or socioeconomically- disadvantaged families or groups.	• No disproportionate adverse effects are anticipated to any ethnically-, racially-, or socioeconomically-disadvantaged families or groups.	• No disproportionate adverse effects are anticipated to any ethnically-, racially-, or socioeconomically-disadvantaged families or groups.

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Erosion and Sedimentation (EQ)	• Increase downstream sedimentation. • Eliminate the dam's ability to store sediments. • Provide no flood protection, and erosion and sediment damages to private property, roads, and utilities could result in downstream areas. • Temporary erosion and sedimentation impacts during and following construction of the breach.	• Decrease downstream sedimentation. • Extend sediment service life to 70 years. • The threat of property damage from dam failure would be reduced. • Temporary erosion and sedimentation impacts could occur during construction.	• Increased downstream sedimentation. • Result in erosion and sediment damages to private property, roads, and utilities in downstream areas. • Temporary erosion and sedimentation impacts could occur during construction.
Streams, Lakes, and Wetlands (EQ)	• The constructed breach would drain the sediment pools and would result in loss and/or disturbance of aquatic, wetland, and riparian habitat associated with Howard H. Baker Senior Lake. • FWOP would impact approximately 53 acres of surface waters, and an estimated 5 acres of fringe wetlands. • FWOP would allow for the re-establishment of a stream channel upstream of the dam.	• Potential wetland impacts associated with 1-foot rise in normal pool elevation. It is estimated that less than 1 acre of wetlands would be affected. • Potential impacts to wetlands and surface waters would require a Section 404 permit from the USACE & a Section 401 WQC from TDEC. • Required mitigation for potential impacts to surface waters and wetlands would be completed, as required by the USACE and TDEC.	• Decommissioning would drain the sediment pools and would result in loss and/or disturbance of aquatic, wetland, and riparian habitat associated with Howard H. Baker Senior Lake. • Decommissioning the dam would impact approximately 53 acres of surface waters, and an estimated 5 acres of fringe wetlands (based on NWI map). • Decommissioning would allow for the re-establishment of a stream channel upstream of the dam.

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Fish and Wildlife/Forest Resources (EQ)	• No Action/FWOP Alternative would cause permanent loss of aquatic and wetland habitat due to elimination of the pool. • Migratory birds utilizing the pool would be permanently disturbed. • Construction could potentially introduce invasive species. • Forest resources could potentially increase over time, due to the draining of the pool.	• Minimal long-term impacts to fish and wildlife habitat would occur. Increasing the pool elevation by 1 foot vertically would inundate approximately an additional 0.7 acre, primarily consisting of a narrow strip along the existing shoreline. • Lake habitat will remain available for fish and wildlife. • Migratory birds and their nesting activities would be temporarily disturbed during construction. • Construction could potentially introduce invasive species.	• Decommissioning would cause permanent loss of aquatic and wetland habitat due to elimination of the pool. • Migratory birds utilizing the pool would be permanently disturbed. • Construction could potentially introduce invasive species. • Forest resources could potentially increase over time, due to the draining of the pool.
Floodplain Management/ Floodwater Damage (EQ)	• No Action/FWOP Alternative would impact flood control and increase risk of downstream flooding. • Would effectively eliminate the dam's ability to store floodwater and sediments. • Would provide no flood protection, and flood damage to private property, roads, and utilities could result in the downstream areas.	• Maintain flood control. • The alternative would rehabilitate the existing dam to meet NRCS High Hazard Class dam criteria and extend the design life by 70 years when the accumulation of sediment has been removed. • The threat of dam failure would be reduced through the proposed modifications, and flood protection would continue for private property, roads, and utilities downstream.	• Decommissioning would maintain flood control by floodproofing or relocation of structures located within the 100-year floodplain. • The threat of property damage from dam failure would be reduced through the removal of the dam, and flood protection would continue for private property, roads, and utilities in benefit area through nonstructural measures.

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Invasive Species (EQ)	• Construction could potentially introduce invasive species.	• Construction could potentially introduce invasive species.	• Construction could potentially introduce invasive species.
Regional Water Resources Plans (EQ)	• Loss of 1.1 million gallons of raw water per day for the Town of Oneida. • Lost Municipal water supply would be acquired from an alternate source.	• Increase the public water supply storage by approximately 19 million gallons for the Town of Oneida.	• Loss of 1.1 million gallons of raw water per day for the Town of Oneida. • Lost Municipal water supply would be acquired from an alternate source.
Riparian Areas (EQ)	• Decrease in shoreline riparian area with removal of storage function of dam. • Addition of riparian area would result along stream with removal of the dam.	• Maintain the shoreline riparian area. • Transition to aquatic or wetland vegetation.	• Decrease in shoreline riparian area with removal of storage function of dam. • Addition of riparian area would result along stream with removal of the dam.
Water Quality (EQ)	• The No Action/FWOP Alternative would result in increased sedimentation and downstream turbidity due to the constructed breach. • Potential temporary impacts to water quality associated with construction activities, such as increased soil erosion, would be reduced through implementation of Stormwater Pollution Prevention Plan (SWPPP).	• Downstream water quality would be protected by capturing and retaining sediment and pollutants in pool area. • Potential temporary impacts to water quality associated with construction activities, such as increased soil erosion, would be reduced through implementation of SWPPP.	• Decommissioning would result in increased sedimentation and downstream turbidity due to the constructed breach. • Potential temporary impacts to water quality associated with construction activities, such as increased soil erosion, would be reduced through implementation of SWPPP.
Land Use (EQ)	• Dam would no longer protect downstream area from flooding.	• Current and planned land uses in the benefit area would be protected and enhanced.	• Dam would no longer protect downstream area from flooding.

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act (EQ)	• Migratory birds and their nesting activities could be temporarily disturbed if construction takes place between April 1 and July 15. • Migratory birds and their nesting activities could be permanently disturbed due to the elimination of the sediment pool.	• Migratory birds and their nesting activities would be temporarily disturbed if construction takes place between April 1 and July 15.	• Migratory birds and their nesting activities could be temporarily disturbed if construction takes place between April 1 and July 15. • Migratory birds and their nesting activities could be permanently disturbed due to the elimination of the sediment pool.
Plants (EQ)	• Permanent conversion of approximately 118 acres of aquatic habitat to wetland or bottomland habitat.	• Permanently remove vegetation from the dam and auxiliary spillway. • 0.74 acre directly affected by the rise in pool elevation, including approximately 0.08 acre of palustrine emergent (PEM) wetland and 0.66 acre of uplands. Vegetation could be affected by the inundation. • 1 acre of currently forested areas adjacent to the dam will be converted to maintained/mowed vegetation.	• Permanent conversion of approximately 118 acres of aquatic habitat to wetland or bottomland habitat.
Water Quality (EQ)	• Decrease water quality during construction and in the long term. • Increase sedimentation and downstream turbidity.	• Downstream water quality would be maintained as the dam would continue to capture and retain sediment and pollutants in the pool area. • Temporary sedimentation and contamination of surface water by hazardous or toxic substances associated with construction efforts.	• Decrease water quality during construction and in the long term. • Increase sedimentation and downstream turbidity

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Waters of the United States/Clean Water Act (EQ)	• Material placed in, or dredged within the bed and banks of a jurisdictional stream. • National Pollutant Discharge Elimination System permit would be required.	• Material placed in, or dredged within the bed and banks of a jurisdictional stream. • National Pollutant Discharge Elimination System permit would be required.	• Material placed in, or dredged within the bed and banks of a jurisdictional stream. • National Pollutant Discharge Elimination System permit would be required.
Wetlands (EQ)	• Wetlands adjacent to Howard Bake Senior Lake may be impacted.	• No long-term change in wetlands will occur. • Temporary impacts to the Project areas may occur during construction.	• Wetlands adjacent to Howard Bake Senior Lake may be impacted.
Public Health and Safety (OSE)	• Threat to human health and safety from dam failure would be eliminated. • Loss of ability to store floodwater and sediments. • Flood protection to downstream populations would not be provided, which could increase the risk of loss of human life due to flooding. • Loss of water supply storage. Water supply would be acquired from an alternate source.	• Threat to human health and safety from dam failure would be reduced. • Rehabilitation would bring the dam into compliance with federal and state criteria. • Threat of dam failure during large storms, and the threat of loss of life or unsafe conditions from dam failure would be reduced. • Improved water supply storage.	• Threat to human health and safety from dam failure would be reduced. • Rehabilitation would bring the dam into compliance with federal and state criteria. • Threat of dam failure during large storms, and the threat of loss of life or unsafe conditions from dam failure would be reduced. • Loss of water supply storage. Water supply would be acquired from an alternate source.

Item/Resource Concern/NRCS Planning Requirements	No Action/FWOP (Sponsor Breach)	Preferred Alternative (Rehabilitation to NRCS High Hazard Class Dam)	Decommissioning with Nonstructural Measures
Flood Control/Floodwater Damage (OSE)	• Flood control would decrease and risk of downstream flooding would increase. • Flood protection of downstream property would decrease. • A constructed breach of the dam would effectively eliminate the ability to store floodwater and sediments. • Threat of dam failure during large storms, and the threat of property damage from the dam failing would be eliminated.	• The service life of the dam would be extended to 70 years. • The threat of property damage from dam failure would be reduced. • The threat of dam failure and resulting property damage would be reduced for private property, roads, and utilities in the benefit area.	• Threat of dam failure from large storm events would be eliminated. • Flood protection would continue for private property, roads, and utilities in the benefit area.
Scenic Beauty (OSE)	• Loss of the aesthetic appeal of Howard H. Baker Senior Lake would be replaced by stream and riparian scene.	• Maintain the current aesthetic appeal of Howard Senior Baker Lake.	• Loss of the aesthetic appeal of Howard H. Baker Senior Lake would be replaced by stream and riparian scene.
Social Issues (OSE)	• Loss of the water supply storage at Howard H. Baker Senior Lake would be replaced by an alternate source.	• Improve the current water supply storage at Howard H. Baker Senior Lake by approximately 19 million gallons.	• Loss of the water supply storage at Howard H. Baker Senior Lake would be replaced by an alternate source.

Benefit/Cost Comparison. The Project Team completed a comparative cost analysis for the alternative plans carried forward for detailed study, which is shown in Table 4-3. Cost items include:

- The intent of the Sponsor to acquire the necessary land rights to modify the auxiliary spillway and raise the dam.
- Construction-related activities such as mobilization, clearing and grubbing, erosion and sediment control, demolition and removal of existing structures, site work, earthwork, fencing, seeding, sediment removal, drainfill, and conduits.
- Engineering activities such as completing design, surveys, geotechnical investigations, construction observations, and Project administration.

4.6 NATIONAL ECONOMIC DEVELOPMENT (NED) ALTERNATIVE

The NED Alternative is the federally-assisted alternative with the greatest net benefits for an existing dam that (a) does not meet the current safety and performance standards, and (b) would put human life at risk if it failed.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 COMPARATIVE ENVIRONMENTAL EFFECTS OF ALTERNATIVES

For the purpose of the following discussions, Project areas are defined below.

Project footprint – The area within the footprint of the proposed rehabilitated structure and auxiliary spillway.

Pool area – This term generically refers to Howard H. Baker Senior Lake, including the area that is typically inundated at the normal pool elevation.

Breach inundation area – This refers to the area below the dam within the study reach that would be directly impacted by sudden dam failure of the existing Significant Hazard Class dam with the water surface behind the dam equal to the maximum existing embankment height.

Benefit area – The benefit area includes floodplain areas downstream of the dam, which benefit from reduced flooding as a result of the structure extending from the dam downstream approximately 4,500 feet to the confluence of Pine Creek.

Contributing areas – This includes the drainage area above Pine Creek Watershed Dam No. 4.

Cultural Resources

- *Existing Conditions*

  A Phase I archaeological survey was conducted within the Project Area of Potential Effect (APE). No archaeological sites or cultural remains were identified during the survey.

  Following completion of the survey, NRCS consulted with the State Historic Preservation Office (SHPO). The SHPO concurred that it is unlikely that intact historic resources are located in the Project area and recommended additional cultural resources surveys.

  NRCS State Conservationist contacted the following tribes inviting interests and comments on the Project:

  - Shawnee Tribe of Oklahoma
  - Alabama-Coushatta Tribe of Texas
  - Alabama-Quassarte Tribal Town of Oklahoma
  - Cherokee Nation
  - Chickasaw Nation of Oklahoma
  - Eastern Band of Cherokee Indians
  - Eastern Shawnee Tribe of Oklahoma
  - Kialegee Tribal Town
  - Muscogee (Creek) Nation of Oklahoma
  - Poarch Band of Creek Indians
  - Seminole Nation of Oklahoma
  - Shawnee Tribe of Oklahoma
  - Thlopthlocco Tribal Town
  - United Keetoowah Band of Cherokee Indians

  Additional documentation is in Appendix A of this report.

- *No Action/Future Without Federal Project (FWOP)*

  No impacts to cultural resources are anticipated and no mitigation measures are required for this alternative. Although no cultural resources were identified in the immediate area of the dam, the downstream area, which could be impacted due to future catastrophic flooding, has not been surveyed. Flooding in the downstream areas could impact undiscovered cultural resources.

- *Rehabilitation to NRCS High Hazard Class Dam*

  No impacts to cultural resources are anticipated and no mitigation measures are required for this alternative. A finding of No Adverse Effect was recommended by NRCS and concurred with by the SHPO.

- *Federal Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Endangered and Threatened Species

- *Existing Conditions*

  Federally-listed species potentially occurring in Scott County include the following:

  - Cumberland bean (*Villosa trabalis*)
  - Littlewing pearlymussel (*Pegias fibula*)
  - Tan riffleshell (*Epioblasma florentina walker*),
  - Cumberlandian combshell (*Epioblasma brevidens*)
  - Blackside dace (*Phoxinus cumberlandensis*)
  - Cumberland darter (*Etheostoma susanae*)
  - Duskytail darter (*Etheostoma percnurum*)
  - Cumberland arrow darter (*Etheostoma sagitta*)
  - Cumberland rosemary (*Conradina verticillata*)
  - Cumberland sandwort (*Minuartia cumberlandensis*)
  - Virginia spiraea (*Spiraea virginiana*)
  - Northern long-eared bat (*Myotis septentrionalis*)
  - Indiana bat (*Myotis sodalis*).

  Specific surveys were not completed for the Project area; however, potential Indiana bat and Northern long-eared bat habitat (i.e., snags) was observed along the perimeter of the lake during the field reconnaissance on January 30, 2014.

- *No Action/Future Without Federal Project (FWOP)*

  As federally-listed species have the potential to occur in the vicinity of the Project, there is a potential for impact; however adverse impacts to federally-listed species are not anticipated, as only minimal disturbance to existing resources will occur during Project implementation. To avoid potential impacts to federally-listed species, NRCS will further coordinate with the USFWS during the permitting process prior to construction. NRCS will also implement BMPs and additional conservation measures (i.e., seasonal clearing restrictions) required by USFWS to avoid adverse impacts to federally-listed species. Therefore, the FWOP is not likely to adversely affect federally-listed species.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Same as the FWOP alternative.

- *Federal Decommissioning with Nonstructural Measures*

  Same as the FWOP alternative.

Environmental Justice

- *Existing Conditions*

  The Project area is located in Census Tract 9751 and has a minority population of approximately 2% according to 2010 US Census data. Approximately 20% of the residents in Census Tract 9751 are below the poverty level. As a comparison, Scott County has a minority population of approximately 2% and approximately 25% of its residents are below the poverty level.

- *No Action/Future Without Federal Project (FWOP)*

  No disproportionate adverse effects are anticipated to any ethnically-, racially-, or socioeconomically-disadvantaged families or groups.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Same as the FWOP alternative.

- *Federal Decommissioning with Nonstructural Measures*

  Same as the FWOP alternative.

Erosion and Sedimentation

- *Existing Conditions*

  Soils and Erosion – Soil information for the Project area was obtained from the NRCS Web Soil Survey. According to the NRCS soil survey, the predominant soils groups are the Allegheny-Cotaco-complex, Gilpin silt loam and Wernock silt loam.

  Sedimentation – Pine Creek Watershed Dam No. 4 is currently functioning to collect and retain sediment from the watershed. The sediment supply upstream of the dam is primarily contributed by an intermittent stream.

- *No Action/Future Without Federal Project (FWOP)*

  The FWOP would allow increased downstream sedimentation. The FWOP includes a constructed breach of the dam, which would effectively eliminate the dam's ability to store sediments. This alternative would provide no flood protection, and erosion and sediment damages to private property, roads, and utilities could result in downstream areas.

  Temporary erosion and sedimentation impacts could occur during and following construction of the breach; however, these impacts would be reduced through the implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP).

- *Rehabilitation to NRCS High Hazard Class Dam*

  This alternative would decrease downstream sedimentation. Rehabilitation of the existing dam to meet NRCS High Hazard Class dam criteria would allow the dam to retain existing sediment storage capacity. This alternative would result in related downstream water quality improvements. The threat of property damage from dam failure would be reduced through the proposed modifications, and erosion control and sediment storage would continue to protect private property, roads, and utilities in the benefit area.

  Temporary erosion and sedimentation impacts could occur during construction; however, these impacts will be reduced through the implementation of Best Management Practices (BMPs) and a site-specific SWPPP. Temporary erosion-control devices, such as silt fences, check-dams, sediment traps, sediment basins, burlap, jute matting, grading, seeding, and sodding would be used to minimize erosion and sedimentation during construction.

- *Federal Decommissioning with Nonstructural Measures*

  Implementation of this alternative would allow increased downstream sedimentation. Decommissioning includes a constructed breach of the dam, which would effectively eliminate the dam's ability to store sediments. This alternative would result in erosion and sediment damages to private property, roads, and utilities in downstream areas.

  Temporary erosion and sedimentation impacts could occur during and following construction of the Decommissioning; however, these impacts would be reduced through the implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP).

Fish and Wildlife

- *Existing Conditions*

  Howard H. Baker Senior Lake and the surrounding shoreline provide habitat for a variety of fish, waterfowl, and other wildlife. Additional information pertaining to fish and wildlife is provided in Section 3.5.

- *No Action/Future Without Federal Project (FWOP)*

  Fish and wildlife habitat would be impacted by this alternative by converting aquatic habitat back to wetland or upland habitat. The aquatic and wildlife habitat provided by the pool would be permanently lost with this alternative. The constructed breach of the dam would eliminate the presence of the fish and wildlife habitat in the pool. Stream flow would no longer be controlled, which could impact fish and riparian habitat downstream of the dam. Availability of water for low-flow augmentation to support fish habitat downstream from the dam would be lost.

Minor temporary increases in turbidity near the construction area could impact fish habitat; however, impacts would be reduced by BMPs for control of erosion and sediment runoff. There could also be minor, temporary disturbances to wildlife due to noise from construction.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would maintain existing fish and wildlife habitat in the long term, as existing conditions would persist. By protecting the dam against failure, rehabilitation would ensure the continued, long-term presence of the fish and wildlife habitat in the pool and the availability of water for low-flow augmentation to support fish habitat downstream of the dam.

  Temporary impacts to fish and wildlife habitat would occur as a result of this alternative. Approximately 2.6 acres of land disturbance would occur during construction consisting of approximately 1.6 acres of maintained/mowed areas and approximately 1 acre of forest. During construction activities, wildlife would be expected to vacate the site; some individuals of the less mobile species (i.e., small mammals, reptiles, amphibians) could be killed or displaced during construction as a result of heavy equipment. Most wildlife would likely vacate the area during construction and return following construction.

  The wildlife habitat provided by the pool would be temporarily reduced during construction as a result of fully or partially draining the lake and/or dewatering areas near the dam. Except for possible temporary, minor increases in turbidity near the construction area, which would be reduced by BMPs for control of erosion and sediment runoff, fish habitat would not be affected in downstream portions of North Fork Pine Creek.

  There could also be minor, temporary disturbances to wildlife due to noise from construction.

- *Federal Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Floodplain Management/Floodwater Damage

- *Existing Conditions*

  The drainage area of the dam, the Project footprint, and the floodplain immediately downstream of the dam are located in Zone X (an area determined to be outside the 0.2 percent-annual-chance floodplain) as shown on the FEMA Flood Insurance Rate Map (FIRM) No. 47151C0070C, Effective September 28, 2007. Approximately 3,000 feet downstream of the dam the floodplain is designated as Zone A (an area designated as a Special Flood Hazard Area subject to flooding by the 1 percent - annual-chance flood, with no base flood elevations determined). A copy of the pertinent area of the FIRM is contained in Appendix B and can be found at the following web address: http://msc.fema.gov/portal/search?AddressQuery=Oneida%2C%

  The construction of the dam has created a water impoundment, used to reduce the duration of downstream overland flooding while increasing the duration of channel flow resulting from the net effect of smaller but more prolonged releases from the dam.

  46 residential and 21 commercial structures are within the breach inundation area from a potential dam failure. The dam reduces flooding downstream for high frequency events up to and including the 100-year storm and as referenced previously, the dam reduces the peak flow by 86% for the 100-year storm. One of the primary purposes of the existing dam is flood control. Pine Creek Watershed Dam No. 4 was originally designed based on limited downstream development and dam failure would impact farm improvements, agricultural land, and country roads. Due to more recent development within the benefit area, failure of the dam poses significant threat of flood damages to private property, roads, and utilities in the breach inundation area. Floodwater damages could include the following.

  - Release of Harmful Materials. Large volumes of sediment and eroded embankment material released to the stream would harm water quality, degrade aquatic habitat and reduce downstream channel capacity.
  - Agricultural Damage. Sedimentation may cause reduced productivity of agricultural land downstream from the structure. Livestock in the inundation area may be injured or killed.

- Infrastructure Destruction. Fences, roads, bridges, public utilities, and farm equipment may be damaged or destroyed.

Per Executive Order 11988, *Floodplain Management*, NRCS shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains while acquiring, managing, and disposing of federal lands and facilities; providing federally-undertaken, financed, or assisted construction and improvements; and conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

- *No Action/Future Without Federal Project (FWOP)*

  This alternative would impact flood control and increase risk of downstream flooding. The FWOP includes a constructed breach of the dam, which would effectively eliminate the dam's ability to store floodwater and sediments. This alternative would provide no flood protection, and flood damage to private property, roads, and utilities could result in the downstream areas.

- *Rehabilitation to NRCS High Hazard Class Dam*

  This alternative would maintain flood control. While the principal spillway pipe will increase in size the structures and transportation facilities will not see significant effect for the high-frequency events. For low-frequency events there is less than 1 foot of rise in the water surface elevation downstream of the dam, roads and bridges are not overtopped, and no building structures are impacted. The high-frequency flows are contained within the channel just downstream of the dam. The channel velocities for the high-frequency events are not considered to be an increased risk for bank instability. The alternative would rehabilitate the existing dam to meet NRCS High Hazard Class dam criteria and extend the service life by 70 years. The threat of dam failure would be reduced through the proposed modifications, and flood protection would continue for private property, roads, and utilities downstream.

- *Federal Decommissioning with Nonstructural Measures*

  This alternative would maintain flood control by floodproofing or relocation of structures located within the 100-year floodplain. The threat of property damage from dam failure would be reduced through the removal of the dam, and flood protection would continue for private property, roads, and utilities in the benefit area through nonstructural measures by relocating and/or elevating structures out of the flood zone.

Invasive Species

- *Existing Conditions*

  Seventy-three exotic species are known to occur in Scott County, Tennessee. It is likely that invasive species or possibly noxious weeds are within or adjacent to the Project area. Construction activities have the potential to introduce invasive species.

- *No Action/Future Without Federal Project (FWOP)*

  Construction could potentially introduce invasive species. However, NRCS would follow the guidelines of Executive Order 13112 in an attempt to control and prevent the spread of invasive exotic species that may occur within the Project site. NRCS would use invasive-free seed mixtures and revegetate with native plant species.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Construction could potentially introduce invasive species. The introduction of invasive species would be minimized by revegetating disturbed areas with native plants, mowing and herbicide application, removing mud, dirt, and plant parts from equipment, and locating and using equipment staging areas.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Land Use

- *Existing Conditions*

  The benefit area downstream from the dam associated with the Project consists of approximately 950 acres of land. The area has experienced a shift in land use since the installation of the existing dam. The existing land use in the Project area is described in Table 5-1.

Table 5-1
Existing Land Use

Resource	Contributing Watershed (acres)
Pasture/Hay	184.7
Deciduous Forest	419.4
Developed, Low Intensity	16.0
Developed, Open Space	66.9
Evergreen Forest	5.9
Mixed Forest	37.7
Grassland/Herbaceous	114.7
Water	52.7
Total	898.0

Source: National Land Cover Database, 2006

- *No Action/Future Without Federal Project (FWOP)*

  The FWOP would affect current and future land use. Impacts to land use would result as all residential, commercial, educational, and transportation structures downstream of the dam would no longer be protected from flooding. The FWOP would prevent future land use development.

- *Rehabilitation to NRCS High Hazard Class Dam*

  This alternative would provide flood protection for existing development. Proposed modifications to the dam would require minimal changes in land use and vegetation cover.

- *Federal Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act

- *Existing Conditions*

  Tennessee lies within the bird migratory route known as the Mississippi Flyway. Hundreds of bird species travel within this migration route. Birds protected under the Migratory Bird Treaty Act (MBTA) include common songbirds, raptors, waterfowl, shorebirds, seabirds, and wading birds. The existing pool and adjacent areas upstream from the dam provide nesting, feeding, and resting habitat for migratory birds. During the site reconnaissance on January 30, 2014, a bald eagle was observed flying over the lake, but no nests were observed.

- *No Action/Future Without Federal Project (FWOP)*

  Migratory birds and their nesting activities could be temporarily disturbed if construction takes place between April 1 and July 15; therefore, care should be taken to minimize the risk of injury to migratory bird species during construction activities. Migratory birds and their nesting activities could be permanently disturbed due to the elimination of the sediment pool.

- *Rehabilitation to NRCS High Hazard Class Dam*

  The existing pools upstream from the dam provide nesting, feeding, and resting habitat for migratory birds. Migratory birds and their nesting activities would be temporarily disturbed if construction takes place between April 1 and July 15; therefore, care should be taken to minimize the risk of injury to migratory bird species during construction activities.

