Section 6
Reclaimed Water Supply Capacity

Potential supplies of reclaimed water to the Town's service areas include the two existing supplies – the NCWRF and SCWRF, the new Western Wake Water Reclamation Facility (WWWRF) expected to be completed in 2014, and the Durham County TWWTP.

The Town has an interlocal agreement with Durham County to provide up to a peak hour of 150,000 gallons per hour reclaimed water from the TWWTP to the West Cary service area through 2021. The interlocal agreement assumes an annual average capacity limit of 0.7 mgd available to the Town of Cary through 2021. However, the Town ultimately anticipates supplying reclaimed water to this service area from its own facilities. Since supply from the TWWTP may be eventually discontinued, it was decided that this source will not be included in the future system scenarios.

The methodology for determining the future available reclaimed water supply from the NCWRF, SCWRF, and WWWRF is discussed in the following sections.

6.1 Methodology

As discussed in **Section 4.2**, the Town's reclaimed water demand, which is based heavily on irrigation, peaks in the summer months when the weather is driest and hottest. This corresponds with the period when wastewater flows are lowest. To avoid over commitment of finite resources, the minimum day wastewater flow is typically used to define the maximum day reclaimed water available. Average annual wastewater flow projections were developed for the following planning years as part of the Town's Long Range Water Resource Plan: 2015, 2020, 2025, 2030, 2035, 2040, 2050, and 2060. The steps used to estimate reclaimed water availability based on the average annual wastewater flow projections for future planning periods are as follows:

1) **Determine minimum day wastewater flow**. Based on daily wastewater flow data from 2006 through 2011 at the NCWRF and SCWRF, the ratio of minimum day to average annual wastewater flow is 0.75. This factor was applied to the average annual wastewater flow projections for each planning year to determine the minimum day flow.

2) **Determine maximum day total reclaimed water supply.** The minimum day wastewater flow was set equal to the total reclaimed water supply available on the maximum reclaimed water demand day.

3) **Subtract non-revenue water uses to determine maximum day supply to reclaimed water customers**. To determine the reclaimed water supply available to satisfy customer demand on the maximum day, the non-potable water use at the WRFs and miscellaneous non-revenue water estimates provided in Section 4 were subtracted from the total maximum day reclaimed water supply.

6.2 North Cary WRF Reclaimed Water Supply

The NCWRF wastewater flow projections and reclaimed water supply projections are provided in **Table 6-1**. By 2060, the NCWRF average annual day wastewater flow is expected to be 12.8 mgd. This corresponds to a total reclaimed water supply of 9.6 mgd, with 8.9 mgd available for the maximum day customer demand.

Table 6-1. North Cary WRF Reclaimed Water Supply Projections

	Wastewater Flow (mgd)		Reclaimed Water (mgd)		
Year	Average Annual Day[1]	Minimum Day[2]	Total Maximum Day Available	Non-Revenue Usage[3]	Maximum Day Available for Customer Demand
2015	8.0	6.0	**6.0**	0.5	**5.5**
2020	9.2	6.9	**6.9**	0.5	**6.4**
2025	10.1	7.6	**7.6**	0.6	**7.0**
2030	10.9	8.2	**8.2**	0.6	**7.6**
2035	11.6	8.7	**8.7**	0.6	**8.1**
2040	12.0	9.0	**9.0**	0.6	**8.4**
2050	12.7	9.5	**9.5**	0.7	**8.8**
2060	12.8	9.6	**9.6**	0.7	**8.9**

1) Average annual day influent wastewater flow projections provided from the Town's Long Range Water Resources Plan
2) Minimum day: average annual day ratio is 0.75 based on 2006-2010 WRF effluent data
3) Assume non-potable use at NCWRF remains constant at the current usage of 200,000 gpd; assume 5% of available reclaimed water for miscellaneous uses (system loss, bulk, safety factor); assume no blowoff on maximum day.

The available reclaimed water supply in Table 6-1 is provided on a daily basis. Since the peak hour of reclaimed water demand does not correspond with the peak hour wastewater effluent flow, equalization storage would be required to meet peak hour demands in the reclaimed system. A 1-million-gallon reclaimed water storage tank is currently located at the NCWRF. Additional peak hour storage could be located at the plant or in the distribution system. Specific storage needs for each future reclaimed water scenario are discussed as part of the hydraulic analysis in Section 8.

