Section IV: Cost Effectiveness

TECHNICAL MEMORANDUM

FEMA Building Resilient Infrastructure and Communities Grant Program

Town of Hillsborough, Resilient Water Supply

Benefit-Cost Analysis Memorandum

November 23, 2021

Table of Contents

1 Introduction 1
2 Proposed Mitigation Activity 1
2.1 Project and Maintenance Costs 1
3 Benefit-Cost Analysis Approach 2
3.1 Software and References 2
3.2 Project Useful Life 2
3.3 Population Served and Water Demand 2
3.4 Regulatory Water Restrictions 2
3.5 Expected Events (Pre-Mitigation Supply Yield) 3
3.5.1 United States Drought Monitor Classification System 3
3.5.2 Determining Recurrence Intervals 5
3.5.3 Drought Duration 6
3.6 Level of Protection (Post-Mitigation Supply Yield) 6
4 Analysis Results 7

1 Introduction

FEMA requires that all projects funded through the Building Resilient Infrastructure and Communities (BRIC) program are cost-effective and designed to increase resilience and reduce risk of injuries, loss of life, and damage and destruction of property, including critical services and facilities. This technical report documents that the Resilient Water Supply Project submitted by the Town of Hillsborough under the BRIC Fiscal Year 2021 application cycle satisfies applicable cost-effectiveness requirements in compliance with OMB Circular A-94 using FEMA benefit-cost analysis (BCA) methods and tools. The technical memorandum covers the proposed mitigation activity, BCA approach including pre-mitigation and post-mitigation losses, and analysis results. Analysis documentation also includes a completed FEMA BCA Toolkit Version 6.0, and a BCA Report.

2 Proposed Mitigation Activity

As detailed in the application, the Town of Hillsborough proposes to build a water booster pumping station at a key location to allow for potable water interconnection with the Orange Water and Sewer Authority (OWASA), providing redundancy and resiliency to the City's potable water supply. The 16-inch piping to allow for interconnection with OWASA is already in place; however, a booster pumping station is needed to allow potable water to flow to the Town of Hillsborough. Since OWASA draws from different watersheds than the Town of Hillsborough, Cane Creek Reservoir and University Lake, the Authority's water supply may not be as heavily impacted by the same drought event. A 250-kW permanent generator will also be included in the project design to assure continued operation during widespread power outage events and severe storms.

Table 1 Resilient Water Supply Project Location

Facility Name	Location Description	Latitude, Longitude
OWASA Booster Pump Station (Resilient Water Supply)	Hillsborough, North Carolina 27278	36.005533, -79.107223

2.1 Project and Maintenance Costs

Table 2 provides total project and annual maintenance costs for implementing the proposed mitigation activity. Project costs were estimated in accordance with FEMA Hazard Mitigation Assistance (HMA) Guidance. Annual maintenance costs include those associated with the following activities:

- Inspection and testing; and
- Minor repairs.

Table 2. Resilient Water Supply Project, Project and Maintenance Costs

Mitigation Activity	Project Cost	Annual Maintenance Cost
OWASA Booster Pump Station (Resilient Water Supply)	$1,407,975	$2,000.00

3 Benefit-Cost Analysis Approach

3.1 Software and References

The BCA for this project was primarily guided by FEMA's BCA Reference Guide and Supplement and the BCA Toolkit Version 6.0. In addition, FEMA's Methodology for Aquifer Storage and Recovery (ASR) Benefit Cost Analysis provides some guidance specific to drought mitigation. While the full methodology presented in the *Methodology for Aquifer Storage and Recovery (ASR) Benefit Cost Analysis Report* cannot be applied to this project due to the differences in type of water storage, specific information on BCAs for drought mitigation can be applied. Similar to this project, the primary benefit of an ASR project is to enhance or increase water supply during drought. Assessing the benefits of ASR for drought mitigation requires identifying the increased water supply capacity provided in relation to the population supported in a drought during the project's useful life. According to this report, a full BCA evaluating drought risk, damages, and mitigation should incorporate the probability of a drought occurring coupled with a system-specific analysis of the damages associated with a given drought, both pre- and post-mitigation. The BCA for this project used this guidance to produce the inputs required for the Drought Module in the BCA Toolkit.

3.2 Project Useful Life

According to the FEMA 2009 BCA Reference Guide – Project Useful Life Table (Appendix B), a project useful life of 50 years should be applied to Pump Stations, Substations, Wastewater Systems. *As such a useful life of 50 years was used for the Resilient Water Supply Project in the BCA Toolkit.*

3.3 Population Served and Water Demand

To ensure project benefits and costs were measured through the determined project useful life, analysts utilized the best available data for population and potable water demand from the Town of Hillsborough Water System. According to system data, the population served by water system is 15,990 and total potable water demand for the region is 1.46 MGD (Table 3 and Appendix C).

Table 3. Service Population and Annual Potable Water Demand, Town of Hillsborough Water System

2021 Data (YTD)	Population	Demand (MGD)
Town of Hillsborough Water System	15,990	1.46

Source: Town of Hillsborough (2021)

3.4 Regulatory Water Restrictions

According to the Palmer Drought Severity Index data, the Town of Hillsborough has experienced drought conditions about 49.7% of the time between 2000 and 2018. Since 1905, the Town has experienced 168 instances of drought. From late 2007 through mid-2008, North Carolina experienced the worst drought in state history. During this time, portions of all four Eno-Haw Region counties experienced exceptional drought conditions. Many of the major reservoirs serving the region experienced dangerously low levels due to ongoing drought conditions and were forced to implement mandatory water restrictions.

The Town of Hillsborough has adopted the *Eno River Capacity Use Investigation, Water Management Operations Plan (WMOP)* (Appendix D) to established water use restrictions for equitable use of the water resources, while providing for minimum flows in the Eno River. In addition to maximum withdrawal limits set for offstream uses in the Eno River Basin, minimum instream flow requirements are established at the Hillsborough streamflow gage (USGS Streamflow Gage #02085000). The requirements in the WMOP are managed and administered by the water users and Orange County, with oversight and coordination by the North Carolina Department of Water Resources (DWR).

According to the WMOP, The Town of Hillsborough Water System is allowed to withdraw a maximum of 1,510,000 gallons of water per day from their intake at Lake Ben Johnston. Maximum allowable withdrawals will change as the lake levels at Lake Orange change. Figure 1 indicates the maximum allowable withdrawal at successive storage levels. Once the percent of storage at Lake Orange falls below 80-percent, or "Stage 2," drought condition actions ranging from voluntary to mandatory water restrictions are put into place.

Table 1. Eno River Water Management and Operations Conditions

	Triggers		Allowable Surface Water Withdrawal			Minimum Releases		
Stage	Percent of Storage Remaining in Lake Orange	Drawdown in Lake Orange from top of flashboard (ft)	Town of Hillsborough (mgd [cfs])	Orange-Alamance (mgd [cfs])	Resco Products (mgd [cfs])	Lake Orange (mgd [cfs])	West Fork Eno Reservoir (WFER) (mgd [cfs])	Instantaneous Instream Flow Requirement at Hillsborough Gage (mgd [cfs])
no stage	>100	spilling	*	*	0.9 [1.4]	1.1 [1.7]	0.65 [1.01]	
Stage 1	100-80	0	1.51 [2.34]	0.82 [1.27]	0.43 [0.67]	1.1 [1.7]	0.65 [1.01]	1.75 [2.71]
Stage 2	80-60	2.0	1.36 [2.10]	0.74 [1.15]	0.38 [0.59]	0.65 [1.01]	0.65 [1.01]	1.3 [2.01]
Stage 3	60-50	4.3	1.28 [1.98]	0.7 [1.08]	0.36 [0.56]	0.45 [0.7]	0.65 [1.01]	1.1 [1.7]
Stage 4	50-40	5.8	1.28 [1.98]	0.7 [1.08]	0.32 [0.5]	0.45 [0.7]	0.65 [1.01]	1.1 [1.7]
Stage 5	40-30	7.4	1.13 [1.75]	0.62 [0.96]	0.19 [0.29]	0	0.65 [1.01]	0.65 [1.01]
Stage 6	<30	9.3	0.68 [1.05]	0.19 [0.29]	0	0	0.65 [1.01]	0.65 [1.01]

million gallons per day (mgd); cubic feet per second (cfs); feet (ft)

Figure 1. Town of Hillsborough, Allowable Surface Water Withdrawal

The long-term nature of drought events and difficulty in identifying the true start of drought conditions tends to result in an underestimation of the measurable costs associated with drought events. The National Centers for Environmental Information reported that of all billion-dollar disasters from 1980 to 2017, droughts caused $232.5 billion in damages (the second highest of all hazards). The average cost of drought events in the United States was $9.6 billion. The strong dependency of the Town of Hillsborough on the Eno River Basin for drinking water and the consistent record of drought impacts on the Eno River and supplying reservoir, indicate that there are potentially high costs associated with drought events in the region.

3.5 Expected Events (Pre-Mitigation Supply Yield)

3.5.1 United States Drought Monitor Classification System

To place the surface water withdrawal restrictions provided in the WMOP in the context of drought severity and impacts, the six WMOP Stages can be connected to categories of drought classification. The United States Drought Monitor has developed a classification system, that categorizes drought

by levels of intensity and are provided in Figure 2. The categories associated this classification system range from D0 - Abnormally Dry to D4 - Exceptional Drought. The drought severity classification table shows the ranges for each indicator for each dryness level. It is this combination of the best available data, local observations, and experts' best judgment that makes the U.S. Drought Monitor more versatile than other drought indicators.

Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered	-1.0 to -1.9
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested	-2.0 to -2.9
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed	-3.0 to -3.9
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions	-4.0 to -4.9
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less

Figure 2. United States Drought Monitor Classification System and Associated PDSI Range

Per the description provided in United States Drought Monitor Classification System related to water restrictions and the WMOP Withdrawal Restrictions, analysts correlated each of the drought categories to the six WMOP Stage. Table 4 provides a description of the expected water restrictions by drought category, and correlated WMOP Stage and Withdrawal Restriction.