- *Federal Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Plants

- *Existing Conditions*

  The Project area includes riparian areas along the border of the lake as well as along North Fork Pine Creek and tributaries flowing into the lake. Based on the site reconnaissance on January 30, 2014, the lake primarily is surrounded by a combination of upland pine forests, upland mixed forests, upland deciduous forests, and grassland, including maintained lawns. In Chapter 3, there are a few areas of herbaceous and scrub-shrub wetlands along portions of the perimeter of the lake which were dominated by willow, alder, buttonbush, and various sedges and rushes.

- *No Action/Future Without Federal Project (FWOP)*

  Implementation of this alternative would cause the permanent conversion of approximately 118 acres of aquatic habitat to wetland or bottomland habitat, as pool areas would be expected to revert back to scrub-shrub or forested lands.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Construction will permanently remove vegetation from the dam and auxiliary spillway.

  As this alternative includes raising the normal pool elevation by one foot, a narrow strip (approximately 0.1-3 feet wide) of riparian and shoreline areas along the lake will be affected. Approximately 0.74 acre would be directly affected by the rise in pool elevation. Based on the National Wetlands Inventory (NWI) dataset and mapping, this would include approximately 0.08 acre of palustrine emergent (PEM) wetland and 0.66 acre of uplands. Vegetation within this additional inundated area could be affected by the inundation, causing a transition to aquatic or wetland vegetation. In areas with relatively steep banks, adjacent vegetation would likely not be affected.

  In addition, based on the current design of the rehabilitated dam, approximately 1 acre of currently forested areas adjacent to the dam will be converted to maintained/mowed vegetation as a result of dam/spillway modifications.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Prime and Unique Farmland

- *Existing Conditions*

  Approximately 225 acres of the benefit area contains prime farmland soils.

- *No Action/Future Without Federal Project (FWOP)*

  As soils present in the floodplain areas below Pine Creek Watershed Dam No. 4 are considered prime farmland, this alternative would reduce flood control of prime and unique farmland areas.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would result in minimal impacts to prime and unique farmland within the Project footprint. The impact on prime farmland would increase from 0 acre impacted at the more frequent events to 4.6 acres for the 100-year event. This alternative would inundate farmland infrequently for short periods. Under this alternative the dam would continue to provide flood control to downstream prime farmlands. This alternative could potentially indirectly impact prime farmland within the benefitted area by allowing for further development downstream of the dam, consequently decreasing prime farmland.

- *Federal Decommissioning with Nonstructural Measures*

  Same as FWOP alternative.

Public Health and Safety

- *Existing Conditions*

  Pine Creek Watershed Dam No. 4 provides flood control within the benefit area. The dam provides a benefit for the population within the Pine Creek Watershed District. These benefits include reduction of flooding of roads, residential development, and agricultural development. The dam provides a level of flood protection; however, populations are at risk since it does not currently meet high hazard criteria.

  46 residential and 21 commercial structures are within the breach inundation area. The dam reduces flooding downstream for high frequency events up to and including the 100-year storm.

  NRCS and Tennessee Department of Environment and Conservation, Division of Water Resources, Dams Section have identified Pine Creek Watershed Dam No. 4 as a High Hazard Class dam. The dam is structurally sound; however, it does not meet current safety and performance standards for High Hazard Class dams. There is a significant threat to human life and safety for residents, motorists, and others using downstream facilities.

  Per Executive Order 11988, *Floodplain Management*, NRCS shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains while acquiring, managing, and disposing of federal lands and facilities; providing federally-undertaken, financed, or assisted construction and improvements; and conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

- *No Action/Future Without Federal Project (FWOP)*

  Implementation of this alternative would reduce the threat to human health and safety from dam failure, but would increase the threat to human health and safety from the current level of flood protection provided by the dam. Approximately half of the water supply would be replaced by the Huntsville Utility District. The threat of loss of life or unsafe conditions due to dam failure would be reduced by removing the storage function of the reservoir. A constructed breach of the dam would effectively eliminate the ability to store floodwater and sediments. This alternative addresses the dam safety concern but fails to meet the Project Purpose and Need as identified through the public scoping process.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would reduce the threat to human health and safety. Rehabilitation would bring the dam into compliance with federal and state criteria, and the threat of dam failure during large storms would be reduced. The threat of loss of life or unsafe conditions from dam failure would be reduced through rehabilitation designed to bring the dam into compliance with NRCS High Hazard Class dam safety criteria. Flood protection would continue for residents, motorists, and other persons using downstream facilities.

- *Decommissioning with Nonstructural Measures*

  Implementation of this alternative would reduce the threat to human health and safety. The threat of loss of life or unsafe conditions from dam failure would be reduced through removing or floodproofing all residential, commercial, educational, and transportation structures downstream from the dam. Easements would be required to prevent future development in the breach inundation area downstream from the dam.

Regional Water Resources Plans

- *Existing Conditions*

  Pine Creek Watershed is located in the South Fork Cumberland River Watershed – Watershed Water Quality Management Plan. Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake provide water supply storage for the Town of Oneida and the surrounding area.

- *No Action/Future Without Federal Project (FWOP)*

  The FWOP alternative would result in the loss of public water supply storage for the Town of Oneida. The lost municipal water supply would be acquired from an alternate source.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would increase the public water supply storage by approximately 19 million gallons for the Town of Oneida.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Riparian Areas

- *Existing Conditions*

  Riparian areas occur adjacent to the existing reservoir pool with the exception of the immediate vicinity of the dam.

- *No Action/Future Without Federal Project (FWOP)*

  This alternative would result in the decrease in shoreline riparian area with removal of storage function of dam. Addition of riparian area would result along stream with removal of the dam.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would maintain the shoreline riparian area. As discussed previously under the Plants Section, vegetation within the additional inundated area could be affected by the inundation, causing a transition to aquatic or wetland vegetation. In areas with relatively steep banks, adjacent riparian vegetation would likely not be affected.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Scenic Beauty

- *Existing Conditions*

  The Project site is located in a region of Tennessee known for its scenic beauty. Scott County is situated atop the Cumberland Plateau and the western foothills of the Appalachian Mountains. Howard H. Baker Senior Lake is nestled within a primarily rural landscape surrounded by a combination of forested slopes, open fields, and scattered homes.

- *No Action/Future Without Federal Project (FWOP)*

  This alternative would result in the loss of the aesthetic appeal of Howard H. Baker Senior Lake and will be replaced by stream and riparian scene.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would maintain the current aesthetic appeal of Howard H. Baker Senior Lake.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Social Issues

- *Existing Conditions*

  Howard H. Baker Senior Lake provides water supply storage for the Town of Oneida, which was identified as an important social issue.

- *No Action/Future Without Federal Project (FWOP)*

  This alternative would result in the loss of the water supply storage at Howard H. Baker Senior Lake.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would improve the current water supply storage at Howard H. Baker Senior Lake by approximately 19 million gallons.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Water-Based Recreation

- *Existing Conditions*

  Howard H. Baker Senior Lake provides water-based recreation in the form of fishing and shoreline recreation.

- *No Action/Future Without Federal Project (FWOP)*

  This alternative would result in the loss of the water-based recreation at Howard H. Baker Senior Lake.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would improve the current water-based recreation at Howard H. Baker Senior Lake.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Water Quality/Water Quantity

- *Existing Conditions*

  North Fork Pine Creek is listed on the 303(d) list as an impaired stream by TDEC. North Fork Pine Creek (TN05130104048_0200) is designated as "not supporting" use due to Escherichia coli caused by on-site treatment systems (septic systems and similar decentralized systems).

  The Town of Oneida uses Howard H. Baker Senior Lake for municipal water supply storage. The current Howard H. Baker Senior Lake and Pine Creek Watershed Dam No. 4 reservoir supplies approximately 54 percent of the water for the Town of Oneida for the 7-year period of record provided. This reservoir supplies approximately 1.1 million gallons of raw water per day. Future demand for water supply is not expected to significantly increase due to the population increases projected through 2030.

  Elevated Manganese levels in the reservoir cause detrimental effects on operation of the Town of Oneida water treatment plant. The elevated levels have been observed after reservoir inversions, which often occur in the fall of each year. Elevated levels reduce the flow rate through filtration processes and increase chemical demand (potassium permanganate) to oxidize the Manganese.

- *No Action/Future Without Federal Project (FWOP)*

  This alternative could decrease water quality during construction and in the long term. In the long term, the FWOP could result in increased sedimentation and downstream turbidity due to the constructed breach.

  During construction, temporary impacts to water quality could occur. The potential for sedimentation in surface water from increased soil erosion and the potential contamination of surface water by hazardous or toxic substances associated with construction efforts would be managed in compliance with a National Pollutant Discharge Elimination System (NPDES) construction permit and the preparation of a site-specific SWPPP. The SWPPP would include the preparation of an erosion and sediment control plan and installation of temporary BMPs to minimize sediment discharge to North Fork Pine Creek during, and subsequent to, disturbances associated with construction activities.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Implementation of this alternative would not change downstream water quality in the long term. Downstream water quality would be maintained as the dam would continue to capture and retain sediment and pollutants in the pool area.

During implementation of the alternative, temporary impacts to water quality could occur. The potential for sedimentation in surface water from increased soil erosion and the potential contamination of surface water by hazardous or toxic substances associated with construction efforts would be managed in compliance with an NPDES construction permit and the preparation of an SWPPP. The SWPPP would include the preparation of an erosion and sediment control plan and installation of temporary BMPs to minimize sediment discharge to the pool and the stream during, and subsequent to, disturbances associated with construction activities.

Increasing the elevation of the pool is not expected to affect existing quality of the water supply, as the pool level will only expand a few feet closer to adjacent residents. Additionally, water utilized for public water supply is treated prior to distribution and consumption.

- *Federal Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Waters of the United States/Clean Water Act

- *Existing Conditions*

  Howard H. Baker Senior Lake, which is created by Pine Creek Watershed Dam No. 4, as well as streams flowing into and out of the lake (North Fork Pine Creek) are likely jurisdictional "Waters of the United States." Additionally, any wetlands adjacent to these features would be considered jurisdictional "Waters of the United States." The NWI map identifies Howard H. Baker Senior Lake as L1UBHh (Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded) with PEM wetlands (Palustrine Emergent wetlands) located at the tips of the fingers of the lake. The presence of PEM wetlands was verified during the January 30, 2014 site reconnaissance, but wetland boundaries were not delineated. No wetlands were observed in the immediate vicinity of the dam itself.

  As discussed previously, North Fork Pine Creek is listed on Tennessee's 303(d) list as impaired.

- *No Action/Future Without Federal Project (FWOP)*

  This alternative would not result in material placed in, or dredged within the bed and banks of a jurisdictional stream. Wetlands adjacent to Howard H. Baker Senior Lake may be impacted.

  The FWOP would involve ground-disturbance of one acre or more; therefore, a National Pollutant Discharge Elimination System permit (administered through TDEC) would be required. NRCS, or their contractor, shall submit the Large Construction Storm Water General Permit Notice of Intent to TDEC upon development of a Project-specific, permit-compliant SWPPP, and a Request for Termination within 30 days of meeting the requirements for termination of permit coverage.

- *Rehabilitation to NRCS High Hazard Class Dam*

  The Rehabilitation alternative would impact the North Fork Pine Creek, surface waters associated with the impoundments of this tributary, and potential jurisdictional wetlands. Wetlands and surface waters adjacent to the stream would be considered Waters of the United States. Section 404 requires a permit for the discharge of dredged or fill material into Waters of the United States. The Project is subject to CWA Section 404 regulations enforced by the USACE and EPA. The Project must be in compliance with EPA's 404(b)(1) guidelines.

  The Rehabilitation alternative would involve ground-disturbance of one acre or more; therefore, a National Pollutant Discharge Elimination System permit (administered through TDEC) would be required. NRCS, or their contractor, shall submit the Large Construction Storm Water General Permit Notice of Intent to TDEC upon development of a Project-specific, permit-compliant SWPPP, and a Request for Termination within 30 days of meeting the requirements for termination of permit coverage.

- *Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

Wetlands

- *Existing Conditions*

  NWI maps and aerial photography were used to delineate potential wetland and surface water areas within the vicinity of the Project.

  The NWI map identifies Howard H. Baker Senior Lake as L1UBHh (Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded) with PEM wetlands (Palustrine Emergent wetlands) located at the tips of the fingers of the lake. The presence of PEM wetlands was verified during the January 30, 2014 site reconnaissance.

  Based on site reconnaissance, the wetlands appear to be a mixture of PEM wetlands and PSS (palustrine scrub-shrub) wetlands. The following species were noted in wetland areas: willow (*Salix sp.*), hazel alder (*Alnus serrulata*), and buttonbush (*Cephalanthus occidentalis*), as well as various grasses, sedges, and rushes.

  As required by Executive Order 11990, *Protection of Wetlands*, NRCS must consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. Additionally, NRCS policy (190 GM, part 411.03(d)) for riparian areas requires: (1) riparian area management to be integrated into plans and alternatives; (2) plans to maintain or improve water quality and quantity benefits; and (3) development of alternatives when land user's objectives are in conflict with conservation of the riparian area resources.

- *No Action/Future Without Federal Project (FWOP)*

  Implementation of the FWOP would decrease the amount of surface waters directly upstream from Pine Creek Watershed Dam No. 4. This includes the pool area. A constructed breach of the dam would be completed by excavating an opening through the dam to the original stream channel grade. The constructed breach would drain the pool created upstream of the dam, and would result in loss of aquatic habitat. This alternative would result in impacts to Waters of the United States and require a CWA Section 404 Permit. Following construction, the disturbed areas would be regraded and revegetated with native species in accordance with permit requirements. A portion of the current pool area would be expected to return to wetland.

- *Rehabilitation to NRCS High Hazard Class Dam*

  Wetlands and uplands within the additional inundated area (less than 1 acre) could be affected by a rise in water elevation, causing a transition to aquatic habitats or wetland habitats in areas that are currently not inundated. In general, a relatively small (<1 acre) net increase in wetlands would be expected to occur due to additionally inundated areas along the edges of the lake. Temporary impacts to the Project areas may occur during construction. Temporary impacts may include the loss of aquatic habitat within pool areas and the loss of hydrology and wetland habitat within fringe wetlands adjacent to pool areas if draining the pool is necessary during construction. Additionally, there would be an increased potential for erosion and sedimentation within downstream portions of North Fork Pine Creek during construction. BMPs and a site-specific SWPPP would be implemented to minimize erosion, turbidity, and/or other potential impacts to streams. Degradation of waters during construction would be avoided through the implementation of BMPs and a site-specific SWPPP. Erosion and sediment control plans would be included in the Project construction plans. Following construction, the disturbed areas would be regraded and revegetated with native species in accordance with USACE permit and mitigation requirements.

- *Federal Decommissioning with Nonstructural Measures*

  Same as FWOP Alternative.

5.2 CUMULATIVE IMPACTS

There are presently no known past, present, or reasonably foreseeable future actions that were not addressed in the Plan/EA.

Construction of Pine Creek Watershed Dam No. 4 has had long-term direct effects on the environment through the excavation of the site, filling of the structure, and development of permanent impoundment

behind the dam that now provides flood control, incidental recreational opportunities, fish and wildlife habitat, and other incidental benefits. Direct impacts from the Project include the following:

- Detention storage
- Sediment storage
- Water supply storage

The dam has indirectly affected the natural environment by permanently flooding areas, by temporarily inundating the floodplain upstream of the dam during rain events, and by trapping sediment that would otherwise move downstream during rain events. The dam has also altered the hydrology of downstream channels by reducing downstream peak flows during storm events, and consequently protecting property and people in otherwise flood-prone areas. Indirect impacts include the following:

- Reduced head cutting
- Reduced downstream flooding
- Reduced channel erosion
- Increased upstream sediment deposition
- Reduced downstream sediment deposition
- increased downstream crop production
- Improved downstream surface water quality
- Improved aquatic habitat

Rehabilitation of the dam under the alternatives considered would not change the hydrology downstream except for protecting the downstream area from catastrophic flooding that could occur if the dam were to fail.

Rehabilitation of the dam under the Preferred Alternative would allow downstream areas within the floodplain to support continued residential, industrial, and commercial development. This, in turn, would support the conversion of agricultural and undeveloped lands to an urban land use. Cumulative impacts resulting from the Project include the following:

- Individual income stability
- Community income stability
- Reduced health and safety issues
- Improved aquatic habitat
- Improved surface water recreation activities

5.3 CONTROVERSY

There are no known areas of controversy.

5.4 RISK AND UNCERTAINTY

Project risk and uncertainty primarily exist in the engineering and economics analyses of the Project alternatives. The Project Team based all preliminary designs and cost estimates on an additional 70 years of functional life using data from the as-built plans, available GIS data, recent topographic surveys, and bathymetry. Geotechnical explorations were not conducted, and the designs relied on minimal soil mechanics data from the original dam design, as-built plans, field observations and experience. Hydrologic data was measured using available GIS data, and field observations. Accuracy of the data impacts uncertainty of the reservoir operation levels, discharge capacities, breach inundation areas, flood damage area, design life, and structure function. Failure of the dam would most likely occur as a result of (1) breach of the embankment due to extreme storm events, or (2) deterioration and failure of the principal spillway conduit.

The Project Team used the Economics and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) to account for flood control benefits associated with the alternatives. Predicting economic benefits naturally involves a moderate degree of uncertainty. The economic analysis used an indexing approach to predict benefits. Uncertainty in the price of inputs, outputs, and the demand for agronomic crops produced will vary in the future. Consequently, the change in land value is the index that is most likely to reflect the value of preventing flood damage because

changes in land value relates to the change in the land's use for various crops, which subsequently reflects the changes in price and productivity.

The original benefits for the Project were indexed to current dollars using applicable indexes. The scope of the study did not include re-evaluation or reconsideration of the original benefits. So the estimated average annual flood damage reduction benefits and intensification benefits may vary from those displayed.

Uncertainties with the analysis of environmental impacts lie with the identification of wetland areas, riparian habitat, and streams. Trained specialists identified environmentally-significant areas using standard, well-accepted protocols.

Within the context of this study, all alternatives were considered on a comparable basis. There does not appear to be any area that would have resulted in a different decision by using different procedures or conducting more intensive studies.

6.0 CONSULTATION, COORDINATION AND PUBLIC PARTICIPATION

6.1 PUBLIC PARTICIPATION

NRCS completed a Rehabilitation Assessment Report and estimated risk-based profile of Pine Creek Watershed Dam No. 4 in December 2007. The evaluation indicated the Risk Index was 82. NRCS reviewed the breach inundation zone downstream from the dam and determined that developments downstream from the dam were subject to flooding during a breach of the dam. The evaluations indicated that the dam did not meet NRCS and State of Tennessee Dam Safety requirements with respect to the current hazard classification and recommended modifications to meet current design criteria.

The Sponsor submitted a formal request for assistance to NRCS on November 3, 2008. The request for assistance listed concerns about compliance with current dam safety standards.

The Project Team developed a Public Participation Plan, including a comprehensive mailing list of agencies, groups and individual stakeholders, in consultation with the Sponsor and NRCS. The Public Participation Plan will comply with NRCS General Title 400, Part 400 – Public Participation Policy.

The comprehensive mailing list included federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Indian tribes; other interested parties; and local libraries and newspapers. This list also included affected landowners who are potential right-of-way grantors, whose property may be used temporarily for Project purposes, or who own homes within certain distances of the Project, and anyone who submits comments on the Project. The mailing list was updated as the analysis proceeded and the information related to this environmental review was sent to individuals, organizations, and government entities interested in and/or potentially affected by the planned Project.

NRCS, the Town of Oneida and members of the Project Team (Table 9-1) conducted a Project kickoff meeting at the Town of Oneida – Courtroom, 121 Municipal Drive, Oneida, Tennessee on November 25, 2013. Shortly after this meeting a Public Participation Plan was prepared to serve as a guide for carrying out the activities related to consultation, coordination, and public participation. The planning effort was conducted in close coordination with the Tennessee Department of Environment and Conservation, Division of Water Resources – Safe Dams Program.

Public scoping open forums were conducted by the Town of Oneida. The Town of Oneida received input, discussed problems and opportunities, and issued updates on progress. All Public Meetings were open forums conducted in compliance with State of Tennessee Sunshine Act which requires public agencies to hold certain meetings and hearings open to the public.

November 25, 2013 – Project Team/NRCS/Town of Oneida, Tennessee. The Project Team, NRCS and the Town of Oneida held a meeting at the Town of Oneida – Courtroom, 121 Municipal Drive, Oneida, Tennessee. This meeting provided instruction and guidance on the Project scope and the extent of activities required for developing the Supplemental Watershed Plan and Environmental Assessment.

March 18, 2014 – Public Forum. The Town of Oneida conducted a public scoping meeting at 121 Municipal Drive, Oneida, Tennessee 37841. Representatives from the Town of Oneida, and United States Department of Agriculture – Natural Resources Conservation Service lead the public meeting to seek input regarding the Supplemental Watershed Plan and Environmental Assessment to consider alternatives to rehabilitate Pine Creek Watershed Dam No. 4 in Scott County, Tennessee.

The objectives of the public scoping meeting included:

- Ensure that the general public; private groups; and local, county, and state government agencies are thoroughly familiar with the proposed Pine Creek Watershed Dam No. 4 rehabilitation Project.
- Promote an atmosphere of extra-agency cooperation.
- Provide a forum for the reception and consideration of public input regarding the Project.
- Clarify the effects of the diverse alternatives under consideration.

- Collect existing resource data regarding Pine Creek Watershed Dam No. 4 from agencies and citizens.
- Incorporate written and verbal comments into the decision-making process.

Individuals requiring additional information, or those who needed special accommodations to attend the public scoping meeting were offered special consideration by contacting Dwight Dixon, District Conservationist, USDA-NRCS, 452 Mark Twain Ave E, Jamestown, Tennessee 38556-7402.

6.2 AGENCY CONSULTATION

The following tribes and agencies received a scoping letter and later the Abstract of the Supplemental Watershed Plan No. 3 and Environmental Assessment for Pine Creek Watershed Dam No. 4:

- Shawnee Tribe of Oklahoma
- Alabama-Coushatta Tribe of Texas
- Alabama-Quassarte Tribal Town of Oklahoma
- Cherokee Nation
- Chickasaw Nation of Oklahoma
- Eastern Band of Cherokee Indians
- Eastern Shawnee Tribe of Oklahoma
- Kialegee Tribal Town
- Muscogee (Creek) Nation of Oklahoma
- Poarch Band of Creek Indians
- Seminole Nation of Oklahoma
- Shawnee Tribe of Oklahoma
- Thlopthlocco Tribal Town
- United Keetoowah Band of Cherokee Indians
- TN Department of Environment & Conservation
- TDEC Knoxville Environmental Field Office
- TDEC Division of Natural Areas
- TDEC Division of Air Pollution Control
- TDEC Division of Remediation
- TDEC/TN Historical Commission
- Tennessee Division of Forestry
- U.S. Forest Service
- TN Wildlife Resources Agency
- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- USACE Nashville District
- National Park Service, Southeast Region
- Farm Services Agency
- Tennessee Valley Authority

In accordance with the Council on Environmental Quality regulations implementing the National Environmental Policy Act (NEPA) at 40 CFR Part 1501.6, NRCS formally requested that the U.S. Army Corps of Engineers become a cooperating agency in the planning and development of the Supplemental Watershed Work Plan No. 3 and Environmental Assessment for Pine Creek Watershed Dam No. 4. This request was made because the U.S. Army Corps of Engineers was identified as having special expertise or jurisdiction by law related to the Project.

Section 12 of PL 83-566 specifically requires coordination with the USFWS. Coordination was conducted with U.S. Fish and Wildlife Service regarding federally-listed species potentially occurring in Scott County, Tennessee. In response to the coordination, the Project Team received written correspondence from Mr. Bryan Watkins, Private Land Biologist, U.S. Fish and Wildlife Service, 446 Neal Street, Cookeville, Tennessee 35801, on May 12, 2014 stating the following:

> "We have reviewed the alternatives provided relative to the Supplemental Watershed Project Plan Environmental Assessment (Plan-EA) for the Pine Creek dam #4 (Howard H. Baker Sr. Lake dam) located in the Pine Creek Watershed in Oneida, Scott County, Tennessee and have no objection or comments in reference to this plan.
>
> Endangered species collection records available to the Service do not indicate that federally-listed or proposed endangered or threatened species occur within the impact area of the Project. We note, however, that collection records available to the Service may not be all-inclusive. Our data base is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality. However, based on the best information available at this time, we believe that the requirements of Section 7 of the Endangered Species Act of 1973, as amended, are fulfilled."

Prior to construction of the dam, consultation with the State Historic Preservation Office (SHPO) determined that no archeological, historic, or cultural resources would be disturbed by the proposed dam construction.

The Project Team consulted with SHPO and the State Archaeologist to ensure compliance with Section 106 of the National Historic Preservation Act (NHPA) and the National Cultural Resources Procedures Handbook (NCRPH). A Phase I cultural resource survey was conducted for the area immediately surrounding the dam. A Phase I cultural resource survey was conducted for the dam itself, which was constructed in 1966, and the surrounding impact area (APE). Consideration was given to the possibility of the water level being altered and the impact this alternative would have on the shoreline. All findings were documented using the NRCS-CPA-52 worksheet.

Since the dam was built in the footprint previously cleared for such resources, none of the proposed Project alternatives pose a risk of impact to archeological or historic resources. A recent follow-up review of The National Register of Historic Places website reconfirmed that while several historical sites are nationally listed for Scott County, none occur in the area of potential effect for the Project. On March 25, 2015, SHPO confirmed there are no known archeological or historical sites in the area of potential effect.

7.0 PREFERRED ALTERNATIVE: REHABILITATE TO NRCS HIGH HAZARD CLASS DAM

7.1 RATIONALE FOR PREFERRED ALTERNATIVE

The following alternatives were developed and presented to the Town of Oneida on February 10, 2015:

- No Action/Future Without Federal Project (FWOP)
- Rehabilitation to NRCS High Hazard Class dam
- Decommissioning
- Decommissioning with Nonstructural Measures (Floodproofing in the Inundation Areas)
- Variations of Dam Rehabilitation Alternative

Three of these alternatives (FWOP, Rehabilitation to NRCS High Hazard Class dam, and Decommissioning with Nonstructural Measures) merited detailed evaluation. The Town of Oneida selected their preferred alternative to be the rehabilitation of the dam as identified by NRCS; with the understanding that the rehabilitation items will be developed during the design phase to minimize disturbance, construction cost, and operation and maintenance costs. Thus the Rehabilitation to NRCS High Hazard Class Dam Alternative is the Preferred Alternative of both NRCS and the Sponsor.

