Section 5
Water Use & Availability in the Watauga River Basin

The chapter titled Permitted and Registered Activities in the Watauga River Basin (Section 4) provides an overview of the programs in place to protect water resources across the state and includes general information regarding water use and drinking water supplies. This chapter provides a more detailed summary of water use in the basin and identifies where more information is needed to fully understand total water use in the basin.

5.1 Geology and Groundwater

The geology of the Watauga River basin consists of highly metamorphosed crystalline rock. Sixty percent of the basin (northwestern portion) is underlain by gneiss and metamorphosed granitic rock of the Blue Ridge Belt with some amphibolite and minor arenite (meta-sedimentary sandstone) near the state line. The remaining 40 percent (southeastern portion) is underlain by older metamorphic sedimentary rock with minor meta-igneous rocks from the Grandfather Mountain Window. These older rocks are exposed at the surface and bordered by thrust faults and younger rock.

The majority of people living in the Watauga River basin rely on groundwater for their everyday water use. Groundwater occurs in the fractures and openings of bedrock (also referred to as basement rock) and in the pore spaces of the overlying regolith which is includes saprolite or weathered basement rock, soils and alluvium. Typically, wells are 6 to 8 inches in diameter and are drilled through the regolith and several feet or more into basement rock. Steel or PVC casing is installed and cemented in place. After the cement cures, the borehole is deepened and left open to intersect any fractures in the underlying rock. Drilling is stopped when enough water is available and the borehole depth gives the user adequate storage. Not commonly used, 2- to 3-foot diameter bored wells can also be installed. Since these bored wells are relatively shallow and do not penetrate bedrock, they derive water from the shallower regolith materials rather and the fractured bedrock of deeper wells.

Water is stored in an unconfined surficial aquifer, or water table aquifer, in the regolith bedrock. Regolith is a mixture of soil and loose rock that can extend as far as 300 feet below the surface in some areas but be almost nonexistent in others. Recharge of the regolith-bedrock aquifer is from direct infiltration of precipitation. A typical hydrograph for a surficial aquifer shows water levels rising and falling throughout the year, sometimes on a daily basis, in response to precipitation and pumping. These changes in water level may range from several inches to a foot or more during precipitation events and by tens of feet over a period of years. Groundwater yield from surficial aquifers varies dramatically depending on infiltration rates, thickness, permeability, well depth and landscape position as well as nearby wells, streams and rivers.

Groundwater availability is a function of the aquifer's ability to store and transmit water. Recharge is equally important as it determines whether a water supply is sustainable. The groundwater monitoring network under DWR's Ground Water Management Branch (GWMB) provides information necessary to gage groundwater availability and ensure North Carolina has and maintains an adequate groundwater supply for current and future use. No groundwater monitoring wells are located in the Watauga River

basin; however, methodology has been developed to help estimate the amount of groundwater available in the basin.

5.1.1 Ground and Surface Water

Baseflow is that portion of the total stream flow that is contributed by groundwater. Precipitation, evapotranspiration, hydrology, geography, land cover and water withdraw all impact baseflow and the amount of water available for consumption, irrigation, recreation and aquatic habitat. Groundwater and surface water are hydraulically connected, but the interactions are often difficult to measure. A surface waterbody can gain water from groundwater (gaining stream). A surface waterbody can also lose water to groundwater (losing stream), or it can gain and lose depending on the streambed, hydrology and geography of the area. In either instance, the interactions between ground and surface water impacts water quality and availability of both (Winter et al., 1998). Major withdraws from surface or groundwater can limit the amount of water available for all uses in the basin.

5.1.2 Groundwater Demand and Availability

Groundwater availability is a function of an aquifer's ability to store and transmit water which can also impact surface water availability and stream flow. Stream flow is monitored by the USGS at selected gaging stations across the state. Flow (abbreviate "Q") is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). Minimum flows are intended to be occasional short-term events that maintain stream conditions. One example is the 7Q10. It is the lowest flow that occurs for seven consecutive days with the probability of occurring once every 10 years. The 7Q10 is a drought flow statistic and is used to determine wastewater effluent limits such that the pollutant load can still be assimilated and chemical water quality standards can still be maintained during the driest week in a given 10-year period.

While calculating minimum flow is important when considering wasteload assimilation from a new or existing discharge and estimating available water for withdraws, it will not protect ecological integrity if it is the only flow in the stream and /or occurs for long periods of time, and it does not incorporate critical characteristics of a flow regime (magnitude, timing, frequency, duration, variability and rate of change) which can impact availability and ecological integrity. Minimum flows lack the variability between different times of year (month and seasonal), as well as the inter-annual variability between different climate years (wet, dry, average).

Public water supply (PWS) systems report the 12-hour supply yield available for each groundwater well they rely on to serve their customer base. The calculated yields also help guide the PWS system in determining if the supply meets the demand of its users. For estimating total groundwater availability in the basin, DWR used historical stream flow data from three USGS gaging stations in the basin and a formula that factors in a stream's baseflow. Two of the USGS gaging stations were located on the Elk River. One station was located near Banner Elk and was used from 1934 to 1940. The second was located near Elk Park and was used from 1934 to 1955. The third is located on the Watauga River near Sugar Grove and has been used consistently since 1940. Baseflow is estimated using a technique that was introduced in 1979 by Lyne and Hollick. More detail on the calculation can be found in Appendix I. Using this calculation, DWR estimates that nearly 6.3 million gallons of groundwater are available each day. Geography, topography and climatic conditions can impact the amount of water available in any given area, but DWR

estimates that current demands are being met in the basin with demand being approximately 43 percent of the available groundwater supply (Table 5.1).