The NCWRF will be the future reclaimed water supply source for the proposed Northwest Cary service area. **Table 6-2** and **Figure 6-1** compare the reclaimed water supply at the NCWRF with the projected demands for the Northwest Cary service area (demands discussed in Section 5). Demand Scenario 2 includes the entire Town of Cary Urban Service Area and is discussed in Section 6.5. The NCWRF has adequate reclaimed water supply to meet the maximum day demands of the Northwest service area for Scenarios 1 and 4.1. Supply at the NCWRF is not enough to meet demand after 2025 for Scenario 3. For Scenario 4, a supply deficit of 1 mgd or less is projected after 2030 with the addition of all first-come first-served demands from Scenario 4.2.

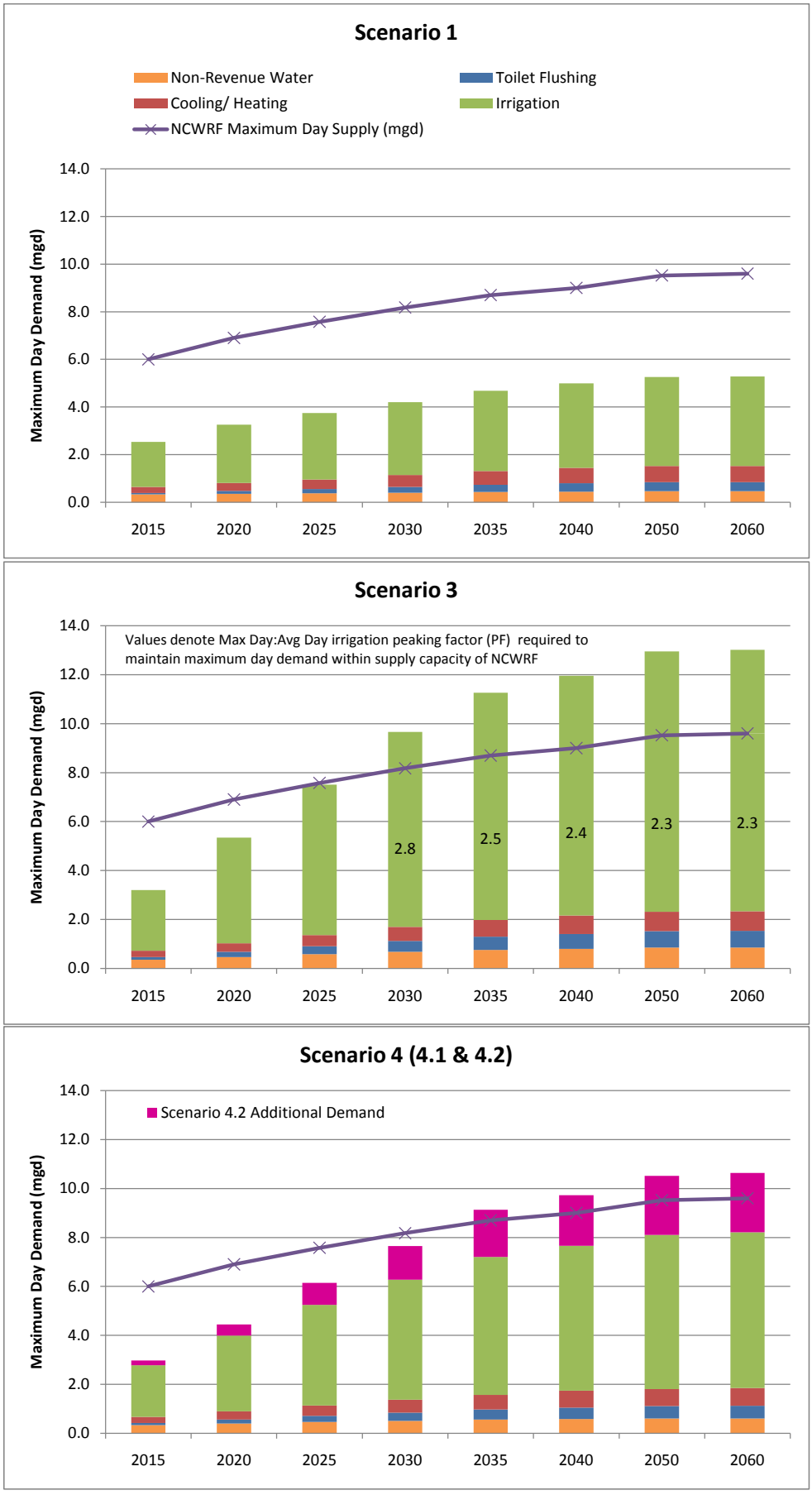

Figure 6-1.
Reclaimed Water Supply and Demand for the North and West Cary Service Area

