

**PRELIMINARY ENGINEERING REPORT**

**CASHIERS WATER SYSTEM CONSOLIDATION**

**TUCKASEIGEE WATER AND SEWER AUTHORITY**

**JACKSON COUNTY, NORTH CAROLINA**



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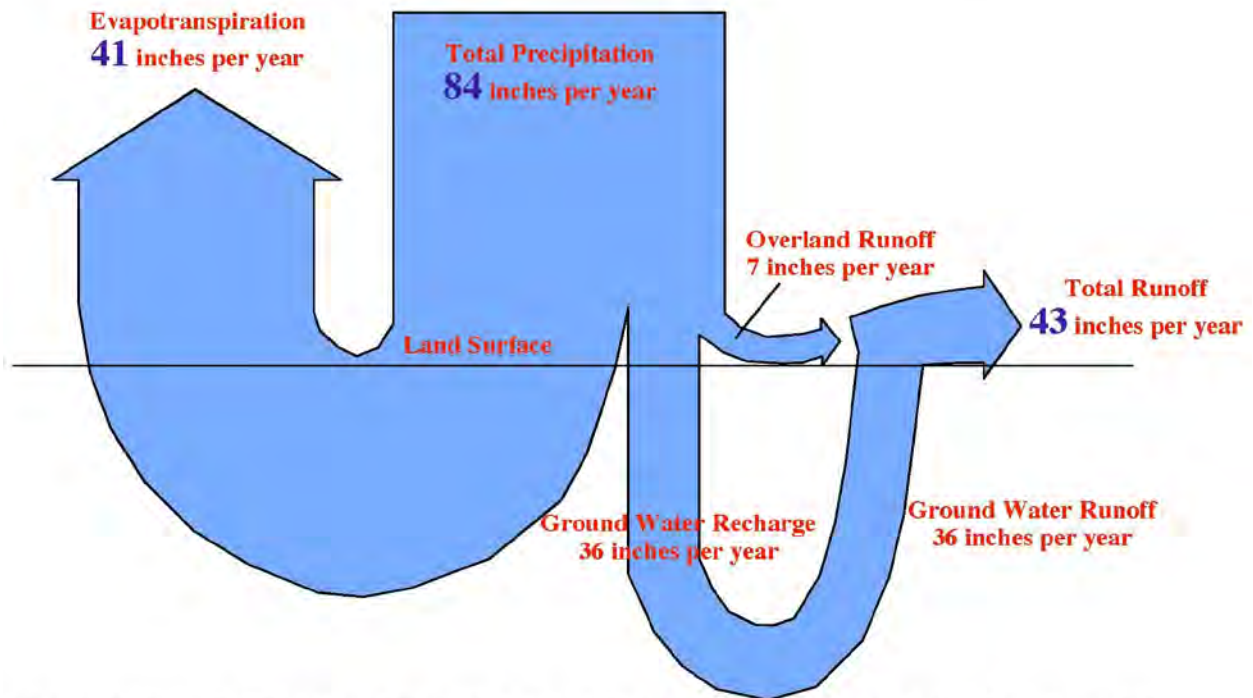


## SECTION 1 – SERVICE AREA AND WATER DEMANDS

### A. Introduction

Cashiers, North Carolina is an unincorporated village in Southern Jackson County, North Carolina roughly centered on the intersection of US Highway 64 and NC Highway 107. The region's beautiful scenery and outdoor recreation opportunities have made Cashiers a popular tourist and vacation destination, and spurred a strong real estate market for both primary and secondary homes, as well as commercial development. The community acts as the commercial hub for southern Jackson County, providing a range of businesses and services. Therefore, Cashiers' potable water demands are greater than its official population would suggest. Despite unusually high levels of precipitation for the state, the ground water supply in the Cashiers area is limited and has historically proven to be difficult to access due to the underlying geology.

### Representative Calculated Natural Water Budget Cashiers, North Carolina Vicinity



Average Precipitation from Highlands 2S, North Carolina Station, 8/1/1948 - 3/31/2004. Data provided by Southeast Regional Climate Center website. Total runoff calculated by averaging data from stream gauges at Rosman, Prentiss, and Cathey's Creek gauging stations. Data provided by USGS website. Ground water recharge and overland runoff calculated by hydrograph separation using USGS program PART and stream gauge data from above gauging stations. Evapotranspiration calculated by subtracting total runoff from total precipitation.

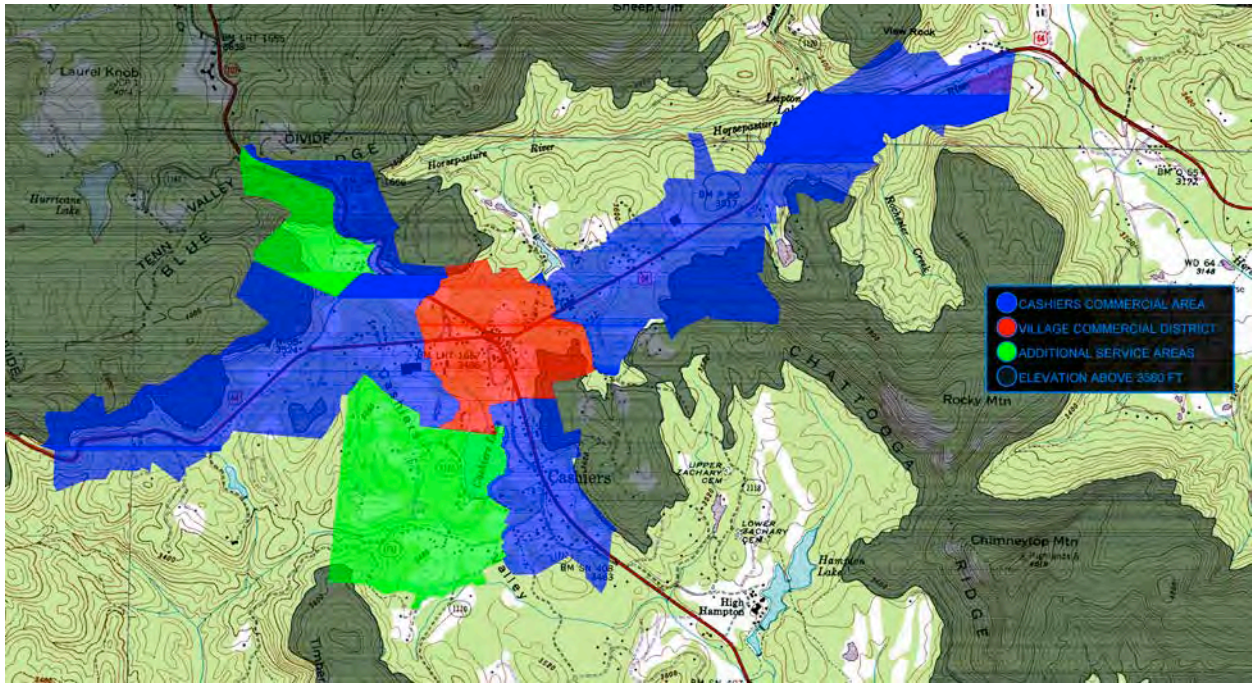
Figure 1. Cashiers Area Natural Water Budget (excerpt from 2005 NCDWR Ground Water Survey)