Table 5.1: Groundwater Supply and Demand (Reported in Gallons per Day) in the Watauga River Basin

County	Supply in Basin (GPD)	Demand from Agriculture in Basin (GPD)	Demand from WWATR in Basin (GPD)	Demand from LWSP in Basin (GPD)	Demand from Residential Wells (GPD)	Total Demand (GPD)	Percent Demand v. Supply
Avery	1,946,762	27,370	94,290	473,721	5,464	600,845	31%
Watauga	4,332,383	6,429	324,507	45,800	1,760,458	2,137,194	49%
	6,279,145	33,799	418,797	519,521	1,765,922	2,738,039	43%

Calculating groundwater supply and the challenges associated with it are also evident in a USGS study where USGS compiled well records in 2007 to evaluate water resources in Avery and Watauga counties. Just over 1,500 wells were examined. No significant patterns were revealed, but the study provides evidence that groundwater is an unreliable source of water for Avery and Watauga counties (High Country Water Resources Plan, 2010). There was a wide range of well depths (20 to 1,024 feet) and yields (0 to 400 gallons per minute) with the highest mean well yield being 32 gallons per minute from the phyllite hydrogeologic unit and the lowest being 12 gallons per minute from the mafic gneiss unit (USGS, 2008).

5.2 Water Use on a County Scale (USGS)

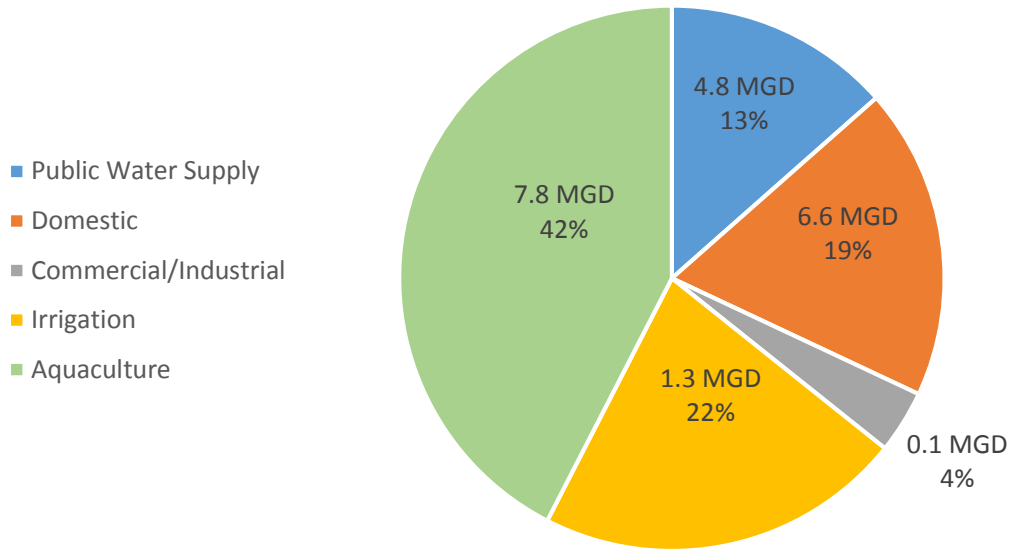
The United States Geological Survey (USGS) collects water use data from all states and provides an estimate of all water use down to the county level. It includes water used for public water supplies, domestic (defined as private residential indoor and outdoor uses), irrigation, livestock, aquaculture, industrial, mining and generating thermoelectric power. During 2010, the USGS estimated that a total of 355,000 million gallons of water is withdrawn each day across the nation, a decrease from estimates reported in 2005. In North Carolina, it was estimated that 12,420 million gallons of water was withdrawn each day with an overwhelming majority of the state relying on surface water (94 percent).

Based on the 2010 USGS report, 76 percent of the water withdrawn in Avery and Watauga County was from surface water (Table 5.2). Total water use (surface and groundwater) in the two counties is estimated to be 35.7 million gallons per day (MGD). Most of the water is used for aquaculture (42 percent) and irrigation (22 percent) (Figure 5.1). Combined, public water supply and domestic water use accounted for 32 percent of the total with estimated 11.4 million gallons of water being used each day. Total population served was estimated to be 68,876. All domestic water use relies on groundwater, and only one PWS system relies on surface water to serve its customers (USGS, 2010).

Table 5.2: Surface versus Groundwater Use in Avery and Watauga Counties (USGS, 2010)

County	Total Surface Water Use (MGD)	Total Groundwater Use (MGD)	Total Water Use (MGD)	Percent Surface Water	Percent Groundwater
Avery	17.9	3.6	21.4	83%	17%
Watauga	9.2	5.1	14.3	64%	36%
Totals	27.1	8.7	35.7	76%	24%

Figure 5.1: Water Use by Type in Avery and Watauga Counties (USGS, 2010)



5.3 Water Use Reported in Local Water Supply Plans (LWSP)

Five public water supply (PWS) systems are required to submit a local water supply plan (LWSP). Combined, the PWS systems supplied 0.823 million gallons of water per day (MGD) to an estimated 5,072 people in 2015. Three of the five PWS systems report seasonal populations and one includes the seasonal population with the total population served by the PWS system. Seasonal population can surge to over 12,760 people increasing total water demand during several months out of the year. Due to terrain, elevation and physical location, each system is independent of the other. Four PW systems obtain water from self-supplied groundwater wells and one (Beech Mountain PWS ID 01-95-104) relies on surface water.

