ARCADIS

Northwest Georgia Regional Wastewater Treatment Study

Appendix C

Study Area Population Trends and Projections and Build-Out Numbers

Study Area Population Trends and Projections and Build-Out Numbers

Available documentation on past trends in study area population indicates a pattern of generally increasing population.

Catoosa County:

1. 167sm/107k ac (JP); 162sm/104k ac (USCB):
2. Population trends (and projections):

1900:	7,000				
1910:	7,184 (HS)				
1920:	6,677 (HS)				
1925:	[8,000](e)				
1930:	9,421 (HS)				
1935:	[10,750](e)				
1940:	12,199 (HS)				
1945:	[13,550](e)				
1950:	15,146 (HS)				
1955:	[17,800](e)				
1960:	21,101 (HS)				
1965:	[24,500](e)				
1970:	28,271 (HS)	28,271 (JP)	28,422 (W&P)		
1975:	[32,500](e)				
1980:	36,991 (CP)	36,991 (JP)	37,133 (W&P)		
1985:	39,805 (CP)	[39,500](e)***			
1990:	42,464 (CP)	42,464 (JP)	42,464 (USCB)	42,691 (W&P)	
1995:	48,808 (CP)	47,482 (JP)			
2000:	53,232 (CP)*	53,358 (JP)	53,282 (USCB)	53,583 (W&P)	53,282 (03)
2005:	58,237 (CP)	59,813 (JP)	60,577 (03)	59,275 (W&P)	
2010:	63,245 (CP)	67,479 (JP)	67,961 (03)	64,966 (W&P)	
2015:	68,432 (CP)	77,196 (JP)	76,684 (03)	71,000 (W&P)	
2020:	73,701 (CP)	[86,450](e)	87,463 (03)	77,112 (W&P)	
2025:	78,900 (CP)	[95,100](e)	101,319 (03)	83,510 (W&P)	

*also 53,424

3. Population rates of growth trends and projections:

1900:	7,000	
1910:	7,184 + 2.6% (HS)	
1920:	6,677 - 7.1% (HS)	
1925:	[8,000]+19.8% (e)	
1930:	9,421 + 17.7% (HS)	
1935:	[10,750] + 14.0% (e)	
1940:	12,199 + 13.5% (HS)	
1945:	[13,550] + 11.1% (e)	
1950:	15,146 + 11.8% (HS)	
1955:	[17,800] + 17.5% (e)	
1960:	21,101 + 18.5% (HS)	
1965:	[24,500] + 16.1% (e)	
1970:	28,271 + 15.4% (HS)	28,422 (W&P)

1975: [32,500] + 15.0% (e) +30.6%			
1980: 36,991 + 13.8% (CP)	36,991 (JP)	37,133 (W&P)	
1985: 39,805 + 7.6% (CP)	[39,500]+ 6.8%(e) +15.0%		
1990: 42,464 + 6.7% (CP)	42,464 + 7.5% (JP)	42,691 (W&P)	
1995: 48,808 + 14.9% (CP)	47,482 +11.8% (JP) +25.5%	53,583 (W&P)	
2000: 53,232* + 9.1% (CP)**	53,358 +12.4% (JP)**	53,282(03)+10.6%	
2005: 58,237 + 9.4% (CP)	59,813 +12.1% (JP)	60,577 +13.7% (03)+ 9.6%	59,275 (W&P)
2010: 63,245 + 8.6% (CP)	67,479 +12.8% (JP)	67,961 +12.2% (03)+ 9.3%	64,966 (W&P
2015: 68,432 + 8.2% (CP)	77,196 +14.4% (JP)	76,684 +12.8% (03)+ 8.6%	71,000 (W&P)
2020: 73,701 + 7.7% (CP)	[86,450]+12.0% (e)	87,463 +14,1% (03)+ 8.3%	77,112 (W&P)
2025: 78,900 + 7.1% (CP)	[95,100]+10.0% (e)	101,319 +15.8% (03)	83,510 (W&P)