Table 6-2. NCWRF Reclaimed Water Supply and Northwest Cary Service Area Demand

Year	Total Max Day Supply (mgd)	Scenario 1		Scenario 3		Scenario 4.1		Scenario 4.1 & 4.2	
		Max Day Demand* (mgd)	Deficit/ Surplus (mgd)	Max Day Demand* (mgd)	Deficit/ Surplus (mgd)	Max Day Demand[1] (mgd)	Deficit/ Surplus (mgd)	Max Day Demand* (mgd)	Deficit/ Surplus (mgd)
2015	**6.0**	2.5	3.5	3.2	2.8	2.8	3.2	3.0	3.0
2020	**6.9**	3.3	3.6	5.3	1.6	4.0	2.9	4.4	2.5
2025	**7.6**	3.8	3.8	7.5	0.1	5.3	2.3	6.1	1.5
2030	**8.2**	4.2	4.0	9.7	-1.5	6.3	1.9	7.7	0.5
2035	**8.7**	4.7	4.0	11.3	-2.6	7.2	1.5	9.1	-0.4
2040	**9.0**	5.0	4.0	12.0	-3.0	7.7	1.3	9.7	-0.7
2050	**9.5**	5.3	4.2	12.9	-3.4	8.1	1.4	10.5	-1.0
2060	**9.6**	5.3	4.3	13.0	-3.4	8.2	1.4	10.6	-1.0

*Maximum day demand projections include non-revenue water, as provided in Tables 5-5 through 5-9.

The NCWRF NPDES permit is based on mass nutrient loading. Conceivably, the NCWRF could be expanded to treat a higher flow and still meet its maximum loading requirement as long as enough nutrients were diverted through reclaimed water usage. Pursuit of this strategy would require an evaluation of the cost effectiveness of expanding the NCWRF to take advantage of the increased flow capability in the winter months. Irrigation use may not be reliable, and using reclaimed water for toilet flushing would not reduce the NCWRF's maximum loading, unless the wastewater is diverted to the WWWRF. Acceptance of this approach by NCDENR would also need to be evaluated.

6.2.1 Scenario 3 Supply Considerations

Based on the existing maximum day peaking factors (3.4 for irrigation use, 2.5 for cooling/heating use, 1.0 for toilet flushing use), the NCWRF will not be able to supply enough reclaimed water to meet the maximum day demand for Scenario 3. The following options were considered for meeting the full Scenario 3 demands:

- Supplement reclaimed water supply – Additional reclaimed water supply from the Durham County TWWTP could be considered, or a pipeline between the SCWRF and Northwest service area could be installed (approximately 10 miles) to supplement reclaimed water supply from the NCWRF.
- Employ demand management – Demand management techniques, such as alternate day watering, summer tiered water rates (on both potable and reclaimed systems), smart irrigation controllers, or revisions to time of day watering restrictions could be considered to reduce the maximum day peaking factor. As shown in Figure 6-1, the maximum day peaking factor on the irrigation portion of the reclaimed water demand would need to be reduced from 3.4 to 2.3 by 2060. It should be noted that the current system's maximum month peaking factor is 2.4. Therefore, future policies to reduce peak usage would need to result in a maximum day peaking factor that is slightly lower than the current maximum month peaking factor.

- Implement onsite customer storage for large user and supply daily demand at a flat rate over a 24 hour period. This could reduce the system peak flow demands and provide added reliability to customers.
- Implement seasonal storage – A large volume of seasonal storage could be implemented to augment the NCWRF supply during peak demand periods. One potential option for seasonal storage is the Triangle Quarry near the NCWRF. A previous study completed by the Town evaluated the potential for water supply storage at the Triangle Quarry. According to the study memorandum, the ultimate storage volume at the quarry is 4.77 billion gallons (CH2MHill, 2010). An analysis was performed to determine the approximate volume of storage needed to meet Scenario 3 maximum day demands. Demands in excess of the maximum month would need to be satisfied from storage. The Town's historical reclaimed water data was reviewed and based on the worst-case year for consecutive demand days exceeding maximum month (2003), the storage volume would need to be approximately 2.9 times the max day demand. This equates to 35 MG in 2060. In addition to the cost of a storage facility, water would need to be re-treated and re-pumped from storage.