Table 5.3: Public Water Systems Required to Submit Local Water Supply Plans (LWSP) (2015)

PWS ID	PWS Name	Ownership	Source Water
01-06-015	Banner Elk	Municipality	Groundwater wells
01-06-025	Elk Park	Municipality	Groundwater wells
01-06-107	Sugar Mountain	Business	Groundwater wells
01-95-104	Beech Mountain	Municipality	Surface water intake
01-95-118	Seven Devils	Municipality	Groundwater wells

In 2015, residential demand accounted for 35 percent of the total water use. Non-residential demand accounted for 15 percent. The remaining 50 percent was used for system processes (cleaning and flushing waterlines, backwash, etc.) or is unaccounted for. By 2060, residential water demand is projected to increase to 41 percent of the total water use and non-residential demand is projected to drop to 13 percent of total use. Combined, the water systems will supply a projected 1.126 MGD to 6,774 people in 2060 (seasonal population 14,965).

Table 5.4: Average Water Use(MGD) Reported in LWSPs (2015)

Water Use – Type	2015	2020	2030	2040	2050	2060
Residential	0.285	0.311	0.346	0.384	0.422	0.460
Non-Residential	0.125	0.111	0.119	0.128	0.137	0.146
System Processes	0.074	0.085	0.085	0.086	0.086	0.087
Unaccounted-for Water	0.339	0.408	0.404	0.415	0.424	0.433
Total Use	0.823	0.915	0.954	1.013	1.069	1.126

Figure 5.2: Current and Projected Water Use (MGD) Reported in the LWSPs (2015)

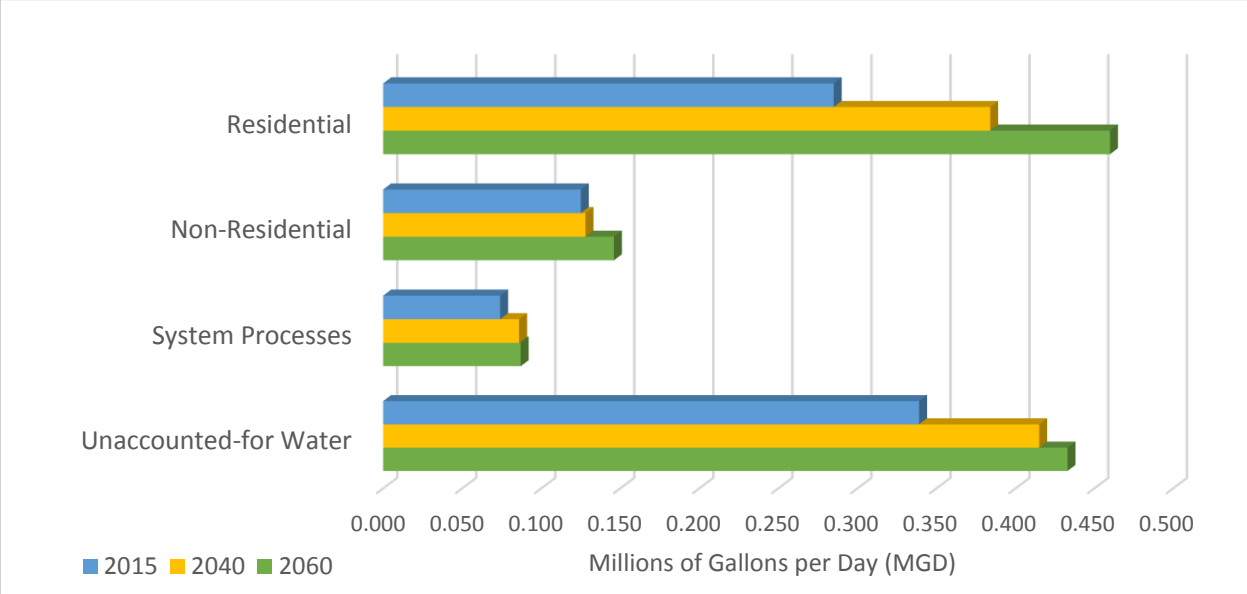
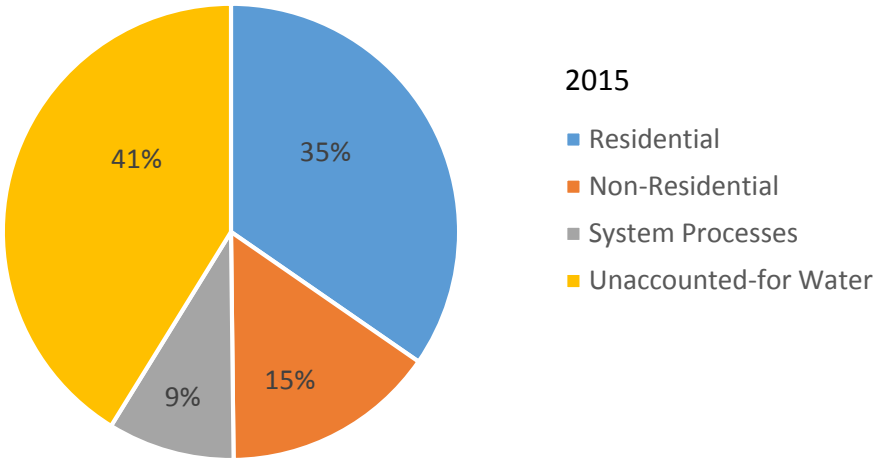