The Pine Creek Watershed Dam No. 4, Supplemental Watershed Plan No. 3 and Environmental Assessment meet all applicable USDA-Natural Resources Conservation Service and State of Tennessee dam safety and performance standards. The service life for the rehabilitated dam will be 70 years.

The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) require the evaluation of a National Economic Development Alternative. This alternative is defined as that which maximizes the net economic benefits, consistent with protecting the Nation's environment. The Rehabilitation to NRCS High Hazard Class Dam Alternative meets the tests of completeness, effectiveness, efficiency, and acceptability. The Preferred Alternative is the NED Alternative with net annual economic benefits of $735,000 and a Benefit/Cost ratio of 7.8 to 1.0.

7.2 MEASURES TO BE INSTALLED

Based on review of the Project Purpose and Project Need, the overall impacts on human and natural environmental resources, and consideration of the NED Alternative, the Preferred Alternative is to rehabilitate Pine Creek Watershed Dam No. 4 to NRCS and State of Tennessee High Hazard Class dam design criteria with a service life of 70 years. The Preferred Alternative will sustain the present level of flood protection and reduce the threat to public health and safety. The Preferred Alternative (See Figure B-3 – Project Site Map in Appendix B) includes the following modifications to the dam:

- Maintain the axis of the dam at its present location
- Raise the top of dam elevation by 0.9 foot.
- Add a 350-foot-wide Roller Compacted Concrete (RCC) overtopping portion of the dam that will serve as the Auxiliary Spillway. The functional crest of the Auxiliary Spillway will be lowered by 0.6 foot.
- Extend the dam embankment across the existing auxiliary spillway.
- Add a stilling basin at the bottom of the RCC to direct flows into the downstream channel.
- Install a sand diaphragm around the principal spillway conduit.
- Relocate the water supply pump station due to spatial conflicts with the stilling basin and to afford future access from the service road.
- Replace the principal spillway riser structure and conduit and increase diameter from 30-inches to 48-inches.
- Increase the elevation of the riser inlet by one foot, adding 59 acre-feet of water supply storage supported by the Reliable Yield/Water Supply study.

Several rehabilitation options were considered for Pine Creek Watershed Dam No. 4 in order to meet the High Hazard Class dam design and safety criteria, and allow for continued operation of the structure for an additional 70 years. Additional constraints were considered in the development of the rehabilitation alternatives, including the Sponsor's desire to keep the proposed top-of-dam as close to the existing elevation as possible.

The two most viable alternatives considered were 1) raising top of dam while widening and lining the auxiliary spillway and 2) maintaining top of dam elevation with the addition of a Roller Compacted Concrete (RCC) overtopping section. In both alternatives, the principal spillway riser and outlet were to be replaced to allow for an additional 70 years of operation. Also, in both alternatives, the existing water supply pump station would need to be relocated to the west side of the stream. Due to the Town of Oneida's desire to maintain the top-of-dam as close to the existing elevation as possible, the RCC alternative was chosen as the preferred rehabilitation alternative.

The alternative to rehabilitate Pine Creek Watershed Dam No. 4 to meet NRCS and State of Tennessee High Hazard Class dam criteria would require construction and modification in three locations of the dam:

Auxiliary Spillway – The embankment will be armored with 350 feet of Roller Compacted Concrete (RCC) to serve as the Auxiliary Spillway. The embankment will be extended across the existing auxiliary spillway. The top of dam elevation will be increased from Elevation 1473.1 feet (NAVD88) to Elevation 1474.0 feet (NAVD88).

Upstream Face – Replacement of the principal spillway riser and conduit structures will first require construction of a coffer dam and installation of a water diversion to dewater the construction area adjacent to the riser structure. The dewatering plan will be developed during the construction phase. Options for the coffer dam will be evaluated during the design phase. Dewatering methods that may be considered include pumping, installation of a siphon, or installation of pipe extending upstream to divert flow directly through the principal spillway conduit and around the riser structure.

Replacement of the riser structure will include demolition of the riser structure, replacement of unsuitable material, installation of the foundation, and installation of the new riser structure. The crest elevation of the principal spillway riser will be increased from Elevation 1465.5 feet (NAVD88) to Elevation 1466.5 feet (NAVD88) and subsequently adding 59 acre-feet of water supply storage capacity.

Replacement of the principal spillway conduit will include excavation of the embankment, demolition of the existing conduit and cutoff collars, removal of the unsuitable material, installation of the foundation, conduit placement, filter diaphragm installation, and embankment backfill. The principal spillway conduit diameter will be increased from the existing 30-inch diameter reinforced concrete pipe to a 48-inch diameter reinforced concrete pipe. An evaluation of the downstream effects of the 30-inch diameter principal spillway outlet pipe versus the 48-inch outlet pipe determined that the maximum increase water surface elevations for high-frequency events up to the 100-year storm event is less than 1 foot. Building structures and transportation facilities are not impacted as a result of the rehabilitation alternative's increase in principal spillway outlet diameter.

Downstream Toe – The existing foundation drain trench near the downstream toe of the dam will be replaced with filter material along the downstream slope of the embankment. Additionally, the existing cutoff collars will be replaced with a filter diaphragm surrounding the principal spillway conduit. Construction techniques of the filter diaphragm will be evaluated in the design phase. The filter diaphragm construction will consist of excavation, subgrade preparation, installation of aggregate material and geotextile, and backfill with suitable material.

The water supply pump station will be relocated to the west side of the stream due to spatial conflicts with the stilling basin and to provide future access from the service road.

The construction will be conducted to minimize erosion and sedimentation, including the development of an erosion and sediment control plan as part of the permitting process. The construction site will be seeded and mulched immediately as phases of work are completed to establish vegetation immediately following construction on all land disturbed by construction activities. Appropriate plants for erosion control and wildlife habitat will be selected based upon the installation season, soils, surrounding

vegetation, and Sponsor's preference. The rehabilitated dam will meet all current NRCS and State of Tennessee dam safety and performance standards.

Detailed information for Preferred Alternative is provided in Table 7-1.

Table 7-1
Preferred Alternative Design Features

Resource	Unit	Existing Condition	Rehabilitate To NRCS High Hazard Class Dam[1]
Elevation, Crest of dam	MSL [2]	1473.10 feet	1474.00 feet
Elevation Crest of auxiliary spillway	MSL [2]	1469.00 feet	1469.00 feet
Elevation, Principal spillway inlet	MSL [2]	1465.50 feet	1466.50 feet
Elevation, Low stage inlet	MSL [2]	1464.00 feet	none
Dam crest length	Feet	400 feet	400 feet
Auxiliary spillway type	Type	Vegetated Earth	Roller Compacted Concrete
Auxiliary spillway bottom width	Feet	40 feet	350 feet
Principal spillway type	Type	Multi-Stage	Single Stage
Principal spillway diameter	Inches	30	48

[1] Information in this table is based on the results of the planning study and may vary from the General Work Plan and As-Built Drawings.

[2] Mean Sea Level, NAVD88

After implementation of the Preferred Alternative, Pine Creek Watershed Dam No 4 will meet all current NRCS and TDEC dam safety and performance standards.

7.3 MITIGATION

No compensatory mitigation is anticipated. All construction will be conducted to minimize erosion and sedimentation, including the development of an erosion and sediment control plan as part of the permitting process. Vegetation will be established immediately following construction on all land disturbed by construction activities. Appropriate plants for erosion control and wildlife habitat will be selected based upon the installation season, soils, surrounding vegetation, and the Sponsor's preference.

In order to take precautions regarding introduction of invasive species as disturbed areas are being revegetated, the construction contract will include standards and specifications drawn from the NRCS Field Office Technical Guide requiring mechanical and/or chemical means of control.

All needed measures will be taken to mitigate (avoid, minimize, and compensate) any adverse impacts during construction and may include timing of the work, sediment controls such as seeding, mulching and silt fences and wetting construction areas to reduce dust.

Potential mitigation measures identified during the permitting process will be incorporated into the Project.

7.4 COMPLIANCE WITH FEDERAL, STATE, AND LOCAL LAWS

All applicable local, state, and federal laws will be complied with in the installation of this Project.

State and Federal Regulations, Permits, and Compliance

- *Dam Permit and General Permits*

  The Dam Owner, Town of Oneida, will be responsible for obtaining a Dam Permit, or other appropriate authorization from the Tennessee Department of Environment and Conservation, prior to commencing construction. There may be fees for these permits.

- *Section 404 of the Clean Water Act Permit*

  The Project (i.e., the Preferred Alternative) would impact North Fork Pine Creek, surface waters associated with the impoundments of this tributary, and potential jurisdictional wetlands. Wetlands and surface waters adjacent to the stream would be considered Waters of the United States. Section 404 requires a permit for the discharge of dredged or fill material into Waters of the United States. The Project is subject to CWA Section 404 regulations enforced by the USACE and EPA. The Project must be in compliance with EPA's 404(b)(1) guidelines.

- *Section 402 of the Clean Water Act – National Pollutant Discharge Elimination System Permit*

  The Project would involve ground-disturbance of one acre or more; therefore, a National Pollutant Discharge Elimination System permit (administered through TDEC) would be required. NRCS, or their contractor, shall submit the Large Construction Storm Water General Permit Notice of Intent to TDEC upon development of a Project-specific, permit-compliant SWPPP, and a Request for Termination within 30 days of meeting the requirements for termination of permit coverage.

- *Section 401 of the Clean Water Act-Water Quality Certification (WQC)*

  Projects requiring a Section 404 permit also require a Section 401 WQC from the State. TDEC administers the 401 WQC Program. The USACE 404 permit is not valid until TDEC grants Section 401 WQC.

- *50 C.F.R. §§ 17.2(b), 402.01(b), Endangered Species Act (ESA) of 1973*

  Section 7 of the ESA applies to NRCS and it imposes an affirmative duty on NRCS to ensure that the Project is not likely to jeopardize the continued existence of a listed species or result in the destruction or modification of critical habitat. The ESA is enforced by USFWS. USFWS initially indicated on March 12, 2014 that endangered species collection records available to the Service do not indicate that federally-listed or proposed endangered or threatened species occur within the impact area of the Project. Due to the potential to affect forested areas in the vicinity of the dam and the recent listing of the Northern long-eared bat on April 2, 2015, NRCS will re-evaluate impacts and potential mitigation measures for endangered and threatened species during the USACE permitting process to identify BMPs and mitigation measures to ensure that the Project will not adversely affect endangered species.

- *36 CFR Part 800 – National Historic Preservation Act*

  Section 106 requires NRCS to identify and assess the effects of the Project on historic properties. NRCS must consult the appropriate state and local officials, the SLO, and members of the public and consider their views and concerns about historic preservation issues when making final Project decisions. If cultural resources are discovered during installation, NRCS will cause work to stop in that area and conduct an investigation and evaluation by a qualified cultural resources specialist.

- *16 U.S.C. 668-668d, 54 Stat. 250, Bald and Golden Eagle Protection Act*

  The Bald Eagle and Golden Eagle Protection Act provides protection to the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. NRCS must ensure that the Project is not likely to jeopardize the continued existence of bald eagles or golden eagles.

- *50 CFR Parts 10, 14, 20 and 21, Migratory Bird Treaty Act (MBTA)*

  Legislation (16 USC § 703 et seq.) makes it unlawful to *take* migratory birds, their eggs, feathers or nests. *Take* is defined in the MBTA to include by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof. A migratory bird is any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. NRCS must ensure that the Project would not result in a take of migratory birds.

- *Executive Order 11988, Floodplain Management*

  Executive Order 11988 requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. This EO requires NRCS to provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains for federally-funded activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

- *Executive Order 11990, Protection of Wetlands*

  The purpose of EO 11990 is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." EO 11990 requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. This EO applies to federally-funded activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

- *Executive Order 13112, Invasive Species*

  EO 13112 directs federal agencies to not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States unless the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

- *Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds*

  EO 13186 requires NRCS to consider the impacts of planned actions on migratory bird populations and habitats for all planning activities.

- *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*

  EO 12898 requires that federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. Socioeconomic and demographic data for the Project area were analyzed to determine if a disproportionate number of minority or low-income persons have the potential to be adversely affected by the proposed Project. The U.S. Census Bureau data for Oneida, Tennessee states that 97.7% of the population is white, 0.0% African American, 0.2% Asian, 0.1% American Indian or Alaska Native, 1.5% two or more races, and 0.5% some other race. No concentration of minority or low-income populations was identified near the proposed Project site.

Local Permits and Compliance Actions

- The Project may be subject to local permits and compliance actions. The Town of Oneida and Scott County, Tennessee may regulate development and construction activities.

7.5 COSTS AND COST SHARING

Tables 1 through 6, located at the end of Section 7 describe the Project costs, Project benefits and structure data for the Preferred Alternative. Estimated installation costs for the Preferred Alternative are shown in Table 1 and Table 2. Total annualized costs are shown in Table 4. The costs shown in Tables 1, 2, and 4 and throughout the document are based on standard cost accounting practices required of federal watershed planning agencies, such as NRCS. The cost accounting guidance is Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. The basis for cost sharing between NRCS and the Sponsor is different and is based on the provisions of the dam rehabilitation amendments of the Watershed Protection and Flood Prevention program. Cost sharing for authorized projects under the dam rehabilitation amendments is based on 390-USDA-NRCS, National Watershed Program Manual, Part 506, Subpart B, April 2014:

> Total eligible rehabilitation Project costs for the purpose of cost sharing include: all costs associated with construction, acquisition of property rights, easements or rights-of-way, non-federal Project administration and contracting, and non-federal technical and engineering assistance for Project planning, design, and installation. Technical engineering and Project administration assistance provided by NRCS shall not be considered as part of the total cost. Sponsor shall be responsible for the cost of all water, mineral and other resource rights and all required permits. These costs shall not be considered part of the total cost. Federal funds will be 65% of the above-defined costs, not to exceed 100% of the construction costs. The Sponsor shall be responsible for 35% of the calculated total cost of the rehabilitation Project based on the above definitions using non-federal funds. In-kind contributions and the value of property rights acquired may be counted as agreed to under a separate Memorandum of Understanding (MOU) between the Sponsor and NRCS.

The estimated cost sharing allocation for the planned Project is shown in Table 7-2.

Table 7-2
Estimated Cost Share

Works of Improvement	NRCS	Sponsors	Total
Cost-Sharable Items [1]			
Rehabilitation of dam (Construction Costs)	$ 1,391,000	$ 682,700	$ 2,073,700
Relocation [2]	$ -	$ -	$ -
Sponsor's Planning Costs	$ -	$ -	$ -
Sponsor's Engineering Costs	NA	$ -	$ -
Sponsor's Project Administration	NA	$ -	$ -
Land Rights Acquisition Cost [3]	NA	$ 66,300	$ 66,300
Subtotal: Cost-Share Costs	$ 1,391,000	$ 749,000	$ 2,140,000
Cost-Share Percentages	**65.0%**	**35.0%**	**100.0%**
Non Cost-Sharable Items			
NRCS Engineering & Project Administration	$ 749,000	NA	$ 749,000
Natural Resource Rights	NA	$ -	$ -
Federal, State and Local Permits	NA	$ 2,500	$ 2,500
Subtotal: Non Cost-Share Costs	$ 749,000	$ 2,500	$ 751,500

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1 Total eligible rehabilitation Project costs for the purpose of cost sharing includes construction; land rights, easements, or rights-of-way; and all non- NRCS technical and engineering assistance for planning, design and Project administration. The Sponsor's share shall be paid with non-federal funds. In-kind contributions may be counted as specified in a separate Memorandum of Understanding between the Sponsor and NRCS.

2 Investigation of the watershed Project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost-shared in accordance with the percentages shown.

3 The Sponsor will acquire land rights with other than Watershed Protection and Flood Prevention Act funds, such real property as will be needed in connection with the works of improvement. The value of real property is eligible as in-kind contributions toward the Sponsor's share of the works of improvement costs. In no case will the amount of an in-kind contribution exceed the Sponsor's share of the cost for the works of improvement. The maximum cost eligible for in-kind credit is the same as that for cost sharing.

4 Price Base 2015.

7.6 Installation and Financing

The works of improvement for rehabilitation of the dam are planned for installation in year one of the evaluation period. The actual installation period is contingent on the availability of funds for design and installation.

If possible, installation should be completed in one construction season in order to minimize the disturbance to plant, wildlife, and human communities. During construction, equipment will not be allowed to operate when conditions are such that soil erosion and water, air, and noise pollution cannot be satisfactorily controlled. NRCS will provide assistance to the Sponsor. The Sponsor has the needed authorities to carry out the Plan and intends to use them as appropriate.

NRCS Responsibilities. NRCS is responsible for the following implementation components of the Preferred Alternative:

- Design of the dam rehabilitation and preparation of construction drawings and construction specifications.
- Execute a Project Agreement with the Sponsor before either party initiates work. This Agreement sets forth detailed financial and working arrangements and other applicable conditions.
- Verify the Memorandum of Understanding with the Sponsor that allocates cost share funding is up to date.
- Request approval from NRCS – National Watershed Rehabilitation Program Coordinator to fund an increase of water supply.
- Execute an updated O&M Agreement for the dam. This Agreement is based on the NRCS National Operation and Maintenance Manual.
- Determine that an Emergency Action Plan is prepared prior to the execution of fund-obligating documents for construction of the structure.
- Provide contract administration technical assistance.
- Provide construction management technical assistance (Inspector and Contracting Officer Technical Representative).
- Provide engineering support, technical assistance, and approval during the design and construction of the Project.
- Provide financial assistance equal to 65 percent of eligible Project costs, not to exceed 100 percent of actual construction costs, as appropriations become available under the Watershed Rehabilitation component of the Watershed Protection and Flood Prevention Act (PL 83-566).
- Certify, in conjunction with TDEC, completion of all installed measures.

Sponsor Responsibilities. Town of Oneida is responsible for the following implementation components of the Preferred Alternative:

- Provide written assurance that they have the legal authority and sufficient funding; that they are willing and able to obtain all necessary land rights, easements, permits and that they will be responsible for ensuring the operation, maintenance, and replacement of installed measures.
- Participate in, and comply with, applicable federal floodplain management and flood insurance programs.
- Update/complete an Emergency Action Plan based on the planned changes for Pine Creek Watershed Dam No. 4.
- Secure all needed permits, easements, and rights for installation, operation, and maintenance.
- Execute any needed updates to the Memorandum of Understanding with NRCS which provides a framework within which cost share funds are credited.
- Execute an Operation and Maintenance Agreement for Pine Creek Watershed Dam No. 4 with NRCS.
- Execute a Project Agreement or similar implementation agreement with NRCS to obligate funds for cost share payments.
- Be responsible for all buried waste found during construction activities, if any, and all associated costs, although such costs could be included for in-kind credit at the Sponsor's request.
- Provide financial assistance or qualifying in-kind services at a rate equal to, or greater than, 35 percent of Project costs using non-federal funds.
- Provide local administrative services necessary for installation of the Project.

Other Organizations' Responsibilities. No organizations other than the Town of Oneida and NRCS have any responsibilities in implementation of this plan.

7.7 Emergency Action Plan

Prior to construction, the Sponsor shall prepare an updated Emergency Action Plan (EAP) for the dam or similar structure where failure may cause loss of life or as required by state and local regulations. The EAP shall meet the minimum content specified in the NRCS Title 180, National Operation and Maintenance Manual (NOMM), Part 500, Subpart F, Section 500.52, and meet applicable State agency dam safety requirements. NRCS will determine that an EAP is prepared prior to the execution of fund-obligating documents for construction of the structure. The EAP shall be reviewed and updated by the Sponsor as required by TDEC.

7.8 Contracting

The Project will be installed by means of a federal contract administered by NRCS, as requested by the Sponsor. Other contracting arrangements will be agreed to between NRCS and the Sponsor before either party commences work activities. A project or other implementation agreement between NRCS and the Sponsor will detail the work activities and financial responsibilities for both parties.

7.9 Real Property

The Sponsor currently owns the property on which the reservoir and dam sit as indicated in Scott County, Tennessee as parcel #051 035.00. Additionally, the Sponsor has intent to acquire land rights necessary for the new top of dam elevation.

7.10 Solid and Hazardous Wastes

There are no known solid or hazardous wastes identified in the Project area. If such wastes are discovered during construction, the Sponsor will ensure that such wastes are identified and disposed of in accordance with all applicable federal, state, and local rules and regulations. The Sponsor will be responsible for waste identification and disposal, and if warranted, testing of soil and groundwater and remediation plans. These activities will generally require the services of a hazardous waste consultant certified by TDEC.

7.11 Cultural Resources

In a letter dated March 25, 2015, the Tennessee State Historic Preservation Office (SHPO) confirmed there are no known cultural resources located in the construction, borrow, and spoils areas for the rehabilitation of Pine Creek Watershed Dam No. 4. If during the design phase it is determined that other areas will be impacted during construction, consultation with SHPO will be done prior to completion of design. If cultural resources are discovered during installation, NRCS will require construction to stop and follow policy contained in NRCS General Manual, 420 Part 401 and will take action in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the regulations (36 CFR 800) of the Advisory Council on Historic Preservation. In the case of a discovery during construction, NRCS will work closely with SHPO to reduce Project effects on cultural resources.

7.12 Financing

The NRCS share of installation costs will be provided from funds appropriated under the Watershed Protection and Flood Prevention Act (PL 83-566), Watershed Rehabilitation. This is not a fund-obligating document, and federal assistance is subject to the availability of Congressional appropriations. The Sponsor has analyzed their financial requirements for carrying out the plan, including components that are not eligible for federal assistance as part of this plan. The Sponsor will arrange for funds to be available, when needed, from donations, non-federal grants, cash reserves, tax revenues and other non-federal sources. Credit for in-kind contributions will be as specified in the Memorandum of Understanding.

The cost, if any, of all water, mineral, and other resource rights and all required permits are not eligible for federal financial assistance. These costs shall be borne, in full, by the Sponsor. The Sponsor also understands that they will be fully responsible for costs incurred for the operation, maintenance, and replacement of installed measures.

7.13 OPERATION, MAINTENANCE, AND REPLACEMENT

Measures installed in this plan, and previously installed measures, will be operated and maintained by the Sponsor with technical assistance from federal, state, and local agencies in accordance with their delegated authority. A new O&M agreement will be developed for Pine Creek Watershed Dam No. 4 utilizing the NRCS-National Operation and Maintenance Manual, and will be executed when the implementation agreement is executed. The new O&M agreement will be for the evaluated life of the rehabilitation project, which is 70 years. The Town of Oneida will be fully responsible for all operation, maintenance, repair and replacement of installed measures until such time that the structure is formally decommissioned in accordance with applicable laws and regulations.

The O&M agreement will specify responsibilities of the Sponsor and include detailed provisions for retention, use, and disposal of property acquired or improved with PL 83-566 cost sharing, requirements for operation and inspection, financial plan for conducting O&M activities, consultation requirements for modifications to works of improvement, notification requirements for emergency situations, policy related to violations of the agreement, recurring review and update of the agreement, preparation and review requirements for an Emergency Action Plan, recordkeeping requirements, and other such requirements. Provisions will be made for free access of Sponsor, state, and federal representatives to inspect all structural measures and their appurtenances at any time.

The operation and maintenance costs for the Preferred Alternative are based on Table 7-3.

Table 7-3
Annual Operation and Maintenance Costs

Item	Annual Cost from Watershed Work Plan[1]	ENR Construction Cost Index From 1960	Current Annual Cost[2]
Routine Annual O&M Costs (Every year)	$ 468	12.18	$ 5,700

Item	Cost[2]	Amortization Rate[3] (%)	Return Period (Years)	Annual Cost[2]
Non-Routine O&M Costs				
Emergency Action Plan(Every 5 years)	$5,000	3.125%	5	$ 1,096

Total Annual Operation and Maintenance Cost	$ 6,800

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[1] From 1961 Watershed Work Plan, Page 25 (Price Base September 1960).

[2] Price base 2015.

[3] Amortized O&M costs over return period at 3.125% interest rate based on Water Resources Discount Rate: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/

Table 1 - Total Estimated Project Installation Cost

Preferred Alternative	Source[1]		Total Estimated Installation Costs[1]
	PL 83-566 Funds	Other Funds	
Rehabilitate to NRCS High Hazard Class Dam	$2,140,000	$751,500	$2,891,500

April-2016

[1] Price base 2015.

Table 2 – Estimated Cost Distribution

Works of Improvement	Installation Cost - Public Law 83-566 [1]				Installation Cost - Other Funds [1]								Total Installation Costs
	Construction	Engineering	Project Administration	PL 83-566 Funds	Construction	Engineering	Real Property	Natural Resource Rights	Relocation Payments	Permits	Administration	Total Other	
Rehabilitate to NRCS High Hazard Class Dam	$1,391,000	$642,000	$107,000	$2,140,000	$682,700	$0	$66,300	$0	$0	$2,500	$0	$751,500	$2,891,500

April-2016

[1] Price base 2015.

Table 3 – Structure Data

Item	Unit	Pine Creek Watershed Dam No. 4[1]
NRCS Hazard Class		High
Seismic zone		1
Uncontrolled drainage area[2]	Square mile	1.40
Controlled drainage area[2]	Square mile	0
Total drainage area[2]	Square mile	1.40
Runoff curve number (1-day) (AMC II)[2]		70
Time of concentration (Tc)[2]	Hours	1.17
Elevation Top of Dam	Feet[3]	1474.00
Elevation crest auxiliary spillway	Feet[3]	1469.00
Elevation crest principal spillway	Feet[3]	1466.50
Auxiliary spillway type	Type	Roller Compacted Concrete
Auxiliary spillway bottom width	Feet	350
Auxiliary spillway exit slope	Percent	67%
Maximum height of dam	Feet	34.0
Total capacity [4]		
Sediment	Acre feet	48.7
Municipal Water Supply	Acre feet	530.2
Floodwater retarding	Acre feet	159.1
Surface Area [4]		
Sediment Pool	Acres	14.46
Floodwater Retarding Pool	Acres	67.90
Principal spillway design		
Rainfall volume (1-day)[2]	Inches	6.7
Rainfall volume (10-day)[2]	Inches	11.60
Runoff volume (1-day)[2]	Inches	3.37
Runoff volume (10-day)[2]	Inches	5.01
Capacity of Principal Spillway	cfs	350
Dimensions of conduit	Inches	48
Type of conduit	Type	RCP
Auxiliary spillway hydrograph[5]		
Percent Chance of Use	Percent	1
Rainfall volume	Inches	14.7
Runoff volume	Inches	10.6
Storm duration	Hours	24
Velocity of flow (Ve)	Feet/second	28.85
Maximum reservoir water surface elevation	Feet	1470.85
Freeboard hydrograph [5]		
Rainfall volume	Inches	37.5
Runoff volume	Inches	32.8
Storm duration	Hours	24
Maximum reservoir water surface elevation	Feet	1473.80
Capacity equivalents		
Sediment volume	Inches	0.65
Floodwater retarding volume	Inches	2.13

1 Information in this table is based on the results of the planning study and may vary from the General Work Plan and As-Built Drawings for structures.
2 Hydrologic data taken from Pine Creek Hydrology HEC-HMS and SITES Model.
3 Vertical Datum, NAVD88.
4 Measured at crest of the auxiliary spillway.
5 The 6-hour and 24-hour storms were evaluated and the 24-hour storm duration controlled.