The Cashiers area contains two types of aquifer: saprolite and fractured bedrock. Saprolite aquifers consist primarily of clay with water stored in the void spaces between clay particles. Older,

large diameter wells were frequently dug or bored into saprolite. Such wells are relatively low yield due to the slow transmission of water through the aquifer. They are also more susceptible to contamination than bedrock wells. Saprolite wells are rare in the Cashiers area. Most of the wells in the area are located near bedrock fractures, which are evident to surface observers by the presence of draws and other topographic lows. Fractured bedrock wells store water in larger spaces formed by breaks in the bedrock. In contrast to saprolite aquifers, groundwater moves quickly through the breaks in bedrock formations, permitting a well withdrawing water from a fractured bedrock aquifer to affect groundwater levels a larger distance from the borehole. When the region of affected groundwater for two or more wells overlap, i.e., those wells are in competition with one another for the same aquifer, those wells are said to be exhibiting well interference. Since many of the wells in the study area are located on common fractures, there is often a high degree of interference between wells that otherwise might appear to be spaced adequately to prevent interference.

#### B. Service Area

The future water service area under discussion in this report consists of the approximately 1,250 acre area designated by the Cashiers Commercial Area Land Development Ordinance, shown in red and blue in Figure 1 below, as the Cashiers Commercial Area (CCA) and two outlying areas located to the north and south of the CCA, shown in green in the figure, which have mild topography and the potential to relatively easily connect to a water or sewer system. The dark green areas shown depict elevations greater than 3,580 feet above sea level, which cannot be served by gravity at a minimum service pressure of 30 psi from the proposed water storage tank described in Section 3 located at an elevation of 3,656 feet.



**Figure 2. Service Areas (see Appendix A, Sheet A-1 for larger version)**

### C. Water Demand Estimates

Multiple estimates of the potential water demands of the CCA have been developed in the past, primarily based upon estimates of potential wastewater collection system demands for the area. Previous demand projections made by McGill Associates (2014; updated 2017) based on actual demands, allocated flows, and mail surveys as well as by CTI Engineers, Inc. (2010) based on estimated flow per unit area have projected potential water demands for the CCA at over 700,000 gallons per day (gpd), taking into account the potential demand of all undeveloped sites within the CCA. However, this estimate may be optimistic for a 25 year projection given the current economic environment. Therefore, this report will consider both current supply and future needs based upon a lower estimate of 400,000 gpd for the 25-year planning period, not taking into account undeveloped portions of the CCA for which no plans have been stated or allocations made. This water demand estimate includes current wastewater treatment plant flow, allocated flows that have been approved but not yet connected, additional allocations requested but not yet approved, and additional flows expected from planned developments identified by a mail survey to property owners. TWSA has secured funding for a planned wastewater treatment plant in the CCA. This facility is now under design. Upon completion of this project, the availability of wastewater treatment capacity is no longer expected to be a limiting factor in the development of the CCA. In the absence of that obstacle, the availability of drinking water and adequate storage to provide fire protection is anticipated to have a larger impact on future development.

The current Cashiers Water Works public water system (PWS), located in the vicinity of Frank Allen Road and Burns Street in Cashiers, consists of two groundwater wells, a hydropneumatic tank, a fire pumping station, and a distribution system. It is currently owned by Jackson County and operated by Tuckasegee Water and Sewer Authority (TWSA). TWSA is currently considering the purchase of this PWS to serve as a water source and foundation for an expanded PWS intended to serve the needs of the Cashiers community.

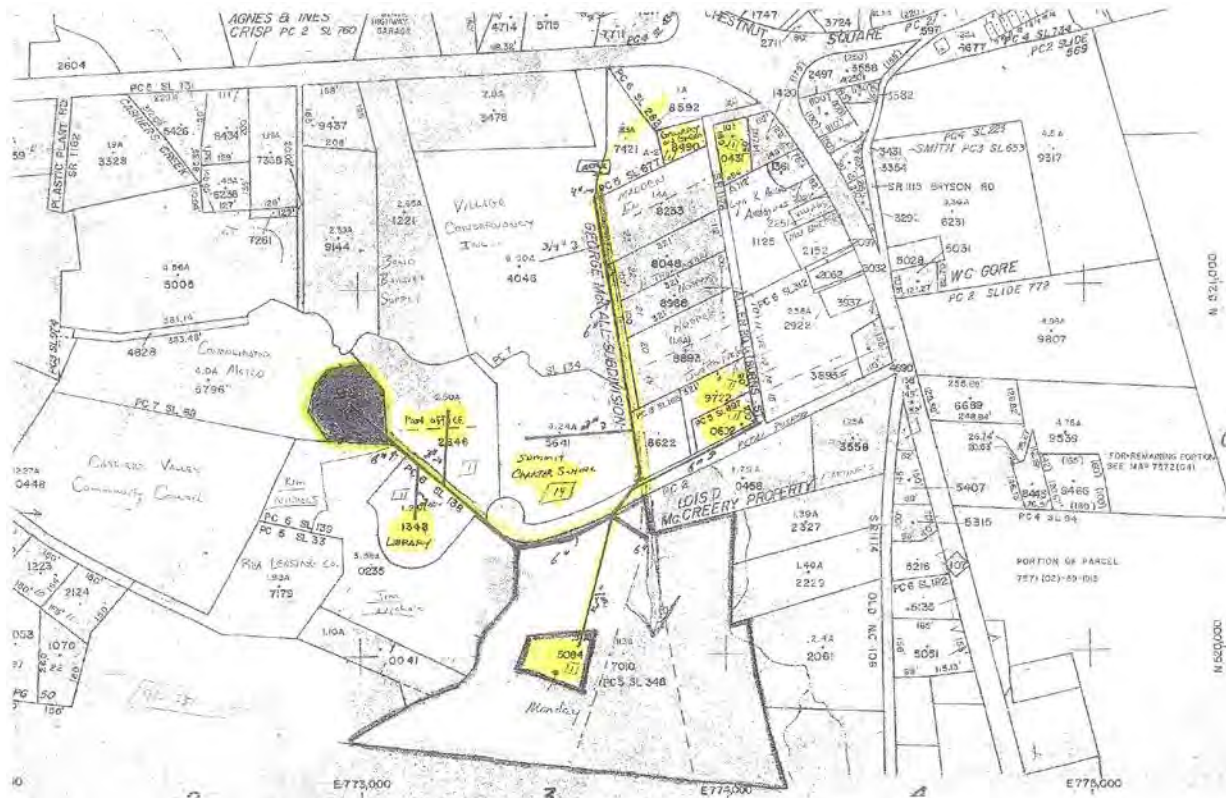
TWSA has also purchased a 16.01-acre property west of central Cashiers on US 64 on the Horsepasture River as a site for a wastewater treatment plant (WWTP). It is anticipated that the site, which is located on a fracture trace, will have adequate space for the construction of at least one well. The site is located roughly between Fairfield Sapphire Well #8, which has a yield of 160 gpm, and Cedar Hill Well #1, which has a yield of 48 gpm.