Figure 5.3: Current Water Use – Percent Use by Type (2015)



5.4 Water Supply and Availability Reported in Local Water Supply Plans (LWSP)

Water systems are advised to maintain adequate water supplies and manage water demands to ensure that the average daily use does not exceed 80 percent of their available supply. Information reported in the 2015 LWSPs indicate that four out of the five systems are below the 80 percent threshold. These four systems rely on groundwater wells and calculate that the combined groundwater supply available over a 12-hour period is 1.744 MGD. One system (Sugar Mountain PWS ID 01-06-107) is planning to add an additional 0.077 MGD to its existing groundwater supply bringing the combined groundwater supply to 1.821 MGD by 2020.

One PWS system (Beech Mountain PWS ID 01-95-104) exceeds the 80 percent threshold and will continue to exceed the threshold into the near future. The Beech Mountain PWS system has historically reported that their existing supply does not meet their current or future demand. Documentation regarding the Town of Beech Mountain's water supply began in 2012 when the town worked with consultants to survey water and sewer lines and analyze safe water yields for the town's surface water supply. Based on the results of the survey and information provided in the LWSP, DWR determined that the town's LWSP could not be approved because the town could not meet the 2012 water demand or long-term water supply needs of its customer base because existing water supply could not meet the current or projected demands (Table 5.5; Figure 5.4). The concern was formally documented in a memo sent to the town mayor in February 2014. The town quickly passed a resolution requesting that the Town enter into an agreement with DEQ to identify water supply needs, sources and storage options and conduct the associated studies, environmental evaluations, and planning and budget estimates needed for acquiring a new or additional source for water supply.

Table 5.5: Beech Mountain Water Use Projections with Existing Supply (LWSP, 2015)

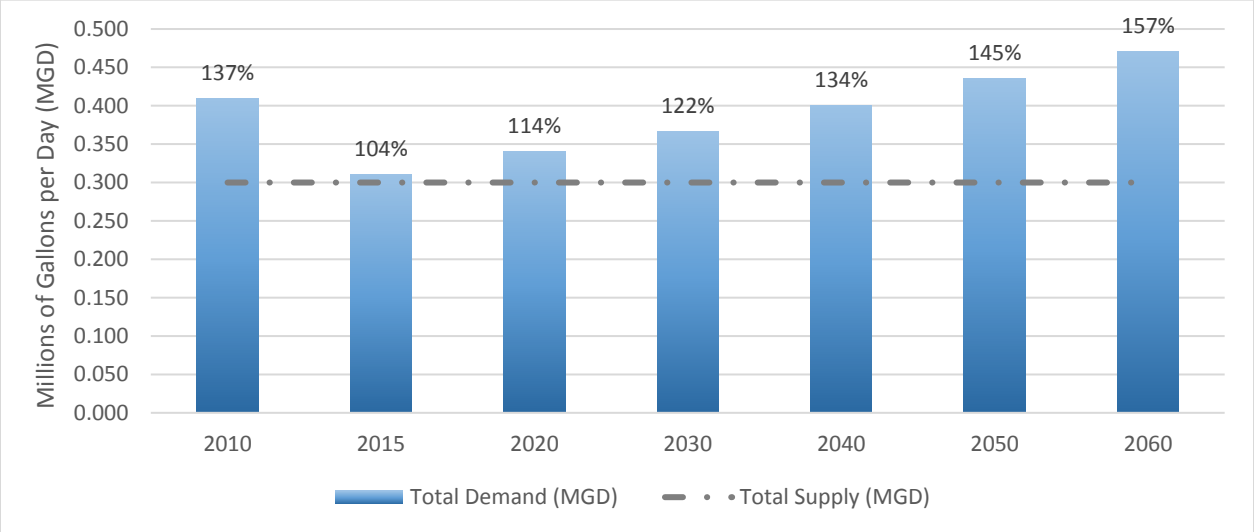
	2010	2015	2020	2030	2040	2050	2060
Average Water Demand (MGD)*	0.410	0.311	0.341	0.366	0.401	0.436	0.471
Maximum Daily Demand (MGD)**	0.826	0.770	0.846	0.908	0.995	1.081	1.170
Available Water Supply (MGD)***	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Average Daily Demand as Percent of Supply	137%	104%	114%	122%	134%	145%	157%

*Average water demand (referred to as Total Demand in the LWSP) includes the amount of water used for system processes (backwash water, water used in the treatment process but not distributed and water needed to maintain water quality in the distribution lines) and unaccounted-for water. In 2015, the amount of unaccounted-for water reported by the PWS was 0.147 MGD. The PWS acknowledges that the unaccounted-for water is unacceptably high. It is attributed to poor design and workmanship by the initial owners and operators.

**Maximum daily demand for 2010 and 2015 was reported in the respective LWSP. Maximum daily demand for 2020 through 2060 is calculated using a peak factor of 2.48. The peak factor is calculated based off of numbers reported in the 2015 LWSP and is the maximum daily demand divided by the average daily demand (MGD) (maximum daily demand/average daily demand = peak factor; average daily demand x peak factor = maximum daily demand).