Table 4 – Estimated Average Annual NED Costs

Item	Rehabilitate to NRCS High Hazard Class Dam[1]	
Annual Costs [2]		
Amortized Installation Costs	$	101,000
O&M and Replacement Costs	$	6,800
Total Average Annual Costs	$	107,800

April-2016

[1] Price base 2015
[2] Amortized over 3 years construction and 70-year service life at a 3.125 % discount rate.

Table 5 – Average Annual Flood Damage Reduction Benefits

Condition	Average Annual Agriculture-Related Flood Damage[1,2]		Damage Reduction
	Without Project	With Project	
Flood Damage			
Residential, Commercial and Transportation	$ 286,900	$ 1,300	$ 285,600
More Intensive Use of Land			$ 18,900
Total	$ 286,900	$ 1,300	$ 304,500

April-2016

[1] Price base 2015.

[2] Agriculture-related damage includes damage to rural communities.

Table 5A – Estimated Average Annual Non-Flood Benefits

Item	Average Annual Agriculture-Related Non-Flood Benefits[1,2]
Municipal Water Supply	$ 470,100
Future Without Federal Project Costs Avoided	$ 68,200
Total	$ 538,300

April-2016

[1] Price base 2015.

[2] Agriculture-related benefits include benefits to rural communities.

Table 6 – Comparison of NED Benefits and Costs

Works of Improvement	Direct Benefits[1]	Other Benefits[2]	Average Annual Benefits[1]	Average Annual Costs [1,4]	Benefit/Cost Ratio[1]
Rehabilitate to NRCS High Hazard Class Dam	$ 774,600	$ 68,200	$ 842,800	$ 107,800	7.8 to 1.0

April-2016

[1] Price base 2015.

[2] Per Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, 1.7.2 (b) (3) - the avoided cost of the most likely alternative to the planned action.

[3] From Table 4.

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9.0 LIST OF PREPARERS

Table 9-1 List of Preparers

Name	Present Title	Education	Years Experience
NRCS Staff			
Dwight Dickson	District Conservationist		29
Carol Chandler	State Resource Conservationist		24
Frank Sagona	Biologist/Environmental Liaison		35
Don Merritt	Archaeologist		45
Michelle Beasley	Economist		24
Ralph Smith	Hydraulic Engineer		13
KLA Environmental Services, Inc.			
Kevin L. Shamburg, PE	Project Administrator	B.S. Civil Engineering	36
Ramona V. Newsom	Data Quality Specialist	B.S. Business Administration	36
Elliott R. Harris, PE	Project Engineer	B.S. Fisheries and Wildlife Biology B.S. Agricultural Engineering	13
Jarred D. Green, PE	Project Engineer	B.S. Civil Engineering	9
Eldon R. Colson, Jr.	Project Technician	-	21
Amec Foster Wheeler			
Andrew Clevenger, PE	Project Manager	B.S. Civil Engineering M.S. Environmental Engineering	20
Sara Johnson, PE, CFM	Senior Water Resources Engineer	B.S. Biosystems Engineering M.S. Biological and Agricultural Engineering	9
Larry Sample, PE	Senior Water Resources Engineer	B.S Agricultural Engineering M.S. Agricultural Engineering	21
Brian Stevens, EIT, CFM	Water Resources Specialist	B.S. Biological and Irrigation Engineering M.S. Civil Engineering	9
Ashwini Kashelikar, PE, CFM	Water Resources Engineer	B.S. Chemical Engineering M.S. Environmental Engineering	6
Brooks Ingram, GISP	GIS Analyst	B.S. Environmental Planning	10
Mary Motte Fikri, PG, PWS	Project Biologist	B.S. Natural Resources M.S. Forest Resources	16
Martin Marchaterre, Esq.	Senior Environmental Planner	B.A. History and Political Science J.D. Law	25
John Hunter	Senior Archaeologist	B.A. Anthropology M.A. Antropology	15

10.0 INDEX

Appendix A
COMMENTS AND RESPONSES

April 14, 2014

TDEC Division of Remediation
ATTN: Mr. Andy Binford
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 14th Floor
Nashville, TN 37243

RE: Supplemental Watershed Project Plan Environmental Assessment
Rehabilitation of Pine Creek Dam #4 (Howard H. Baker Sr. Lake)
Oneida, Scott County, Tennessee

Dear Mr. Binford:

The Town of Oneida, Tennessee and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) are currently preparing a Supplemental Watershed Project Plan Environmental Assessment (Plan-EA) for the Pine Creek Dam #4 (Howard H. Baker Sr. Lake dam) located in the Pine Creek Watershed in Scott County, Tennessee (refer to Figures 1 and 2). The Pine Creek Watershed Work Plan was originally prepared in 1961 by the Pine Creek Watershed District, Scott County Soil Conservation District, and the Town of Oneida, with assistance from the USDA Soil Conservation Service and USDA Forest Service. The objective of the project was to reduce floodwater damages to all of the floodplain, including the portions of the town of Oneida lying within this area. Secondary objectives included eliminating unsanitary conditions associated with flooding, obtaining an adequate source of water for municipal uses, and creating water storage for fish and wildlife development. Dam #4 was then constructed in 1966 and is maintained on an as-needed basis by the Town of Oneida. Dam #4 currently does not meet Federal safety standards for a High Hazard dam. Therefore, the Town of Oneida and NRCS are preparing this Plan-EA to evaluate alternatives to meet the current needs of the Town of Oneida with respect to floodwater protection as well as continuing to meet municipal water supply needs.

Specifically, the purpose of the project includes the following:

- Maintain or improve the current level of flood damage reduction provided by the Pine Creek Dam No. 4 for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features.
- Maintain or improve the existing municipal water supply availability provided by the Pine Creek Dam No. 4 and Howard H. Baker Sr. Lake.
- Comply with applicable design, performance and safety criteria for a High Hazard dam.

The Plan-EA will consider alternatives for Dam #4 and may include: 1) No Action (future without project), 2) Structural Rehabilitation (+/- non-structural measures), 3) Decommissioning (+/- non-structural measures), and 4) National Economic Development (NED) Alternative. Specific alternatives are currently being developed.

AMEC Earth & Environmental, Inc.
3800 Ezell Road, Ste 100
Nashville, TN
USA 37211
Tel (615) 333-0630
Fax (615) 781-0655
www.amec.com

Your agency may have an interest in this project. AMEC, a contractor for NRCS, invites you to provide input into the development of the Plan-EA. Please identify any special concerns or resources that should be considered during the development of this document. Written comments should be received on or before May 16, 2014.

Please send your correspondence directly to the following address:

Andrew Clevenger
AMEC Environment & Infrastructure, Inc.
3800 Ezell Road, Suite 100
Nashville, Tennessee 37211
Andrew.clevenger@amec.com

If you have any questions or require additional information, please contact Mr. Andrew Clevenger at (615) 333-0630 or above-listed address.

Sincerely,
AMEC Environment & Infrastructure, Inc.

Andrew W. Clevenger, P.E.
Project Manager

Mary Motte Fikri
Senior Scientist

Enclosures

cc: Ralph Smith - NRCS

From:	Fikri, Mary Motte
To:	Johnson, Sara R
Subject:	FW: Pine Creek #4 Rehab Project: Tribal Consultation
Date:	Thursday, November 13, 2014 2:37:00 PM
Attachments:	PineCk4_EasternBandofCherokeeTribe_ConsultationLtr_05202014.pdf

See below and attached.

From: Clevenger, Andrew W
Sent: Wednesday, July 16, 2014 3:52 PM
To: Fikri, Mary Motte
Subject: FW: Pine Creek #4 Rehab Project: Tribal Consultation

fyi

From: Smith, Ralph - NRCS, Nashville, TN [mailto:ralph.smith@tn.usda.gov]
Sent: Wednesday, July 16, 2014 3:50 PM
To: Clevenger, Andrew W; Kevin Shamburg <KShamburg@klaenviro.com> (KShamburg@klaenviro.com)
Cc: Anderson, Robert - NRCS, Nashville, TN; Chandler, Carol - NRCS, Nashville, TN; Sagona, Frank - NRCS, Chattanooga, TN
Subject: FW: Pine Creek #4 Rehab Project: Tribal Consultation

Andy:

Please include the following in your records.

Ralph E. Smith
USDA | NRCS | Tennessee | State Hydraulic Engineer
615/277-2562 o | ralph.smith@tn.usda.gov
615/290-2797 c | http://www.nrcs.usda.gov
Helping People Help the Land

Ralph:

I have checked with Courtney and NRCS has not received a reply or comments to Kevin Brown's May 20, 2014 letter to the Cherokee Tribal Historic Preservation Office (THPO). The letter asked the THPO if the Cherokee Tribe Eastern Band would like to be considered as a consulting party on the Pine Creek #4 Rehabilitation Environmental Assessment (EA) currently under way.

According to policy and guidance (GM-Title 420, Part 401 Subpart C, and National Cultural Resources Procedures Handbook, Section 601.62) we offer the Tribe an opportunity to participate as a consulting party. We allow a 30-day period for reply. Since we have not heard from the Tribe, we may assume that the Tribe does not intend to be a consulting party for the EA.

We are still required by policy and guidance to afford the Tribe an opportunity to participate and consult on development of certain decisions that may affect them. It is likely that the Tribe has no interest in the Pine Creek #4 Rehab Project EA, but we will still correspond with the Tribe and

document correspondence as the project progresses until they notify Kevin in writing of no interest in the Pine Creek #4 Rehab project.

Attached for your file is a copy of the letter sent from Kevin Brown to the Tribe.

Frank

Frank Sagona, Biologist/Environmental Liaison
USDA Natural Resources Conservation Service
6183 Adamson Circle
Chattanooga TN 37416
423-894-1687 Ext. 100 (office)
423-453-1935 (cell/voicemail)

From: Clevenger, Andrew W
To: Fikri, Mary Motte
Subject: FW: Pine Creek Dam, Oneida, TN (FWS-0423)
Date: Monday, May 12, 2014 8:08:13 AM

For the file

From: Timothy Watkins [mailto:timothy_watkins@fws.gov]
Sent: Monday, May 12, 2014 7:52 AM
To: Clevenger, Andrew W
Cc: Tammy Bilbrey
Subject: Pine Creek Dam, Oneida, TN (FWS-0423)

Mr. Clevenger,

We have reviewed the alternatives provided relative to the Supplemental Watershed Project Plan Environmental Assessment (Plan-EA) for the Pine Creek dam #4 (Howard H. Baker Sr. Lake dam) located in the Pine Creek Watershed in Oneida, Scott County, Tennessee and have no objection or comments in reference to this plan.

Endangered species collection records available to the Service do not indicate that federally listed or proposed endangered or threatened species occur within the impact area of the project. We note, however, that collection records available to the Service may not be all-inclusive. Our data base is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality. However, based on the best information available at this time, we believe that the requirements of section 7 of the Endangered Species Act of 1973, as amended, are fulfilled. Obligations under section 7 of the Act must be reconsidered if (1) new information reveals impacts of the action that may affect listed species or critical habitat in a manner not previously considered, (2) the action is subsequently modified to include activities which were not considered during this consultation, or (3) new species are listed or critical habitat designated that might be affected by the action.

Thanks,

Bryan Watkins
Private Lands Biologist
Tennessee Ecological Services Field Office
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, Tennessee 38501
(931)525-4996 Office
(931)528-7075 Fax

USDA

United States Department of Agriculture

May 20, 2014

Mr. Russell Townsend, Tribal Historic Preservation Officer
Eastern Band of Cherokee Tribe
P.O. Box 455
Cherokee, North Carolina 28719

RE: Consultation under Section 106 of the National Historic Preservation Act of 1966, Amended for Supplemental Watershed Project Plan Environmental Assessment Rehabilitation of Pine Creek Dam #4
Oneida, Scott County, Tennessee

Dear Mr. Townsend:

The USDA Natural Resources Conservation Service (NRCS) is assisting the Town of Oneida, Tennessee by preparing a Supplemental Watershed Project Plan Environmental Assessment (EA) for Pine Creek Dam #4 (Howard H. Baker Sr. Lake dam) located in Scott County, Tennessee (refer to enclosed Figures 1 and 2).

The Pine Creek Watershed Work Plan was originally prepared in 1961 by the Pine Creek Watershed District, Scott County Soil Conservation District, and Town of Oneida with assistance from the USDA Soil Conservation Service and USDA Forest Service. The objectives of the original project were to reduce floodwater damages in the floodplain including portions of the town lying within the floodplain, eliminate unsanitary conditions associated with flooding, obtain an adequate source of water for municipal uses, and create water storage for fish and wildlife development. Pine Creek Dam #4 was constructed in 1966 and is maintained by the Town of Oneida on an as-needed basis. Currently, Pine Creek Dam #4 does not meet Federal and State safety standards for a High Hazard dam. Therefore, NRCS is preparing this Supplemental Watershed Plan-EA to evaluate alternatives of current needs of the Town of Oneida with respect to floodwater protection and municipal water supply.

The scope of the supplemental project plan will consider alternatives to:

- Maintain or improve the current level of flood damage reduction provided by Pine Creek Dam #4 for public safety, bridges, roads, agricultural and other lands, buildings, structures, infrastructure, and other features;
- Maintain or improve the existing municipal water supply availability provided by Pine Creek Dam #4 and Howard H. Baker Sr. Lake; and
- Comply with applicable design, performance and safety criteria for a High Hazard dam.

Natural Resources Conservation Service
675 US Courthouse, 801 Broadway
Nashville, Tennessee 37203
Voice (615) 277-2531 Fax (615) 277-2577

The Plan-EA will evaluate alternatives that may include: 1) no action (future without the project), 2) structural rehabilitation, 3) decommissioning, and 4) National Economic Development (NED) alternative. Data and information are being collected now to develop specific alternatives to be considered.

This consultation is being conducted pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, (16 USC §470 et. seq.) and the Protection of Historic Properties (36 CFR Part 800). NRCS is requesting review of the proposed project area shown in the enclosed figures. We invite your comments or interests in this project.

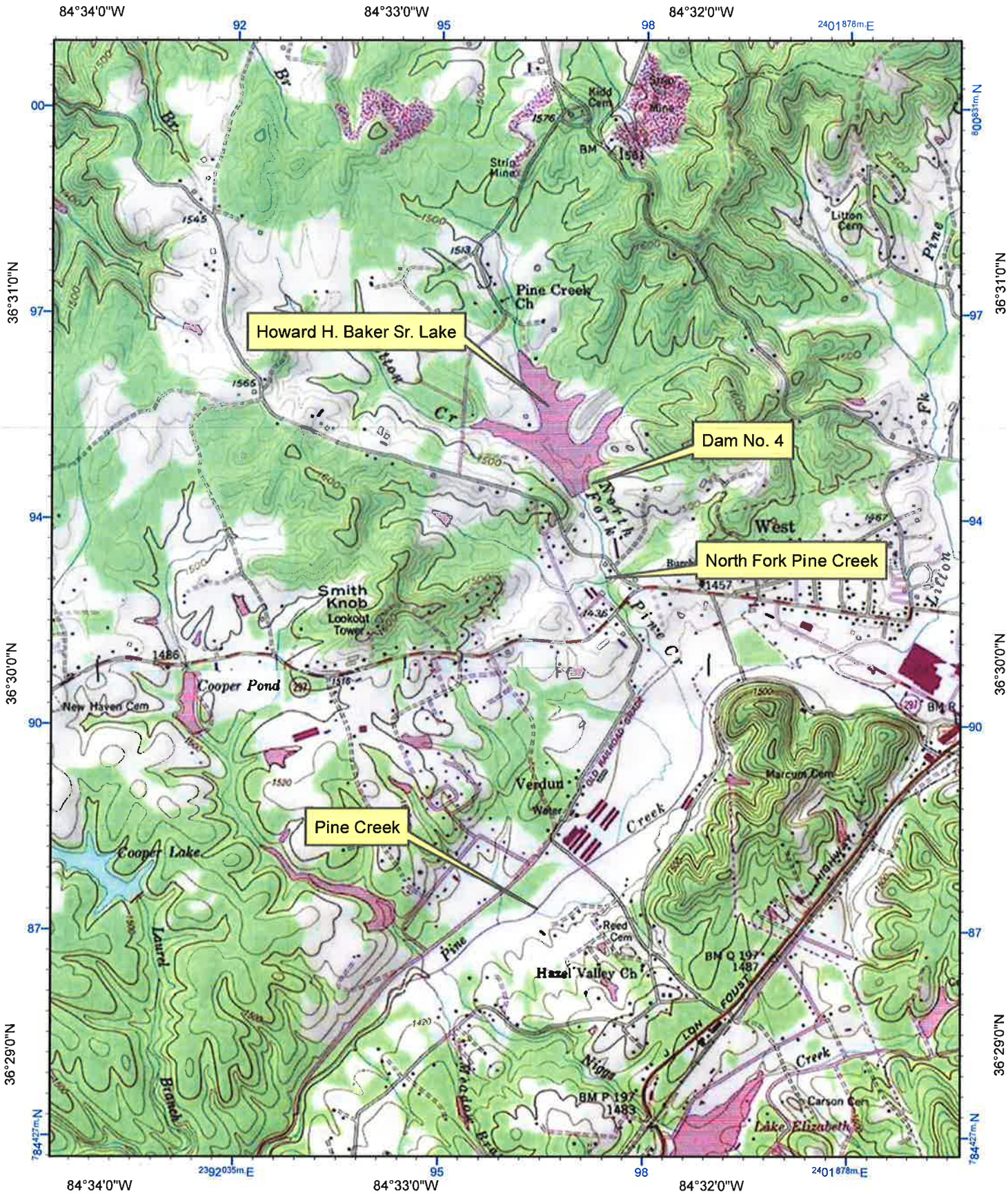
Please reply within 30 days of this letter if you would like to be considered as a consulting party for the environmental assessment process; or if you have identified any historic properties that are of religious, sacred, or traditional cultural properties in the area. We want to work closely with you as we prepare this Supplemental Plan-EA and to develop appropriate measures for managing these properties. NRCS will protect information you provide regarding the existence of sacred or religious historic properties and the locations of Native American archaeological sites pursuant to Federal and State guidelines and policies.

If you have any questions or require additional information, please contact me at 615-277-2531 or ask for any of the NRCS Technical Planning Staff on the Pine Creek Project.

Sincerely,

Kevin Brown
State Conservationist

Enclosures (2)



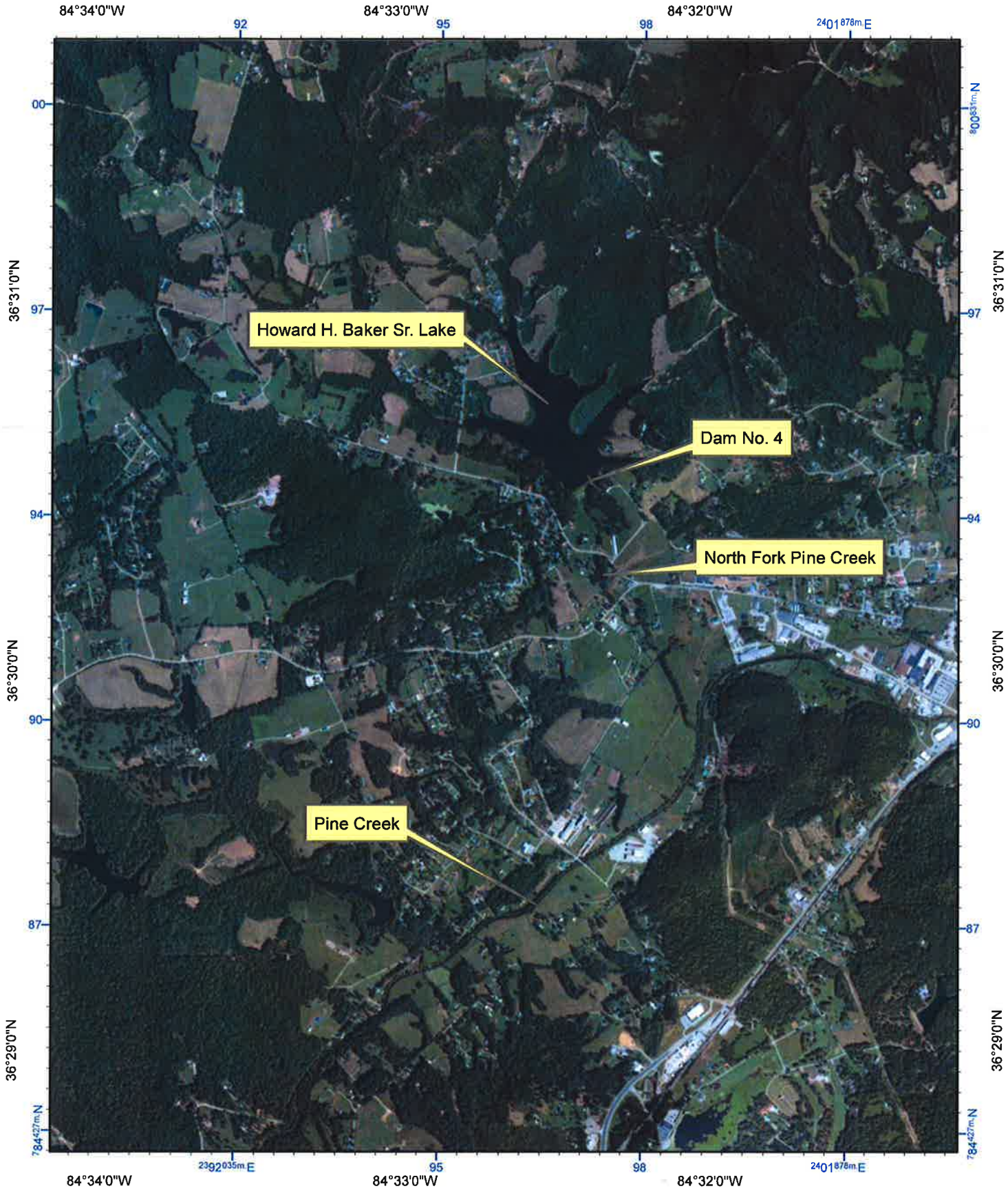
Supplemental Watershed Project Plan
Environmental Assessment

Howard H. Baker Sr. Lake / Dam No. 4
Oneida, Scott County, TN

FEBRUARY 2014

Figure 1

amec



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Supplemental Watershed Project Plan
Environmental Assessment

Howard H. Baker Sr. Lake / Dam No. 4
Oneida, Scott County, TN

FEBRUARY 2014

Figure 2

amec

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
2941 LEBANON ROAD
NASHVILLE, TENNESSEE 37214
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

March 25, 2015

Mr. Matthew Prybylski
AMEC
11003 Bluegrass Parkway
Louisville, Kentucky, 40299

RE: TVA, PINE CREEK DAM # 4, UNINCORPORATED, SCOTT COUNTY

Dear Mr. Prybylski:

In response to your request, received on Monday, March 16, 2015, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process.

After considering the documents you submitted, we determine that THERE ARE NO NATIONAL REGISTER OF HISTORIC PLACES LISTED OR ELIGIBLE PROPERTIES AFFECTED BY THIS UNDERTAKING. We have made this determination either because: the undertaking will not alter any characteristics of an identified eligible or listed Historic Property that qualify the property for listing in the National Register, the undertaking will not alter an eligible Historic Property's location, setting or use, the specific location, scope and/or nature of the undertaking precluded affect to Historic Properties, the size and nature of the undertaking's area of potential effects precluded affect to Historic Properties, or, no National Register listed or eligible Historic Properties exist within the undertaking's area of potential effects. Therefore, we have no objections to your proceeding with your undertaking.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. If you are applying for federal funds, license or permit, you should submit this letter as evidence of consultation under Section 106 to the appropriate federal agency, which, in turn, should contact us as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination of eligibility and effect to us for comment. You may find additional information concerning the Section 106 process and the Tennessee SHPO's documentation requirements at http://www.tennessee.gov/environment/hist/federal/sect106.shtm. You may direct questions or comments to Joe Garrison (615) 770-1092.This office appreciates your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

TENNESSEE HISTORICAL COMMISSION
STATE HISTORIC PRESERVATION OFFICE
2941 LEBANON ROAD
NASHVILLE, TENNESSEE 37214
OFFICE: (615) 532-1550
www.tnhistoricalcommission.org

April 23, 2014

Mr. Andrew W. Clevenger
AMEC
3800 Ezell Road/100
Nashville, Tennessee, 37211

RE: NRCS, PINEY CREEK DAM# 4 REHAB, ONEIDA, SCOTT COUNTY

Dear Mr. Clevenger:

In response to your request, received on Wednesday, April 16, 2014, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. You have submitted documents that are insufficient for us to complete our review. To complete the Tennessee State Historic Preservation Office review of this undertaking, you will need to provide us with ALL of the following documents unless instructed otherwise by the Tennessee Historical Commission's Review and Compliance Coordinator:

1. A letter requesting Section 106 review of your undertaking that should include: (a) The name of the federal agency funding, licensing, or permitting your undertaking. (b) The name, address, and phone number of the applicant for federal funding, licensing, or permitting. (c) The street address, city, and county of the undertaking. (d) A list of Consulting Parties invited to participate in consultation relative to the undertaking. (e) A USGS 7 1/2 minute topographic map (be sure to include the name of the map) clearly indicating the boundary of the undertaking, the location of all undertaking elements, and the undertaking's Area of Potential Effects. You may obtain such a map by contacting the Department of Environment and Conservation, Division of Geology, Maps and Publications Sales Office at (615) 532-1516. Please be sure to give us the name of the quad map.

2. Other suitably scaled maps or site plans as necessary to depict the extent of the undertaking and its locational relationship to its surroundings and environment.