While none of these options are desirable to the Town from a planning perspective, it is recognized that, in the future, it may be possible to reduce the peaking factor significantly due to technological advances in irrigation water conservation or changes in water usage patterns. If future reclaimed water peaks are lower, it may be possible to extend the system to serve the entire Scenario 3 service area.

6.2.2 Scenario 4 Supply Considerations

Although Table 6-2 and Figure 6-1 indicate a supply deficit for Scenario 4, this scenario was defined to balance the extent of the reclaimed water service area and targeted end uses with the future available supply from the NCWRF. With the current maximum day peaking factors, not all of the Scenario 4.2 additional areas would be able to be served. The system could be extended on a first-come, first-served basis as supply is available. However, due to future technological advances in irrigation water conservation or changes in water usage patterns, peaking factors may be reduced in the future which would allow for extension of the reclaimed water system to serve a greater portion or all of the Scenario 4 area.

6.3 South Cary WRF Reclaimed Water Supply

The SCWRF wastewater flow projections and reclaimed water supply projections are provided in **Table 6-3**. By 2060, the SCWRF average annual day wastewater flow is expected to be 8.4 mgd. This corresponds to a total reclaimed water supply of 6.3 mgd, with 5.7 mgd available for the maximum day customer demand.

The available reclaimed water supply in Table 6-3 is provided on a daily basis. Since the peak hour of reclaimed water demand does not correspond with the peak hour wastewater effluent flow, equalization storage would be required to meet peak hour demands in the reclaimed system. Peak hour storage could be located at the plant or in the distribution system. Specific storage needs for each future reclaimed water scenario are discussed as part of the hydraulic analysis in Section 8.

Table 6-4 and Figure 6-2 compare the reclaimed water supply at the SCWRF with the projected demand scenarios for the South Cary service area (demands discussed in Section 5). Demand Scenario 2 includes the entire Town of Cary Urban Service Area and is discussed in Section 6.5. In Scenarios 1, 3, and 4 there is a surplus in reclaimed water supply from the SCWRF. However, due to the distance between the Northwest Cary service areas and the SCWRF, it was decided that transmitting reclaimed water from the SCWRF to the Northwest Cary service areas would not be feasible.

Table 6-3. South Cary WRF Reclaimed Water Supply Projections

	Wastewater Flow (mgd)		Reclaimed Water (mgd)		
Year	Average Annual Day[1]	Minimum Day[2]	Total Maximum Day Available	Non-Revenue Usage[3]	Maximum Day Available for Customer Demand
2015	5.3	4.0	**4.0**	0.4	**3.6**
2020	5.8	4.4	**4.4**	0.4	**4.0**
2025	6.4	4.8	**4.8**	0.4	**4.4**
2030	6.9	5.2	**5.2**	0.5	**4.7**
2035	7.4	5.6	**5.6**	0.5	**5.1**
2040	7.7	5.8	**5.8**	0.5	**5.3**
2050	8.4	6.3	**6.3**	0.6	**5.7**
2060	8.4	6.3	**6.3**	0.6	**5.7**

1) Average annual day influent wastewater flow projections provided from the Town's Long Range Water Resources Plan
2) Minimum day: average annual day ratio is 0.75 based on 2006-2010 WRF effluent data
3) Assume non-potable use at SCWRF is 3% of average annual wastewater flow; assume 5% of available reclaimed water for miscellaneous water (system loss, bulk, safety factor); assume no blowoff on maximum day.

Table 6-4. SCWRF Reclaimed Water Supply and South Cary Service Area Demands

Year	Total Max Day Supply (mgd)	Scenario 1		Scenario 3 / Scenario 4[2]	
		Max Day Demand[1] (mgd)	Deficit/ Surplus (mgd)	Max Day Demand[1] (mgd)	Deficit/ Surplus (mgd)
2015	4.0	0.5	3.5	0.6	3.4
2020	4.4	0.5	3.9	0.7	3.7
2025	4.8	0.6	4.2	0.9	3.9
2030	5.2	0.6	4.6	1.1	4.1
2035	5.6	0.6	5.0	1.4	4.2
2040	5.8	0.6	5.2	1.5	4.3
2050	6.3	0.6	5.7	1.7	4.6
2060	6.3	0.6	5.7	1.7	4.6