***Available water supply (referred to as Total Supply in the LWSP) is reported by the Beech Mountain PWS. The system relies on surface water from Buckeye Lake (an impoundment on Buckeye Creek) to supply water to its customers.

Figure 5.4: Beech Mountain Water Use Projections with Existing Supply (LWSP, 2015)



Working with DWR, the town recognized that the unaccounted-for amount of water reported in the 2015 and 2016 LWSP is “unacceptably high”. The loss is due to how the system was constructed by the initial developer before the system was incorporated by the town. In 2015, the town estimated that it would cost $16 million to replace all 53 miles of water lines in the distribution system (LWSP, 2015). The town

has committed to a long-range plan to replace 0.5 miles of water line each year beginning with the main trunk lines. Consequently, average daily demand decreased between 2010 and 2015 (Table 5.5). Since 2011, the town has replaced 95 percent of the water meters, began using digital readouts to identify leaks, and has constructed a new water treatment facility (WTP). The town estimates these efforts have resulted in water loss being reduced from 85 to 47 percent. In addition, water rates have increased to provide for system upgrades, and the town plans to replace the main transmission line to relieve flow restrictions in the system and encourages year-round voluntary water conservation measures (LWSP, 2015; LWSP, 2016). DWR continues to work with the town to identify how best to meet current and future water supply needs.

5.5 Public Water Supply versus Private Groundwater Wells

To estimate the population served by a PWS system versus a private groundwater well, 2015 population numbers were used on the county and municipality scale as reported by the Office of State Budget and Management (OSBM). These numbers were then compared to population numbers and water use reported in the LWSP. Numbers were also used to account for those citizens served by a community well. When comparing the number of people served by a PWS or community well to the total population in that portion of the county living in the river basin, the majority of the population in Watauga County watershed rely on private groundwater wells for potable water. In Avery County, the majority of the population is served by a PWS or community well (Table 5.6). These numbers are calculated on the assumption that the population is evenly distributed throughout the county and estimates water use in the basin.

Table 5.6: Population Served by Public Water Supply versus Private Groundwater Wells

County	Percent of County in the Basin	Population 2015 (OSBM)	Estimated Population in the Basin 2015	Population LWSP or Community Well 2015*	Percent Population Served by LWSP or Community Well	Percent Population with Private Groundwater Wells
Avery	26%	17,816	4,632	3,105	67%	33%
Watauga	45%	53,737	24,182	5,823	24%	76%
Totals		71,553	28,814	8,928		

5.6 Water Use Reported in the Water Withdrawal & Transfer Registration (WWATR) Database

Thirteen facilities (Table 5.7) withdraw a combined 1.197 MGD over the course of a year with the majority being used for seasonal recreational use. Registered withdrawers include 4 water supply systems (PWS), 5 golf courses, 3 ski resorts and one mining operation. In 2015, the four water systems used 0.213 MGD from groundwater wells. Most of the water used was for snow-making, followed by golf course irrigation (Table 5.8; Figure 5.5).

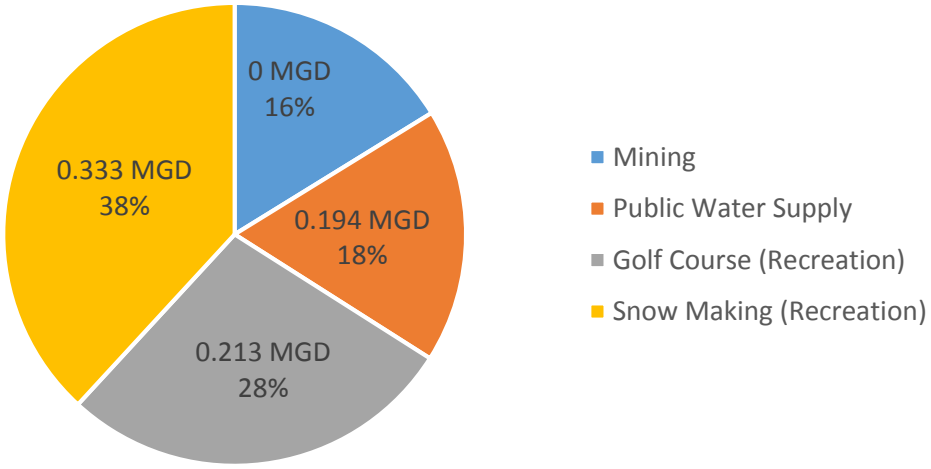
Table 5.7: Water Withdrawal & Transfer Registration (WWATR) in the Watauga River Basin (2015)