Table 4. Correlation of US Drought Monitor to WMOP Stages, Town of Hillsborough

Category	Description	Water Restrictions	WMOP Stage	WMOP Withdrawal Restriction (MGD)
D0	Abnormally Dry	None	**Stage 1**	1.51
D1	Moderate Drought	Voluntary water conservation begins	**Stage 2**	1.36
D2	Severe Drought	Water restrictions imposed	**Stage 3 & 4**	1.28
D3	Extreme Drought	Widespread water shortages or restrictions	**Stage 5**	1.13
D4	Exceptional Drought	Shortages of water in reservoirs, streams, and wells creating water emergencies	**Stage 6**	0.68

Source: US Drought Monitor Classification System; Eno River Capacity Use Investigation, Water Management Operations Plan (2021)

3.5.2 Determining Recurrence Intervals

To use the US Drought Monitor Classification System Categories and associated WMOP Stages for the in this analysis, recurrence intervals need to be assigned to each of the drought five categories. With each US Drought Monitor Classification System Category, the US Drought Monitor provides an associated Palmer Drought Severity Index (PDSI) range. The PDSI uses readily available temperature and precipitation data to estimate relative dryness. It is a standardized index used nationwide that spans from -10 (dry) to +10 (wet) to measure drought conditions.

To determine the recurrence intervals for each category, analyst used frequency statistics from the *National Drought Mitigation Center, Drought Risk Atlas for Durham Station (312515*), which the closest station to the project site. The Drought Risk Atlas provides site specific frequencies and return periods (year) for each PDSI value (Appendix F). To determine the recurrence interval for each drought category PDSI range, analyst calculated the average recurrence interval for each PDSI range and rounded to the nearest whole number for entry into the BCA Toolkit. The result of this calculation is provided in Table 5.

Table 5. US Drought Monitor Classification System Categories, Calculated PDSI Range Recurrence Interval

Category	WMOP Stage	PDSI Range	Recurrence Interval (Durham Station)
D0	Stage 1	-1.0 to -1.9	5.72 (6)
D1	Stage 2	-2.0 to -2.9	9.11 (9)
D2	Stage 3 & 4	-3.0 to -3.9	24.49 (25)
D3	Stage 5	-4.0 to -4.9	49.97 (50)

D4	Stage 6	-5.0 or less	67.70 (68)

Source: US Drought Monitor Classification System; Eno River Capacity Use Investigation, Water Management Operations Plan (2021); National Drought Mitigation Center - Drought Risk Atlas

3.5.3 Drought Duration

The National Drought Mitigation Center, Drought Risk Atlas aggregates drought frequencies by month order to calculate each of the indices at the various time steps. Since this dataset was used for the analysis, the pre- and post- mitigation duration entered is 30 days. As detailed in the methodology provide in this technical memorandum, the following values were entered into the BCA Toolkit Drought Module for the Pre-Mitigation Impacts (Table 6).

Table 6. US Drought Monitor Classification System Categories, Calculated PDSI Range Recurrence Interval

Recurrence Interval (Durham Station)	Water Demand (MGD)	Pre-Mitigation WMOP Withdrawal Restriction (MGD)	Pre-Mitigation Duration of Impact (Day)
5.72 (6)	1.46	1.51	30
9.11 (9)	1.46	1.36	30
24.49 (25)	1.46	1.28	30
49.97 (50)	1.46	1.13	30
67.70 (68)	1.46	0.68	30

Source: US Drought Monitor Classification System; Eno River Capacity Use Investigation, Water Management Operations Plan (2021); National Drought Mitigation Center - Drought Risk Atlas

3.6 Level of Protection (Post-Mitigation Supply Yield)

The *Agreement for the Sale Transfer of Supplemental Drinking Water Supply Between OWASA and the Town of Hillsborough* (Appendix G) directs the sharing of water between the Town of Hillsborough and OWASA in times of water shortage emergencies (including drought events). The agreement states that OWASA will be able to provide a maximum of 2 million gallons of water per day to the Town. Therefore, the amount of water available to the Town in during each WMOP stage will increase by 2 MGD if the water booster pump station is constructed. Table 7 below shows the pre- and post-mitigation system supply yield values that were entered into the BCA Toolkit.

The comparison of water demand to pre- and post-mitigation supply shows that this project will protect above the 67.70-year drought event. Before mitigation, demand is greater than supply, but after the project is implemented, there is a surplus of water supply provided by the OWASA booster pump station implementation.

> (b) The AUTHORITY fully expects that upon completion of the AUTHORITY's Cane Creek Reservoir project and the Jones Ferry Road Water Plant expansion project the AUTHORITY will be able to provide a maximum of 2 million gallons of water per day to the TOWN during the Original Term of this Agreement.

Figure 3. Excerpt from the Town of Hillsborough and OWASA Water Supply Agreement

Table 7. Town of Hillsborough, Potable Water Demand versus Pre- and Post-Mitigation System Supply Yields

Recurrence Interval (Durham Station)	Water Demand (MGD)	Pre-Mitigation WMOP Withdrawal Restriction (MGD)	Pre-Mitigation Duration of Impact (Day)	Post-Mitigation Supply Yield (MGD)	Post-Mitigation Duration of Impact (Day)
5.72	1.46	1.51	30	3.46	30
9.11	1.46	1.36	30	3.36	30
24.49	1.46	1.28	30	3.28	30
49.97	1.46	1.13	30	3.13	30
67.70	1.46	0.68	30	2.68	30

Source: US Drought Monitor Classification System; Eno River Capacity Use Investigation, Water Management Operations Plan (2021); National Drought Mitigation Center - Drought Risk Atlas; Agreement for the Sale Transfer of Supplemental Drinking Water Supply Between OWASA and the Town of Hillsborough

4 Analysis Results

The benefit-cost ratio (BCR) for the project is listed in Table 8. Costs included in the determination of the BCR include maintenance costs over the project useful life of the mitigation project. **The total project BCR is 9.72 which demonstrates that the mitigation project is a cost-effective solution**. The BCA Report is provided in Appendix A.

Table 8: Resilient Water Supply Project, BCA Results

Description	Benefits	Costs	BCR
OWASA Booster Pump Station (Resilient Water Supply)	$13,690,129	1,407,975	9.72

Source: BCA Toolkit 6.0

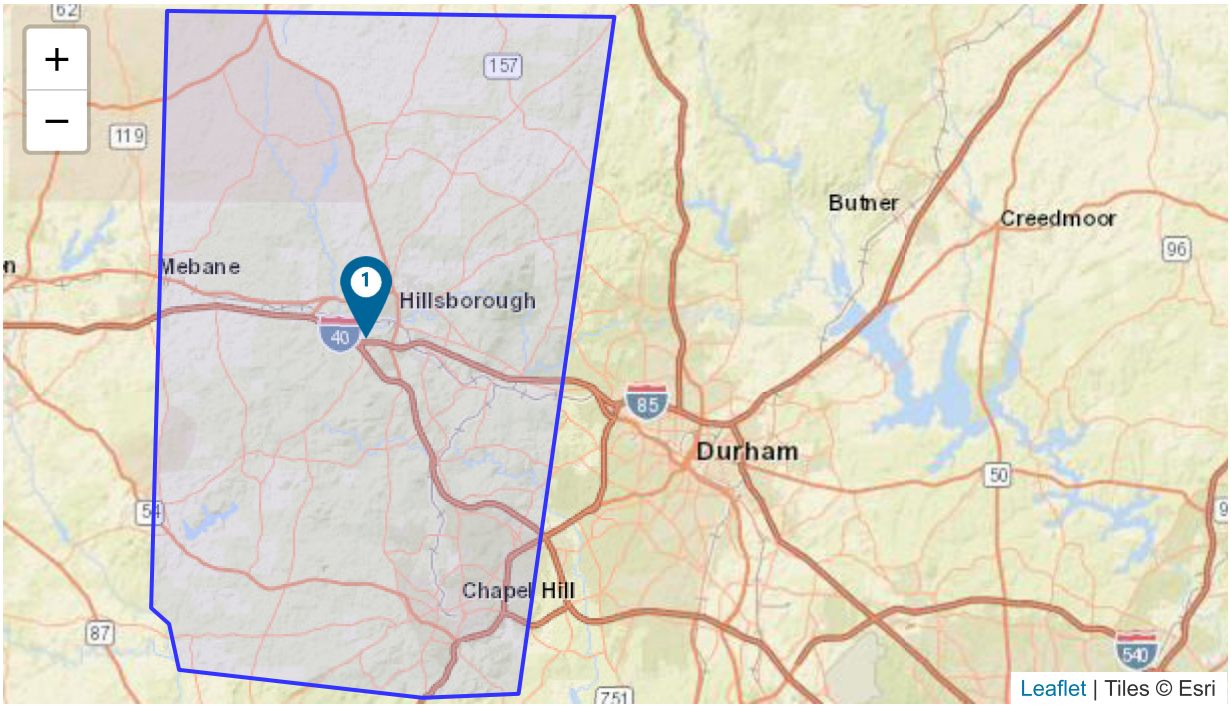
Appendix A
Benefit Cost Analysis Report

Benefit-Cost Calculator

V.6.0 (Build 20211021.0641)

Benefit-Cost Analysis

Project Name: Hillsborough Resilient Water Supply Project



Map Marker ▲	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)
1	Aquifer Storage and Recovery @ Orange County, North Carolina		Drought	$ 13,690,129	$ 1,407,975	9.72
TOTAL (SELECTED)				**$ 13,690,129**	**$ 1,407,975**	**9.72**
TOTAL				**$ 13,690,129**	**$ 1,407,975**	**9.72**

Property Configuration

Property Title:	Aquifer Storage and Recovery @ Orange County, North Carolina
Property Location:	27278, Orange, North Carolina
Property Coordinates:	36.0613973, -79.1205954
Hazard Type:	Drought
Mitigation Action Type:	Aquifer Storage and Recovery
Property Type:	Utilities
Analysis Method Type:	Modeled Damages

Cost Estimation

Aquifer Storage and Recovery @ Orange County, North Carolina

Project Useful Life (years):	50
Project Cost:	$1,380,373.53
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$2,000