1) Maximum day demand projections include non-revenue water, as provided in Tables 5-5 through 5-9.
2) South Cary Service Area demands are the same for Scenario 3 and Scenario 4

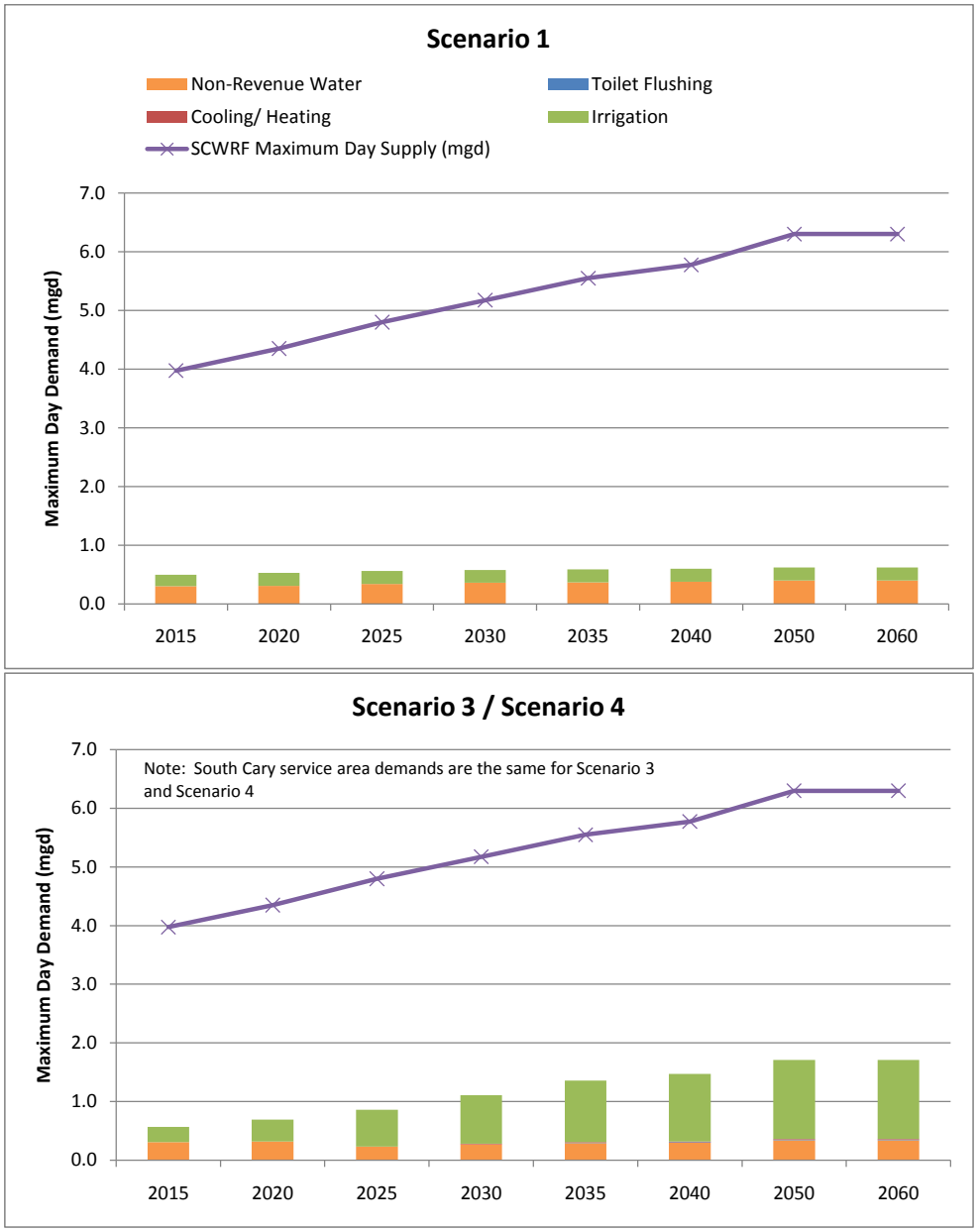

Figure 6-2.
Reclaimed Water Supply and Demand for the South Cary Service Area

6.4 Western Wake WRF Reclaimed Water Supply

The WWWRF is located north of US 1 and just south of Old US 1 in the southwestern portion of Wake County, as shown in **Figure 6-3**. The regional facility will treat wastewater flow from the Towns of Apex, Cary, and Morrisville. The WWWRF treatment train includes a biological nutrient removal treatment process, secondary clarifiers, tertiary filters, and UV disinfection. Construction is expected to be completed in 2014. The facility will be capable of producing reclaimed water for distribution that meets the NCDENR reclaimed water quality standards.