Conversations with principals of local drillers at Merrill Well & Pump Co., Inc., and Hedden Brothers Well Drilling have revealed that initial blow testing and even 24-hour drawdown testing can lead to overestimation of well yield in the Cashiers area. Wells may actually produce 60-75% of their initial blow test yield when actually put into service.



## SECTION 2 – EXISTING FACILITIES

Jackson County currently owns a public water system (PWSID NC0150180) which provides water to the County’s library, Recreation Center, athletic fields, and other County Offices. The system originally consisted of one groundwater well with a yield of 110 gallons per minute (gpm) of water along with 3,000 gallon hydropneumatic storage tank and fire pumping station. The distribution system consists of 2,170 linear feet (LF) of 6-inch, 284 LF of 4-inch, 536 LF of 2-inch, and 615 LF of ¾-inch water lines. The number of customers served by the system has fluctuated historically, although current NCDEQ records indicate that there are 21 service connections to the system. The 2014 permit states that the population served is 100. The highlighted areas of Figure 2 below show the extents of the original Cashiers Water Works PWS and locations of its eight customers at the time.



**Figure 3. Original Cashiers Water Works System**

Jackson County initially purchased the system, historically named “Grouse Point and Charter School,” from Cashiers Water Works in January of 2009 for \$350,000. Since then, Jackson County has made a number of improvements to the system. A 2009 project by Lofquist & Associates, Inc. proposed the addition of the package fire pumping station, reduced pressure

backflow preventer, two air release valves, 290 LF of 6-inch DIP non-potable fire sprinkler main, 935 LF of 4-inch DIP water line, and improvements to the pump and hydropneumatic tank.

The existing well has been evaluated by drawdown testing twice since Jackson County began considering acquisition of the Cashiers Water Works system. The first test, performed in 2008 by Altamont Environmental, Inc., and the second test, performed by CTI Engineers, Inc., in November of 2009, both conclude that the well has a maximum yield of 106 gpm, or 76,320 gallons per day (gpd). The current well pump, a Grundfos Model 85S75-6, installed in February of 2013, is rated to deliver only 85 gpm.

A second well, located behind the Albert Carlton Cashiers Community Library, has been evaluated by CTI Engineers, Inc. as having a maximum yield of 30 gpm in the absence of interference from the main Jackson County well, and 17 gpm when operated simultaneously with the main well. This additional 21,600 gpd can be added to the system for little additional expense and will be considered part of the system for the sake of this analysis. SCADA controls can ensure that the wells are not pumped simultaneously, preventing interference between the two.

Existing Jackson County Public Water System  
Preliminary Value Estimate  
Cashiers Water System Consolidation  
Tuckaseegee Water and Sewer Authority  
Jackson County, North Carolina  
September 2018

Description	Qty	Units	Unit Cost	Initial Value	Purchased	Depreciation*	Present Worth
Cashiers Water Works	1	LS	\$45,779	\$45,779	unknown	20%	\$36,600
6-inch DIP Water Line	290	LF	\$70	\$20,300	2010	20%	\$16,200
4" DIP Water Line	935	LF	\$50	\$46,750	2010	20%	\$37,400
1" Service Line	130	LF	\$20	\$2,600	2010	20%	\$2,100
Package Fire Pumping Station Complete w/ Backup Generator	1	LS	\$300,000	\$300,000	2010	40%	\$180,000
1.5" Reduced Pressure Backflow Preventer	1	LS	\$3,400	\$3,400	2010	20%	\$2,700
Air Release Valve	2	EA	\$2,000	\$4,000	2010	20%	\$3,200
4" Gate Valve	3	EA	\$1,000	\$3,000	2010	20%	\$2,400
6-inch Post Indicator Valve	1	EA	\$1,000	\$1,000	2010	20%	\$800
Flushing Station Assembly	3	EA	\$800	\$2,400	2010	20%	\$1,900
Hydropneumatic Tank Upgrades	1	LS	\$5,000	\$5,000	2010	40%	\$3,000
Well Pump	1	LS	\$14,264	\$14,264	2013	50%	\$7,100
<b>Total Depreciated Value:</b>							<b>\$293,400</b>

\*straight line depreciation with \$0 salvage value, 40 year service life for pipes, 20 year service life for fire pump and tank upgrades, and 10 year service life for well pump

## **SECTION 3 – ALTERNATIVES CONSIDERED**

This PER considers three alternatives to serve the Cashiers water service area. Each alternative will include the water source(s), main transmission lines, and one storage tank. The three alternatives considered are Alternative 1, construction of multiple water supply wells, Alternative 2, interconnection with an existing large private water system, and Alternative 3, the utilization of Lake Glenville as a water source. Installation of the main water distribution system will also be considered in this alternatives analysis. See Appendix A, Sheet A-2 for a layout map of Alternatives 2 and 3, and Appendix A, Sheet A-3 for a layout of the proposed water storage tank site.

### **ALTERNATIVE 1 – Construction of Multiple Water Supply Wells**

#### **Description**

Alternative 1 consists of multiple phases. The first phase would involve the construction of a 250,000-gallon water storage tank located at an elevation of 3,656 ft on a hill near the intersection of US 64 and NC 107. The existing Library Well was drilled but not developed, so this alternative includes the development of the Library Well. The water tank would then be connected to the existing Cashiers Water Works wells via an 8-inch diameter ductile iron pipe extension of the existing 6-inch water line along Frank Allen Road to NC 107, where it would connect to an 8-inch water line extending from the new tank to the intersection of NC 107 and US 64. An east-west trunk line, consisting of 8-inch ductile iron pipe, would extend along the commercial areas on US 64 for 7,020 feet from Hearthstone Center to Ingle's. A north-south trunk line, also consisting of 8-inch and ductile iron pipe, would extend along NC 107 for 3,850 feet from Slab Town Road to the Cornucopia Restaurant near Cashiers Lake. The first phase would consist of the construction of the new water storage tank and access road, upgrades to the well pump at the existing Jackson County Well, construction of one booster pump station to serve customers at higher elevations, development of the second Cashiers Water Works well behind the library, 13,830 LF of 8-inch water line, and 250 service connections to existing wastewater customers.

The second phase of the project would involve the development of two existing 8-inch wells located south of Cashiers Lake on NC 107 and the construction of a new 8-inch well at the future WWTP site on US 64 east of Cashiers. The driller of the two 8-inch wells south of Cashiers Lake has stated that dual drawdown testing of those two wells gave a final yield of 72 gpm for the more productive well and 12 gpm for the less productive well. These wells are in close proximity to one another and can share treatment facilities as well as controls. It is unlikely that they could be



purchased separately. An additional 540 LF of 6-inch water main would be needed to connect these wells to the trunk line previously constructed on NC 107. A new 8-inch well at the future WWTP site would be drilled and the water main previously constructed along US 64 would be extended an additional 7,430 feet to the WWTP site using a combination of 8-inch and 6-inch piping, and connected to the well. At this time, an existing 6 ¼ -inch well located on the western edge of the CCA on US 64 would be purchased for future use. While the well is labeled as 100 gpm, the drilling company that originally drilled the well in 2003 has stated that they believe its actual production will be around 75% of that rate and recommended drawdown testing be performed on the well. The second phase would consist of the drilling and development of a new well and purchase and development of two existing wells and the construction of an additional 7,970 LF of 8-inch and 6-inch water line.