3. A narrative which describes the undertaking in sufficient detail to enable a reader unfamiliar with the undertaking or its location to gain a full understanding of the undertaking and all of its elements and their potential to affect directly and indirectly any historic properties within the Area of Potential Effects.

4. Original chemical or digital high resolution photographs of the undertaking Area of Potential Effects that are numbered and clearly keyed to one of the above maps or site plans.

5. Any available information including dates of construction of buildings either inside the undertaking footprint or within view or sound of the undertaking. Be sure to include photographs of buildings within the undertaking's Area of Potential Effects.

Upon receipt of this documentation, we will complete our review of this undertaking as quickly as possible. Please be advised that until this office has provided you a final written comment on this undertaking, you have not met your Section 106 obligation under federal law. Please direct questions and comments to Joe Garrison (615) 532-1550-103. We appreciate your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg

From:	Clevenger, Andrew W
To:	Fikri, Mary Motte
Subject:	FW: Environmental Assessment of Pine Creek #4 Dam
Date:	Thursday, May 01, 2014 10:12:44 AM
Attachments:	image001.png

From: Terrell Hendren [mailto:Terrell.Hendren@tn.gov]
Sent: Tuesday, April 22, 2014 1:45 PM
To: Clevenger, Andrew W
Cc: Michael Atchley; Erich Webber
Subject: Environmental Assessment of Pine Creek #4 Dam

Mr. Clevenger,

I wanted to take this opportunity to provide comments concerning the proposed Environmental Assessment concerning the Pine Creek #4 Dam. The Division of Water Resources would like to encourage any plan that would provide additional water supply capacity for the Town of Oneida. In times of low rainfall, Oneida has struggled to meet their Drinking Water demand due to their limited water supply. In addition, the hazard category of the dam was changed from a significant hazard to a high hazard due to downstream development. Although the dam is exempt from the spillway requirements of the Safe Dams Act, the State would encourage any activity that would increase the spillway capacity of the dam. If you have any questions, feel free to contact me at the phone number or the email address listed below.

Thanks

Terrell Hendren
Environmental Protection Specialist, Division of Water Resources
Knoxville Environmental Field Office
Office: (865)594-5562
Email: Terrell.Hendren@tn.gov

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Appendix B
MAPS

Figure B-1
Project Location Map

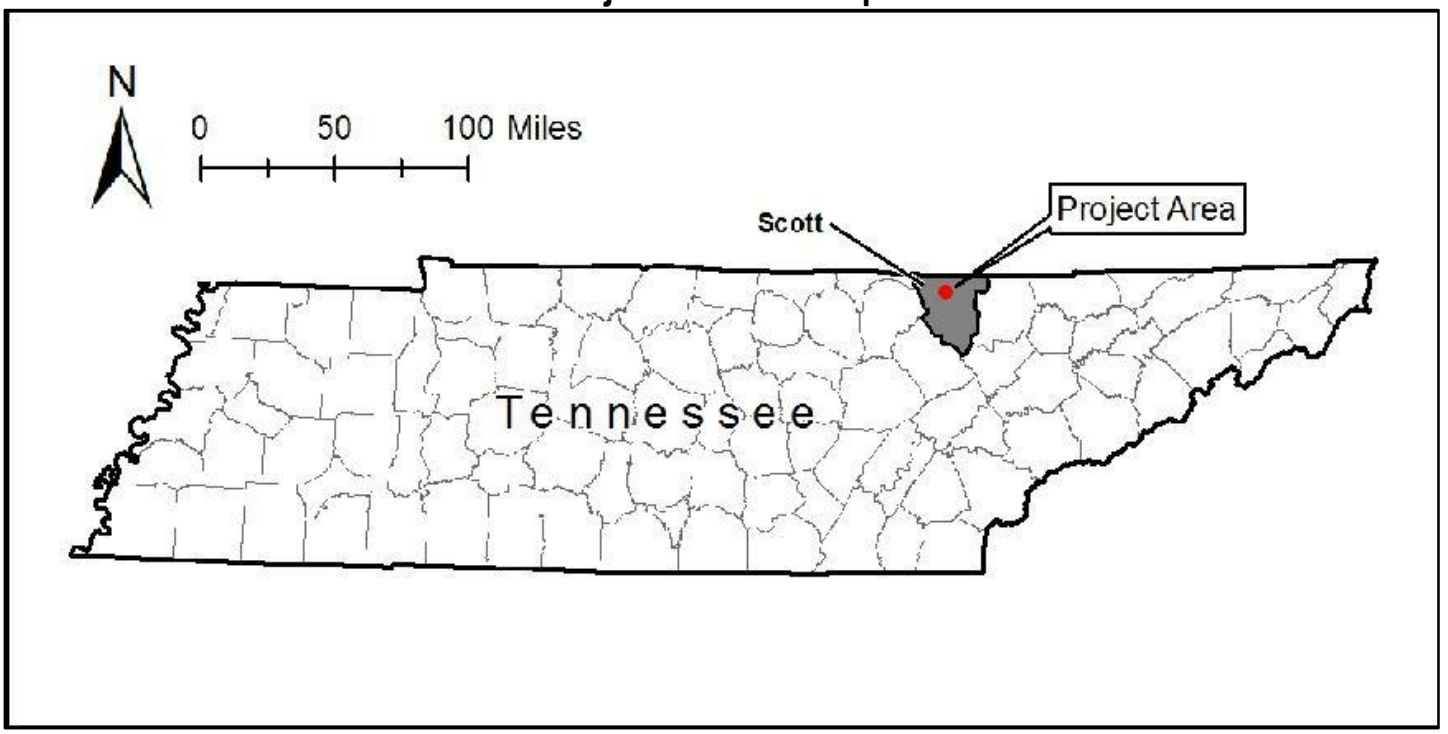


Figure B-2
Project Watershed Map

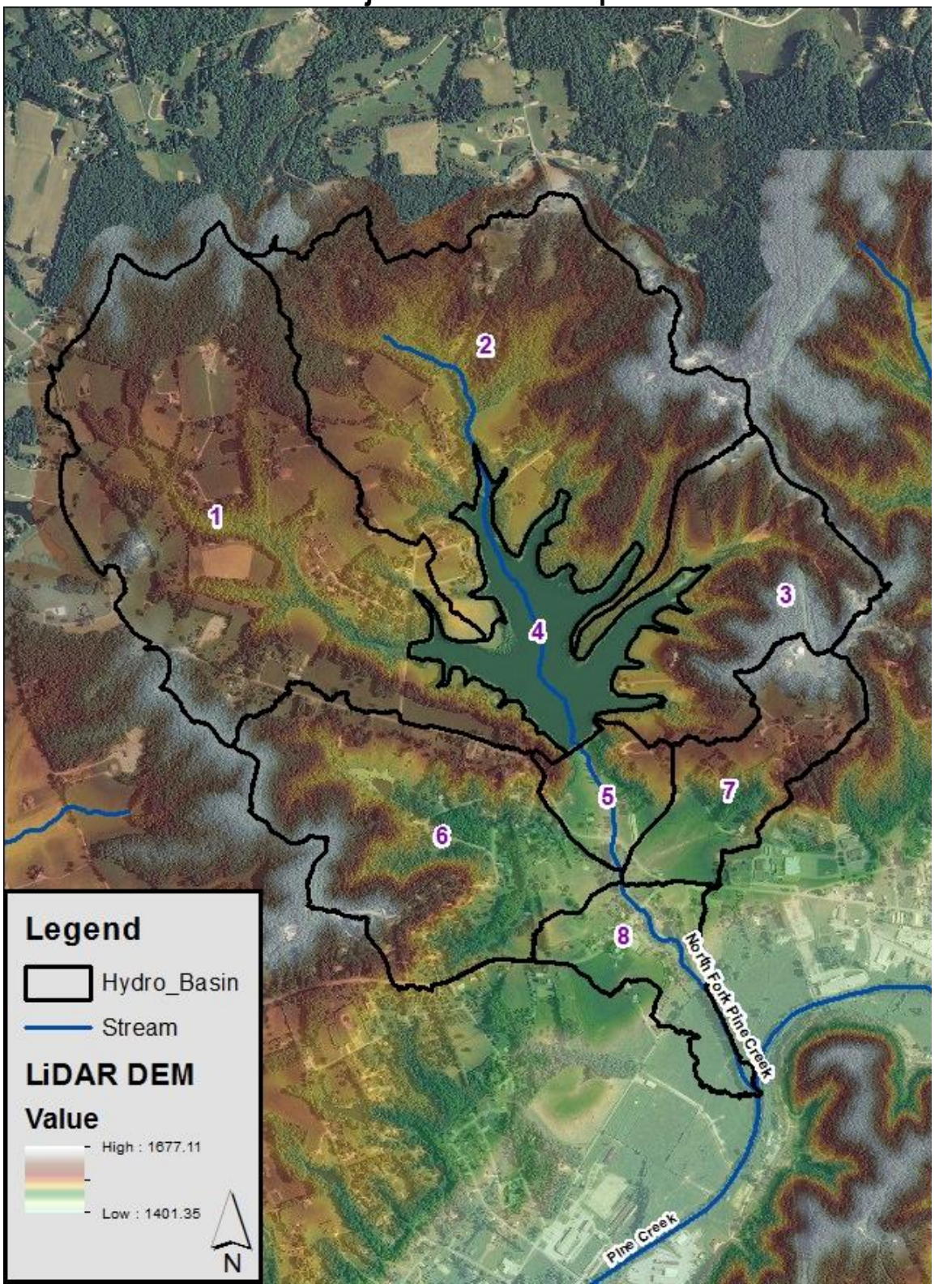


Figure B-3
Project Site Map

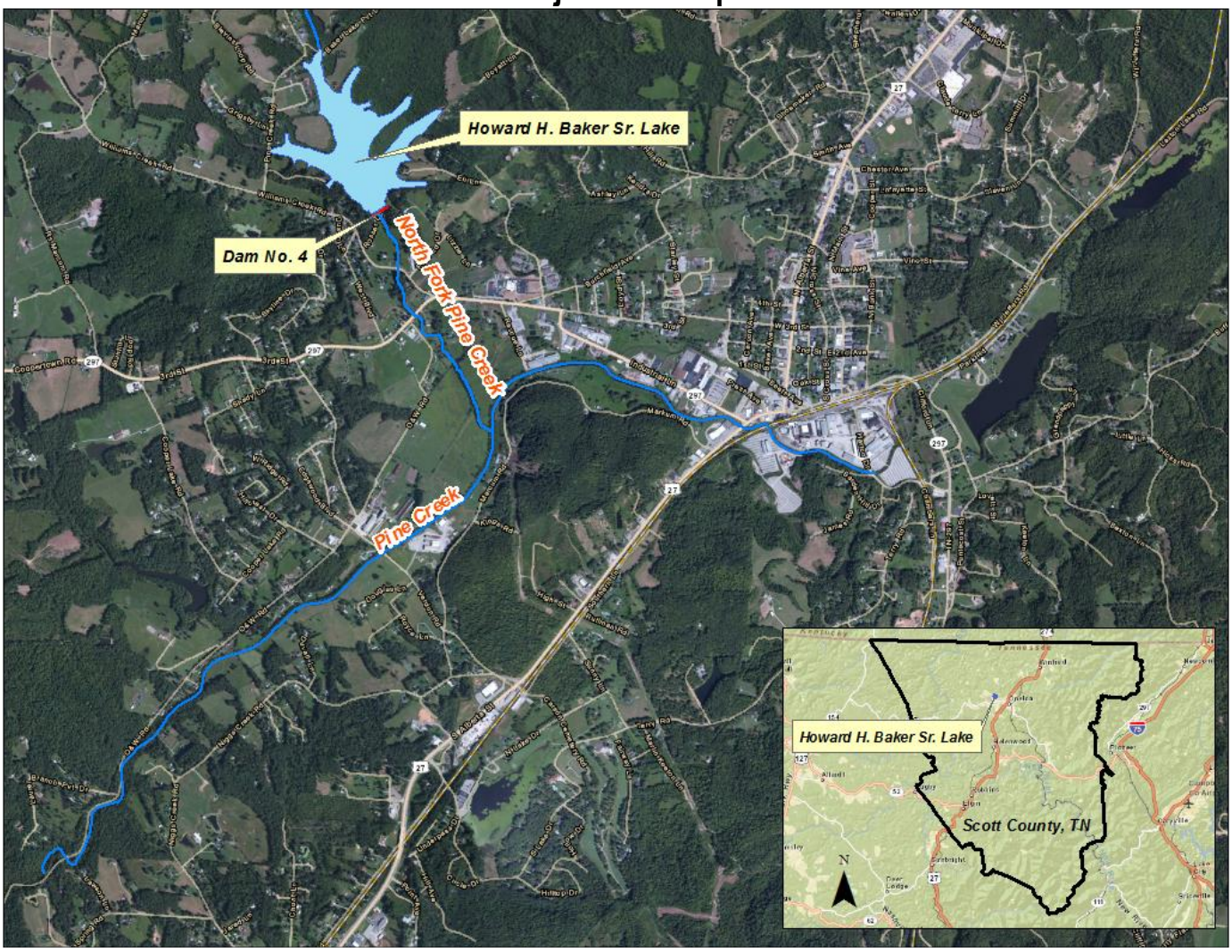


Figure B-4
Prime Farmland Map

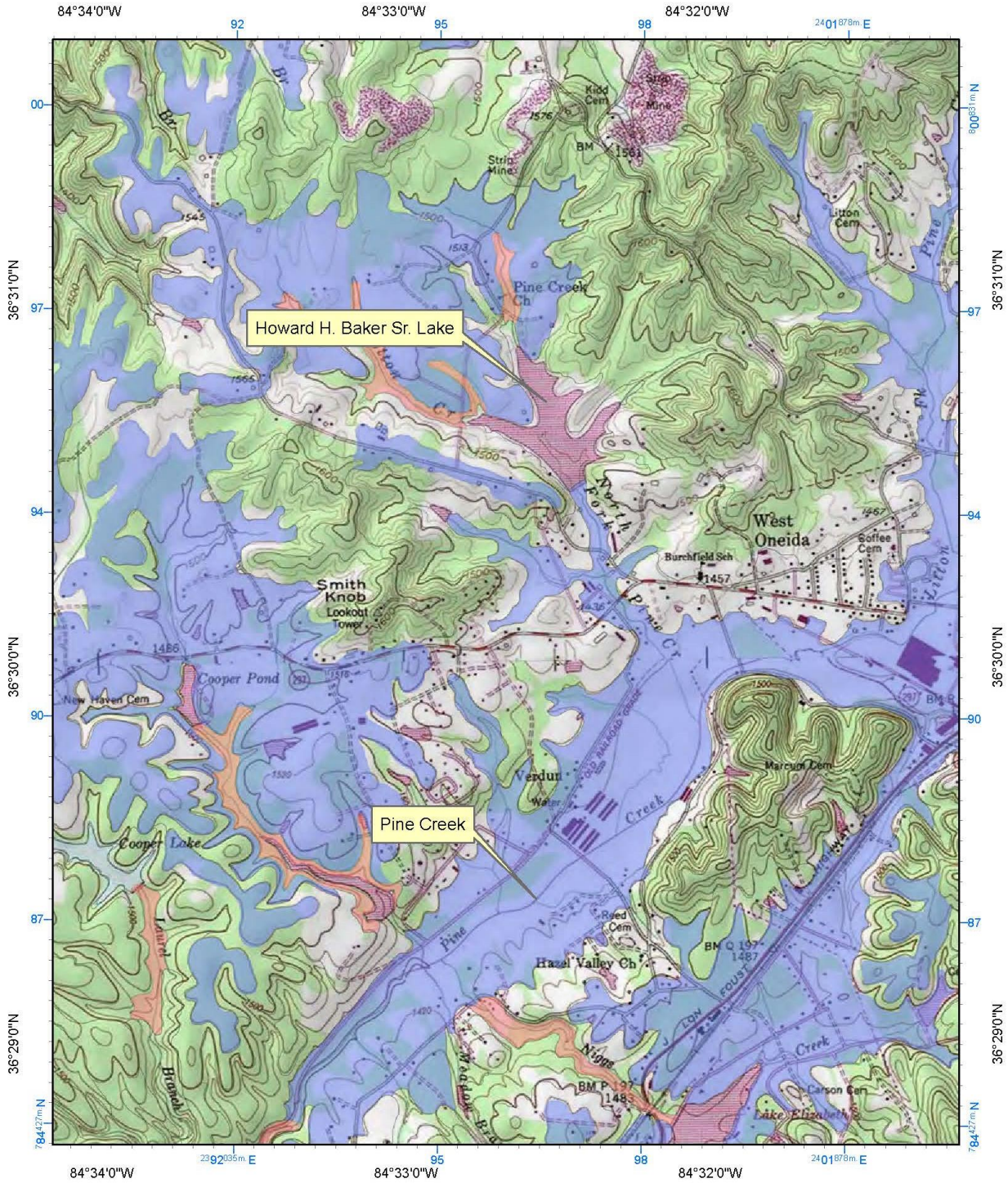


Figure B-5
Wetlands Map

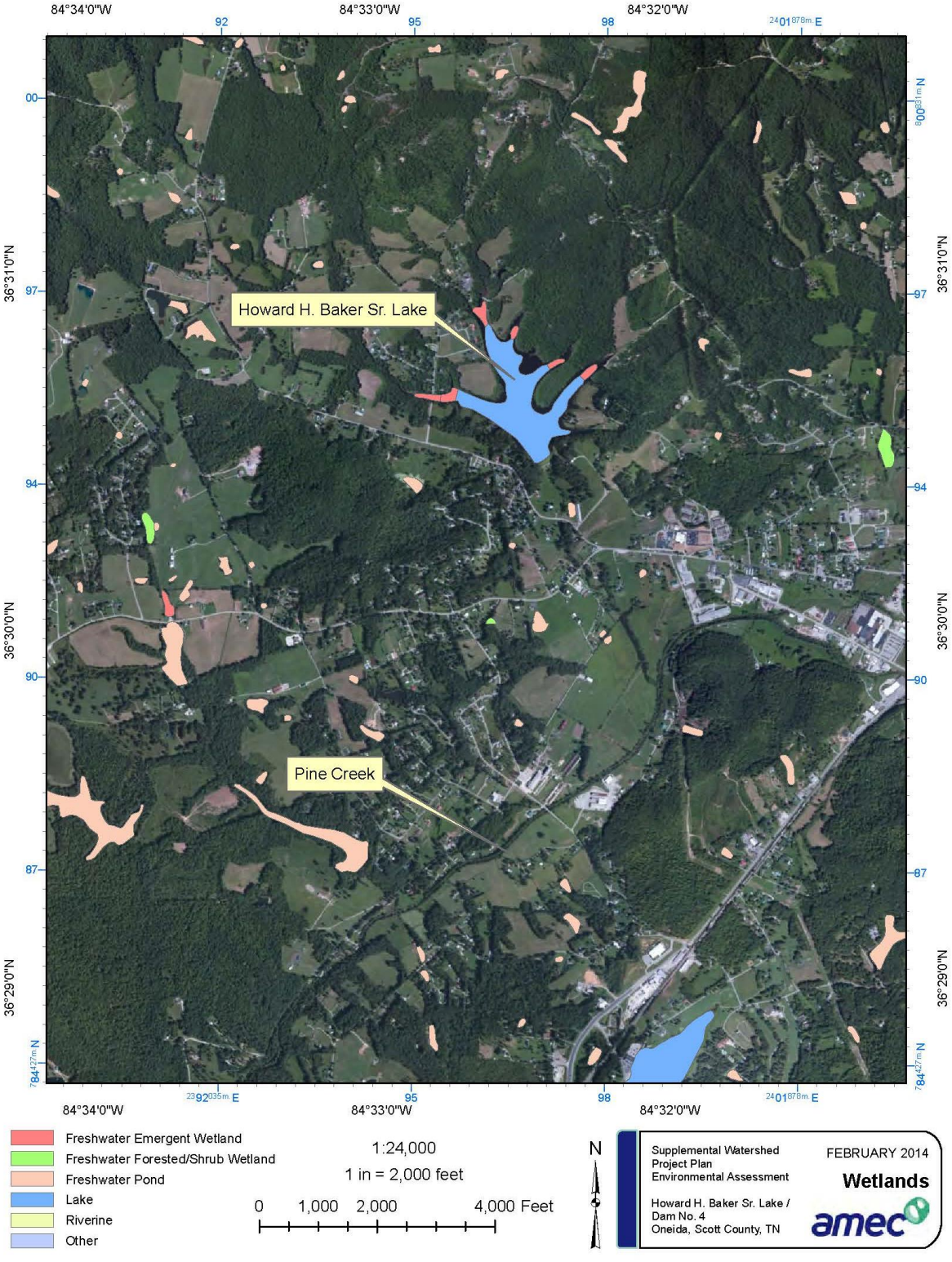
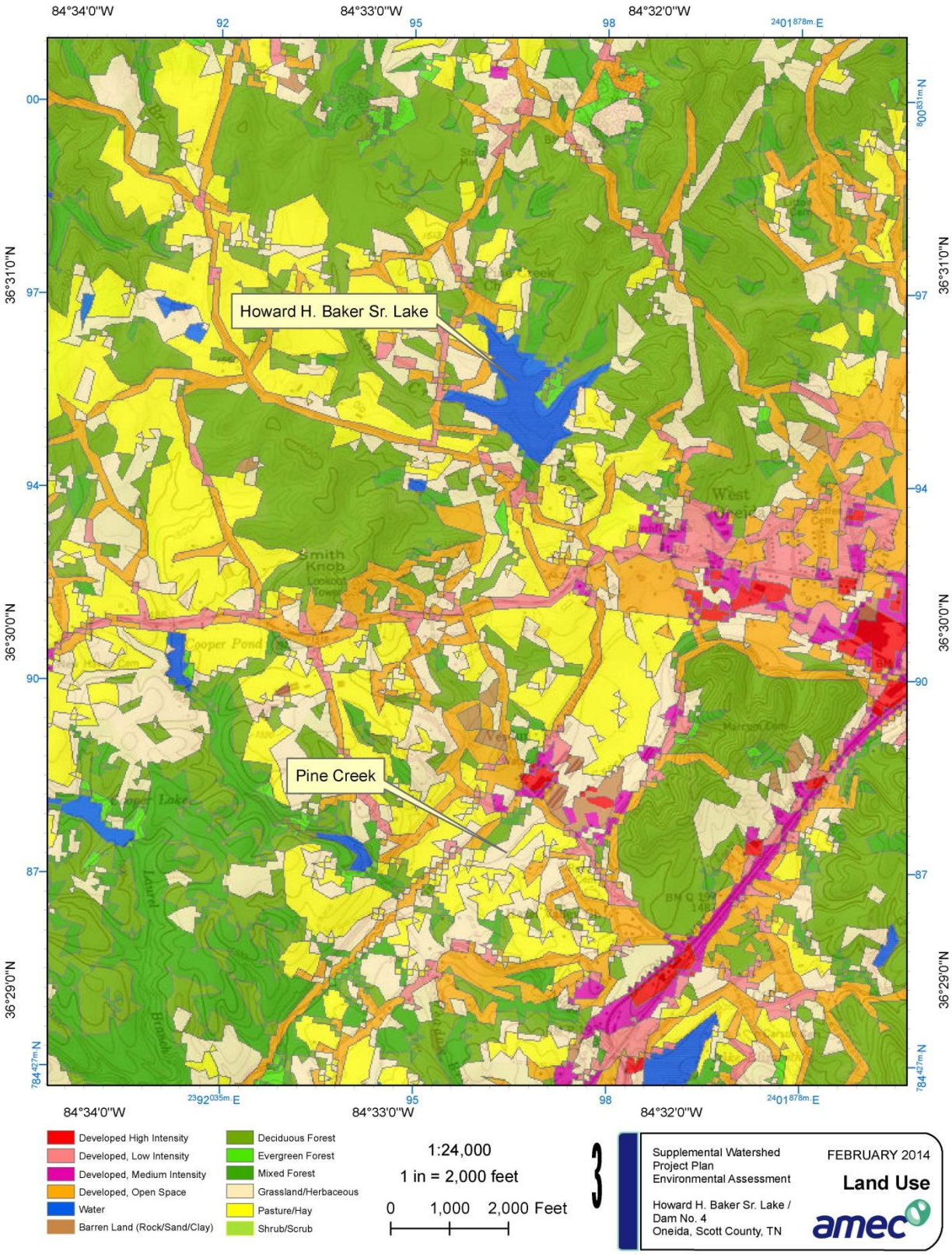