HUC	Facility Name	Facility ID	Use Type	Source Water
060101030301	Crystal Mountain	0378-0021	Public Water Supply PWS ID 01-95-110	Groundwater wells
060101030301	Hound Ears	0378-0004	Public Water Supply PWS ID 01-95-112	Groundwater wells
060101030301	Hound and Ears Club, Inc.	0636-0001	Recreation – Golf Course	Surface water – pond
060101030301	Hawksnest	0405-0001	Recreation – Snow Making	Surface water – ponds
060101030303	Vulcan Construction Materials, L. P.	0199-0023	Mining – Mining Extraction	Surface water – quarry
060101030305	Beech Mountain Club	0766-0001	Recreation – Golf Course	Surface water – lake
060101030305	Ski Beech (Beech Mountain Resort, Inc.)	0404-0001	Recreation – Snow Making	Surface water – pond
060101030201	Diamond Creek Golf Club	0767-0001	Recreation – Golf Course	Groundwater wells Surface water – pond
060101030201	Elk River Club	0724-0001	Recreation – Golf Course	Surface water – pond
060101030201	Mountain Glen Golf Course	0723-0001	Recreation – Golf Course	Groundwater well Surface water – pond
060101030201	Sugar Mountain Ski Area	0415-0001	Recreation – Snow Making	Surface water – pond
060101030201	Ski Country	0378-0017	Public Water Supply PWS ID 01-06-119	Groundwater well
060101030201	Elk River (Elk River Utilities, Inc.)	0378-0011	Public Water Supply PWS ID 01-06-118	Groundwater wells

Table 5.8: Total Water Use of Registered Water Users by Type (2015)

Use Type	Number of Facilities	Annual Average (MGD)	Percent of Total Use
Agriculture	0	0	0.0%
Mining	1	0.194	16%
Public Water Supply	4	0.213	18%
Golf Course (Recreation)	5	0.333	28%
Snow Making (Recreation)	3	0.457	38%
Total	**13**	**1.197**	**100.0%**

Figure 5.5: Total Water Use of Registered Water Users by Type (2015)



5.7 Total Water Use and Availability Based on Information Presented in the LWSPs and WWATR Database

Using the information provided in the LWSP and the WWATR, total water use in the basin in 2015 was 2.029 million gallons per day (MGD) with 51 percent being used by public water supply (PWS) systems (Figure 5.6). Five of the nine PWS systems are required to submit LWSPs and only one relies on surface water. Snow making and golf course irrigation accounted for 71 percent of the total surface water withdrawn and PWS systems accounted for 78 percent of the total groundwater withdrawn (Table 5.9). These numbers do not take into account the amount of water withdrawn by private groundwater wells, small agricultural operations, aquaculture facilities or water used for generating power.

Figure 5.6: Total Estimated Water Use as Reported in the LWSPs and WWATR (2015)

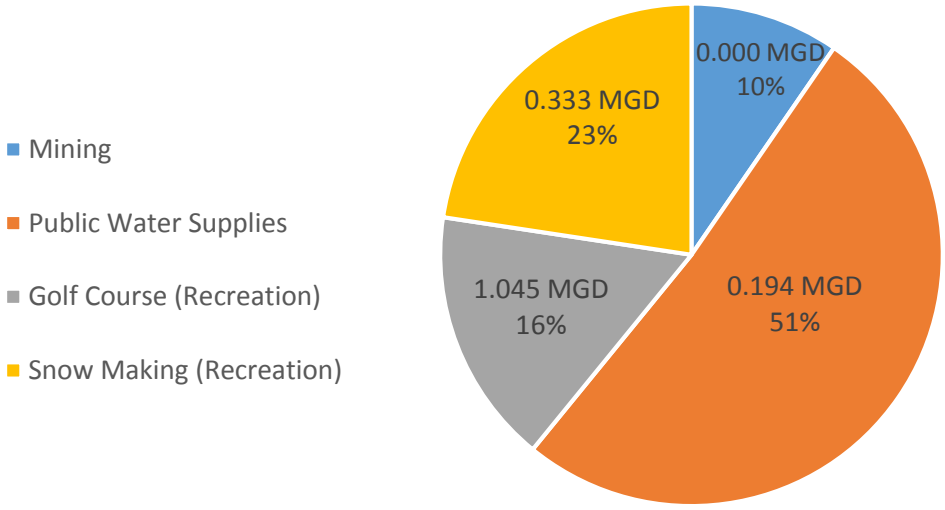


Table 5.9: Total Estimated Water Use by Type and Source as Reported in LWSPs and WWATR (2015)

Use Type	Groundwater (MGD)	Surface Water (MGD)	Total (MGD)
Agriculture*	0.000	0.000	0.000
Mining	0.194	0.000	0.194
Public Water Supplies	0.734	0.311	1.045
Golf Course (Recreation)	0.016	0.317	0.333
Snow Making (Recreation)	0.000	0.457	0.457
Total (MGD)	0.945	1.085	2.029
Percent of Total	47%	53%	100%

*Agriculture operations are not required to register water use with the WWATR unless the operation is withdrawing more than 1.0 MGD. Agriculture water use can be estimated based on Census data available through USDA.

5.8 Water Use and Agriculture

Under legislation enacted in 2008 (Session Law 2008-0143), the North Carolina Department of Agriculture and Consumer Services (NCDA&CS) Agriculture Statistics Division is required to collected annual information from farmers who withdraw more than 10,000 gallons on any given day. Individual responses remain confidential and are only used in combination with other reports, produce and livestock totals. Operations that withdraw more than 1.0 million gallons per day are required to register with DWR through WWATR and are not included in the Water Use Studies published by NCDA&CS. For those operations that withdraw more than 10,000 gallons per day, the unique number of operations, annual average daily use of ground and surface water, and capacity is published by county and by hydrologic unit code (HUC). If there were less than three operations in any category or if one report included more than 60 percent of the total, data was not disclosed.