The third phase of the project would be the completion or construction of additional wells as needed to meet demands if unexpected growth occurs, or if the wells identified in Phase 2 are unavailable or do not perform as anticipated. Assuming the anticipated yields from the wells acquired in Phases 1 and 2 are obtained, the equivalent of two additional 85 gpm wells would need to be constructed at locations yet to be determined. In this phase the 70 gpm well at the western edge of the CCA purchased in Phase 2 would also be developed and connected to the 8-inch water main constructed along US 64 in Phases 1 and 2 via a 7,020 LF extension of 8-inch and 6-inch ductile iron water main. The third phase would consist of the drilling and development of two or more wells and the development of an existing well and any additional water line necessary to connect these wells to the existing system. Additional wells have recently been completed in the Cashiers Lake area which have potential use in a public system. The developer of that property has expressed interest in turning the wells and water mains over to a public system. The capacity of those wells is unknown at this time.

## Design Criteria

### Water Supply Capacity

Phase 1 would provide 97,920 gpd of water to the CCA from the two wells connected in that phase, which is approximately the current seasonal flow received at the Cashiers WWTP.

Phase 2 of the project would add up to another 132,480 gpd of water to the CCA from the two existing wells connected, bringing the total water supply for the CCA to 230,400 gpd.

Phase 3 of the project would bring additional water supply into the system as needed, up to the projected 25-year demand of 400,000 gpd.

<b>Cashiers Water System Consolidation Alternative #1 Total Water Supply</b>		
	gpm	gpd
Phase 1		
Jackson County Well	106	76,320
Library Well	30	21,600
<b>total</b>		<b>97,920</b>
Phase 2		
Lake Cashiers Well #1	72	51,840
Lake Cashiers Well #2	12	8,640
WWTP Well	100	72,000
<b>total</b>		<b>230,400</b>
Phase 3		
Additional Well at Location TBD #1	85	61,200
Additional Well at Location TBD #2	85	61,200
US 64 Well at Western Edge of CCA	70	50,400
<b>total</b>		<b>403,200</b>

\*Note: well production based on 12-hour pumping

### Hydraulic Considerations

Almost all customers will be served by gravity from the new water storage tank with the exception of approximately 15 customers located along Highway 107 North at the northern edge of the CCA. These houses will be served with one booster pump station that TWSA would own and operate. A tank located at 3,656 feet above mean sea level would be capable of serving all other customers with a minimum service pressure of 30 psi. The construction using 8-inch and 6-inch water lines should provide adequate flow capacity for both regular drinking water

service and fire flows, but the actual line sizes and lengths should be confirmed during the design of the water system to ensure adequate pressures are achieved. Customers on the eastern end of the CCA below 3,470 ft will require pressure reducing valves (PRVs) on their water service lines as their water pressure will exceed 80 psi when they are transferred to the system.

Phase 1:

Water can be pumped into the storage tank from the existing two Jackson County wells if appropriate pumps are installed to meet the increased pressure head condition. The fire pumping station should no longer be needed as fire flows from the tank can be delivered by gravity.

Phase 2:

The 8-inch wells located south of Cashiers Lake are located at a ground elevation approximately 180 feet below the tank, and water can be pumped from these wells to the tank if appropriate pumps are installed to meet the increased pressure head condition. Any potential well located at the future WWTP site would be around 460 feet below the tank. Rather than pump the water from this well to the main storage tank, it may be more effective to erect a new storage tank at the future WWTP site and create a separate pressure zone. This decision can be made during the design of Phase 2.

Phase 3:

As the locations of additional wells have not yet been determined, no hydraulic considerations have been identified for those wells at this time. The well on US 64, located on the west end of the CCA, is 915 feet deep according to its tag and there would be 11,600 lf of pipe connecting it to the tank. Appropriately sized pumps are available for this application, but energy costs will be higher than for the other pumps. As with Phase 2, rather than pump the water from west end of the CCA to the main storage tank, it may be more effective to erect a new storage tank at the future WWTP site and create a separate pressure zone. This decision can be made during the design of Phase 3.

## **Regulatory Requirements**

Conveyance of the existing Cashiers Water Works system from Jackson County to TWSA will require a formal written request/application to the North Carolina Public Water Supply Section (NCPWSS). NCPWSS is aware of the potential request and no issues are anticipated. Similar NCPWSS approval would be needed if TWSA acquires and assumes ownership of the other existing wells. In accordance with State rules (15A NCAC 18C .0203), a 100 feet radius around the well must be owned or controlled by the entity supplying the water. This rule also requires minimum setbacks from sanitary sewage systems, underground fuel and chemical tanks, and other setback requirements. Therefore, this requirement will need to be taken into consideration when identifying potential wells for acquisition, or for siting locations for new wells. The NCPWSS has a well site approval procedure that will be necessary for new wells. All water system improvements must be permitted through the NCPWSS. TWSA will also be required to modify their sampling plan, operation and maintenance plan, and Local Water Supply Plan.

Other permits that may be required for the water tank and water line construction include permits from the United States Army Corps of Engineers and North Carolina Division of Water Quality for stream or wetland crossings, and erosion and sedimentation control plan approval from the North Carolina Department of Environmental Quality (NCDEQ) for land disturbance exceeding 1 acre. The permits that will actually be required would be confirmed as the design of the infrastructure is being completed.

Depending on the agencies utilized for funding of the project, environmental assessments or other environmental documents may be required to be prepared and approved by State and Federal regulatory and resource agencies.

## **Land Requirements**

This project includes the purchase of the existing Jackson County PWS as part of Phase 1 of both this alternative and Alternative 3.

It is anticipated that the sites of the well on the west end of the CCA and the two 8-inch wells south of Cashiers Lake would be purchased outright, while around half of the 12.3 acre parcel near the tank site and the parcel adjacent to it would be purchased for the construction of the water tank and access road. Water system improvements within NCDOT right-of-ways will require encroachment

agreements, and utility easements will be required for water lines to be constructed outside of recorded NCDOT rights-of-way.

### **Potential Construction Issues**

No significant construction problems are anticipated for Alternative 1. However, some uncertainty remains regarding the maximum yields of many of the wells proposed for Phases 1, 2, and 3. More conclusive testing should be performed for each of these wells before it is brought into the system. In addition, the cost estimates in this report assume that all wells will require only chlorination and pH adjustment, and that no treatment for synthetic or organic contaminants removal will be required.