Projections of wastewater flow from the Town of Cary, Town of Morrisville, Research Triangle Park South, and the Raleigh-Durham International Airport to the WWWRF are included in **Table 6-5**. The potential reclaimed water supply from the portion of the plant's flow attributed to the Town of Cary wastewater service area (excluding wastewater flow from Town of Apex) is also provided in Table 6-5. By 2060, this portion of the WWWRF average annual day wastewater flow is expected to be 7.5 mgd. This corresponds to a total reclaimed water supply of 5.6 mgd, with 5.1 mgd available for maximum day customer demand.

Table 6-5. Western Wake WRF Reclaimed Water Supply Projections

Year	Average Annual Day[1]	Minimum Day[2]	Maximum Day Available	Other Non-Revenue Water[4]	Maximum Day Available for Customer Demand[3]
2015	2.9	2.2	**2.2**	0.11	**2.0**
2020	4.0	3.0	**3.0**	0.15	**2.7**
2025	5.0	3.8	**3.8**	0.19	**3.4**
2030	5.7	4.3	**4.3**	0.21	**3.9**
2035	6.5	4.9	**4.9**	0.24	**4.4**
2040	7.0	5.3	**5.3**	0.26	**4.8**
2050	7.5	5.6	**5.6**	0.28	**5.1**
2060	7.5	5.6	**5.6**	0.28	**5.1**

1) Average annual day wastewater flow projections provided from the Town's Long Range Water Resources Plan. Includes wastewater flow from the Town of Cary, Town of Morrisville, RTP South, and RDU Airport
2) Minimum day: average annual day ratio is 0.75 based on 2006-2010 WRF effluent data
3) Assume non-potable use at WWWRF is 3% of average annual wastewater flow; assume 5% of available reclaimed water for miscellaneous uses (system loss, bulk, safety factor); assume no blowoff on maximum day.

The potential supply of reclaimed water from the WWWRF available for the Town's use is less than the available supply from the NCWRF or SCWRF. In addition, the facility is located a significant distance from the reclaimed water service areas. The distance from the WWWRF to the West Cary service area (nearest to the plant) following Old US 1 Highway and Kelly Road is approximately 9 miles. It is estimated that a pipeline from the WWWRF to the southern tip of the West Cary service area would cost $20 to $30 million. Due to the high cost of conveying reclaimed water from the WWWRF to the Town's service areas, it was decided that the WWWRF will not be considered as a source of reclaimed water for the future scenarios.