Figure B-6
Land Use Map



Appendix C
SUPPORT MAPS

Figure C-1
Approximate Breach Inundation Map

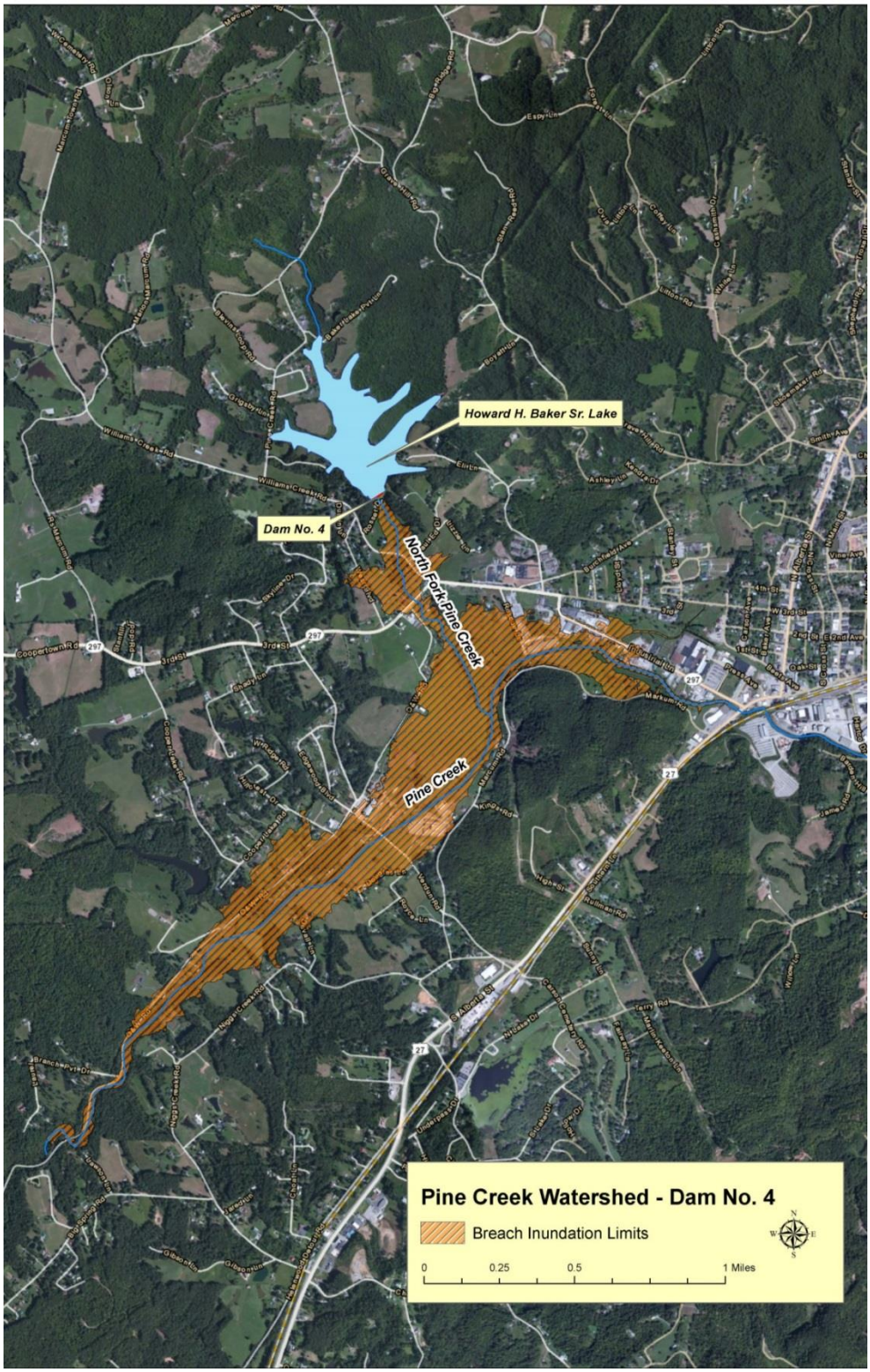
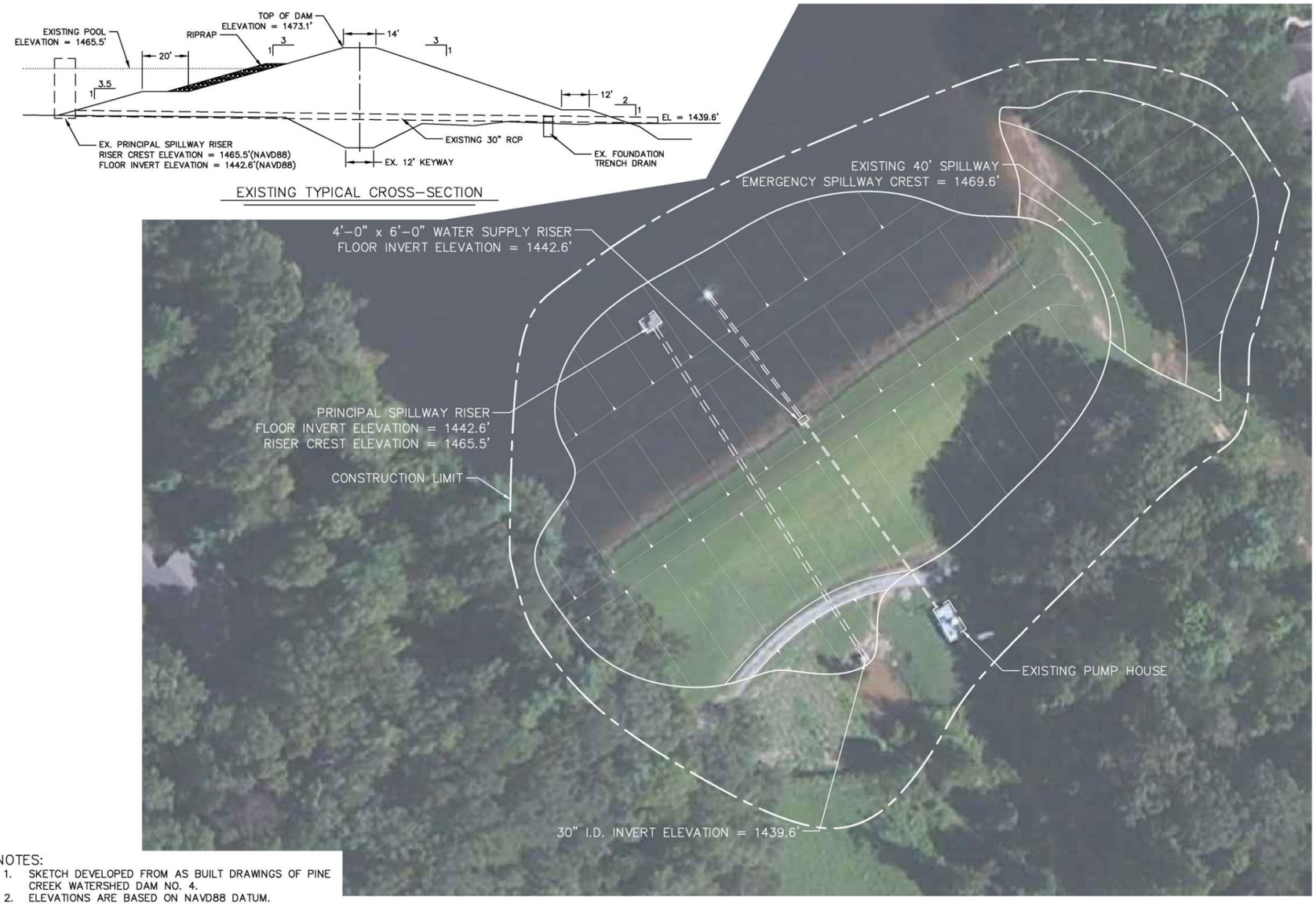


Figure C-2
Existing Conditions



NOTES:
1. SKETCH DEVELOPED FROM AS BUILT DRAWINGS OF PINE CREEK WATERSHED DAM NO. 4.
2. ELEVATIONS ARE BASED ON NAVD88 DATUM.
3. AERIAL ORTHOIMAGERY WAS DOWNLOADED FROM ESRI BASEMAP DATA.

Plotted By: vince.adams Date: 22-Apr-15-10:38
File: Q:\0911780104 Pine Creek_A13\Cadd\SITES\CAD\0104 Base.dwg

Amec Foster Wheeler
Environment & Infrastructure, Inc.
100 SE 9th STREET, SUITE 400
TOPEKA, KANSAS 66604
PHONE: 785.272.6830
FAX: 785.272.6878
amec foster wheeler
NRCS United States Department of Agriculture Natural Resources Conservation Service
KLA ENVIRONMENTAL SERVICES, INC.

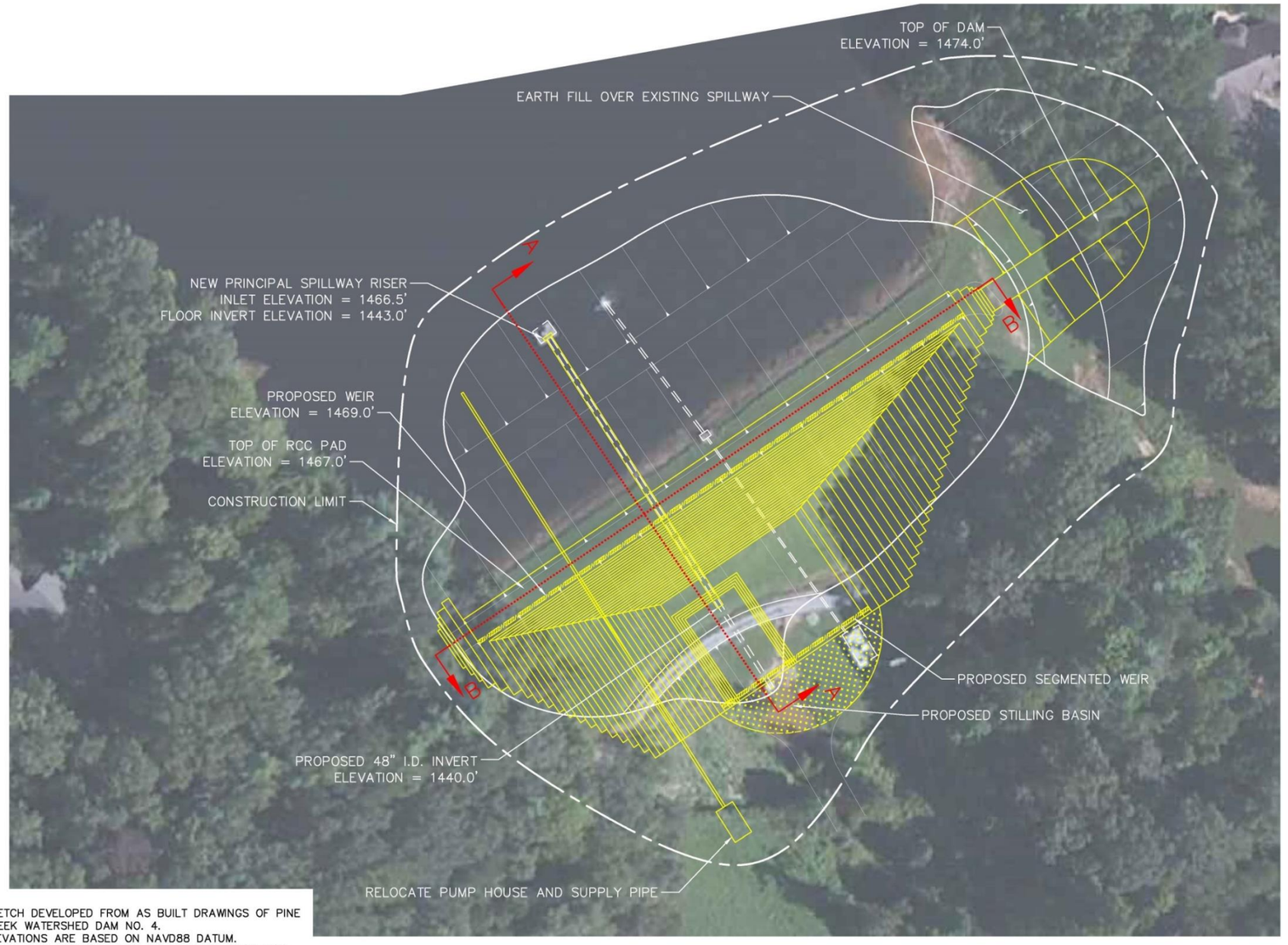
MARK | DESCRIPTION | DATE APPD

DAM NO. 4
PINE CREEK WATERSHED
SCOTT COUNTY, TENNESSEE
PREPARED FOR
Natural Resources Conservation Service
KLA Environmental Services, Inc.

DESIGNED BY:	DATE: 04/21/2015
DWN BY: VLA	CHD BY: BDR
APP BY: LJS	
FILE NAME: 0104 BASE.DWG	
AMEC PROJ. NO. 0911780104	

EXISTING CONDITIONS
1

Figure C-3
Rehabilitation Alternative Plan View



NOTES:
1. SKETCH DEVELOPED FROM AS BUILT DRAWINGS OF PINE CREEK WATERSHED DAM NO. 4.
2. ELEVATIONS ARE BASED ON NAVD88 DATUM.
3. AERIAL ORTHOIMAGERY WAS DOWNLOADED FROM ESRI BASEMAP DATA.

Plotted By: vince.adams Date: 21-Apr-15 16:13
File: Q:\09117801O4 Pine_Creek_AT\topeka\SITES\CAD\0104 Base.dwg

Amec Foster Wheeler
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100 SE 9th STREET, SUITE 400
TOPEKA, KANSAS 66604
PHONE: 785.272.8530
FAX: 785.272.8578

MARK | DESCRIPTION | DATE | APPD

United States Department of Agriculture Natural Resources Conservation Service
NRCS
KLA ENVIRONMENTAL SERVICES, INC.

DAM NO. 4
PINE CREEK WATERSHED
SCOTT COUNTY, TENNESSEE
PREPARED FOR
Natural Resources Conservation Service
KLA Environmental Services, Inc.

DESIGNED BY: | DATE: 04/21/2015
DWN BY: VLA | CHD BY: BH | APP BY: LJS
FILE NAME: 0104 BASE.DWG
AMEC PROJ. NO. 09117801O4
PROPOSED SPILLWAY
2

Figure C-4
Rehabilitation Alternative Profiles

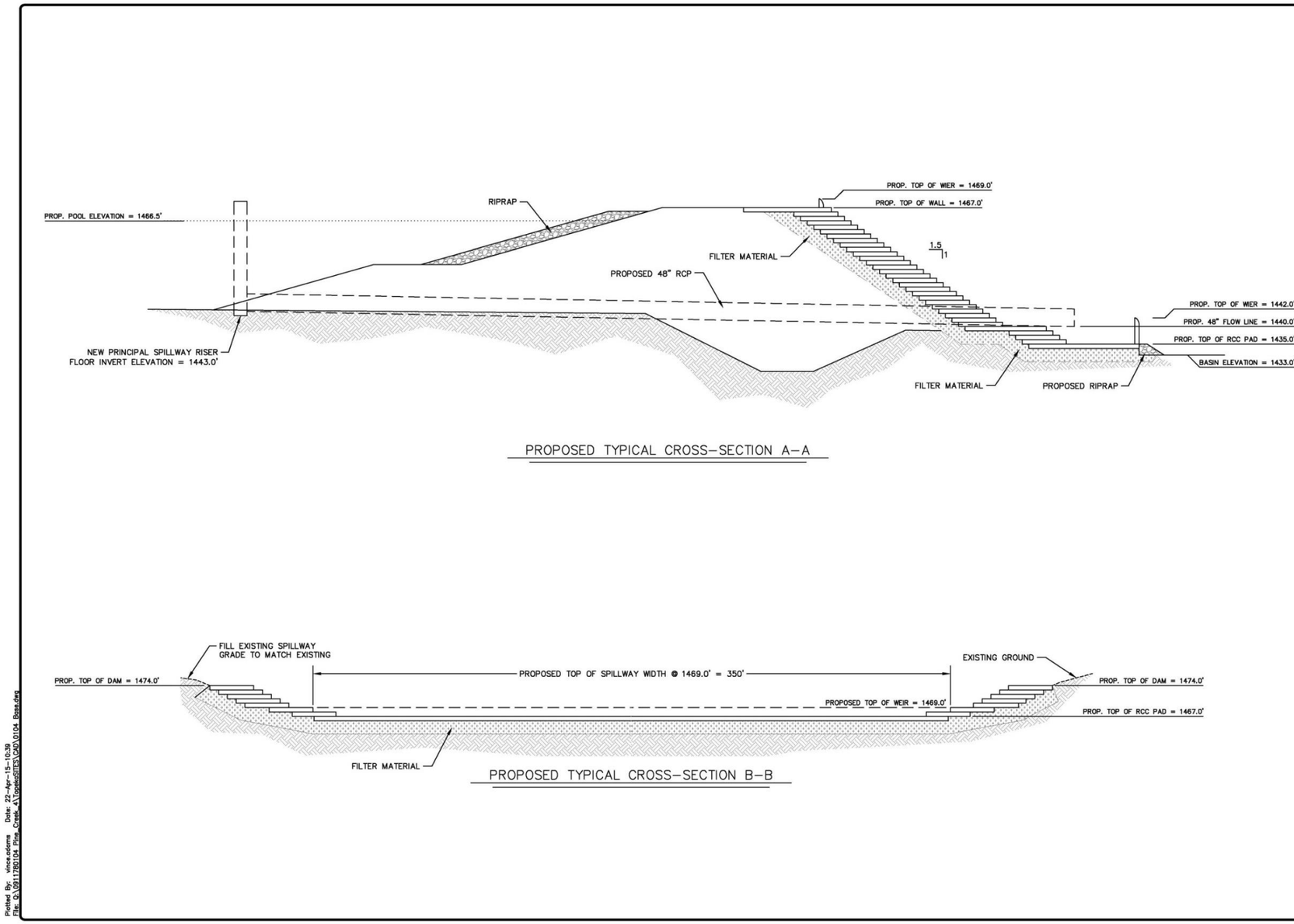
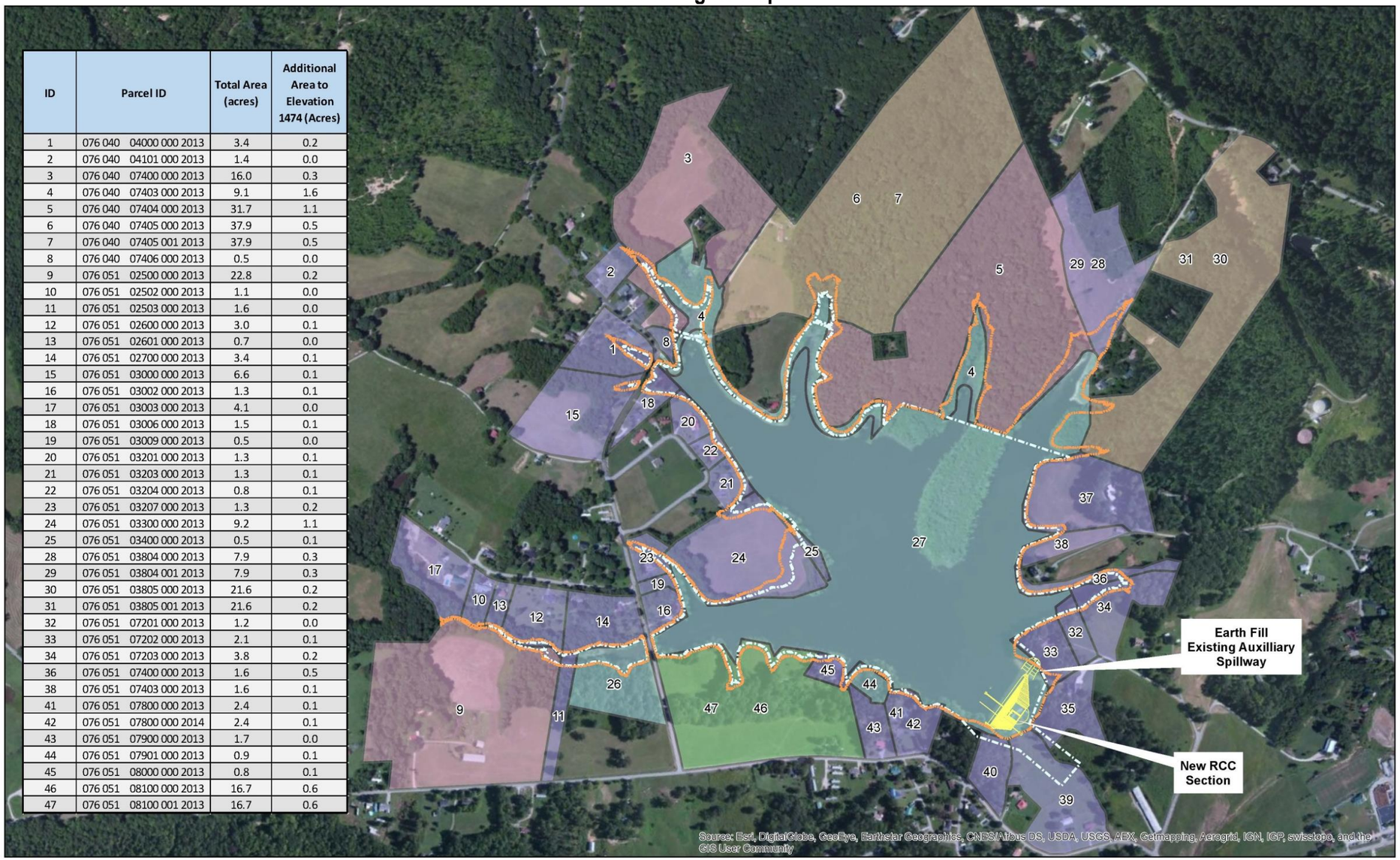


Figure C-5
Land Rights Map

ID	Parcel ID	Total Area (acres)	Additional Area to Elevation 1474 (Acres)
1	076 040 04000 000 2013	3.4	0.2
2	076 040 04101 000 2013	1.4	0.0
3	076 040 07400 000 2013	16.0	0.3
4	076 040 07403 000 2013	9.1	1.6
5	076 040 07404 000 2013	31.7	1.1
6	076 040 07405 000 2013	37.9	0.5
7	076 040 07405 001 2013	37.9	0.5
8	076 040 07406 000 2013	0.5	0.0
9	076 051 02500 000 2013	22.8	0.2
10	076 051 02502 000 2013	1.1	0.0
11	076 051 02503 000 2013	1.6	0.0
12	076 051 02600 000 2013	3.0	0.1
13	076 051 02601 000 2013	0.7	0.0
14	076 051 02700 000 2013	3.4	0.1
15	076 051 03000 000 2013	6.6	0.1
16	076 051 03002 000 2013	1.3	0.1
17	076 051 03003 000 2013	4.1	0.0
18	076 051 03006 000 2013	1.5	0.1
19	076 051 03009 000 2013	0.5	0.0
20	076 051 03201 000 2013	1.3	0.1
21	076 051 03203 000 2013	1.3	0.1
22	076 051 03204 000 2013	0.8	0.1
23	076 051 03207 000 2013	1.3	0.2
24	076 051 03300 000 2013	9.2	1.1
25	076 051 03400 000 2013	0.5	0.1
28	076 051 03804 000 2013	7.9	0.3
29	076 051 03804 001 2013	7.9	0.3
30	076 051 03805 000 2013	21.6	0.2
31	076 051 03805 001 2013	21.6	0.2
32	076 051 07201 000 2013	1.2	0.0
33	076 051 07202 000 2013	2.1	0.1
34	076 051 07203 000 2013	3.8	0.2
36	076 051 07400 000 2013	1.6	0.5
38	076 051 07403 000 2013	1.6	0.1
41	076 051 07800 000 2013	2.4	0.1
42	076 051 07800 000 2014	2.4	0.1
43	076 051 07900 000 2013	1.7	0.0
44	076 051 07901 000 2013	0.9	0.1
45	076 051 08000 000 2013	0.8	0.1
46	076 051 08100 000 2013	16.7	0.6
47	076 051 08100 001 2013	16.7	0.6



LEGEND

- PROPOSED IMPROVEMENTS
- 00 RESIDENTIAL
- 02 CITY
- 10 FARM
- 11 AGRICULTURAL
- 12 FOREST
- PROPOSED TOP OF DAM ELEV (1474')
- ORIGINAL EASEMENT (1471')

0 300 600 1,200 Feet

N

Pine Creek Dam #4
Rehabilitation Alternatives
Parcel Map
MARCH 2015

amec foster wheeler

Figure C-6
Future Without Federal Project Alternative

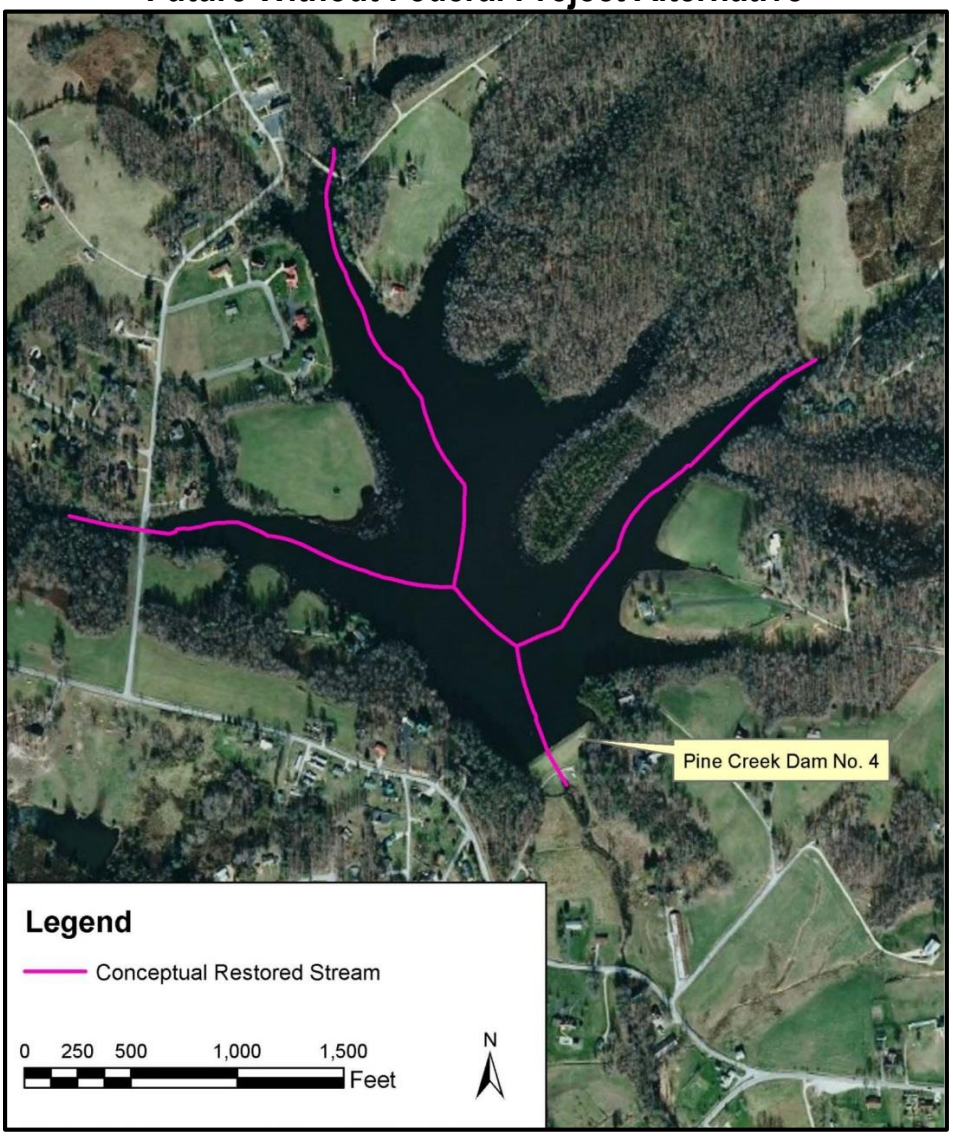
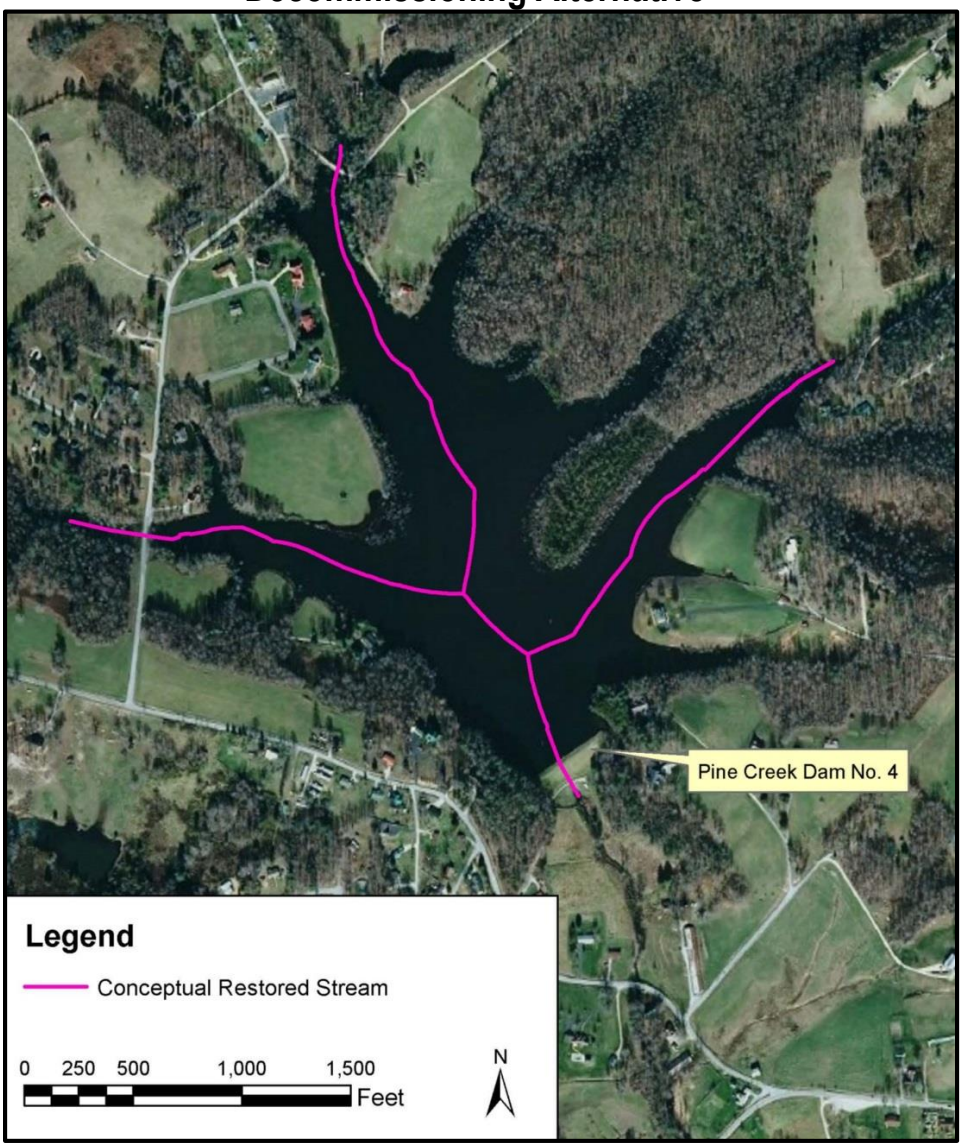


Figure C-7
Decommissioning Alternative



Appendix D
INVESTIGATIONS AND ANALYSES REPORT

D.1 INTRODUCTION

This Appendix provides supplementary information regarding the investigations and analyses conducted for the Project. The administrative record contains additional information relevant to each of the sections in this Appendix.