**Cost Estimates**

Alternative 1: Multiple Well Supply System (Phase 1)  
Preliminary Cost Estimate  
Cashiers Water System Consolidation  
Tuckaseigee Water and Sewer Authority  
Jackson County, North Carolina  
September 6, 2018

Item No.	Description	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	LS	\$74,000	\$74,000
2	250,000 Gallon Water Storage Tank	1	LS	\$378,000	\$378,000
3	Tank Access Road	1	LS	\$75,600	\$75,600
4	Well #1 Pump Upgrade	1	LS	\$29,100	\$29,100
5	Develop Library Well	1	EA	\$82,600	\$82,600
6	8" DIP Water Main	13,830	LF	\$90	\$1,244,700
7	SCADA and Electrical	1	LF	\$117,000	\$117,000
8	Booster Pump	1	LS	\$233,000	\$233,000
9	Service Connections	250	EA	\$1,200	\$300,000
<b>Construction Subtotal</b>					<b>\$2,534,000</b>
Contingency					\$507,000
Technical Services					\$633,500
Easements					\$50,000
Legal and Administration					\$50,700
Property Acquisition					\$869,400
Acquisition of Jackson Co. PWS					\$293,400
<b>Project Total</b>					<b>\$4,938,000</b>

Note: The Property Acquisition line item estimate is based on Jackson County tax values for the property needed for the water storage tank and booster pump station. It is assumed that Jackson County will convey the properties associated with the existing Cashiers Water Works to TWSA for no cost, and that the parcels needed can be subdivided.

Alternative 1: Multiple Well Supply System (Phase 2)  
Preliminary Cost Estimate  
Cashiers Water System Consolidation  
Tuckaseegee Water and Sewer Authority  
Jackson County, North Carolina  
September 6, 2018

Item No.	Description	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	LS	\$40,300	\$40,300
2	8" Well Drilling	850	LF	\$18	\$15,300
3	8" Well Casing & Grout	60	LF	\$70	\$4,200
4	Develop Cashiers Lake Wells	1	EA	\$107,000	\$107,000
5	Develop New Well after Drilling	1	LS	\$83,000	\$83,000
6	8" DIP Water Main	6,680	LF	\$90	\$601,200
7	6" DIP Water Main	1,290	LF	\$80	\$103,200
8	SCADA and Electrical	1	LS	\$35,000	\$35,000
9	Service Connections	330	LS	\$1,200	\$396,000
<b>Construction Subtotal</b>					<b>\$1,385,200</b>
Contingency					\$277,000
Technical Services					\$346,300
Easements					\$20,000
Legal and Administration					\$27,800
Property Acquisition					\$765,000
<b>Project Total</b>					<b>\$2,821,300</b>

Note: Property acquisition is based on information from Jackson County land records for the parcels containing the three wells.

Alternative 1: Multiple Well Supply System (Phase 3)  
Preliminary Cost Estimate  
Cashiers Water System Consolidation  
Tuckaseegee Water and Sewer Authority  
Jackson County, North Carolina  
September 6, 2018

Item No.	Description	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	LS	\$56,600	\$56,600
2	8" Well Drilling (for two wells)	1,700	LF	\$18	\$30,600
3	8" Well Casing & Grout	120	LF	\$70	\$8,400
4	Develop New Well after Drilling	3	EA	\$83,000	\$249,000
5	8" DIP Water Main	6,270	LF	\$90	\$564,300
6	6" DIP Water Main	5,750*	LF	\$80	\$460,000
7	SCADA and Electrical	1	LS	\$60,000	\$60,000
8	Service Connections	430	EA	\$1,200	\$516,000
<b>Construction Subtotal</b>					<b>\$1,944,900</b>
Contingency					\$389,000
Technical Services					\$486,200
Easements					\$50,000
Legal and Administration					\$38,900
Property Acquisition					\$500,000
<b>Project Total</b>					<b>\$3,409,000</b>

\*estimated 5,000 LF 6-inch DIP to connect new wells to existing system



## **Operations and Maintenance Costs**

The operations and maintenance costs of groundwater supply systems are much lower than those of surface water systems. Depending on the quality of the groundwater, it is likely that no treatment would be necessary beyond chlorination, in which case most of the operational expenses associated with this alternative would be electrical costs for operation of well pumps.

Our recent review of operations costs for a similar system in Buncombe County consisting of 10-12 wells producing approximately 5.1 million gallons per month showed an operational cost of \$0.49 per 1,000 gallons of finished water pumped.

The wells proposed to be used as a water supply for Phase 1 would have an estimated total capacity of approximately 35.2 million gallons per year pumping 12 hours per day for an estimated annual operating cost of \$17,150. Specific well yields for further phases of this alternative are unknown, but assuming the same cost per gallon, operational costs for a groundwater system supplying the full 400,000 gpd demand of the area would be approximately \$72,000 per year.

## **Advantages / Disadvantages**

Advantages of Alternative 1 include the following:

- This alternative provides for both current and future water demands in the CCA.
- This alternative would assure the residents and businesses in the CCA of a maintained, approved water system.
- This alternative employs conventional design and construction processes.

Disadvantages of Alternative 1 include the following:

- This alternative requires acquisitions of easements for portions of the water lines and property acquisition for a new storage tank, wells, and pump stations.

## **ALTERNATIVE 2 – Interconnection with an Existing Large Private Water System.**

### **Description**

Alternative 2 consists of interconnection between the existing Jackson County PWS and a nearby existing private water system such as those located at High Hampton Country Club or Fairfield Sapphire. McGill Associates contacted the president of McKee Properties, the development company who drilled the wells for several of the larger private developments in the Cashiers area. McKee Properties indicated that there is not significant excess capacity in the systems with which they have been involved. McGill Associates also spoke to a local geologist who has extensive experience in the Cashiers area. This geologist indicated that it is his experience that water systems in the area do not have excess capacity. Based on these discussions, there does not appear to be significant interest in the existing private system owners providing water outside of their developments. Therefore, connection to an existing water system does not appear to be a feasible option for supplying water to the identified Cashiers service area and has not been considered further.

## ALTERNATIVE 3 – Utilization of Lake Glenville as a Surface Water Source

### Description

Alternative 3 consists of the construction of a surface water intake structure on Lake Glenville (Thorpe Lake), a large artificial lake operated by Duke Energy between two and seven miles north of Cashiers on NC 107, and a water treatment plant to be located on NC 107 within the CCA. See Figure 3 below for the location of Lake Glenville. Due to the extended length of time needed to obtain necessary approvals for a lake intake and new water plant, this alternative also includes the purchase of the current Jackson County PWS and construction of a water storage tank to serve the community's immediate needs. Construction of this alternative includes the purchase of the existing Jackson County PWS and the construction of a surface water intake, 0.4 MGD water treatment plant, water storage tank, 11,680 LF of 6-inch water main to distribute finished water within the CCA, 39,930 LF of 8-inch water main along NC 107 from the surface water intake on Lake Glenville to the northern end of the 6-inch water main on NC 107, and 2,150 LF of 8-inch water main from the water storage tank to the intersection of NC 107 and US 64.