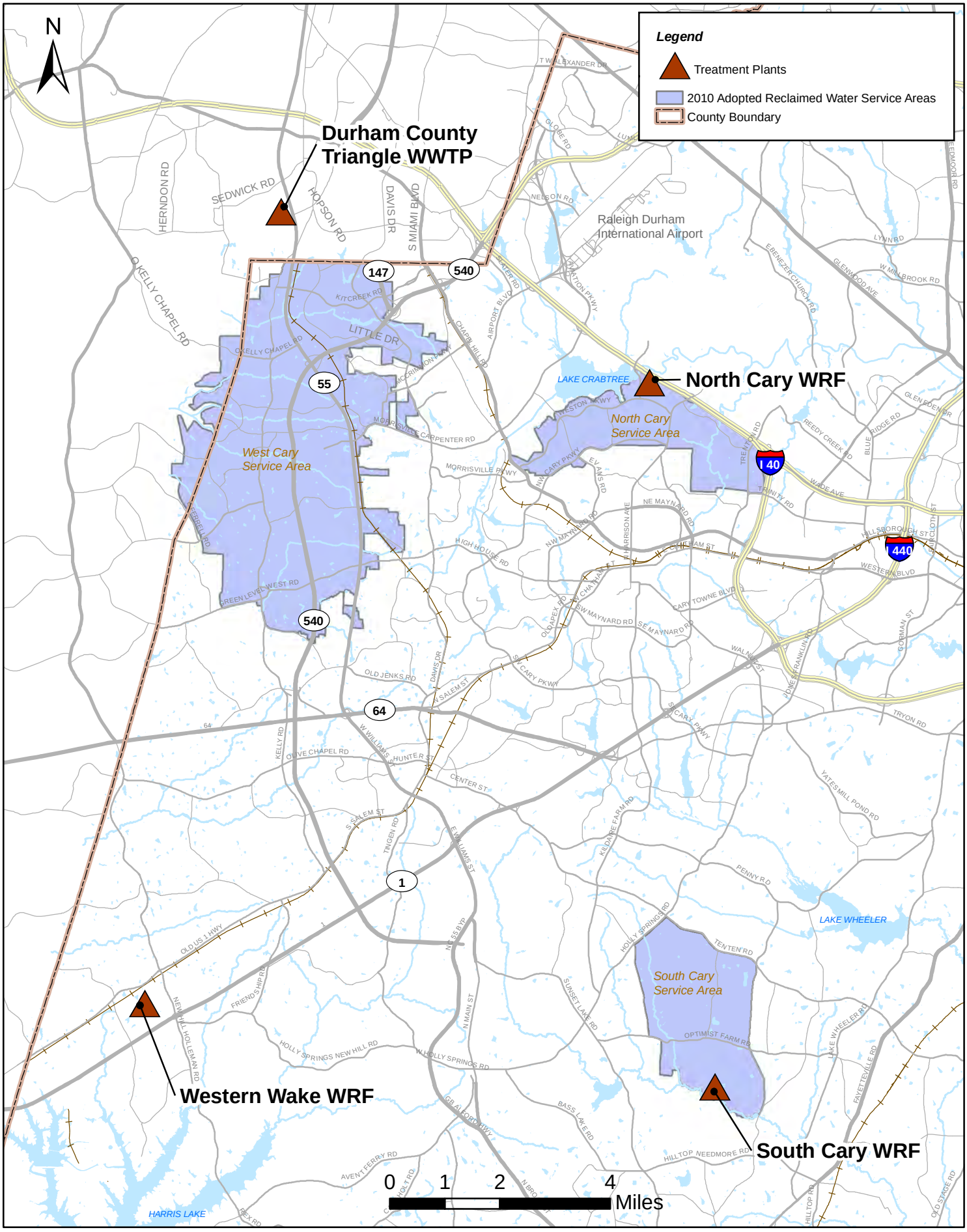

Figure 6-3
Location of Western Wake WRF

6.5 Total Supply Capacity

Demand Scenario 2 (discussed in **Section 5**) provides reclaimed water to the entire Town of Cary Urban Service Area. **Table 6-6** summarizes the reclaimed water supply available from all sources. Even including the WWWRF, the supply of reclaimed water is not sufficient to meet the maximum day demands of Scenario 2. **Figure 6-4** compares the combined reclaimed water supply from the NCWRF and SCWRF with the projected demands for Scenario 2. The maximum day demand exceeds supply from the NCWRF and SCWRF by approximately 5 mgd in 2030 and 10 mgd by 2060. This deficit could be partially mitigated by adoption of maximum flow rate delivery of reclaimed water, system storage and on-site customer storage to extend and maximize the benefit of reclaimed water in the service area as discussed in section 6.2.1.

However, as shown in Figure 6-4, a reduction in the maximum day peaking factor on the irrigation portion of the reclaimed water demand from 3.4 to 1.9 by 2060 would need to be achieved to meet the Scenario 2 peak demands with supply from the NCWRF and SCWRF. The irrigation peaking factor of 1.9 that would be required for this scenario is almost the same as the Town's summer average day reclaimed water peaking factor (1.6). Additionally, the overall maximum day peaking factor for the potable water system (1.64) is only slightly lower than the 1.9 peaking factor that would need to be achieved for reclaimed water irrigation. Without significant quantities of seasonal storage, it would not be feasible to implement a reasonable peak management program that would reduce the peaking factor this low.