No individual or specific data on water use was disclosed for Avery or Watauga counties; however, based on the 2012 Census of Agriculture conducted by the United States Department of Agriculture (USDA), there a total of 1,092 farms in Avery and Watauga counties. Of these, 54 farms irrigate a total of 402 acres each year. The census indicated that less than one percent of all farmland in the two counties was irrigated during 2012. The amount of water used for irrigation was not reported. Using numbers reported in the 2013 USDA Farm and Ranch Irrigation Survey, however, water use can be estimated. Using numbers provided in the irrigation survey, if water is applied at a rate of four inches per acre per year, the agricultural water demand in both counties is approximately 33,800 gallons per day.

USDA defines aquaculture as the farming of aquatic organisms. It includes baitfish, crustaceans, food fish, mollusks, ornamental fish, sport or game fish and other aquaculture products. Farming involves some form of intervention in the rearing process. Examples include seeding, stocking, feeding or protecting the aquatic organism from predators. Farming also implies individual or corporate ownership of the stock being cultivated in a controlled environment at least part of the time. The Census of Aquaculture expands on the data collected about aquaculture that is collected through the Census of Agriculture and includes information related to production volume and methods, surface water acres and sources, sales, point of first sale outlets and aquaculture distributed for restoration, conservation, enhancement or recreational purposes. The 2013 Census of Aquaculture reports a total of five aquaculture operations in Avery and Watauga counties. Four are in Avery County and total $81,000 in sales and distribution of trout fish food. One operation is located in Watauga County but information was withheld to avoid disclosing data for individual farms. Statewide, there are 122 freshwater aquaculture operations totaling 2,610 acres. Groundwater and on-farm surface water are used as water sources. NCDA&CS water use studies report that aquaculture water withdraws are typically flow-through withdraws and are non-consumptive.

5.9 Management Under Drought Conditions

Droughts are unpredictable, but their occurrence is inevitable. A drought plan, or water shortage response plan (WSRP), can help reduce the impacts to water resources and minimize disruptions to water withdraws. A WSRP establishes authority for declaring a water shortage, defines different stages of water shortage severity and outlines appropriate responses for each stage. All public and privately-owned water systems subject to General Statute 143-355 (l) are required to prepare and submit a WSRP as part of their LWSP. WSRPs are updated every five years but can updated more often to address changes to population, water sources and/or additional demands. The plans can also be updated to address any issues that may have been identified when implementing or evaluating the effectiveness of the plan.

The North Carolina Drought Management Council (NCDMAC) has been monitoring drought conditions weekly since 2000 and was given official statutory status and assigned the responsibility for issuing drought advisories in 2003. The NCDMAC assesses drought conditions based on several indices including stream flow, groundwater levels, rainfall, reservoir levels and soil moisture and issues advisories on a county by county basis. The council provides consistent and accurate information as it relates to drought and includes representatives from ground and surface water hydrology, meteorology, water system operation and management, reservoir management, emergency response as well as local governments, agriculture and agribusiness, forestry, manufacturing and water utilities.

During the ten-year assessment period (September 2004 - August 2014), the Watauga River basin experienced extreme weather conditions from above average rainfall due to remnants of three hurricanes (September 2004) to all levels of drought (2000-2008). Five drought designations, or classifications, were established by the NCDMAC. One drought designation is published on a weekly basis for each county, and the designation is applied when at least 25 percent of the land area of the county is impacted. The drought monitor history (Figure 5.6) provides a graphical representation of the drought designation, and the length of time the basin was in a specific designation. The longest duration was between 2000 and 2003 with the basin being designated as abnormally dry to extreme drought. The designation of exceptional drought, however, hit the basin between November 2007 and January 2008. Most of the state was designated extreme or exceptional drought during that same period. Stream flow conditions at the USGS gauge in the Watauga River near Sugar Grove ranks 2007 and 2008 as the second and third driest years on record (Table 5.10).

Drought Classification
D0 – Abnormally Dry
D1 – Moderate Drought
D2 – Severe Drought
D3 – Extreme Drought
D4 – Exceptional Drought

Figure 5.7: Drought Monitor History for Watauga River Basin (January 2000 - December 2016)