Hazard Probability Parameters - Drought

Aquifer Storage and Recovery @ Orange County, North Carolina

Recurrence Interval (years)	Water Demand (mgd)	Pre-Mitigation System Supply Yield (mgd)	Pre-Mitigation Duration of Impact (days)	Post-Mitigation System Supply Yield (mgd)	Post-Mitigation Duration of Impact (days)
6	1.46	1.46	30	3.46	30
9	1.46	1.36	30	3.36	30
24	1.46	1.28	30	3.28	30
50	1.46	1.13	30	3.13	30
68	1.46	0.68	30	2.68	30

Population Impact and Demand

Aquifer Storage and Recovery @ Orange County, North Carolina

Population Served:	15990

Damage Results

Aquifer Storage and Recovery @ Orange County, North Carolina

Recurrence Interval (years)	Damages Before Mitigation ($)	Annual Damages Before Mitigation ($)	Damages After Mitigation ($)	Annual Damages After Mitigation ($)
6	0	0	-68997945.20547944	0
9	3449897.2602739683	321425.19955678633	-65548047.945205465	0
24	6209815.068493149	182176.13592434168	-62788130.1369863	0
50	11384660.958904112	92662.5016998301	-57613284.24657533	0
68	26909198.63013698	395720.8183465881	-42088746.57534248	0

Benefits-Costs Summary

Aquifer Storage and Recovery @ Orange County, North Carolina

Total Standard Mitigation Benefits:	$13,690,129
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$13,690,129
Total Mitigation Project Cost:	$1,407,975
Benefit Cost Ratio - Standard:	9.72
Benefit Cost Ratio - Standard + Social:	9.72

Appendix B

Project Useful Life Table

Table 14.1 Default Full Replacement Cost Models (Means, 2006)

HAZUS Occupancy Class Description		Sub-category	Means Model Description (Means Model Number)	Means Typ Size	Means Cost/SF (2006)
OCC Code	OCC Description	OCC sub-class			
RES1	Single Family Dwelling	See Table 14-2			
RES2	Manufactured Housing	Manufactured Housing	Manufactured Housing Institute, 2004 average sales price and size data for new manufactured home (latest data available)	1,625	$35.75
RES3A	Multi Family Dwelling – small	Duplex	SFR Avg 2 St., MF adj, 3000 SF	3,000	$79.48
RES3B		Triplex/Quads	SFR Avg 2 St., MF adj, 3000 SF	3,000	$86.60
RES3C	Multi Family Dwelling – medium	5-9 units	Apt, 1-3 st, 8,000 SF (M.010)	8,000	$154.31
RES3D		10-19 units	Apt., 1-3 st., 12,000 SF (M.010)	12,000	$137.67
RES3E	Multi Family Dwelling – large	20-49 units	Apt., 4-7 st., 40,000 SF (M.020)	40,000	$135.39
RES3F		50+ units	Apt., 4-7 st., 60,000 SF (M.020)	60,000	$131.93
RES4	Temp. Lodging	Hotel, medium	Hotel, 4-7 st., 135,000 SF (M.350)	135,000	$132.52
RES5	Institutional Dormitory	Dorm, medium	College Dorm, 2-3 st, 25,000 SF (M.130)	25,000	$150.96
RES6	Nursing Home	Nursing home	Nursing Home, 2 st., 25,000 SF (M.450)	25,000	$126.95
COM1	Retail Trade	Dept Store, 1 st	Store, Dept., 1 st., 110,000 SF (M.610)	110,000	$82.63
COM2	Wholesale Trade	Warehouse, medium	Warehouse, 30,000 SF (M.690)	30,000	$75.95
COM3	Personal and Repair Services	Garage, Repair	Garage, Repair, 10,000 SF (M.290)	10,000	$102.34
COM4	Prof./ Tech./Business Services	Office, medium	Office, 5-10 st., 80,000 SF (M.470)	80,000	$133.43
COM5	Banks	Bank	Bank, 1 st., 4100 SF (M.050)	4,100	$191.53
COM6	Hospital	Hospital, medium	Hospital, 2-3 st., 55,000 SF (M.330)	55,000	$224.29

Table 14.2 Default Full Replacement Cost Models (Means, 2006) (Continued)

HAZUS Occupancy Class Description		Sub-category	Means Model Description (Means Model Number)	Means Typ Size	Means Cost/SF (2006)
OCC Code	OCC Description	OCC sub-class			
COM7	Medical Office/Clinic	Med. Office, medium	Medical office, 2 st., 7,000 SF (M.410)	7,000	$164.18
COM8	Entertainment & Recreation	Restaurant	Restaurant, 1 st., 5,000 SF (M.530)	5,000	$170.51
COM9	Theaters	Movie Theatre	Movie Theatre, 12,000 SF (M.440)	12,000	$122.05
COM10	Parking	Parking garage	Garage, Pkg, 5 st., 145,000 SF (M.270)	145,000	$43.72
IND1	Heavy	Factory, small	Factory, 1 st., 30,000 SF (M.200)	30,000	$88.28
IND2	Light	Warehouse, medium	Warehouse, 30,000 SF (M.690)	30,000	$75.95
IND3	Food/Drugs/Chemicals	College Laboratory	College Lab, 1 st., 45,000 SF (M.150)	45,000	$145.07
IND4	Metals/Minerals Processing	College Laboratory	College Lab, 1 st., 45,000 SF (M.150)	45,000	$145.07
IND5	High Technology	College Laboratory	College Lab, 1 st., 45,000 SF (M.150)	45,000	$145.07
IND6	Construction	Warehouse, medium	Warehouse, 30,000 SF (M.690)	30,000	$75.95
AGR1	Agriculture	Warehouse, medium	Warehouse, 30,000 SF (M.690)	30,000	$75.95
REL1	Church	Church	Church, 1 st., 17,000 SF (M.090)	17,000	$138.57
GOV1	General Services	Town Hall, small	Town Hall, 1 st., 11,000 SF (M.670)	11,000	$107.28
GOV2	Emergency Response	Police Station	Police Station, 2 st., 11,000 SF (M.490)	11,000	$166.59
EDU1	Schools/Libraries	High School	School, High, 130,000 SF (M.570)	130,000	$115.31
EDU2	Colleges/Universities	College Classroom	College Class. 2-3 st, 50,000 SF (M.120)	50,000	$144.73

Appendix C

Town of Hillsborough Water System Data (2021)

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER
1/1/21	1.349	0.057	0.0	1.292	0.0	1.292				
1/2/21	1.712	0.045	0.0	1.667	0.0	1.667				
1/3/21	1.342	0.009	0.0	1.333	0.0	1.333				
1/4/21	1.467	0.054	0.0	1.413	0.0	1.413				
1/5/21	1.534	0.053	0.0	1.481	0.0	1.481				
1/6/21	1.428	0.057	0.0	1.371	0.0	1.371				
1/7/21	1.434	0.055	0.0	1.379	0.0	1.379		40.8		0.3
1/8/21	1.311	0.012	0.0	1.299	0.0	1.299				
1/9/21	1.444	0.053	0.0	1.391	0.0	1.391				
1/10/21	1.628	0.045	0.0	1.583	0.0	1.583				
1/11/21	1.548	0.376	0.0	1.172	0.0	1.172				
1/12/21	1.575	0.254	0.0	1.321	0.0	1.321				
1/13/21	1.704	0.090	0.0	1.614	0.0	1.614		39.8		0.2
1/14/21	1.450	0.055	0.0	1.395	0.0	1.395				
1/15/21	1.412	0.057	0.0	1.355	0.0	1.355				
1/16/21	1.468	0.055	0.0	1.413	0.0	1.413				
1/17/21	1.425	0.011	0.0	1.414	0.0	1.414				
1/18/21	1.425	0.054	0.0	1.371	0.0	1.371				
1/19/21	1.510	0.102	0.0	1.408	0.0	1.408				
1/20/21	1.413	0.057	0.0	1.356	0.0	1.356				
1/21/21	1.712	0.045	0.0	1.667	0.0	1.667		39		0.1
1/22/21	1.326	0.014	0.0	1.312	0.0	1.312				
1/23/21	1.403	0.055	0.0	1.348	0.0	1.348				
1/24/21	1.412	0.054	0.0	1.358	0.0	1.358				
1/25/21	1.474	0.055	0.0	1.419	0.0	1.419				
1/26/21	1.415	0.053	0.0	1.362	0.0	1.362				
1/27/21	1.402	0.057	0.0	1.345	0.0	1.345				
1/28/21	1.724	0.045	0.0	1.679	0.0	1.679				
1/29/21	1.180	0.020	0.0	1.160	0.0	1.160		39.8		1.8
1/30/21	1.406	0.055	0.0	1.351	0.0	1.351				
1/31/21	1.373	0.101	0.0	1.272	0.0	1.272				
Monthly Total	45.406	2.105	0.000	43.301	0.000	43.301				
Daily Average	1.465	0.068		1.397		1.397				

Cleaned Basin #1 and floculators on Monday, used 331,000 gallons.
Cleaned Basin #2 on Tuesday, used 254,000 gallons.