D.2 EXISTING DATA

NRCS provided the following existing data from its archived files to the Project Team:

- As-Built Drawings
- Watershed Work Plans
- Supporting Documentation
- Design Documentation
- General Work Plan & Supplements
- Environmental Studies

D.3 EFFECTS ANALYSIS

Ecological, cultural, and socio-economic effects of alternatives were evaluated using the NRCS-CPA-52 – Environmental Evaluation form. This analysis was conducted with consideration to the public participation scoping requirements set forth in the National Watershed Program Manual (NWPM) by considering the potential occurrences of and/or Project impacts/risks to the list of 31 natural resources and other issues of concern presented in Section 501.24 Part B of the NWPM. The information presented in the Plan-EA is an overview of the relevant watershed characteristics compiled from existing information. In addition various websites, as referenced, were used to provide information on natural resource conditions at the site. On-site observations were made to verify and supplement the compiled site information presented in this report.

Once alternatives were formulated, the Project Team evaluated the effect of each alternative on relevant resource concerns and special environmental concerns. The Dam Rehabilitation alternative involves minimal changes to the existing features and functions of the dam and the construction will be confined to the existing dam and auxiliary spillway.

D.4 ECONOMIC AND SOCIAL EFFECTS

Scope. The scope of the Economic and Social Effects analyses are identified in Attachment 5, Resource and Economic Evaluation in the Project Statement of Work of NRCS' Scope of Work for Architect and Engineering Services (August, 28, 2013) for the Pine Creek Watershed Dam No. 4 Project.

Benefit Analysis Summary. Changes to the land use composition of the benefit area since the last supplement were incorporated and evaluated by prorating the original benefits to the revised land use composition based on a ratio of areas for each land use. After updating based on land use changes, the original benefits for the Project were indexed to current dollars and prorated for Pine Creek Watershed Dam No. 4 based on the ratio of Average Annual Flood Prevention Benefits for each dam in the original Watershed Work Plan.

The Project Team observed the dam site and the flood impact zones below the dam. The predominant land uses in the benefit area were qualitatively inventoried and the changes observed from the original plan and supplements were noted. The previously formulated flood damage benefits were adjusted consistent with the increase in floodplain development observed since the original evaluation. After adjusting the flood damage reduction benefits based on the changes in land use, all benefits were indexed to reflect current values. Indexing was completed using procedures consistent with National Watershed Program Handbook 604.1 (B).

The results of this Project benefit analysis will be used to determine the relative benefit/cost ratio for each Project alternative by comparing the average annual benefit with the amortized rehabilitation costs.

The following is a brief outline of the Project Benefit Analysis:

1. Inventory the previous Supplemental Watershed Plans and determine the most recently calculated benefits.
2. Allocate the Watershed Work Plan benefits to the appropriate Project (Pine Creek Watershed Dam No. 4).
3. Evaluate substantial changes in number of houses and businesses with reduced flood damages.
4. Determine the appropriate economic indices for each of the benefit items.
5. Calculate all economic indices for each price base.
6. Update the flood damage reduction benefits allocated to Pine Creek Watershed Dam No. 4 to current values.

The original benefits in the Pine Creek Watershed Plan and supplements were assigned to each planned measure in the 1961 Watershed Plan based on a September 1960 Price Base. Supplemental Watershed Plan No. 1 in 1964 and Supplemental Watershed Plan No. 2 in 1967 continued to use the original benefits with a September 1960 Price Base. Therefore, the original benefits for Pine Creek Watershed Dam No. 4 were based on Table 7 – Monetary Benefits from Structural Measures and Land Treatment Measures for Flood Prevention in the original Watershed Work Plan.

The appropriate flood damage reduction benefits were allocated to Pine Creek Watershed Dam No. 4 based on the ratio of the controlled drainage area for Pine Creek Watershed Dam No. 4 and the total controlled drainage area for the watershed.

Although the benefit analysis described results in a large amount of uncertainty in the potential NED benefits and costs of the respective alternatives, the potential variation will not affect the NED plan selection thus an abbreviated analysis can be used per P&G.

Population-At-Risk. The population-at-risk was estimated based on the dam breach inundation zone and affected structures from the Evaluation of Potential Rehabilitation Projects worksheet completed by NRCS.

Flood Damage Benefit Area Review. Changes to the land use composition of the benefit area since the last supplement were incorporated and evaluated by prorating the original benefits based on a ratio of the areas for each land use experiencing notable changes.

Minor changes in the number of houses and businesses with reduced flood damages were identified. The Watershed Plan Agreement for Pine Creek Watershed considered four dams. The stream reaches were obtained from the Location Map in the original Watershed Work Plan.

The FEMA Zone A regions were overlaid on 1960 and 2012 historical aerial photography of the downstream flood damage reduction benefit areas.

Developed areas were delineated and measured for both years. The flood damage benefits formulated with the original Watershed Work Plan were adjusted consistent with the increase in floodplain development observed during the evaluation period.

A comprehensive review of the land use changes in the benefit area indicated that the only notable change since the original Watershed Work Plan was an increase in Other – Residential, Business and Industrial development. Consequently, the average annual Other – Residential, Business and Industrial flood damage benefits for Pine Creek Watershed Dam No. 4 are updated to account for development in the benefit area based on the ratio of the observed floodplain development in 2012 and 1960 (208.40 acres/52.32 acres). Since the corresponding reduction in undeveloped land area is very small when compared to the undeveloped area considered in the original Watershed Work Plan, no reductions in agricultural flood damage benefits were considered.

The original work plan included an Average Annual Monetary Benefit for “Changed Land Use to Urban” of $2,240 (Price Base 1960). The narrative in the original work plan states that, “Expected changed land use benefits will accrue as a result of the change of 38 acres from agricultural to urban use. The town of Oneida has bought about 56 acres of agricultural land to be used for industrial development.”

Accounting for the benefit for "Changed Land Use to Urban" AND updating the Other – Residential, Business and Industrial flood damage benefit based on the observed changes in land use, would introduce a redundancy. Therefore, it was assumed that the benefit for "Changed Land Use to Urban" can be disregarded because it will be measured and accounted for by identifying and measuring the actual land use changes as described. Using this approach it is assumed that the once anticipated development leading to the benefit subsequently occurred.

Economic Index. P&G Section 1.7.2(a)(4)(ii) and 2.1.1(b)(2) allows abbreviated procedures to evaluate Project benefits. Consequently, indexing will be used instead of hydrologic and economic evaluation for updating the benefits for those areas where no substantial land use changes have occurred. The original and supplemented Project benefits were indexed to Price Base 2015 consistent with the tools provided at the NRCS Economics Web Site:

http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/tools

The Project benefits were last updated in 1961 (Price Base 1960) in the original Watershed Work Plan for Pine Creek Watershed. For this analysis, the flood damage reduction benefits allocated to Pine Creek Watershed Dam No. 4 were updated to Price Base 2015 using the price and cost indices.

Updated flood control benefits were calculated consistent with P&G and NREH Part 611. Benefits represent costs or damages that would occur in the absence of the Project. Indexing methods are described in Economics Handbook Part 611 and documented in Table D-1:

Table D-1
Price and Cost Index

Benefit Item	Index	1960	2015	Index from 1960
Residential	Consumer Price Index [1]	29.60	238.654	8.06
Commercial	Consumer Price Index [1]	29.60	238.654	8.06
Other Agricultural	Prices paid by farmers [1]	26.44	221	8.36
Crop and Pasture	Prices received by farmers [1]	35.86	168	4.68
Bridge and Road	ENR Construction Cost [1]	824.00	10038.49	12.18
Sediment Damage	ENR Construction Cost [1]	824.00	10038.49	12.18
Erosion Damage	Land Value [2]	132.00	3650.00	27.65
Indirect	Consumer Price Index [1]	29.60	238.654	8.06
More Intensive Land Use	Land Value [2]	132.00	3650.00	27.65

Water Resource Discount Rates (as published)	
Rate for 2016 [1]	
Amortization Rate equals the published WR Discount Rate of	3.125%
Rate for 1960 [1]	
Amortization Rate equals the published WR Discount Rate of	2.500%

[1] http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/
[2] http://quickstats.nass.usda.gov

National Economic Development Alternative (NED) Analysis. The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies were used to determine the NED. This alternative is defined as that which maximizes the net benefits consistent with protecting the Nation's environment. The economic evaluation was performed in accordance with Chapter 2, Section 4 of the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and the NRCS National Watershed Program Manual (Parts 501.11 A(2); 501.12 C; 505.35 B (1) (iii)-(1V); 505.35 E-F).

D.5 ENVIRONMENTAL STUDIES

Scope. The scope of the Environmental Studies is identified in Attachment 4 - NWPM 501.24 Public Participation and Scoping of NRCS' Scope of Work for Architect and Engineering Services (August, 28, 2013) for the Pine Creek Watershed Dam No. 4 Project.

The environmental evaluation identifies and analyzes the environmental concerns related to the planning alternatives and the recommended plan. The evaluation is an NRCS planning process that is described in the National Planning Procedures Handbook. The Project Team used the NRCS-CPA-52 Environmental Evaluation Worksheet for scoping and documenting environmental impacts. This Worksheet documents the planning and environmental evaluation process and the need for an Environmental Assessment (EA). The Project Team conducted studies and evaluations regarding the following resource concerns.

Wetland Determinations. For the purposes of this EA, estimates of wetland type and extent within the Project boundaries were analyzed using existing data from U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) maps combined with interpretation of aerial photographs. Site reconnaissance was conducted on January 30, 2014, but no formal wetland delineations have been performed. *Wetland and surface water boundaries are estimated and have not been field verified or approved by the USACE.*

The NWI map (Figure B-5) identifies Howard H. Baker Senior Lake as L1UBHh (Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded) with PEM wetlands (Palustrine Emergent wetlands) located at the tips of the fingers of the lake. The presence of PEM wetlands was verified during the January 30, 2014 site reconnaissance, but wetland boundaries were not delineated. Based on site reconnaissance, the wetlands appear to be a mixture of PEM wetlands and PSS (palustrine scrub-shrub) wetlands. The following species were noted in wetland areas: willow (*Salix* sp.), hazel alder (*Alnus serrulata*), and buttonbush (*Cephalanthus occidentalis*), as well as various grasses, sedges, and rushes.

Impacts to wetlands and other Waters of the United States are regulated under Section 404 of the Clean Water Act. Implementation of the Preferred Alternative would have minimal effects on jurisdictional wetlands as no wetlands occur in the immediate vicinity of the dam. Wetlands along the margins of the lake would be affected in the long term by increased inundation caused by a one-foot rise in the normal pool elevation.

Wetland impact estimates are preliminary and are subject to change. However, NRCS will ensure that no net loss of wetland functions occurs by implementing required mitigation measures defined during the CWA Section 404 permitting process.

Implementation of the No Action Alternative/FWOP or the Decommissioning with downstream floodproofing would affect wetlands along the lake margins by removing a water source; however, additional wetlands could form along the stream channel as it becomes re-established above the dam.

Federally-Listed Threatened and Endangered Species. Based on information from the U.S. Fish and Wildlife (USFWS), federally-listed species potentially occurring in Scott County include: Cumberland bean *(Villosa trabalis*), littlewing pearlymussel (*Pegias fibula*), tan riffleshell (*Epioblasma florentina walker*), Cumberlandian combshell (*Epioblasma brevidens*), blackside dace (*Phoxinus cumberlandensis*), Cumberland darter (*Etheostoma susanae*), duskytail darter (*Etheostoma percnurum*), Cumberland arrow darter (*Etheostoma sagitta*), Cumberland rosemary (*Conradina verticillata*), Cumberland sandwort (*Minuartia cumberlandensis*), Virginia spiraea (*Spiraea virginiana*), Northern long-eared bat (*Myotis septentrionalis*), and Indiana bat (*Myotis sodalis*). Specific surveys were not completed for the Project area;

however, potential Indiana bat habitat (i.e., snags) was observed along the perimeter of the lake during the field reconnaissance on January 30, 2014. In an email dated May 12, 2014, the USFWS stated:

> *"Endangered species collection records available to the Service do not indicate that federally listed or proposed endangered or threatened species occur within the impact area of the project. We note, however, that collection records available to the Service may not be all-inclusive. Our data base is a compilation of collection records made available by various individuals and resource agencies. This information is seldom based on comprehensive surveys of all potential habitat and thus does not necessarily provide conclusive evidence that protected species are present or absent at a specific locality. However, based on the best information available at this time, we believe that the requirements of section 7 of the Endangered Species Act of 1973, as amended, are fulfilled."*

Although bald eagles are no longer protected by the Endangered Species Act (ESA), they are protected by the Bald and Golden Eagle Protection Act. No bald eagle nests are known to occur in the vicinity of the Project area; however, during the site reconnaissance on January 30, 2014, a bald eagle was observed flying over the lake.

As federally-listed species are known to occur in the vicinity of the Project, there is a potential for impact; however adverse impacts to federally-listed species are not anticipated, as only minimal disturbance will occur during Project implementation.

Fish and Wildlife Habitat Assessment. Fish and wildlife resources include native or naturalized plants and animals and the habitats in which they occur. In general habitats in the vicinity of the lake appeared healthy during site reconnaissance in January 2014. The lake primarily is surrounded by upland mixed forests, upland hardwood forests, and maintained lawns. Tree species observed along the perimeter of the lake include: Virginia pine (*Pinus virginiana*), Eastern white pine (*Pinus strobus*), American holly (*Ilex opaca*), American beech (*Fagus grandifolia*), sassafras (*Sassafras albidum*), sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and various oaks, including white oak (*Quercus alba*) and chestnut oak (*Quercus montana*). As discussed above, there are a few areas of herbaceous and scrub-shrub wetlands along the portions of the perimeter of the lake.

The lake provides habitat for fish, waterfowl, and other wildlife. Species observed on January 30, 2014 include: great blue heron (*Ardea herodias*), redhead duck (*Aythya americana*), and American coot (*Fulica americana*).

D.6 GEOLOGY

The Embankment and Geotechnical Evaluation, completed by Amec Foster Wheeler, documents the geology investigation completed at the dam.

Scope. The purpose of the subsurface exploration, testing, and analysis was to perform a geotechnical evaluation of the existing Pine Creek Watershed Dam No. 4 at Howard H. Baker Senior Lake in Oneida, Tennessee. The scope of the geotechnical evaluation is identified in Sections 1.2 and 1.3 of Attachment 3 (Engineering Procedures and Checklist) of NRCS' Scope of Work for Architect and Engineering Services (August, 28, 2013) for the Pine Creek Watershed Dam No. 4 Project. The subsurface exploration was conducted on March 25, 2014.

Karst. The site is not susceptible to the formation of karst-related features (sinkholes) because the site is underlain by sandstone and shale and not carbonate bedrock, such as limestone and dolomite.

Seismic Potential. Oneida is located within a relatively stable geological setting located west of the seismically-active Appalachian Mountain region. The site is near Latitude 36.507791° north, Longitude 84.540128° west. Using the United States Geologic Service (USGS) web application and 2009 NEHRP Recommended Seismic Provisions, the peak ground acceleration (PGA) is 0.120 g at the Project site.

The Watershed Work Plan for the Pine Creek Watershed (April 1961) indicates that the Pine Creek fault is located within the watershed. According to the Work Plan, the fault begins near the upstream end of the

Pine Creek gorge and extends to the northeast about four miles to Oneida. The bedrock on the southeast side of the fault is dropped relative to the bedrock on the northwest side. We reviewed the previously referenced geologic map and observed a mapped unnamed fault that corresponds to the one mentioned in the Work Plan.

Area Geology. Pine Creek Watershed Dam No. 4 is located on the Cumberland Plateau, which is within the Appalachian Plateau Province. The Cumberland Plateau is comprised of relatively flat-lying Pennsylvanian and older sediments that were deposited in an ancient shallow sea. The sedimentary rocks within the Cumberland Plateau primarily consist of limestone, shale, coal, and sandstone formations.

The East-Central Sheet of the Geologic Map of Tennessee indicates that the site is underlain by the Slatestone Formation. This formation consists of alternating sandstone and shale layers. The shale intervals also contain occasional coal beds.

Subsurface Exploration. The subsurface exploration included advancing five geotechnical soil borings at the site (Borings B-1 through B-5). Borings B-1 through B-4 were drilled along the auxiliary spillway, and Boring B-5 was drilled along the dam crest. The report contains a Boring Location Plan, which shows the approximate boring locations. The Amec geotechnical engineer established the boring locations in the field by pacing distances from existing features; therefore, the locations should be considered approximate.

Amec subcontracted with Tri-State Drilling (TSD) to perform the drilling for the geotechnical soil borings. TSD power-augured the borings through the overburden and obtained soil samples at various intervals in general accordance with ASTM D 1586 (Standard Penetration Test and Split Barrel Sampling of Soils). We extended each of the borings to refusal. The four spillway borings were subsequently cored using diamond core drilling techniques per ASTM D 2113 (Diamond Core Drilling for Site Investigation). A member of Amec's professional staff was on-site to document the exploration and log the soil and rock core samples in the field. Amec field classified soil samples with respect to material type and consistency and logged the bedrock core for lithology, weathering, and physical weaknesses. Upon completion of auger drilling, Amec checked each boring for the presence of groundwater. TSD backfilled the borings with bentonite-cement grout mixture after the drilling and coring was completed.

Subsurface Conditions. Each of the borings from the exploration initially encountered three to six inches of topsoil. Below the topsoil, Borings B-1 through B-4 (spillway borings) encountered residual soils to auger refusal at depths between about six inches and nine feet. The residuum consisted of silty and clayey sands and clays. The silty and clayey sands were medium dense to dense in consistency, and the clays were medium stiff to very stiff. Below the topsoil at Boring B-5, we encountered existing fill to auger refusal at a depth of about 35 feet. The existing fill was used to construct the dam embankments and keyway. The fill consisted of medium stiff to very stiff sandy clay.

Amec cored five feet of bedrock materials at Borings B-1 through B-4. The cored bedrock was logged for lithology, weaknesses, Rock Quality Designation (RQD), and recovery percentage. The recovered core consisted of light gray and brown, hard sandstone with moderate to severe weathering in the upper one foot. Recovery for the five-foot core runs ranged between 88% and 100%. The RQD for the recovered core ranged between 67% and 82%, which is indicative of fair to good quality rock.

The Boring Logs contain descriptions and interpretations of the materials encountered.

The As-Built Drawings for Pine Creek Watershed Dam No. 4 include eight boring logs drilled along the dam alignment during its design. The boring logs provide the soil and rock type encountered within the dam's foundation. The boring logs provided in the As-Built Drawings are consistent with those performed during this study.

Groundwater. Each of the borings was dry upon boring completion. The boreholes were not developed to enhance water flow or to determine stabilized groundwater levels.

Laboratory Testing. Amec returned the collected soil and rock samples to their Geotechnical and Construction Materials Laboratory in Nashville, Tennessee. Select samples were tested to assess the soils' classification and index properties, such as natural moisture content, grain size analysis, and Atterberg limits.

Critical Cross Sections. We selected two critical sections of the dam embankment to represent critical case scenarios based upon the observed conditions. The critical aspects of the dam include areas with the steepest slopes, highest slopes, landside ditches, toe drains, etc. We selected Stations 5+30 and 6+30 along the dam centerline as critical sections. We estimated the subsurface conditions at each of the above critical sections using the information obtained from our subsurface exploration as well as the subsurface information provided in the As-Built Drawings.

Soil Engineering Parameters. The findings from the exploration and laboratory work indicate that the soils used to construct the dam generally consisted of sandy clay. The dam embankment also included a zoned rock fill and trench drain (sand). The exploration and the As-Built Drawings indicate that the dam foundation generally consists of a mixture of clayey sand and sandy clay overlying bedrock.

The provided As-Built Drawings and Work Plan did not include the engineering parameters used for the dam design. Therefore, Amec derived the engineering parameters from laboratory analysis in conjunction with published correlations and experience with similar soil types. Amec estimated the unit weights for these materials based on soil types, experience and published correlations to estimate strength properties for the foundation and embankment soils based on N-values. Amec estimated the strength properties for zoned rock fill and the trench drain based on experience with similar materials. Amec estimated the hydraulic conductivity for each of the soil types using published correlations based on soil type. In addition to the values indicated in the table below, Amec also used a ratio of vertical permeability to horizontal permeability of one for each of the soil types.

Seepage Analyses. Amec performed seepage analyses at the two critical sections using finite element methods, performed the analyses using Seep/W software in general accordance with Corps of Engineers document Seepage Analysis and Control for Dams. This document provides acceptance criteria for seepage exit gradients at the landside toe of dams and recommends using a minimum factor of safety between 2.5 and 5, depending on knowledge of soil and seepage conditions.

Amec modeled each critical section to evaluate seepage through and beneath the dam embankment. Critical sections were modeled in a steady state condition with a lake level equal to the auxiliary spillway elevation. For the steady state condition, the model assumes that the boundary conditions have been in place for an infinite amount of time and will remain in that state in the future. The computer models allowed seepage to pass through the entire cross section of the dam and its foundation soil. The software then calculates the phreatic surface, head pressures, and gradient for each mesh element of the model.

The seepage analysis at each critical section indicates that the phreatic surface does not reach the ground surface and does not produce exit gradients at the toe of the dam. This condition is consistent with observations while on-site. Therefore, each of the modeled sections produced a factor of safety with regards to seepage exit gradients greater than 5, as required.

Slope Stability Analyses. Amec performed slope stability analyses at each critical section using Slope/W geotechnical software, to analyze slope stability. Amec used the Morgenstern-Price limit equilibrium method, which produces a circular failure surface, at each critical section and used Earth Dams and Reservoirs criteria for minimum acceptable factor of safety for the existing dam.

Amec analyzed a two-dimensional representation of the levee's critical cross sections for each of the design conditions, except for End of Construction condition. The End of Construction condition was not applicable for this evaluation because this is an existing dam. We analyzed the remaining three conditions at each critical cross section.

Case A represents the condition of the dam with the lake level at the auxiliary spillway elevation in a steady state condition. Case B represents the same condition as Case A, but also includes applying a horizontal seismic force. The seismic force consists of a horizontal acceleration that is typically ⅓ to ½ of the PGA. We applied a horizontal seismic coefficient of 0.05 g as recommended in Figure 4-1 of TR-60 Earth Dams and Reservoirs. This seismic coefficient corresponds to about 40% of the PGA for the site (0.120 g). Case C represents sudden drawdown of the lake from the auxiliary spillway elevation to the low stage inlet elevation of the principle spillway. To analyze a sudden drawdown condition, Amec used the Staged Undrained Strength Method proposed by Duncan, Wright, and Wong per Geo-Slope's built-in procedure.

Amec's slope stability analyses indicate that the dam exceeds the required minimum required factor of safety at the critical sections.