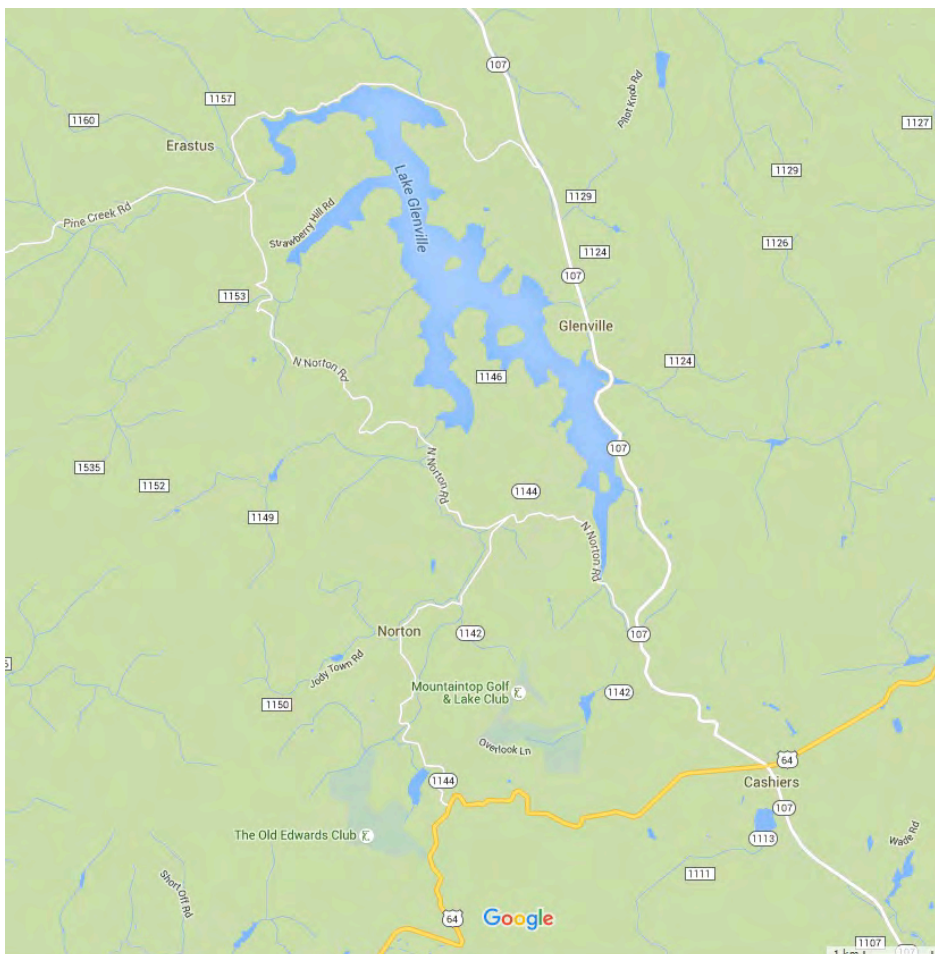


Figure 4. Lake Glenville

Due to the lengthy permitting process that would be required for a proposed intake and water treatment plant, this alternative could be constructed in multiple phases. However, for the purposes of this report, it has been assumed that the project would be designed and constructed as a single project. This alternative is based on the construction of a packaged water treatment plant. Since the water supply is a reservoir, it is assumed that NCPWSS will permit the packaged plant construction without the need for a pretreatment of the raw water. If pretreatment is required, additional facilities and associated costs would be needed for this alternative.

## Design Criteria

### Water Supply Capacity

Lake Glenville (Thorpe Lake) is already classified by the North Carolina Division of Water Resources as a Water Supply III surface water. Determination of the safe yield for Lake Glenville is beyond the scope of this study. This alternative is discussed with the assumption that adequate water supply is available.

### Hydraulic Considerations

While the route has not been surveyed, significant elevation differences from a minimum of around 3475 feet to a maximum of 3940 feet above sea level will affect hydraulics along the proposed route from the intake near Thorpe Dam to any potential water treatment plant site. Energy losses from friction over the seven mile distance from the intake to the water treatment plant must also be overcome by pumping, possibly in multiple stages over the distance. These terrain constraints will contribute to significant energy costs associated with this alternative. Figure 4, below, shows the approximate elevation profile between the likely intake location near Thorpe Dam to the intersection of NC 107 and US 64.



Figure 5. Elevation Profile from Lake Glenville Intake Site to Cashiers (Source: Google Earth)

## **Regulatory Requirements**

Lake Glenville (Thorpe Lake) is currently classified as a Water Supply III surface water by the State of North Carolina. However, since the lake is controlled by Duke Energy, construction of a raw water intake will require a Conveyance Permit from Duke Energy. Duke Energy may have restrictions as to the elevation of the intake to prevent impacts to its existing power generation water intake on the lake. As part of Duke Energy's permitting process, the Federal Energy Regulatory Commission (FERC) must review and approve the permit application for the water withdrawal in conjunction with Duke Energy's approval. Duke Energy also requires an Environmental Assessment review process that also must be completed as part of their permit review. The Duke Energy/FERC permit approval process is lengthy and could take several years to complete.

A permit from the US Army Corps of Engineers (USACE) and a water quality certification from the North Carolina Division of Water Quality will be required for the construction of the intake in the lake. The federal USACE permit will require review from the US Fish and Wildlife Service and the North Carolina Wildlife Resource Commission, and could result in the requirement for environmental assessments, archaeological and biological surveys, and other environmental document preparations and approvals. Depending on the agencies utilized for funding of the project, additional environmental assessments and other environmental documents may be required to be prepared and approved by State and Federal regulatory and resource agencies.

For the initial phase of this alternative, conveyance of the existing Cashiers Water Works system from Jackson County to TWSA will require a formal written request/application to the North Carolina Public Water Supply Section (NCPWSS). NCPWSS is aware of the potential request and no issues are anticipated.

All water system improvements associated with the proposed water treatment plant, water storage tank, and water lines must be permitted through the NCPWSS. Other permits that may be required for the water tank and water line construction include permits from the United States Army Corps of Engineers and North Carolina Division of Water Quality for stream or wetland crossings, and erosion and sedimentation control plan approval from the North Carolina Department of Environmental Quality (NCDEQ) for land disturbance exceeding one acre.

## **Land Requirements**

A number of suitable locations appear to be available for the construction of a water treatment plant for the Cashiers community. Property values near Lake Glenville are high, and sites suitable for construction are too few to permit construction of the water treatment plant near the intake structure. It is likely that a water treatment plant would instead have to be constructed near Cashiers on NC 107.

## **Potential Construction Issues**

Anticipated construction issues associated with this alternative include the likelihood of encountering significant amounts of rock during construction of the water lines associated with this alternative as well as unknown variables that may be encountered with the construction of the surface water intake. Close consultation with Duke Energy and the USACE would be necessary in order to design a safe, effective surface water intake for Lake Glenville.