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER
2/1/21	1.729	0.045	0.0	1.684	0.0	1.684				
2/2/21	1.397	0.054	0.0	1.343	0.0	1.343				
2/3/21	1.454	0.010	0.0	1.444	0.0	1.444				
2/4/21	1.415	0.057	0.0	1.358	0.0	1.358		41.5		1
2/5/21	1.515	0.099	0.0	1.416	0.0	1.416				
2/6/21	1.410	0.010	0.0	1.400	0.0	1.400				
2/7/21	1.520	0.055	0.0	1.465	0.0	1.465				
2/8/21	1.512	0.055	0.0	1.457	0.0	1.457				
2/9/21	1.443	0.087	0.0	1.356	0.0	1.356				
2/10/21	1.708	0.045	0.0	1.663	0.0	1.663		42		0.3
2/11/21	1.477	0.010	0.0	1.467	0.0	1.467				
2/12/21	1.360	0.057	0.0	1.303	0.0	1.303				
2/13/21	1.427	0.057	0.0	1.370	0.0	1.370				
2/14/21	1.459	0.054	0.0	1.405	0.0	1.405				
2/15/21	1.456	0.098	0.0	1.358	0.0	1.358				
2/16/21	1.456	0.046	0.0	1.410	0.0	1.410				
2/17/21	1.500	0.000	0.0	1.500	0.0	1.500		44.9		0.2
2/18/21	1.540	0.065	0.0	1.475	0.0	1.475				
2/19/21	1.549	0.055	0.0	1.494	0.0	1.494				
2/20/21	1.476	0.057	0.0	1.419	0.0	1.419				
2/21/21	1.521	0.053	0.0	1.468	0.0	1.468				
2/22/21	1.719	0.045	0.0	1.674	0.0	1.674				
2/23/21	1.332	0.057	0.0	1.275	0.0	1.275				
2/24/21	1.499	0.012	0.0	1.487	0.0	1.487				
2/25/21	1.445	0.056	0.0	1.389	0.0	1.389				
2/26/21	1.419	0.057	0.0	1.362	0.0	1.362		45		0
2/27/21	1.528	0.057	0.0	1.471	0.0	1.471				
2/28/21	1.439	0.053	0.0	1.386	0.0	1.386				
				0.000		0.000				
Weekly Total	41.705	1.406	0.000	40.299	0.000	40.299				
Daily Average	1.489	0.050		1.390		1.390				

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER	
3/1/21	1.707	0.045	0.0	1.662	0.0	1.662					
3/2/21	1.707	0.090	0.0	1.617	0.0	1.617					
3/3/21	1.710	0.045	0.0	1.665	0.0	1.665					
3/4/21	1.706	0.045	0.0	1.661	0.0	1.661					
3/5/21	1.491	0.056	0.0	1.435	0.0	1.435		44.4		0.01	
3/6/21	1.463	0.053	0.0	1.410	0.0	1.410					
3/7/21	1.715	0.045	0.0	1.670	0.0	1.670					
3/8/21	1.713	0.000	0.0	1.713	0.0	1.713					
3/9/21	1.708	0.045	0.0	1.663	0.0	1.663					
3/10/21	1.704	0.045	0.0	1.659	0.0	1.659					
3/11/21	1.703	0.045	0.0	1.658	0.0	1.658					
3/12/21	1.520	0.327	0.0	1.193	0.0	1.193		43.3		0.00	Washed basin
3/13/21	1.689	0.045	0.0	1.644	0.0	1.644					
3/14/21	1.375	0.010	0.0	1.365	0.0	1.365					
3/15/21	1.705	0.045	0.0	1.660	0.0	1.660					
3/16/21	1.698	0.045	0.0	1.653	0.0	1.653					
3/17/21	1.703	0.045	0.0	1.658	0.0	1.658					
3/18/21	1.205	0.930	0.0	0.275	0.0	0.275		42.3		0.40	
3/19/21	1.475	0.012	0.0	1.463	0.0	1.463					
3/20/21	1.452	0.058	0.0	1.394	0.0	1.394					
3/21/21	1.479	0.055	0.0	1.424	0.0	1.424					
3/22/21	1.703	0.045	0.0	1.658	0.0	1.658					
3/23/21	1.687	0.045	0.0	1.642	0.0	1.642					
3/24/21	1.474	0.911	0.0	0.563	0.0	0.563					
3/25/21	1.692	0.45	0.0	1.242	0.0	1.242		41.2		0.10	
3/26/21	1.419	0	0.0	1.419	0.0	1.419					
3/27/21	1.659	0.022	0.0	1.637	0.0	1.637					
3/28/21	1.339	0.115	0.0	1.224	0.0	1.224					
3/29/21	1.700	0.045	0.0	1.655	0.0	1.655					
3/30/21	1.697	0.090	0.0	1.607	0.0	1.607					
3/31/21	1.436	0.012	0.0	1.424	0.0	1.424					
Monthly Total	49.434	3.821	0.000	45.613	0.000	45.613					
Daily Average	1.595	0.123		1.471		1.471					

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER	
4/1/21	1.531	0.090		1.441		1.441		42.5		0.5	
4/2/21	1.419	0.021		1.398		1.398					
4/3/21	1.425	0.134		1.291		1.291					
4/4/21	1.491	0.123		1.368		1.368					
4/5/21	1.518	0.123		1.395		1.395					
4/6/21	1.498	0.307		1.191		1.191					Washed basin 2
4/7/21	1.684	0.090		1.594		1.594					
4/8/21	1.682	0.045		1.637		1.637					
4/9/21	1.681	0.090		1.591		1.591		41.3		0.00	
4/10/21	1.673	0.000		1.673		1.673					
4/11/21	1.438	0.054		1.384		1.384					
4/12/21	1.597	0.045		1.552		1.552					
4/13/21	1.384	0.073		1.311		1.311		40.8		0.2	
4/14/21	1.690	0.045		1.645		1.645					
4/15/21	1.412	0.061		1.351		1.351					
4/16/21	1.693	0.045		1.648		1.648					
4/17/21	1.691	0.045		1.646		1.646					
4/18/21	1.535	0.054		1.481		1.481					
4/19/21	1.675	0.045		1.630		1.630					
4/20/21	1.673	0.090		1.583		1.583					
4/21/21	1.672	0.045		1.627		1.627					
4/22/21	1.675	0.045		1.630		1.630		38.4		0.00	
4/23/21	1.394	0.055		1.339		1.339					
4/24/21	1.509	0.045		1.464		1.464					
4/25/21	1.613	0.056		1.557		1.557					
4/26/21	1.671	0.000		1.671		1.671					
4/27/21	1.436	0.053		1.383		1.383					
4/28/21	1.660	0.090		1.570		1.570					
4/29/21	1.628	0.045		1.583		1.583					
4/30/21	1.355	0.094		1.261		1.261		38.3		0.2	
Monthly Total	47.003	2.108	0.000	44.895	0.000	44.895					
Daily Average	1.567	0.070		1.497		1.497					

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER	
5/1/21	1.436	0.053		1.383		1.383					
5/2/21	1.331	0.271		1.060		1.060					Basin washed.
5/3/21	1.656	0.045		1.611		1.611					
5/4/21	1.331	0.100		1.231		1.231					
5/5/21	1.667	0.045		1.622		1.622		37.8		0.3	
5/6/21	1.195	0.057		1.138		1.138					
5/7/21	1.661	0.045		1.616		1.616					
5/8/21	1.242	0.045		1.197		1.197					
5/9/21	1.404	0.066		1.338		1.338					
5/10/21	1.375	0.009		1.366		1.366					
5/11/21	1.442	0.053		1.389		1.389					
5/12/21	1.652	0.045		1.607		1.607					
5/13/21	1.254	0.055		1.199		1.199					
5/14/21	1.653	0.045		1.608		1.608		37.5		0.2	
5/15/21	1.458	0.053		1.405		1.405					
5/16/21	1.648	0.045		1.603		1.603					
5/17/21	1.652	0.045		1.607		1.607					
5/18/21	1.401	0.057		1.344		1.344					
5/19/21	1.652	0.000		1.652		1.652					
5/20/21	1.402	0.055		1.347		1.347					
5/21/21	1.641	0.045		1.596		1.596		37.6		0	
5/22/21	1.379	0.045		1.334		1.334					
5/23/21	1.668	0.045		1.623		1.623					
5/24/21	1.653	0.045		1.608		1.608					
5/25/21	1.661	0.045		1.616		1.616					
5/26/21	1.530	0.259		1.271		1.271					Basin washed.
5/27/21	1.636	0.045		1.591		1.591		37.7		0	
5/28/21	1.644	0.045		1.599		1.599					
5/29/21	1.641	0.045		1.596		1.596					
5/30/21	1.652	0.000		1.652		1.652					
5/31/21	1.407	0.054		1.353		1.353					
Monthly Total	47.024	1.862	0	45.162	0	45.162					
Daily Average	1.517	0.060		1.457		1.457					

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER	
6/1/21	1.497	0.053		1.444		1.444					
6/2/21	1.432	0.050		1.382		1.382					
6/3/21	1.513	0.012		1.501		1.501					
6/4/21	1.395	0.061		1.334		1.334		37.9		1.4	
6/5/21	1.278	0.010		1.268		1.268					
6/6/21	1.455	0.010		1.445		1.445					
6/7/21	1.434	0.053		1.381		1.381					
6/8/21	1.361	0.055		1.306		1.306					
6/9/21	1.655	0.000		1.655		1.655		38		0.4	
6/10/21	1.339	0.055		1.284		1.284					
6/11/21	1.435	0.061		1.374		1.374					
6/12/21	1.399	0.009		1.390		1.390					
6/13/21	1.433	0.055		1.378		1.378					
6/14/21	1.370	0.053		1.317		1.317					
6/15/21	1.651	0.000		1.651		1.651					
6/16/21	1.644	0.045		1.599		1.599					
6/17/21	1.650	0.045		1.605		1.605		37.7		0.000000	
6/18/21	1.040	0.337		0.703		0.703					Basin washed.
6/19/21	1.635	0.000		1.635		1.635					
6/20/21	1.638	0.045		1.593		1.593					
6/21/21	1.474	0.053		1.421		1.421					
6/22/21	1.544	0.045		1.499		1.499		37.8		0.7	
6/23/21	1.634	0.000		1.634		1.634					
6/24/21	1.359	0.055		1.304		1.304					
6/25/21	1.626	0.045		1.581		1.581					
6/26/21	1.423	0.008		1.415		1.415					
6/27/21	1.487	0.054		1.433		1.433					
6/28/21	1.624	0.045		1.579		1.579					
6/29/21	1.618	0.045		1.573		1.573					
6/30/21	1.623	0.045		1.578		1.578					
Monthly Total	44.666	1.404	0	43.262	0	43.262					
Daily Average	1.489	0.047		1.442		1.442					