Table 6-6. Summary of Total Reclaimed Water Supply and Scenario 2 (Town-Wide) Demands

Year	Maximum Day Available Supply[1] (mgd)	Maximum Day Available Supply w/ WWWRF[2] (mgd)	Scenario 2	
			Max Day Demand (mgd)	Deficit (mgd)[3]
2015	10.0	12.2	4.4	5.6
2020	11.3	14.3	8.3	3.0
2025	12.4	16.2	12.9	-0.5
2030	13.4	17.7	18.3	-4.9
2035	14.3	19.2	22.5	-8.2
2040	14.8	20.1	23.9	-9.1
2050	15.8	21.4	25.7	-9.9
2060	15.9	21.5	25.8	-9.9

1) Includes NCWRF and SCWRF
2) Includes NCWRF, SCWRF, and WWWRF
3) Based on NCWRF and SCWRF available supply

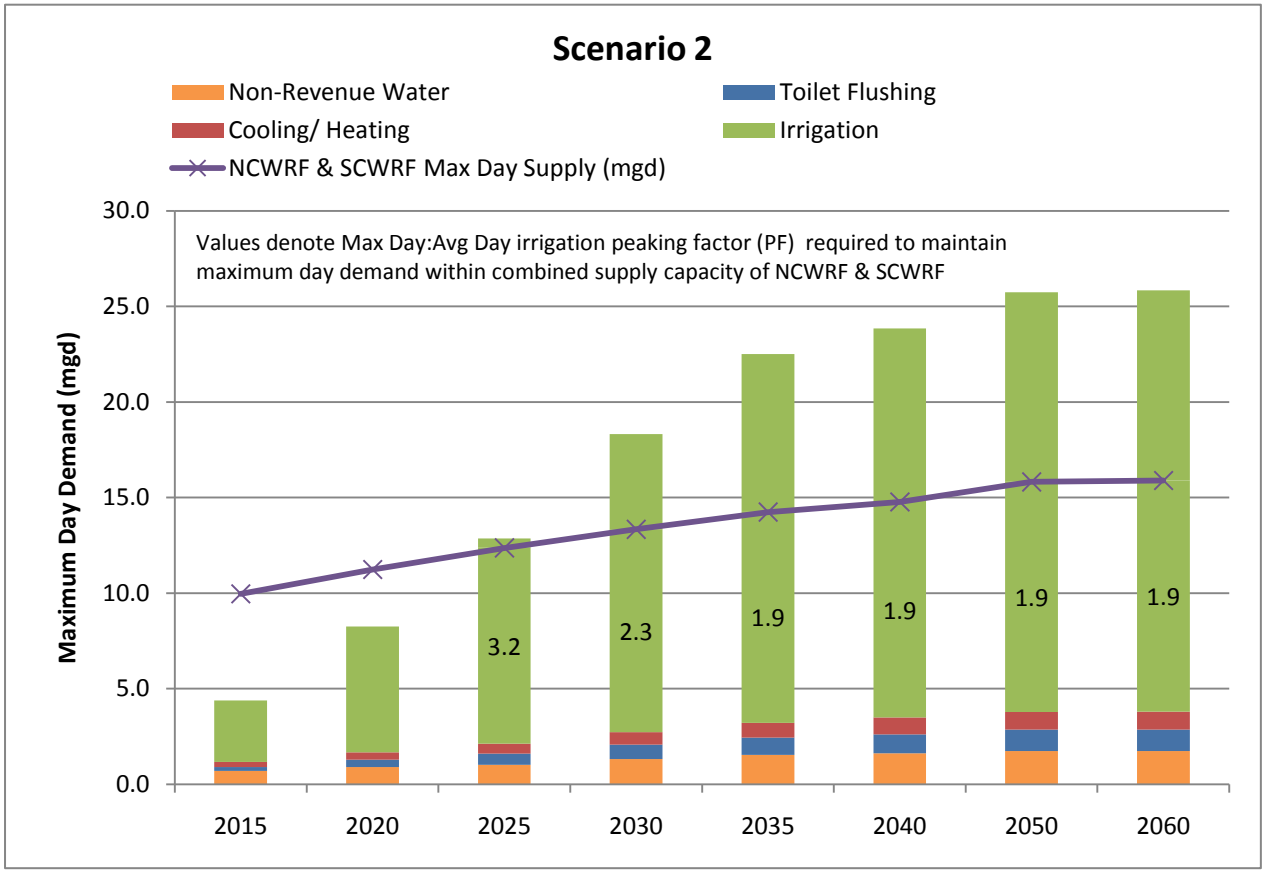

Figure 6-4.
Reclaimed Water Supply and Demand for the Urban Service Area (Scenario 2)