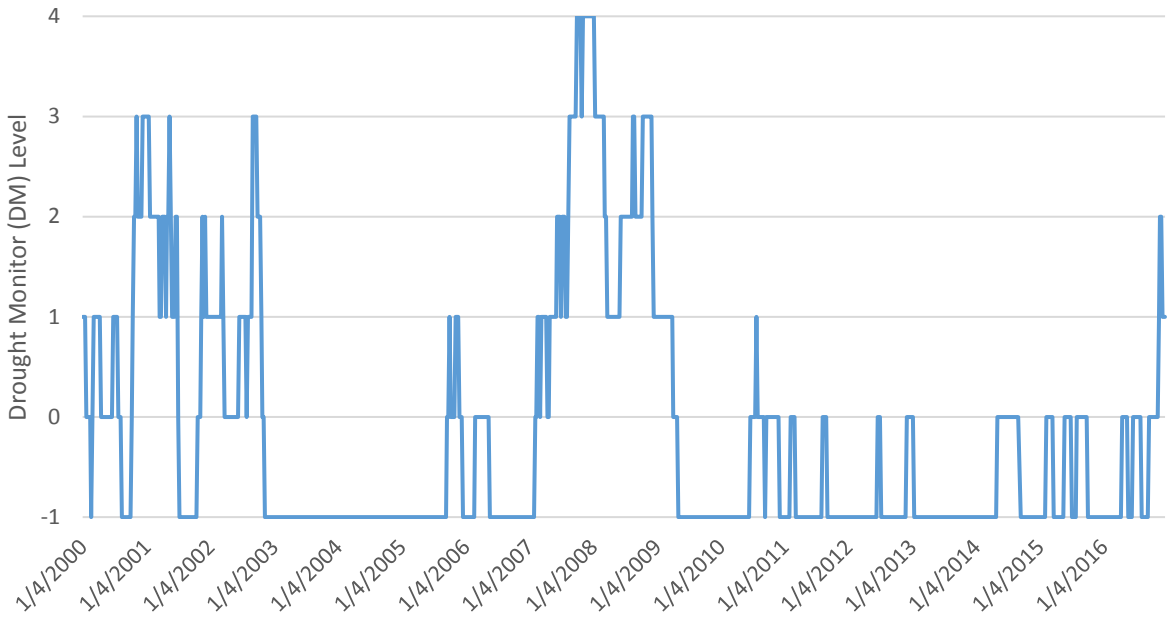


Figure 5.8: North Carolina Drought Monitor Map (December 2007)

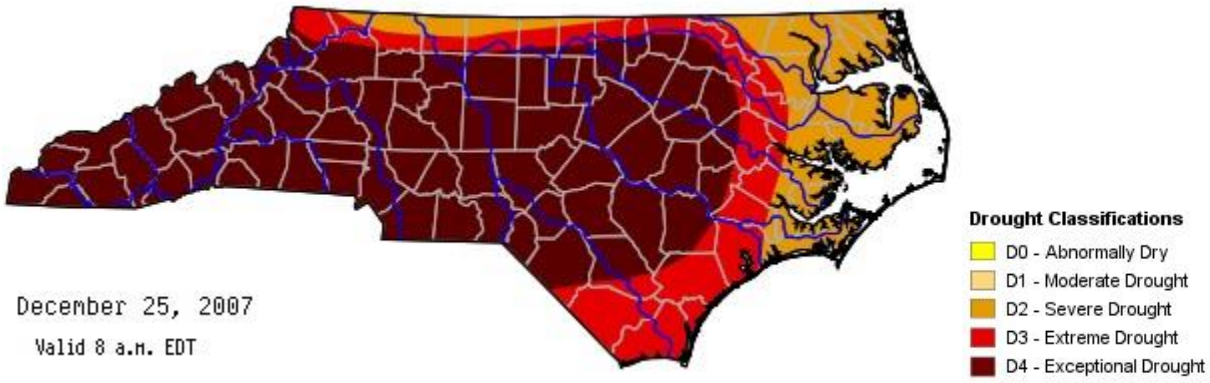


Table 5.10: Stream Flow Rankings by Climatic Year (USGS Station 03479000 Watauga River)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Climatic Year
1940				51	23	58	63	77	65	36	26	39	
1988	22	7	1	27	6	1	5	5	30	15	43	8	1
2007	56	5	17	8	3	7	33	13	7	34	7	11	2
2008	6	10	52	7	1	8	24	37	39	26	20	34	3
1941	12	1	4	24	2	4	75	38	11	9	8	24	4
1986	26	26	8	1	11	6	7	12	43	21	30	58	5
2001	5	2	25	13	4	32	72	61	41	27	17	16	6

5.10 Regional Planning

Avery and Watauga counties are two of seven counties that are part of North Carolina's High Country Council of Governments (HCCOG). Two droughts within the last two decades forced local governments in the region to review and address short-term water shortages, current and future demands, and long-term water supply availability and sources. In December 2010, the COG released the High Country Water Resource Plan. The plan includes information pertaining to water resource planning, development and protection. The plan provides an overview of water use, demand and sources as well as ways to protect water quality. Water conservation ordinances adopted by local governments in the region vary widely in purpose and in scope and are either stand-alone ordinances or part of a larger ordinance associated with water and sewer systems or public utilities. Example stormwater ordinances are also included in the plan and the plan encourages the development of Capital Improvement Programs (CIP) or Asset Management

Plans for long-term financial planning for replacing aging infrastructure, purchasing new infrastructure and planning for future demand.

5.11 Conclusions

Groundwater is the sole source of water supply for residential and domestic use for all citizens in the basin with the exception of those served by the Town of Beech Mountain. Projected growth in the basin will require identifying new ground and surface water sources. Improvements are also needed for existing infrastructure to reduce the amount of unaccounted-for water and insure that water is used efficiently.

Optimizing groundwater production calls for balancing withdrawals with recharge. Using the state groundwater monitoring network in combination with stream gauge data allows DWR to determine if groundwater supplies are adequate and being used sustainably especially in highly developed areas where groundwater use is highest. Currently, water levels cannot be tracked in the Watauga River basin because no groundwater monitoring wells are located in the basin. Monitoring wells are needed in order to adequately determine supply and reliability.

To understand how surface water withdraws can change water availability in the basin, a hydrologic computer model is needed. A model can also assist with planning for increased water uses due to continuous growth, regulatory decisions on waste assimilative capacity and managing resources during drought conditions. DWR will work towards developing a model for the Watauga, New and French Broad River basins within the next planning cycle. The model will use historic and current data as it relates to stream flow, water supply planning (LWSP and WWATR) and water supply shortage response plans to develop a tool to assist with future planning endeavors.

5.12 References

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