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER
7/1/21	2.253	0.090		2.163		2.163		37.7		0
7/2/21	1.793	0.000		1.793		1.793				
7/3/21	1.409	0.055		1.354		1.354				
7/4/21	1.171	0.049		1.122		1.122				
7/5/21	1.503	0.008		1.495		1.495				
7/6/21	1.521	0.053		1.468		1.468				
7/7/21	1.680	0.045		1.635		1.635				
7/8/21	1.698	0.045		1.653		1.653				
7/9/21	0.986	0.022		0.964		0.964		37.8		1.3
7/10/21	1.386	0.053		1.333		1.333				
7/11/21	1.554	0.008		1.546		1.546				
7/12/21	1.528	0.052		1.476		1.476				
7/13/21	1.423	0.057		1.366		1.366				
7/14/21	1.715	0.000		1.715		1.715				
7/15/21	1.582	0.045		1.537		1.537				
7/16/21	1.716	0.045		1.671		1.671		37.7		0.1
7/17/21	1.220	0.012		1.208		1.208				
7/18/21	1.717	0.045		1.672		1.672				
7/19/21	1.542	0.053		1.489		1.489				
7/20/21	1.637	0.045		1.592		1.592				
7/21/21	1.407	0.013		1.394		1.394				
7/22/21	1.725	0.045		1.680		1.680				
7/23/21	1.548	0.057		1.491		1.491		38		0.9
7/24/21	1.553	0.014		1.539		1.539				
7/25/21	1.736	0.045		1.691		1.691				
7/26/21	1.635	0.053		1.582		1.582				
7/27/21	1.565	0.008		1.557		1.557				
7/28/21	1.412	0.065		1.347		1.347				
7/29/21	2.131	0.045		2.086		2.086				
7/30/21	2.153	0.045		2.108		2.108		37.9		0.0
7/31/21	1.815	0.072		1.743		1.743				
Monthly Total	49.714	1.244	0	48.470	0	48.470				
Daily Average	1.604	0.040		1.564		1.564				

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	SCADA Rainfall at the WFER	
8/1/21	1.502	0.053		1.449		1.449					
8/2/21	1.542	0.009		1.533		1.533					
8/3/21	1.497	0.054		1.443		1.443					
8/4/21	1.332	0.333		0.999		0.999					Basin washed
8/5/21	1.877	0.057		1.820		1.820					
8/6/21	1.499	0.372		1.127		1.127		37.40		0.10	Basin washed
8/7/21	1.482	0.061		1.421		1.421					
8/8/21	1.419	0.011		1.408		1.408					
8/9/21	1.382	0.055		1.327		1.327					
8/10/21	1.511	0.065		1.446		1.446					
8/11/21	1.590	0.020		1.570		1.570					
8/12/21	1.875	0.061		1.814		1.814		37.80		0.30	
8/13/21	1.854	0.061		1.793		1.793					
8/14/21	1.302	0.061		1.241		1.241					
8/15/21	1.517	0.009		1.508		1.508					
8/16/21	0.890	0.067		0.823		0.823					
8/17/21	1.656	0.008		1.648		1.648					
8/18/21	1.682	0.061		1.621		1.621					
8/19/21	1.144	0.073		1.071		1.071					
8/20/21	1.738	0.016		1.722		1.722		37.70		1.20	
8/21/21	1.426	0.053		1.373		1.373					
8/22/21	1.365	0.055		1.310		1.310					
8/23/21	1.409	0.009		1.400		1.400					
8/24/21	1.923	0.054		1.869		1.869					
8/25/21	1.642	0.061		1.581		1.581					
8/26/21	1.550	0.055		1.495		1.495					
8/27/21	1.402	0.015		1.387		1.387		37.30		0.00	
8/28/21	1.889	0.053		1.836		1.836					
8/29/21	1.494	0.054		1.440		1.440					
8/30/21	1.567	0.012		1.555		1.555					
8/31/21	1.530	0.054		1.476		1.476					
Monthly Total	47.488	1.982	0	45.506	0	45.506					
Daily Average	1.532	0.064		1.468		1.468					

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER	
9/1/21	1.774	0.056		1.718		1.718					
9/2/21	1.535	0.061		1.474		1.474					
9/3/21	1.629	0.020		1.609		1.609					
9/4/21	1.472	0.052		1.420		1.420					
9/5/21	1.329	0.054		1.275		1.275					
9/6/21	1.429	0.010		1.419		1.419					
9/7/21	1.591	0.053		1.538		1.538					
9/8/21	1.667	0.061		1.606		1.606					
9/9/21	1.578	0.059		1.519		1.519					
9/10/21	1.536	0.014		1.522		1.522					
9/11/21	1.071	0.056		1.015		1.015					
9/12/21	1.462	0.053		1.409		1.409					
9/13/21	1.613	0.010		1.603		1.603					
9/14/21	1.497	0.318		1.179		1.179					Basin washed.
9/15/21	1.759	0.063		1.696		1.696					
9/16/21	1.728	0.070		1.658		1.658		35.9		0.00	
9/17/21	1.512	0.063		1.449		1.449					
9/18/21	1.596	0.010		1.586		1.586					
9/19/21	1.372	0.055		1.317		1.317					
9/20/21	1.644	0.058		1.586		1.586					
9/21/21	1.736	0.056		1.680		1.680					
9/22/21	1.301	0.025		1.276		1.276					
9/23/21	1.618	0.013		1.605		1.605					
9/24/21	1.617	0.061		1.556		1.556		35.7		1.90	
9/25/21	1.486	0.011		1.475		1.475					
9/26/21	1.512	0.057		1.455		1.455					
9/27/21	1.505	0.010		1.495		1.495					
9/28/21	1.602	0.062		1.540		1.540					
9/29/21	1.223	0.016		1.207		1.207					
9/30/21	2.198	0.045		2.153		2.153					
Monthly Total	46.592	1.552	0	45.040	0	45.040					
Daily Average	1.553	0.052		1.501		1.501					

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER	
10/1/21	1.077	0.014		1.063		1.063					
10/2/21	1.708	0.165		1.543		1.543					
10/3/21	1.559	0.070		1.489		1.489					
10/4/21	1.664	0.015		1.649		1.649					
10/5/21	1.264	0.057		1.207		1.207					
10/6/21	1.271	0.012		1.259		1.259					
10/7/21	1.826	0.055		1.771		1.771					
10/8/21	1.299	0.017		1.282		1.282		35.5		0.5	
10/9/21	1.532	0.065		1.467		1.467					
10/10/21	1.346	0.022		1.324		1.324					
10/11/21	1.788	0.045		1.743		1.743					
10/12/21	1.244	0.284		0.960		0.960					Washed Basin
10/13/21	1.825	0.013		1.812		1.812					
10/14/21	1.148	0.043		1.105		1.105					
10/15/21	1.816	0.057		1.759		1.759		35.5		0.6	
10/16/21	1.480	0.010		1.470		1.470					
10/17/21	1.480	0.010		1.470		1.470					
10/18/21	1.470	0.100		1.370		1.370					
10/19/21	1.405	0.011		1.394		1.394					
10/20/21	1.716	0.012		1.704		1.704					
10/21/21	1.088	0.016		1.072		1.072					
10/22/21	2.190	0.090		2.100		2.100		34.8		0.1000000	
10/23/21	1.549	0.011		1.538		1.538					
10/24/21	1.514	0.010		1.504		1.504					
10/25/21	1.550	0.056		1.494		1.494					
10/26/21	1.178	0.057		1.121		1.121					
10/27/21	1.405	0.014		1.391		1.391					
10/28/21	2.071	0.108		1.963		1.963					
10/29/21	1.104	0.010		1.094		1.094		34.7		1.1	
10/30/21	1.650	0.055		1.595		1.595					
10/31/21	1.539	0.056		1.483		1.483					
Monthly Total	46.756	1.560	0	45.196	0	45.196					
Daily Average	1.508	0.050		1.458		1.458					

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER
11/1/21	1.541	0.043	0.0	1.498	0.0	1.498				
11/2/21	1.539	0.011	0.0	1.528	0.0	1.528				
11/3/21	1.576	0.055	0.0	1.521	0.0	1.521		34.2		0
11/4/21	1.203	0.055	0.0	1.148	0.0	1.148				
11/5/21	1.486	0.055	0.0	1.431	0.0	1.431				
11/6/21	1.425	0.016	0.0	1.409	0.0	1.409				
11/7/21	1.98	0.101	0.0	1.879	0.0	1.879				
11/8/21	1.514	0.055	0.0	1.459	0.0	1.459				
11/9/21	1.654	0.099	0.0	1.555	0.0	1.555				
11/10/21	1.85	0.013	0.0	1.837	0.0	1.837				
11/11/21	1.157	0.102	0.0	1.055	0.0	1.055				
11/12/21	1.802	0.056	0.0	1.746	0.0	1.746				
11/13/21	1.641	0.056	0.0	1.585	0.0	1.585				
11/14/21	1.505	0.054	0.0	1.451	0.0	1.451				
11/15/21			0.0	0.000	0.0	0.000				
11/16/21			0.0	0.000	0.0	0.000				
11/17/21			0.0	0.000	0.0	0.000				
11/18/21			0.0	0.000	0.0	0.000				
11/19/21			0.0	0.000	0.0	0.000				
11/20/21			0.0	0.000	0.0	0.000				
11/21/21			0.0	0.000	0.0	0.000				
11/22/21			0.0	0.000	0.0	0.000				
11/23/21			0.0	0.000	0.0	0.000				
11/24/21			0.0	0.000	0.0	0.000				
11/25/21			0.0	0.000	0.0	0.000				
11/26/21			0.0	0.000	0.0	0.000				
11/27/21			0.0	0.000	0.0	0.000				
11/28/21			0.0	0.000	0.0	0.000				
11/29/21			0.0	0.000	0.0	0.000				
11/30/21			0.0	0.000	0.0	0.000				
Monthly Total	21.873	0.771	0.000	21.102	0.000	21.102				
Daily Average	1.562	0.055	0.000	0.703	0.000	0.703				

https://icfonline.sharepoint.com/sites/KCIICF-N.CarolinaandS.CarolinaFunding/Shared Documents/General/04 Town of Hillsborough/01 Resilient Water Supply/Application/Attachments/04_BCA/Supporting Data/Daily Withdrawals Hillsborough WTP.xls