## Cost Estimates

Alternative 3: Utilization of Lake Glenville as a Surface Water Source  
Preliminary Cost Estimate  
Cashiers Water System Consolidation  
Tuckaseegee Water and Sewer Authority  
Jackson County, North Carolina  
September 6, 2018

Item No.	Description	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	LS	\$342,800	\$342,800
2	Intake Structure on Lake Glenville	1	LS	\$580,000	\$580,000
3	0.4 MGD WTP at site TBD	1	LS	\$3,730,000	\$3,730,000
4	250,000 Gallon Water Storage Tank	1	LS	\$290,000	\$290,000
5	Tank Access Road	1	LS	\$76,000	\$76,000
6	8" DIP Water Main	53,760	LF	\$90	\$4,838,400
7	Booster Pump	3	LS	\$233,000	\$699,000
8	Service Connections	1,010	EA	\$1,200	\$1,212,000
<b>Construction Subtotal</b>					<b>\$11,768,200</b>
Contingency					\$2,353,600
Technical Services					\$2,942,100
Easements					\$100,000
Legal and Administration					\$235,400
Property Acquisition					\$1,800,000
Acquisition of Jackson Co. PWS					\$293,400
<b>Project Total</b>					<b>\$19,492,700</b>

### Advantages / Disadvantages

The advantages of Alternative 3 include the following:

- This alternative provides for both current and future water demands in the CCA.
- This alternative would assure the residents and businesses in the CCA of a maintained, approved water system.
- This alternative employs conventional design and construction processes.

The disadvantages of Alternative 3 include the following:

- This alternative involves a long and complex approval process.
- This alternative would have higher O&M costs than Alternative 1.
- This alternative has an estimated cost of over \$19,000,000.
- This alternative may be politically unpalatable to the community surrounding Lake Glenville.

## SECTION 4 – CONCLUSIONS

This Preliminary Engineering Report has evaluated the technical, regulatory and cost issues associated with several options for providing a public water system to serve the identified Cashiers water service area. The projected 25-year water demand is approximately 400,000 gpd to serve approximately 1,000 connections. The option of interconnecting with an existing, large private water system (Alternative No. 2) was determined to be unlikely at this time due to lack of interest by the existing water system owners, and was therefore not included in the cost estimate analysis. Project costs were estimated for Alternatives 1 and 3 shown in the summary table below:

**Alternatives Cost Summary**

<b>Alt. No.</b>	<b>Description</b>	<b>Estimated Preliminary Cost</b>
1	Groundwater Supply System	\$11,168,300
2	Connection to Existing Private Water System	Not Feasible
3	Utilization of Lake Glenville for Water Source	\$19,492,700

**\*Alternative 1 cost based on the combined total of all 3 phases.**

Alternative 1 is the lowest-cost, feasible alternative for providing both current and future water supply for the Cashiers community. Alternative 1 may be constructed in multiple phases as needed, allowing for flexibility in funding and implementation. The first phase of the proposed project, which would provide a water supply of approximately 98,000 gpd, consists of the purchase of the existing Jackson County PWS and the construction of a 250,000 gallon water storage tank with an access road, approximately 13,830 LF of 8-inch diameter ductile iron water line, pump upgrades to the existing Jackson County PWS Well No. 1, development of the existing Library Well, and all necessary testing, SCADA, and electrical improvements to those wells, as well as the construction of one booster pump station and 250 service connections in order to expand and convert the Jackson County PWS into the Tuckasegee Water and Sewer Authority Cashiers PWS. The estimated cost of this initial phase is \$4,938,000.



## Potential Funding Sources

There are multiple potential funding agencies that could be utilized for the construction of the proposed water system improvements. A partial list of potential federal and state funding sources for the project are listed below:

- USDA-Rural Development (USDA-RD)
- NCDEQ Drinking Water State Revolving Fund (DWSRF)
- NCDEQ State Grant Reserve
- North Carolina Golden LEAF Foundation

USDA-RD provides 40-year fixed interest loans for infrastructure projects. Depending on the community and its needs, loans are currently available at a 3.125% intermediate rate or a 2.375% “poverty rate,” which can also be applied to projects intended to alleviate a severe public health need.

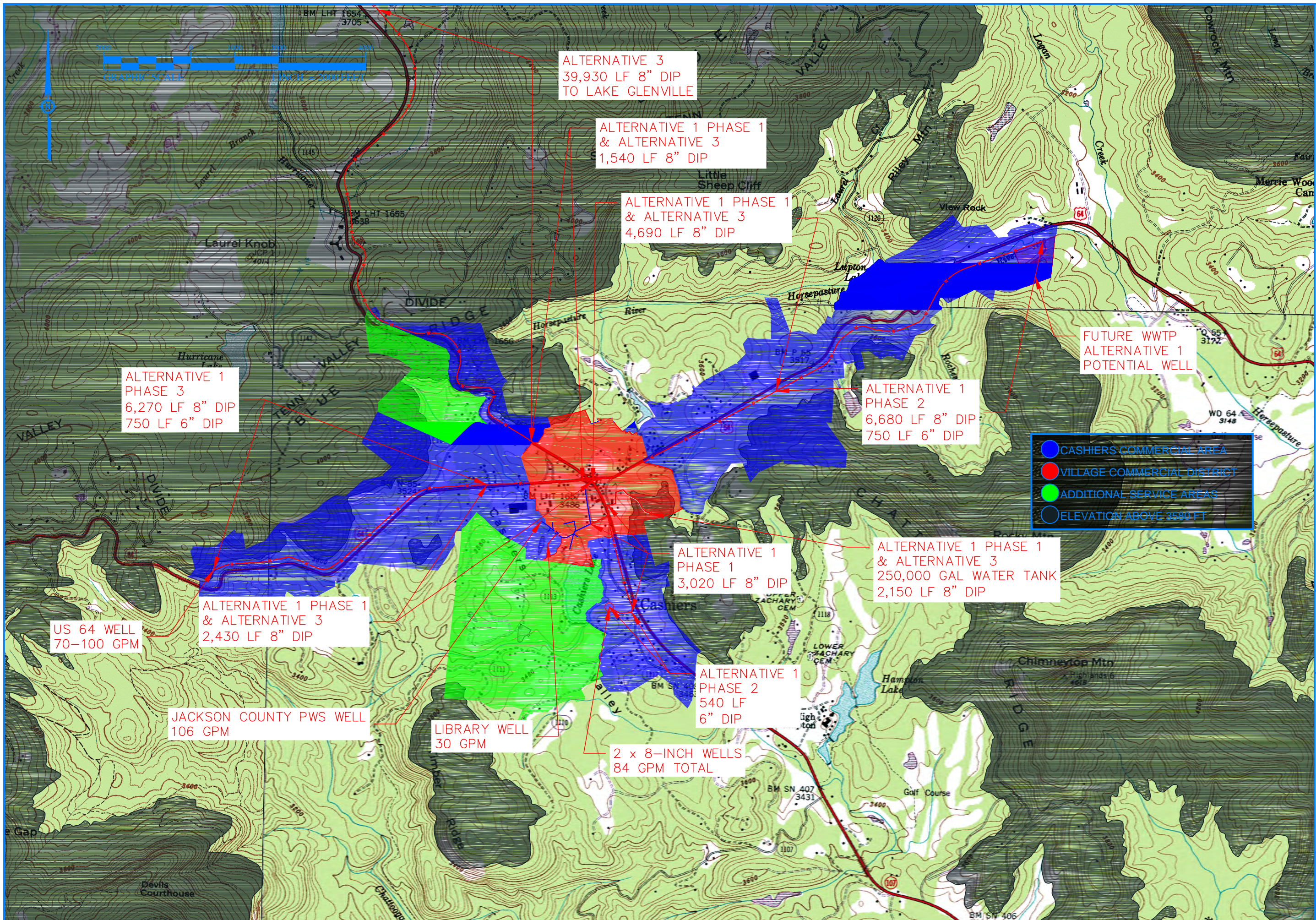
The following table presents potential debt service for a 40-year USDA-RD loan assuming 90% of the project cost is financed by USDA:

	Multiple Well Groundwater System			Lake Glenville Surface Water System
	Phase 1	Phase 2	Phase 3	
Project Total	\$4,938,000	\$2,821,300	\$3,409,000	\$19,492,700
USDA Loan Amount	\$4,444,200	\$2,539,170	\$3,068,100	\$17,543,430
Annual Debt Service at Poverty Rate	\$173,334	\$99,033	\$119,663	\$684,232
Annual Debt Service at Intermediate Rate	\$196,171	\$112,081	\$135,429	\$774,382
USDA Loan Term (years)	40			
Poverty Rate	2.375%			
Intermediate Rate	3.125%			

## **APPENDIX A**



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ALTERNATIVE 1  
PHASE 3  
6,270 LF 8" DIP  
750 LF 6" DIP

ALTERNATIVE 3  
39,930 LF 8" DIP  
TO LAKE GLENVILLE

ALTERNATIVE 1 PHASE 1  
& ALTERNATIVE 3  
1,540 LF 8" DIP

ALTERNATIVE 1 PHASE 1  
& ALTERNATIVE 3  
4,690 LF 8" DIP

FUTURE WWTP  
ALTERNATIVE 1  
POTENTIAL WELL

ALTERNATIVE 1  
PHASE 2  
6,680 LF 8" DIP  
750 LF 6" DIP

- CASHIERS COMMERCIAL AREA
- VILLAGE COMMERCIAL DISTRICT
- ADDITIONAL SERVICE AREAS
- ELEVATION ABOVE 3580 FT

ALTERNATIVE 1  
PHASE 1  
3,020 LF 8" DIP

ALTERNATIVE 1 PHASE 1  
& ALTERNATIVE 3  
250,000 GAL WATER TANK  
2,150 LF 8" DIP

US 64 WELL  
70-100 GPM

ALTERNATIVE 1 PHASE 1  
& ALTERNATIVE 3  
2,430 LF 8" DIP

JACKSON COUNTY PWS WELL  
106 GPM

LIBRARY WELL  
30 GPM

ALTERNATIVE 1  
PHASE 2  
540 LF  
6" DIP

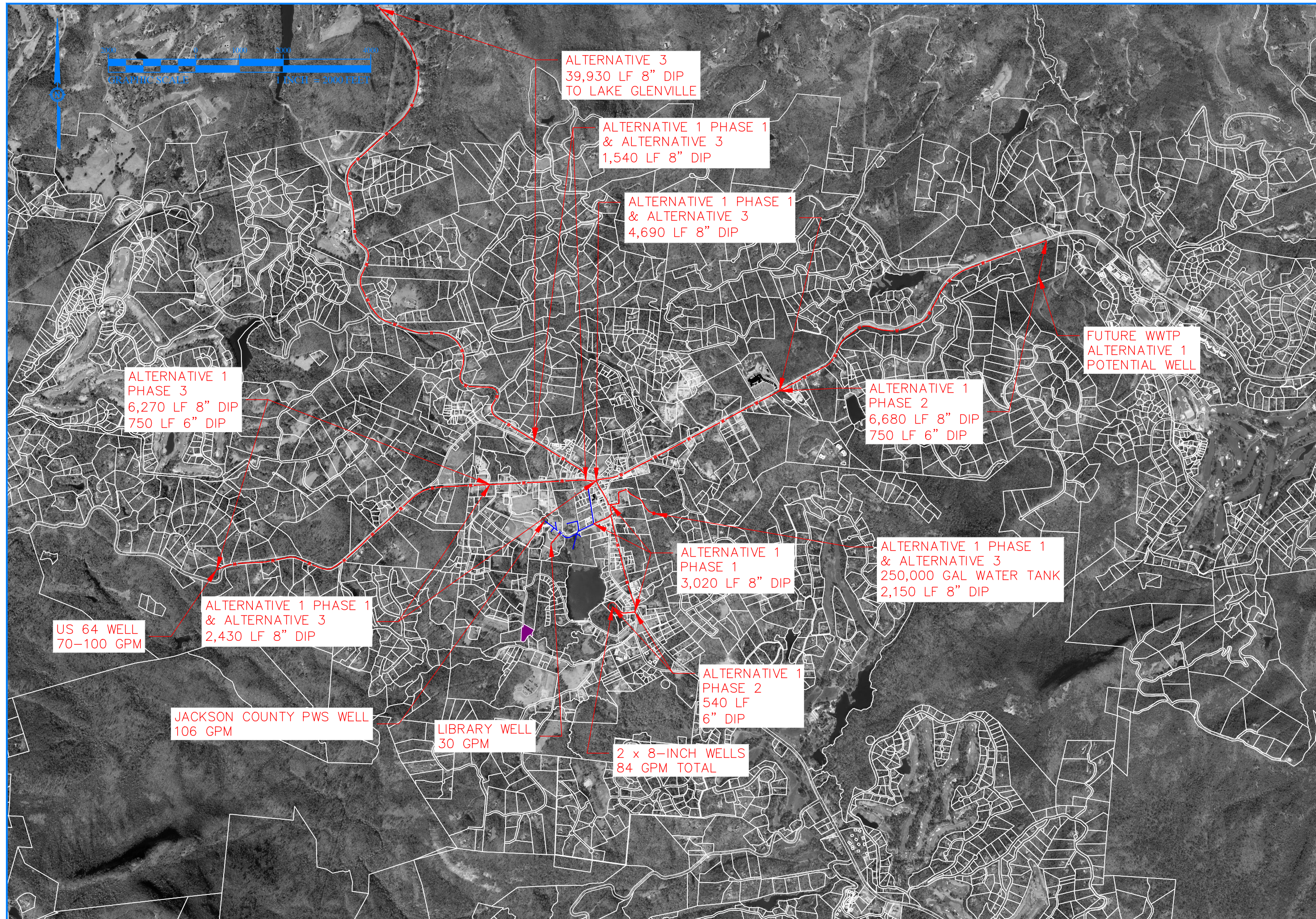
2 x 8-INCH WELLS  
84 GPM TOTAL







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