Settlement Potential. The provided survey information indicates that the ground surface elevation along the dam crest ranges from about 1473.5 feet near the abutments to about 1475 feet near its center. The As-Built drawings indicate that the ground surface elevation along the dam crest is 1473.1 feet NAVD88 after settlement. Based on these elevations, it appears that the dam embankment has settled to the extent expected during design. Because of the age of the dam (48 years old), it is expected that additional settlement of the dam embankment and/or foundation will be negligible, unless additional loading is applied (i.e., raise dam height).

D.7 ENGINEERING

Scope. The purpose of the engineering analysis was to evaluate existing, future without federal project and rehabilitation alternatives for Pine Creek Watershed Dam No. 4 at Howard H. Baker Senior Lake in Oneida, Tennessee. The scope of the engineering analysis is identified in Sections 1 and 2 of Attachment 3 (Engineering Procedures and Checklist) of NRCS' Scope of Work for Architect and Engineering Services (August, 28, 2013) for the Pine Creek Watershed Dam No. 4 Project.

Surveys. To supplement data from available As-Built Drawings, Amec conducted a topographic field survey of the site on January 15, 2014. The survey included one profile along the centerline of the dam crest, one profile of the auxiliary spillway (inlet channel, control section and exit channel) and one profile through the dam embankment at the principal spillway. Additional spot elevations were collected along the upstream and downstream faces of the dam embankment, auxiliary spillway, and around the outlet structure. Survey point elevations were obtained using a survey grade GPS receiver with an OPUS solution. The vertical datum used for elevations in this plan are in NAVD88.

The bathymetric and sediment surveys of the permanent pool area were performed in January 2014. The results of these surveys are provided in the separate sediment survey submittal.

Flood Storage Capacity. The flood storage curve for existing conditions was developed using the ArcGIS Surface-Volume Tool. The flood storage capacity of Pine Creek Watershed Dam No. 4 was determined by evaluating the cumulative storage capacity above the normal pool elevation.

Runoff Curve Number. The Runoff Curve Number (RCN) development for the Pine Creek Watershed Dam No. 4 drainage area followed TR-55 methodology. Arc Hydro tools, in conjunction with the USACE HEC-GeoHMS software, were used to combine land use data with corresponding soil types and develop a weighted RCN for the entire watershed.

Time of Concentration. The Time of Concentration (Tc) was developed using the segmental/velocity approach, described in TR-55, and the USACE HEC-GeoHMS software. An automated tool in HEC-GeoHMS uses the terrain to determine the paths with minimal slope for shallow concentrated flow, sheet flow, and open channel flow. The HEC-GeoHMS tool develops a preliminary longest flow path using the DEM, which can be adjusted as needed. The adjustments include identifying the locations of flow-type transitions from sheet flow to shallow concentrated flow, and from shallow concentrated flow to channel flow.

Precipitation Data. Precipitation data for the Pine Creek Watershed Dam No. 4 drainage area was derived using the following sources:

- Hydrometeorological Report 51 – Probable Maximum Precipitation (PMP) Estimates, United States East of the 105th Meridian, which provides PMP values for various storm durations; and
- NOAA Atlas 14, Volume 2 (Ohio River Basin and Surrounding States) – Provides rainfall depth-duration-frequency data for 13 Mid-Atlantic and central states. The data can be accessed online at http://hdsc.nws.noaa.gov/hdsc/pfds/

Rainfall depth from the above-mentioned sources was used to develop design hydrographs and evaluate the principal spillway capacity; stability and integrity of auxiliary spillway; and dam capacity (top of dam elevation).

TR-60 design criteria require that the principal spillway capacity be evaluated by routing the Principal Spillway Hydrograph (PSH) with a combined 1-day/10-day 100-year return period rainfall. Two methods for estimating runoff volumes were used: (1) the runoff curve number procedure and (2) runoff volumes based on stream gage studies (TR-60, Figures 2-1(a) and 2 1(b)). The procedure that results in the higher auxiliary spillway crest elevation, when the PSH is routed through the structure, were used. The top of dam elevation and integrity of the auxiliary spillway (i.e., head-cutting and breaching) were evaluated by routing the Freeboard Hydrograph (FBH). For "High Hazard" dams, such as Pine Creek Watershed Dam No. 4, the FBH is generated by a PMP storm. A short-duration (6-hour) and a long-duration (24-hour) storm were analyzed and the most critical result used. The stability of the auxiliary spillway (i.e., erosion and scour along the exit channel) were evaluated by routing the Stability Design Hydrograph (SDH).

Per TR-60, the rainfall depths are temporally distributed using the standard NRCS 6-hour storm distribution (for the SDH and 6-hour FBH), the NRCS 5-point rainfall curve (for the 24 hour FBH), and the NRCS 1-day/10-day distribution (for the PSH). The 1-day/10-day and 6-hour distributions are applied by SITES directly. The 5-point rainfall curve is a critically stacked distribution, which is developed using PMP data for 6-, 12-, and 24-hour PMP storms. The 6-hour PMP is applied uniformly in the second increment of the stacked distribution. Each of the remaining incremental rainfalls is applied uniformly in adjoining 6-hour increments. A site-specific 5-point rainfall curve for Pine Creek Watershed Dam No. 4 was developed using a guidance document/spreadsheet ("5-point 24-hour NRCS Dimensionless Rainfall Distribution & TR-60 SDH/FBH Hydrologic Criteria") provided by the NRCS.

Sediment Volume. Amec performed an evaluation to determine the current condition of sediment accumulation, available flood storage, and water supply capability, as well as to Project future sediment rates, flood storage, and water supply capability in the pool area behind Pine Creek Watershed Dam No. 4 in Oneida, Tennessee. This evaluation supports the ongoing Watershed Rehabilitation Plan and Environmental Assessment.

The stage-storage curve was evaluated by comparing the bathymetric survey collected by Amec with the available storage as shown in the As-Built Drawings dated January 1964. Based on the 1964 As-Built Drawings the designed top of dam was 1473.1 feet (NAVD88). The normal pool elevation was originally 1463.6 feet (NAVD88), however, the normal pool was modified in 1974 to 1465.5 feet (NAVD88) after the low stage inlet was closed and the high stage inlet was notched at the new elevation on the principal spillway structure. According to the As-Built Drawings, at this modified normal pool elevation the total flood storage, above the normal pool elevation of 1465.5 feet (NAVD88) and below the design top of dam of 1473.1 feet (NAVD88), is 534.63 acre-feet. For the current flood pool storage evaluation, based on LiDAR and supplemental survey, the current lowest surveyed top of dam is 1473.65 (NAVD88), with a total flood storage of 581.43 acre-feet above the current normal pool elevation.

According to the As-Built Drawings, the sediment pool included the water supply capability of the Project as well as total sediment storage before flood storage capacity was impacted. The sediment survey results show the estimated sediment volume below the normal pool elevation of 1465.5 feet (NAVD88) is 116.1 acre-feet, based on bathymetry field measurements. When comparing the cumulative storage volumes at various elevations between the current conditions and As-Built Drawings, the analysis indicates a total reduction of 18% of volume available below the normal pool elevation. However, there is a total reduction of 2% of volume (10.51 acre-feet) available between the normal pool elevation and the lowest surveyed top of dam elevation.

The sedimentation rate below the normal pool level was estimated to be 2.42 acre-feet per year. According to population growth estimates, no significant development is anticipated for Pine Creek Watershed Dam No. 4 drainage area. Therefore, the current rate of sedimentation is estimated to continue. Based on this evaluation, the estimated 519.4 acre-feet of remaining sediment storage capacity is adequate to allow sedimentation to accumulate up to the sediment pool elevation for the next 215 years until the year 2229, after which the flood storage will be impacted. It is estimated that the sediment pool has an extended period of life and sedimentation is not considered a major factor in the life of the Project to provide flood control.

Two water supply intake conduits supply water from Howard H. Baker Senior Lake. An available clearance of 1 foot below the intakes was assumed as usable sediment pool. The sediment survey

results show the estimated sediment volume below the lower intake usable sediment pool elevation of 1452.6 feet (NAVD88) is 43.7 acre-feet and below the upper intake usable sediment pool elevation of 1457.6 feet (NAVD88) is 76.7 acre-feet. Comparing the current conditions and As-Built Drawings, the analysis indicates a total reduction of 40% below the lower intake and 30% below the upper intake.

The sedimentation rate below the lower and upper intake was estimated to be respectively 0.91 and 1.60 acre-feet per year. Based on this evaluation, the estimated volume of sediment storage below the usable water supply intake elevations is respectively 64.4 and 182.6 acre-feet, and allows sediment to accumulate for the next 71 years for the lower intake and 114 years for the upper intake. It is estimated that the upper water supply intake has an extended period of life and sedimentation is not considered a major factor in the life of the water supply capability of the Project.

Total available storage for Pine Creek Watershed Dam No. 4 was obtained from the As-Built Drawings. Amec developed a digital surface using available LiDAR data which was supplemented with the bathymetry data points to construct a complete storage surface. Then using the ArcHydro volume characterization toolset within ArcMap 10.0 the current available storage was calculated, which was compared to the As-Built available storage. Based on the current available storage the sediment volume at the normal pool elevation is estimated to be 116.1 acre-feet.

Current Survey Data. Amec performed the bathymetric survey and sediment survey evaluation as per the Plan of Work section III.E.1 – Watershed Dam Survey and Project Scope of Work item 1.3.8.1 of NRCS' Scope of Work for Architect and Engineering Services (August, 28, 2013) for the Pine Creek Watershed Dam No. 4 Project. Existing sediment storage levels were identified within Howard H. Baker Senior Lake by a survey crew collecting sedimentation levels using a depth finder. The survey crew used reasonable spacing between data points sufficient to estimate sediment levels in the lake.

A bathymetric survey was conducted by Amec at the reservoir area on February 27, 2014. Approximately 30 subsurface cross sections were obtained with points that are approximately 21 feet apart in the main body of the storage area as well as the fingers of the lake. The subsurface cross sections and other point locations around the lake and the upstream dam face accumulated 647 total survey points.

Flood Storage Capacity. The flood storage curve for current conditions was developed using the ArcHydro volume characterization toolset within ArcMap 10.0. The flood storage capacity of Pine Creek Watershed Dam No. 4 was determined by evaluating cumulative storage capacity above the normal pool elevation. The As-Built storage values were obtained from the Pine Creek Watershed Dam No. 4 As-Built Drawings completed in 1964 provided by NRCS. The datum conversion from NGVD29 to NAVD88 is -0.404 foot at the dam site, which was applied to elevations reported in the As-Built Drawings.

Water Supply Capacity. The water supply capacity for current conditions was identified using the storage curve developed using the ArcHydro volume characterization toolset within ArcMap 10.0. The As-Built Drawings indicate the invert elevations for the 2″ - 18″ water supply intakes are at 1453.6 and 1458.6 feet (NAVD88), respectively. To accommodate backwashing of the intake filters 1 foot of allowable space between sediment pool and invert of the intakes was assumed. Therefore, the usable intake elevations for the water supply are respectively 1452.6 and 1457.6 feet (NAVD88).

The current available storage for the lower water supply intake is 64.4 acre-feet, a reduction of 40% from the as-built water supply conditions. The current available storage for the upper water supply intake is 182.6 acre-feet, a reduction of 30% from the as-built water supply conditions.

Reliable Yield Study for Water Supply. The reliable yield assessment evaluated the Pine Creek Watershed Dam No. 4 drainage area with respect to water supply and water supply alternatives. The Town of Oneida utilizes Pine Creek Watershed Dam No. 4 and Howard H. Baker Senior Lake as the main sources of water supply for their community.

The water supply analysis methodology chosen for Pine Creek Watershed Dam No. 4 was limited by the amount of available inputs data. RESOP and other models require time series inflows to the water supply lakes (Pine Creek Watershed Dam No. 4 and Pine Creek Watershed Dam No. 1) which were not available for this area. Therefore, a spreadsheet analysis was developed to describe the current water

demand and the benefits of the alternatives chosen to increase water supply storage in Pine Creek Watershed Dam No. 4.

Data was collected from the Sponsor and nationally-recognized climate data sources as inputs into the spreadsheet model. Daily reservoir withdrawals were collected for the following years 2007, 2008, 2009, 2012, and 2013. The cost and amount of water previously purchased from other utilities was collected. Precipitation and evapotranspiration data was collected from the Daymet climate data and Prism Climate Group. Reservoir storage-elevation data was extracted from the as-built plans for Pine Creek Watershed Dam No. 4 and estimated from Pine Creek Watershed Dam No. 1 As-Built Documentation.

Reservoir storage volume was extracted from As-Built Drawings for Pine Creek Watershed Dam No. 4 for the water supply and sediment pool. The available storage was then calculated as the difference in volume between the top of the lowest water supply inlet elevation and the principal spillway elevation. Reservoir storage volume for Pine Creek Watershed Dam No. 1 was estimated from the As-Built Drawings and derived from the assumption that 75% of the volume in the recreation pool would be available for water supply. Pine Creek Watershed Dam No. 1 will not be modified.

The average daily withdrawal was calculated for each year of data available and the maximum yearly average daily withdrawal of 1.4 MG was used to estimate the average daily demand on the system. This amount is not expected to increase significantly when the population projections are considered.

When the withdrawals from Pine Creek Watershed Dams No. 4 and No. 1 were evaluated there was not a pattern observed that indicated a consistent method of withdrawal from either reservoir could be predicted. Therefore total reservoir storage volume from each reservoir was combined as if it was acting as one reservoir.

Monthly precipitation and evapotranspiration data from 1980 to 2013 was utilized for this model. Evapotranspiration was estimated using the Penman-Monteith equation. Evapotranspiration was subtracted from a calibrated precipitation for each month to obtain a net depth of water. The calibration factor for precipitation was 0.9 and was based on recent precipitation values for Williamsburg, KY (USGS Gage, 03404000). The calibration factor was developed by comparing the USGS precipitation station data to the Prism data referenced above. The net depth of water was distributed over both watersheds to simulate monthly inflow volume supplied to each reservoir.

The spreadsheet model was set up to simulate a water balance based on the supply and demand on a monthly basis. If, after demand was subtracted from available runoff, water remained at the end of the month, the surplus amount was added to the previous month's storage volume. Conversely, if insufficient runoff was available to satisfy demands, the deficiency was subtracted from the previous month's storage volume. If the total capacity of the two reservoirs was exceeded at the end of a month, storage was set equal to total reservoir capacity.

This simulation was performed for five scenarios, Current, Current +1 foot of added storage in Howard H. Baker Senior Lake, Current +2 feet of storage in Howard H. Baker Senior Lake, Current +3 feet of storage in Howard H. Baker Senior Lake and Current +5 feet of storage in Howard H. Baker Senior Lake.

The model was calibrated to the Current model reservoir simulation. The shortages where the community needed to purchase water lagged behind the shortages shown in the model for the Current condition during 2007; however, during 2012 the purchases of water corresponded well to when the community purchased water. The year 2007 was one of the driest years in the recent past and other factors may have influenced the purchase of water such as available water in Pine Creek Watershed Dam No. 1 and the actual reservoir operation decisions during that period. Again without elevation data for the reservoirs this is our best estimate of reservoir levels during this time. Thus, only the calibration of precipitation was applied to the model.

This initial analysis assumed that the watershed(s) could supply the volume of water necessary to fill the reservoir each month. The following section describes a more detailed monthly analysis that provides a better estimation of reservoir filling frequency.

From the data, the utility has purchased a maximum of 51 MG in the five years with records. That amount cost $91,000, or about $1,800/MG. The smallest amount of water they purchased cost them $3,900/MG. This is the range of unit benefits from the raise. If the volumetric capacity from the raise is greater than or equal to 51 MG, then the benefit from water supply is $91,000/year. If the capacity from the raise is less than 51 MG, then the benefit is calculated using a unit value that increases linearly from $1,800/MG at 51MG to $3,900/MG for the first MG based on past demand and cost of purchasing water.

The community has noted that they do not anticipate buying water from the McCreary Co. Utility in the future and plan to buy from the Huntsville Utility District. The current rate (wholesale) for the Huntsville Utility District water is $1.98/1,000 gallons for the first 999,999,999 gallons. Therefore, the cost of water in the future is $1,980/MG and there is no cost associated with purchasing the water outside of per/MG cost (i.e. finishing, transport etc.)

If the raise is larger than 51 MG the community could potentially save approximately $100,980 per year on purchased water based on the current Huntsville Utility District rate.

Each scenario was run in the spreadsheet model over the time period from 1980 to 2013 (396 months). The scenarios were run for each level of increase in the storage for Pine Creek Watershed Dam No. 4. The total number of months the reservoirs had 10% or less available volume was calculated for each scenario.

During the last 33 years the number of months simulated to have no water available for the community was 54 months out of 396 or 13.6% of months, and the number of months where there was 10% or less of the total available storage volume remaining was 78 months or 19.7%. Based on the 33-year simulation, even with 5 feet of raise in the elevation of Pine Creek Watershed Dam No. 4, approximately 5.8% of months during a 33-year period the reservoirs cannot supply the amount of water necessary to support the customer demand.

***Sedimentation Rate Impact on Future Available Flood Storage*.** The volume of measured accumulated sediment below the normal pool elevation of 1465.5 feet since the construction of the dam is 116.1 acre-feet, which was estimated as having an average annual sedimentation rate of 2.42 acre-feet per year.

The watershed is located northwest of the city and is fairly remote to development along roadways. Figure B-6 shows the NLCD land use in the watershed. Approximately 52% of the land use is forested, 33% is either in grassland or pasture/hay, and 9% is either developed open space or low intensity development. The remaining 6% is covered by Howard H. Baker Senior Lake. According to population growth estimates, no significant development is anticipated for the Pine Creek Watershed Dam No. 4 drainage area.

With the assumption of no significant development anticipated for the watershed, the annual sedimentation rate is not expected to vary significantly from the estimate provided. Therefore, at the current sedimentation rate of 2.42 acre-feet per year the remaining life of the sediment pool is estimated to be 215 years or the year 2229, after which the flood storage will be impacted.

As the sediment pool has been filled only 18% in the 48 years since construction the sediment pool has an extended period of life and sedimentation is not considered a major factor in available flood storage.

Sedimentation Rate Impact on Future Available Water Supply Intake Ability. The volume of measured accumulated sediment below the lower usable water supply intake elevation of 1452.6 feet since the construction of the dam is 43.7 acre-feet, which was estimated as having an average annual sedimentation rate of 0.91 acre-foot per year. Therefore at the current rate of sedimentation rate of 0.91 acre-foot per year the remaining life of the lower water supply intake is 71 years.

The volume of measured accumulated sediment below the upper usable water supply intake elevation of 1457.6 feet since the construction of the dam is 76.7 acre-feet, which was estimated as having an average annual sedimentation rate of 1.6 acre-feet per year. Therefore, at the current sedimentation rate of 1.6 acre-feet per year the remaining life of the upper water supply intake is 114 years.

As the lower water supply pool has been filled only 40% and the upper water supply pool has been filled only 30% with sediment in the 48 years since construction, the water supply intake structures are expected to have an extended period of life, and sedimentation is not considered a major factor in the water supply intake ability of the Project.

Site Walk. Amec conducted a site visit to document the current conditions of Pine Creek Watershed Dam No. 4 on March 25, 2014. The site visit included a visual review and photographic documentation of the exposed areas of the dam and associated structures. The ground surface of the dam embankment was vegetated with turf-type grass. Some bedrock outcrops along the auxiliary spillway. The surface drainage of the embankment was good (crest surface slopes slightly downward from centerline). Amec did not observe wet areas, puddles, or water-stained depressions on the dam. There were no indications of through-seepage or under seepage exiting the ground surface along the downstream face of the dam. There was minor erosion of the dam's upstream slope between the existing lake level and the auxiliary spillway elevation. Field observations are consistent with the design geometry shown on the As-Built Drawings.

Principal Spillway Video Inspection. Amec performed a TV inspection of the Pine Creek Watershed Dam No. 4 principal spillway in October 2014. The objectives of the inspection were to document the current condition of the principal spillway outlet pipe and riser structure, measure the joint gap at each pipe segment, and identify any potential issues.

The principal spillway investigation consisting of an examination of the existing condition of the interior pipe barrel was conducted on October 3, 2014 by Amec survey personnel. The crew used an inspection system mounted with a video camera to view and measure pipe joints (shown in "Pine Creek Dam Measurement Video.MP4") and capture video sufficient to perform a conditions assessment throughout the spillway outlet (shown in "Pine Creek Dam Pipe Video.MP4").

The pipe is approximately 256 feet and is divided into 16 equal sections of 16 feet with a diameter of 30 inches. It is constructed of reinforced concrete and was found to be in good condition. No cracks or corrosion were found. Slight evidence of abrasion was observed along the bottom of the pipe, and was consistent among all segments.

The video was evaluated using the Kansas State University (KSU) 1 visual rating system as a guide for the general evaluation of the existing condition of the outlet pipe. The KSU rating system evaluates four aspects of a pipe: cracking, corrosion, lining condition, and joint condition. Each aspect is rated on a scale of 0 (poorest) to 9 (best). The lowest rating of any one of the aspects becomes the rating of the overall pipe.

The video equipment also allowed Amec to measure the gap spacing at each joint within the pipe using an integrated laser tool. The smallest spacing was approximately 0.71 mm, while the largest was approximately 2.80 mm.

Hazard Class Evaluation. The downstream limit of the hydraulic study was evaluated downstream of Pine Creek Watershed Dam No. 4 to a point where the flood elevations from a breach of Pine Creek Watershed Dam No. 4 does not exceed the predicted 100-year flood elevation in the stream.

An unsteady HEC-RAS hydraulic model was constructed utilizing the watershed schematic and cross sections developed using HEC-GeoRAS methods. LiDAR cross section and surveyed road crossing data were incorporated into the hydraulic model. Bank station locations were placed based on breaks in the main channel slope as well as using available aerial imagery and survey data. The HEC-RAS model included two scenarios: existing conditions and FWOP.

A breach hydrograph was produced using TR-60 methodology which was routed through the constructed hydraulic model to determine peak water surface elevations and velocities at downstream resources. The TR-60 methodology utilized parameters such as storage behind the dam, depth of water (water surface at top of dam elevation), cross sectional area of the embankment, breach width at the water surface elevation and the width of the valley at the water surface elevation to determine a breach hydrograph.

The effects of the breach analysis were documented and analyzed using a detailed breach inundation map showing critical sites downstream of Pine Creek Watershed Dam No. 4 and the resulting inundation depths at habitable structures and road crossings. The breach inundation extents were plotted using

available LiDAR data. The detailed inundation map produced included the breach inundation extents, 100-year floodplain, cross sections showing the distance downstream from Pine Creek Watershed Dam No. 4, the latest Digital Orthophoto Quarter Quadrangle (DOQQ), habitable structures and road crossings affected by the breach inundation as well as other downstream resources affected by the breach. The inundation depths at habitable structures and road crossings will be evaluated to determine the hazard classification of Pine Creek Watershed Dam No. 4 according to definitions in the National Engineering Manual, Part 520, Subpart C – Dams. Documentation will be produced that includes the location and description of the dam, configuration of the valley, description of existing development (houses, utilities, highways, railroads, farm and commercial buildings, and other pertinent improvements), potential for future development, and other pertinent information.

D.8 ALTERNATIVE FORMULATION

The Project Team completed a conceptual/preliminary engineering analysis to determine the alternatives to be evaluated in detail.

The formulation process began with formal discussions between NRCS, TDEC, Sponsor, KLA Environmental Services, Inc. and Amec. Alternative plans were developed based on their ability to address the Project Purpose and Need that was identified in the Initiate Planning phase. The alternatives considered included the following:

Future Without Federal Project (FWOP) (no action). The FWOP alternative was identified in coordination with NRCS and the Sponsor and is also known as the no action alternative. The FWOP alternative is a minimum level Sponsor breach of the dam, as directed by TDEC. According to the National Watershed Program Handbook, The FWOP is based on the course of action that the Sponsor is most likely to take in the event that no federally-financed rehabilitation work were to be undertaken. The Sponsor requested the following FWOP statement: "The Sponsor has indicated that a minimum level breach of the dam, such as the removal of a portion of the earthen embankment, as directed by the Tennessee Department of Environment and Conservation, Division of Water Resources, Safe Dam Program, would be the FWOP approach conducted by the Town of Oneida."

Rehabilitation to NRCS High Hazard Class dam. The alternative to rehabilitate Pine Creek Watershed Dam No. 4 would require construction and modification in three locations of the dam: the auxiliary spillway, the downstream toe, and the upstream face of the dam. Pine Creek Watershed Dam No. 4 would be rehabilitated to meet current NRCS and TDEC High Hazard Class dam design and safety criteria. The service life would be 70 years.

Dam Decommissioning. The Decommissioning alternative was formulated to restore the stream by reconnecting the upstream and downstream channel in a non-erosive manner and restoring the stream/river. The entire dam embankment would be excavated to allow normal flows and up to 100-year flood flows through the site in a non-erosive manner. Accumulated sediment would not be removed. The decommission alternative was developed in consideration of guidance in NRCS National Engineering Handbook, Part 653, Stream Corridor Restoration: Principles, Processes, and Practices. The decommissioning alternative would eliminate flood storage and protection provided by the dam, which could possibly expose downstream properties to an increased risk of flooding, property damage, and loss of life. As a result, the decommissioning alternative alone would not meet the objective to maintain the downstream flood damage reductions provided by the existing Project. To meet this objective, the decommissioning alternative would have to be supplemented by other measures such as floodproofing or relocation of structures located within the 100-year floodplain.

Dam Decommissioning with Nonstructural and Other Measures. This alternative includes Decommissioning as noted above and removing all structures within the 100-year floodplain. Estimated costs include relocation, property acquisition, demolition, and site stabilization/restoration along with decommissioning utilities, septic structures, wells and similar facilities.

Acquisition/Relocation of At-Risk Structures and Other Non-Structural Measures (Floodproofing in the Inundation Areas). The non-structural alternatives were formulated to remove the downstream hazard and allow the Dam to be reclassified as a Low Hazard Class dam. Land use restrictions were considered to prevent future upgrades to High Hazard Class dam due to downstream development within the breach inundation area. The threat to human life from sudden dam failure would be reduced by relocating the residential and commercial structures and raising and/or relocating the roadways within the potential breach inundation.

Cost Estimates. The Project Team prepared predictions of probable costs for all alternatives. The predictions of probable costs are intended for comparing the alternatives. Unless otherwise noted predictions of probable costs were prepared using the RS Means method for engineering cost estimation.