Date	Raw Water Treated	Wash Water Discharge	Amount Purchased	Total to System	Amount Sold	Total Consumption	SCADA WFER level (43.1' = full)	Manual WFER level (43.1' = full)	Lake Orange level (615 ft msl=full)	Rainfall at the WFER
1/1/21			0.0	0.000	0.0	0.000				
1/2/21			0.0	0.000	0.0	0.000				
1/3/21			0.0	0.000	0.0	0.000				
1/4/21			0.0	0.000	0.0	0.000				
1/5/21			0.0	0.000	0.0	0.000				
1/6/21			0.0	0.000	0.0	0.000				
1/7/21			0.0	0.000	0.0	0.000				
1/8/21			0.0	0.000	0.0	0.000				
1/9/21			0.0	0.000	0.0	0.000				
1/10/21			0.0	0.000	0.0	0.000				
1/11/21			0.0	0.000	0.0	0.000				
1/12/21			0.0	0.000	0.0	0.000				
1/13/21			0.0	0.000	0.0	0.000				
1/14/21			0.0	0.000	0.0	0.000				
1/15/21			0.0	0.000	0.0	0.000				
1/16/21			0.0	0.000	0.0	0.000				
1/17/21				0.000		0.000				
1/18/21				0.000		0.000				
1/19/21				0.000		0.000				
1/20/21				0.000		0.000				
1/21/21				0.000		0.000				
1/22/21				0.000		0.000				
1/23/21				0.000		0.000				
1/24/21				0.000		0.000				
1/25/21				0.000		0.000				
1/26/21				0.000		0.000				
1/27/21				0.000		0.000				
1/28/21				0.000		0.000				
1/29/21				0.000		0.000				
1/30/21				0.000		0.000				
1/31/21				0.000		0.000				
Monthly Total	0.000	0.000	0.000	0.000	0.000	0.000				
Daily Average	#DIV/0!	#DIV/0!	0.000	0.000	0.000	0.000				

Daily Average Total to System
1.464398198

Appendix D

Eno River Capacity Use Investigation, Water Management Operations Plan (WMOP)

Department of Environmental Quality (formerly, Department of Natural Resources and Community Development)

Division of Water Resources

ENO RIVER CAPACITY USE INVESTIGATION

WATER MANAGEMENT OPERATIONS PLAN

August 19, 1988

Endorsed by Environmental Management Commission
September 8, 1988

Modified or Revised: March 1989,

July 1990, March 2000, and July 2021

Table of Contents

INTRODUCTION *3*

Background 3

Town of Hillsborough Water System 5

Orange-Alamance Water System (OAWS) 5

ResCo Products (formerly, Piedmont Minerals) 5

City of Durham Water System 5

West Point Grist Mill 5

Irrigators with Average Use Exceeding 100,000 Gallons/Day 5

Users Withdrawing in Excess of 100,000 Gallons Per Day 5

FLOW AND STORAGE RERQUIREMENTS *6*

Instream Flow 6

Additional Storage 6

Outside Sources 6

PLAN ADMINISTRATION *6*

Periodic Review and Changes 6

Plan Support 6

Reporting 7

Table 1 – Revised July 1990 (Original withdrawal table first superceded by the March 2000 revision, and then by the October 2020 revision, page 10). *8*

Addendum 1 –Hillsborough Water Purchases (June 1991) *9*

Table 1 - October 2020 Revision *10*

EMC Resolution *12*

INTRODUCTION

The Water Management Operations Plan (WMOP) was the result of a Capacity Use Investigation (CUI) by the Department of Environmental Quality (DEQ) (formerly, Department of Natural Resources and Community Development) – Division of Water Resources (DWR) and a subsequent cooperative effort by the DWR and primary water users at the time to avoid a formal Capacity Use designation and regulations. The WMOP, instead, established voluntary water use restrictions that provide for equitable use of the water resources, while providing for minimum flows in the Eno River. The requirements in the WMOP are managed and administered by the water users and Orange County, with oversight and coordination by DWR. The DWR is responsible for production of the quarterly and annual reports based on available information and organization of an annual meeting of the water users group. Based upon the Environmental Management Commission (EMC) Resolution (attached), the intent of the WMOP is to institute a "voluntary water management plan [that] includes the essential elements of a declared capacity use area with the exception of the provisions for enforcement, … [to] satisfactorily address the capacity use-related problems in the Eno River area."

The specific changes or additions made for each of the previous modifications or revisions listed on the cover page (March 1989, July 1990, March 2000) are not entirely known. However, the changes made in July 1990 and March 2000 included revisions to Table 1. Both versions of Table 1 are included in this current version of the WMOP. The March 2000 revision of Table 1 was specifically concerned with integrating the minimum release requirements for the newly constructed West Fork Eno Reservoir (WFER). These minimum release requirements were from federal and state permits (Clean Water Act - Sections 401/404, and NCDEMLR Dam Safety Permit) for the dam construction, and established outside of requirements by the EMC related to the Eno River WMOP. This June 2020 revision is limited to editorial changes for clarifications, intent statement based on the EMC Resolution, and to create a modern digital version. This revision in no way implies any management or operational changes to the WMOP.

Background

Issues with using the Eno River as a dependable water supply had been documented for many years, dating back to the 1950's, especially during times of drought. As a result, the Orange County Board of Commissioners formed a water resource task force in the early 1980's to study potential options available to improve the situation, who issued a report of their findings in May 1981. According to the Capacity Use Investigation (CUI), issued December 1988, by the DEQ, "The [task force] report discussed possible designation of the Upper Neuse Basin as a Capacity Use Area; concerns over maintaining instream flow needs; water supply limitations; water conservation; potential reservoir sites; and other related items. The County

has worked closely with the State in attempting to achieve their water resource objectives." The CUI continues describing the findings from the task force report, "The State has worked closely with the local governments in the Eno River Area in attempting to provide for adequate water supplies and minimum instream flow needs. The State has assisted local water supply interests in determining storage volumes available in the three reservoirs [i.e, Lake Ben Johnson, Corporation Lake and Lake Orange], developing and improving system operating rules, and assisting the County in preparing a draft water conservation ordinance." Several years later, as documented in the CUI, "at the request of the [Orange] County Manager, a simulation was conducted reflecting water demands for Hillsborough and Orange-Alamance as they existed in June of 1986." The results of this modeling concluded that "with the projected water demands in the early 1990's the Eno River would cease to flow at the water intakes ten times and the systems would be in crisis mandatory rationing thirty-two times (a total of 1,830 days). The CUI goes on to say, that "even under existing water supply demands, the potential for a water supply disaster is imminent."

Orange County is not one of the six water users, listed below, directly affected by controls under the WMOP, because Orange County does not withdrawal water from the Eno River, as it does not operate a water system or other water withdrawal purpose. However, as the owner of Lake Orange, the County is responsible for the management and operations of Lake Orange to meet specified flow targets in the Eno River through the release of water from Lake Orange. This WMOP establishes the three existing reservoirs as the means by which required minimum flows in the Eno River are controlled; however, with Lake Orange the largest and most upstream at the time of the issuance of the WMOP in 1988, it serves as the primary controlled water source (i.e., reservoir) to meet flow targets in the Eno River downstream during low flows.

1. Town of Hillsborough -- Lake Ben Johnston withdrawal and releases and West Fork Eno Reservoir releases.

2. Orange-Alamance -- Corporation Lake withdrawal and reservoir releases.

3. ResCo Products (formerly, Piedmont Minerals) -- Eno River withdrawal.

4. City of Durham -- Eno River withdrawal.

5. West Point Grist Mill -- Eno River.

6. Irrigators whose monthly average withdrawal exceeds 100,000 gallons per day.

The limited capacity of the basin requires these users to be subject to the following controls.

Town of Hillsborough Water System

The Town of Hillsborough Water System will be allowed to withdraw a maximum of 1,510,000 gallons of water per day from their intake at Lake Ben Johnston. Maximum allowable withdrawals will change as the lake levels at Lake Orange change. Table 1 indicates the maximum allowable withdrawal at successive storage levels.

Orange-Alamance Water System (OAWS)

The Orange-Alamance Water System will be allowed to withdraw a maximum of 820,000 gallons of water per day from its intake at Corporation Lake. Allowed withdrawals will be reduced as storage at Lake Orange is reduced. Table 1 indicates the maximum allowable withdrawal for given storage levels at Lake Orange.

ResCo Products (formerly, Piedmont Minerals)

ResCo Products will be allowed to withdraw a maximum of 900,000 gallons of water per day from their intake in the Eno River below Lake Ben Johnston when flows at the Eno gage are 14 cfs and above. This will be reduced to 430,000 gallons per day when flows are between 14 cfs and 4 cfs. Below 4 cfs, the maximum allowable withdrawal will depend on the storage and lake levels in Lake Orange, as shown in Table 1.

City of Durham Water System

The City of Durham Water System will be allowed to withdraw water from the Eno River below the U.S. 501 Bridge in amounts up to 5,000,000 gallons of water per day when the flows, as measured at the USGS Eno River gage at Durham, are above 30 cfs from March through May and 10 cfs during other times of the year. Withdrawals will cease when flows fall below these levels.

West Point Grist Mill

The West Point Grist Mill is a run-of-river operation. The Mill will be permitted to use water from the Eno for mill power and return it to the river immediately downstream.

Irrigators with Average Use Exceeding 100,000 Gallons/Day

Irrigators will be allowed to withdraw up to their maximum monthly use, based on water use figures collected by the Division of Water Resources in 1987 for the severe drought year of 1986. Current (1986) water use would not be restricted, but increases in existing water use and large new users may be restricted. The short-range objective is to limit the expansion of irrigation acreage and facilities until downstream water supply sources can be improved.

Users Withdrawing in Excess of 100,000 Gallons Per Day

Any users, not previously mentioned, which withdraw more than 100,000 gallons per day from either ground or surface water sources in the Eno River Basin, upstream of the confluence with the Little River, will be required to agree to limits, but are not now included in this plan.

FLOW AND STORAGE RERQUIREMENTS

Instream Flow

In addition to maximum withdrawal limits set for offstream uses in the Eno River Basin, minimum instream flow requirements are established at the Hillsborough streamflow gage (USGS Streamflow Gage #02085000). A minimum of 1.7 cfs (1,100,000 gallons per day) is to be maintained at the gage when Lake Orange is greater than 80 percent total storage. This value is reduced as the storage level decreases at Lake Orange. Table 1 lists the minimum instream flow requirements. Orange County will be responsible for coordinating releases from Lake Orange, the West Fork Eno Reservoir, Corporation Lake, and Lake Ben Johnston – via communication with the owner/operators of each reservoir – to maintain minimum flows at the gage. The three major withdrawers will provide withdrawal schedules to the County at least one week in advance and will notify the County immediately regarding emergencies and other necessary changes in the withdrawal schedule.

Additional Storage

The withdrawal allocation can be revised whenever additional storage facilities are completed in the capacity use area or when additional water supplies are made available from sources outside the area. New storage facilities will be reviewed to ensure that there are no adverse effects upon the permit holders or on streamflow as measured at the Hillsborough gage.

Outside Sources

Water obtained from sources outside of the area designated as capacity use will not be limited under the Eno Capacity Use regulations. During periods of higher flows (over 10 cfs or 6.452 MGD), public water supply systems may take additional water from the Eno, provided that they have long-term contracts for obtaining an equal amount of water from outside the basin when the flow in the Eno drops. This type of adjustment will be evaluated on a case-by-case basis by the N.C. Division of Water Resources.

PLAN ADMINISTRATION

Orange County will be responsible for notifying affected water users of levels at Lake Orange, the West Fork Eno Reservoir, Corporation Lake, and Lake Ben Johnston and of the reductions of water withdrawals as required by the Plan.

Periodic Review and Changes

Withdrawal allowances will be subject to review every 5 years or when changes have been made to current systems, storage, or supply sources.

Plan Support

Technical support, plan clarification, and approval of minor interim adjustments and modifications will be provided by the N.C. Division of Water Resources.

Reporting

Average daily withdrawal in million gallons per day (MGD) for Orange-Alamance Water System (OAWS), Town of Hillsborough Water System, and ResCo Products (formerly, Piedmont Minerals) will be reported monthly to the Division of Water Resources. Average daily withdrawals in MGD for agricultural users will be reported annually in March.

Table 1 – Revised July 1990 (Original withdrawal table first superceded by the March 2000 revision, and then by the October 2020 revision, page 10).

Maximum Allowable Surface Water Withdrawals
Based on Lake Orange Level

Percent of Storage Remaining at Lake Orange	Drawdown in feet from top of 1-ft. flashboard	Allowable Surface Water Withdrawal --------gallons per day---------- Town of Hillsborough	Orange – Alamance	Piedmont Minerals	Instream Flow Requirement
> 100	Spilling	*	*	**	1,100,000
100 – 80	0.0	1,510,000	820,000	430,000	1,100,000
80 – 60	2.0	1,360,000	740,000	380,000	650,000
60 – 50	4.3	1,280,000	700,000	360,000	450,000
50 – 40	5.8	1,280,000	700,000	320,000	450,000
40 – 30	7.4	1,130,000	620,000	190,000	0
<= 30	9.3	680,000	370,000	0	0

notes:

*- Adjusted to reflect outside source agreement for Hillsborough and Orange-Alamance.

- Excess withdrawals from Eno River based on outside source agreement may be made when flows at the Eno River at Hillsborough Gage are 10 cubic feet per second (cfs) and above, regardless of water level in Lake Orange. Maximum withdrawals shall be limited to the total of the contract amount and the allocated amount.

- A low flow period will begin on the 7th consecutive day of the average daily flow at the Hillsborough Gage dropping below 10 cfs. On the 4th day, the Orange County Engineer will request that affected parties prepare for a low flow period.

- When flows are between 10 cfs and 3 cfs at the Hillsborough Gage during a low flow period, withdrawals from the Eno River shall be limited to the 100-80 percent of storage remaining amount shown above, regardless of water level in Lake Orange.

- When flows are below 3 cfs at the Hillsborough Gage during a low flow period, withdrawals will be limited to amounts shown above for percent of storage remaining at Lake Orange.

- A low flow period will be terminated when average daily flow at the Hillsborough Gage registers 10 cfs or greater for a period of 7 consecutive days. The Orange County Engineer will notify affected parties when the low flow period is terminated.

**- For Piedmont Minerals Inc: When flows at the Hillsborough Gage are 14 cfs and above, withdrawals from the Eno River will be limited to 900,000 gallons per day (gpd). Between 14 cfs and 4 cfs, withdrawals will be limited to 430,000 gpd, regardless of water level in Lake Orange. Below 4 cfs, withdrawals will be limited to amounts shown above for percent of storage remaining.

Addendum 1 –Hillsborough Water Purchases (June 1991)

To the Eno River Voluntary Water Use Agreement

When Lake Orange is above 100 percent full and is spilling, Hillsborough will be allowed partial credit for water purchased from an outside source and discharged into the Eno River west of county road 1009 during the monitoring week that the discharge occurs, at a credit rate of 60 percent of the total discharge, when the discharge is made over a 24-hour period or greater. The credit volume will be divided by 7 days and added to the withdrawal limit listed in Table 1, to determine the allowed average daily withdrawal for that week. In the event that the flushing discharge straddles two monitoring weeks, the credit volume will be applied equally between the two weeks. The Orange County Engineer, or DWR staff in his absence, must be notified of the volume and the duration upon completion of the flushing. A written report of the flushing, detailing exact dates, times, and volumes, shall be included in the monthly report to DWR. If notification is not received with that month's water use report, no credit will be granted and any excess water use will be labeled as a violation of this agreement. The Division of Water retains the right to revoke permission for Hillsborough to receive credit for flushed flows if at any time, in the opinion of the Division, the ability of Ben Johnston Dam to meet downstream flows may be compromised. Said revocation will be in effect until there is notice by DWR that the problem has been corrected to its satisfaction. If Lake Orange is not spilling, no credit will be allowed.

- In the event that flow at the Eno River at Hillsborough streamflow gage is over 10 cfs, Corporation Lake and Lake Ben Johnston are both spilling water over the dams, purchases of water are being made from outside of the Eno River Basin, and the low flow period has not yet ended, users may cease their outside purchase of water and withdraw the amount of water allowed in the absence of a low flow period, as long as the ability to resume purchase of water for immediate customer delivery remains. This time period has been determined to be three days for the OWASA line. Water purchases will be made as often as necessary to flush the lines and keep them from stagnating. If flows drop below 10 cfs before the low flow period is over, Eno River withdrawals must immediately be reduced to Table 1 levels.

- Transfer of water allocation between users is permissible under the following conditions: 1) Lake Orange is greater than 80 percent full; 2) notification of the duration and specific volume of the transfer will be given by the surrendering party to the Orange County Engineer, or the DWR in his absence, a minimum of one day before the transfer is to take place; 3) the total allocation will be adjusted if necessary by the averaging period of the surrendering party, and 4) written notification of the duration and volume of the transfer will be provided by both involved parties in their monthly water use reports to DWR. If prior notification is not received, DWR will not recognize the allocation transfer.

Table 1 - October 2020 Revision

Table 1. Eno River Water Management and Operations Conditions

Stage	Triggers		Allowable Surface Water Withdrawal			Minimum Releases		Instantaneous Instream Flow Requirement at Hillsborough Gage (mgd [cfs])
	Percent of Storage Remaining in Lake Orange	Drawdown in Lake Orange from top of flashboard (ft)	Town of Hillsborough (mgd [cfs])	Orange-Alamance (mgd [cfs])	Resco Products (mgd [cfs])	Lake Orange (mgd [cfs])	West Fork Eno Reservoir (WFER) (mgd [cfs])	
no stage	>100	spilling	*	*	0.9 [1.4]	1.1 [1.7]	0.65 [1.01]	
Stage 1	100-80	0	1.51 [2.34]	0.82 [1.27]	0.43 [0.67]	1.1 [1.7]	0.65 [1.01]	1.75 [2.71]
Stage 2	80-60	2.0	1.36 [2.10]	0.74 [1.15]	0.38 [0.59]	0.65 [1.01]	0.65 [1.01]	1.3 [2.01]
Stage 3	60-50	4.3	1.28 [1.98]	0.7 [1.08]	0.36 [0.56]	0.45 [0.7]	0.65 [1.01]	1.1 [1.7]
Stage 4	50-40	5.8	1.28 [1.98]	0.7 [1.08]	0.32 [0.5]	0.45 [0.7]	0.65 [1.01]	1.1 [1.7]
Stage 5	40-30	7.4	1.13 [1.75]	0.62 [0.96]	0.19 [0.29]	0	0.65 [1.01]	0.65 [1.01]
Stage 6	<30	9.3	0.68 [1.05]	0.19 [0.29]	0	0	0.65 [1.01]	0.65 [1.01]

million gallons per day (mgd); cubic feet per second (cfs); feet (ft)

* When flows are greater than 10 cfs as measured at the Hillsborough gage, additional withdraws beyond those allowed in Table 1 can commence at rates less than or equal to that of contracts held by the Town of Hillsborough & Orange-Alamance for water supply sources outside the basin.

Low Flow Stage Conditions:

-A low flow period will begin at the end of the 7th consecutive day when the average daily flow at the Hillsborough gage has been below 10 cfs. At the end of the 4th day, the Orange County Engineer will request that affected parties prepare for a low flow period.

-When flows are between 10 cfs and 3 cfs at the Hillsborough gage during a low flow period, withdrawals from the Eno River shall be limited to the Stage 1 amount shown above (100-80 percent of storage remaining), regardless of water level in Lake Orange.

-When flows are below 3 cfs at the Hillsborough gage during a low flow period, withdrawals shall be limited to amounts shown above for percent of storage remaining at Lake Orange.

-A low flow period will be terminated when average daily flow at the Hillsborough gage registers 10 cfs or greater for a period of 7 consecutive days. The Orange County Engineer will notify affected parties when the low flow period is terminated.

-The Orange County Engineer will notify the affected parties when moving between Low Flow Stages.

Conditions for All Water Users:

-Allowable withdrawal values are based on natural flow estimates and releases from Lake Orange.
-Excess withdrawals from the Eno River based on an outside source agreement may be made when flows at the Hillsborough gage are 10 cfs and above, regardless of water level in Lake Orange. Maximum withdrawals shall be limited to the total of the contract amount and the allocated amount.

Conditions for the Town of Hillsborough:

-Allowable withdrawals for the Town of Hillsborough shown above do not include withdrawals of water supply releases from the WFER.

-Minimum releases from the WFER are based on Army Corps of Engineers Permit Condition, not the Eno River Water Management and Operations Plan.

-Releases from Lake Orange and/or the WFER may need to exceed the minimum releases shown in Table 1 to meet the minimum instream flow requirements as shown in Table 1 due to natural conditions.

Conditions for Orange County:

-Releases from Lake Orange and/or the WFER may need to exceed the minimum releases shown in Table 1 to meet the minimum instream flow requirements as shown in Table 1 due to natural conditions.

Conditions for Resco Products:

When flows at the Hillsborough gage are 14 cfs and above, withdrawals from the Eno River will be limited to 0.9 mgd. Between 14 cfs and 4 cfs, withdrawals will be limited to 0.43 mgd, regardless of water level in Lake Orange. Below 4 cfs, withdrawals will be limited to amounts shown above for percent of storage remaining.

EMC Resolution

RESOLUTION NO. 88-13
ENVIRONMENTAL MANAGEMENT COMMISSION

WHEREAS, at the direction of the Environmental Management Commission (EMC), the Department of Natural Resources and Community Development has completed a capacity use investigation of the Eno River portion of the Neuse River Basin, pursuant to the provisions of the N.C. Water Use Act of 1967 (G.S. 143-215.11 et. seq.}.

WHEREAS, the Department found that:

1. The aggregate use of surface water from the Eno River has grown to the point where coordination is required to prevent conflicts and to protect the interests and rights of riparian owners.

2. During low flow periods the demand for water exceeds the amount of water available from the Eno River.

3. Limited regulation of water users appears to be an equitable short-term alternative until new water supply sources are developed.

4. A means is needed to encourage cooperation and conservation among all water users in order that greater efficiencies in water use are promptly implemented.

5. The rapid present and projected growth of water use in the Eno Basin requires action soon to avoid the risk of even more severe water supply problems.

WHEREAS, the Department recommended that the estimated 150 square miles of the Eno River watershed area upstream from the confluence with the Little River be designated as a capacity use area.

WHEREAS, the Department developed a proposed water management plan for the Eno Basin to illustrate the types of regulations and permits that would be proposed under the capacity use designation.

WHEREAS, the water users in the Eno Basin have committed themselves to follow the proposed water management plan.

WHEREAS, the voluntary water management plan includes the essential elements of a declared capacity use area with the exception of the provisions for enforcement.

WHEREAS, the General Statute directs the Department to present "actions which might preclude the need for additional

regulation."

WHEREAS, the voluntary plan, if adhered to by those involved, satisfactorily addresses the capacity use-related problems in the Eno River area.

NOW THEREFORE, BE IT RESOLVED that the EMC accepts the Eno River Capacity Use Investigation Hearing Officer's Report and endorses the voluntary Water Management Operations Plan and directs the staff of the Division of Water Resources to monitor compliance with the plan and make periodic reports to the EMC.

BE IT FURTHER RESOLVED, that should the plan not be adhered to by those involved, that the EMC intends to proceed with a designation of capacity use for the Eno River area, as outlined in the Department's report.

This the 8th day of September 1988.

Charles L. Baker
Chairman,
Environmental Management Commission

Appendix E

National Drought Mitigation Center, Drought Risk Atlas for Durham Station (312515)

National Drought Mitigation Center
Drought Risk Atlas
Drought Index Frequencies
Atlas Station: 312515 (DURHAM)

With this tool, it is possible to see how frequently a drought index hits a certain magnitude. These data also show how many times this value has occurred during the period of record for the currently selected station.

Threshold	Frequency	Return Period (Years)
-6.5	1	104.42
-6.4	3	34.75
-6.2	2	52.17
-6	1	104.42
-5.9	4	26.08
-5.7	1	104.42
-5.6	2	52.17
-5.5	2	52.17
-5.4	5	20.83
-5.3	2	52.17
-5.1	1	104.42
-5	1	104.42
-4.9	2	52.17
-4.8	2	52.17
-4.7	2	52.17
-4.5	1	104.42
-4.4	2	52.17
-4.3	3	34.75
-4.2	7	14.92
-4.1	2	52.17
-4	3	34.75
-3.9	2	52.17
-3.8	4	26.08

Threshold	Frequency	Return Period (Years)
-3.7	5	20.83
-3.6	6	17.33
-3.5	3	34.75
-3.4	3	34.75
-3.3	6	17.33
-3.2	7	14.92
-3.1	11	9.42
-3	6	17.33
-2.9	10	10.42
-2.8	7	14.92
-2.7	12	8.67
-2.6	15	6.92
-2.5	9	11.58
-2.4	8	13
-2.3	15	6.92
-2.2	14	7.42
-2.1	20	5.17
-2	17	6.08
-1.9	18	5.75
-1.8	19	5.42
-1.7	17	6.08
-1.6	21	4.92
-1.5	18	5.75
-1.4	15	6.92
-1.3	16	6.5
-1.2	20	5.17
-1.1	16	6.5
-1	25	4.17
-0.9	19	5.42
-0.8	33	3.08

Threshold	Frequency	Return Period (Years)
-0.7	23	4.5
-0.6	22	4.67
-0.5	19	5.42
-0.4	19	5.42
-0.3	24	4.33
-0.2	22	4.67
-0.1	6	17.33
0	16	6.5

Results for **DURHAM (312515)** aggregated by month.

https://droughtatlas.unl.edu/Data/Climate.aspx

Appendix F

Agreement for the Sale Transfer of Supplemental Drinking Water Supply Between OWASA and the Town of Hillsborough

AGREEMENT FOR THE SALE AND TRANSFER OF SUPPLEMENTAL DRINKING WATER SUPPLY BETWEEN ORANGE WATER AND SEWER AUTHORITY AND THE TOWN OF HILLSBOROUGH

NORTH CAROLINA
ORANGE COUNTY

THIS AGREEMENT, made and entered into and executed in duplicate originals, this the 16th day of February, 1988, by and between Orange Water and Sewer Authority, a public body politic and corporate, organized and existing under the provisions of Chapter 162A of the North Carolina General Statutes, with its principal office in Carrboro, North Carolina, hereinafter referred to as "AUTHORITY," and the TOWN OF HILLSBOROUGH, hereinafter referred to as "TOWN."

WITNESSETH:

WHEREAS, the AUTHORITY owns and operates a water supply, treatment and distribution system, which includes a Water Treatment Facility classified as Class A by the Department of Human Resources, and said facilities serve the Town of Chapel Hill, Town of Carrboro and surrounding areas in southeastern Orange County; and

WHEREAS, the TOWN owns and operates a water supply, treatment and distribution system, which includes a Water Treatment Facility classified as Class A by the Department of Human Resources, and said facilities serve the TOWN and surrounding areas in central Orange County; and

WHEREAS, the TOWN and AUTHORITY are authorized under N.C. General Statutes to enter into agreements for the joint operation and provision of water and wastewater facilities and services; and

WHEREAS, the AUTHORITY and TOWN desire to obtain additional drinking water supplies and share existing and future supplies at such time as sufficient capacity may be available to meet the needs of their respective customers during water shortage emergencies, including but not limited to those caused by treatment plant outages, power failures, water main breaks, major fires, supply contamination, or extended droughts; and

WHEREAS, in 1978, at its own expense, the AUTHORITY constructed a water system interconnection consisting of a 16-inch water main, booster pump station and flow measurement station connecting the AUTHORITY's water distribution system with the TOWN's water distribution system; and

WHEREAS, the AUTHORITY entered into agreements with the TOWN on August 26, 1977 and with Orange County on August 1, 1977 providing for the release of supplemental raw water supply from Lake Orange and subsequent treatment by the TOWN for delivery to the AUTHORITY through the AUTHORITY's water system interconnection; and the parties hereto acknowledge the continuing validity of the said County agreement and wish to supersede the previous agreement between the TOWN and the AUTHORITY by this Agreement; and

3. The AUTHORITY's Executive Director or his designate shall administer requests for water on a day to day basis and the AUTHORITY agrees to notify the TOWN in writing as to what person or persons have been so designated. The TOWN's Administrator or his designate shall administer requests for water on a day to day basis and the TOWN agrees to notify the AUTHORITY in writing as to what person or persons have been so designated.

4. (a) The quantity of water, if any, available from the Seller to the Purchaser or the ability of the Seller's system to transfer finished water to the Purchaser shall be determined by the Seller, in its sole discretion at the time of the request, in light of the following factors: a) the amount of raw water in existing or future water supplies at such time as they are available; b) present water demand, including demands under normal or emergency conditions; c) the amount of water available for purchase from other water purveyors; d) water filtration capacity; and e) water distribution mains, pumps, facilities and capacities and operating constraints thereto.

(b) The AUTHORITY fully expects that upon completion of the AUTHORITY's Cane Creek Reservoir project and the Jones Ferry Road Water Plant expansion project the AUTHORITY will be able to provide a maximum of 2 million gallons of water per day to the TOWN during the Original Term of this Agreement.

5. The Purchaser agrees to provide written notification to the Seller when water purchases from the Seller are no longer needed. Upon request by the Seller, during the period in which the Seller is providing water under this Agreement, the Purchaser shall impose water use restrictions for its customers at least equal to those imposed by the Seller. The Seller may make the provision of water to the Purchaser contingent upon such water use restrictions being imposed in the Purchaser's service area.

6. It is mutually understood and agreed that the rates and charges for water provided by one party to the other, and any changes or revisions thereof, shall be fair and reasonable. The charge for the water the Seller provides to the Purchaser pursuant to the provisions of Paragraph 4 of this Agreement shall be the Seller's direct and indirect cost of such water and shall be based on the unit costs of all expenses incurred to produce water, including but not limited to the costs of: energy and electricity; chemicals; materials; testing; maintenance; insurance; taxes; depreciation; debt service; salaries and benefits of employees directly involved in the operation of the Seller's water treatment plant and system, water purchases from other water purveyors; and other direct and indirect costs normally incurred in the supply, treatment, and distribution process and incremental costs of pertinent administrative services; provided, however, that in the event the Seller is purchasing finished water from another system during any part of the time it is also providing water to the Purchaser, the Seller may impose an additional reasonable surcharge applicable to water sales to the Purchaser. Said surcharge shall permit the Seller to adjust the water rate to reflect the actual cost of providing water to the Purchaser.