*also 53,424
**53,282 USCB

4. Density (persons/sm) using (CP) populations and (USCB) area of 162sm (CP) vs. area of 167sm (JP):

1900: 7,000 / 162 = 43 (CP) / 167 = 42 (JP)
1910: 7,184 / 162 = 44 (CP) / 167 = 43 (JP)
1920: 6,677 / 162 = 41 (CP) / 167 = 40 (JP)
1930: 9,421 / 162 = 58 (CP) / 167 = 56 (JP)
1940: 12,199 / 162 = 75 (CP) / 167 = 73 (JP)
1950: 15,146 / 162 = 93 (CP) / 167 = 91 (JP)
1960: 21,101 / 162 = 130 (CP) / 167 = 126 (JP)
1970: 28,271 / 162 = 175 (CP) / 167 = 169 (JP)
1980: 36,991 / 162 = 228 (CP) / 167 = 222 (JP)
1985: 39,805 / 162 = 246 (CP) / 167 = 238 (JP)
1990: 42,464 / 162 = 262 (CP) / 167 = 254 (JP)
1995: 48,808 / 162 = 301 (CP) / 167 = 292 (JP)
2000: 53,232 / 162 = 329 (CP) / 167 = 319 (JP)
2005: 58,237 / 162 = 359 (CP) / 167 = 349 (JP)
2010: 63,245 / 162 = 390 (CP) / 167 = 379 (JP)
2015: 68,432 / 162 = 422 (CP) / 167 = 410 (JP)
2020: 73,701 / 162 = 455 (CP) / 167 = 441 (JP)
2025: 78,900 / 162 = 487 (CP) / 167 = 472 (JP)

Dade County:

1. 168sm/108k ac (JP); 174sm/111k ac (USCB)
2. Population trends (and projections):

1970:	10,100 (CP)	9,910 (JP)	10,052 (W&P)		
1975:	[11,200] (e)				
1980:	12,300 (CP)	12,318 (JP)	12,298 (W&P)		
1985:	11,800 (CP)				
1990:	13,053 (CP)	13,147 (JP)	13,190 (W&P)	13,147 (USCB)	
1995:	14,506*(CP)	14,102 (JP)			
2000:	15,959*(CP)	15,802 (JP)	15,154 (03)	15,154 (USCB)	15,167 (W&P)
2005:	17,412*(CP)	17,455 (JP)	16,464 (03)	[16,400] (e)	
2010:	18,865*(CP)	19,322 (JP)	17,852 (03)	17,554 (W&P)	
2015:	(CP)	21,346 (JP)	19,259 (03)	[18,800] (e)	
2020:	(CP)	[23,500](e)	20,641 (03)	20,147 (W&P)	
2025:	(CP)	[25,800](e)	22,033 (03)	[21,658] (e)	

*using the linear regression method

3. Population rates of growth trends and projections:

1970:	10,100 (CP)	9,910 (JP)	10,052 (W&P)	
1975:	[11,200] + 10.9% (e)	[11,100]+12.0% (e)+22.3%		
1980:	12,300 + 9.8% (CP)	12,318 + 9.7% (JP)	12,298 (W&P)	
1985:	11,800 - 4.2% (CP)	[12,700]+ 5.7% (e) + 7.3%		
1990:	13,053 + 10.6% (CP)	13,147 + 3.5% (JP)	13,190 (W&P)	
1995:	14,506* + 11.1% (CP)	14,102 + 7.3% (JP)+25.0%		
2000:	15,959* + 10.0% (CP)**	15,802 +12.1% (JP)**	15,154 (03) + 8.1%	15,167 (W&P)
2005:	17,412* + 9.1% (CP)	17,455 +10.5% (JP)	16,464 +8.6% (03) + 7.0%	[16,400](e)
2010:	18,865* + 8.3% (CP)	19,322 +10.7% (JP)	17.852 + 8.4% (03) + 7.1%	17,554 (W&P)
2015:	(CP)	21,346 +10.5% (JP)	19.259 + 7.9% (03) + 7.2%	[18,800](e)
2020:	(CP)	[23,500]+10.0% (e)	20,641 + 7.2% (03) + 7.5%	20,147 (W&P)
2025:	(CP)	[25,800]+10.0% (e)	22,033 + 6.7% (03)	[21,658](e)

*using the linear regression method
**15,154 (USCB)

4. Density (persons/sm) using (CP) populations and (CP) and (JP) area of 168sm vs. (USCB) area of 174sm:

1970:	10,100 / 168 = 60 (CP)	/ 174 = 58 (USCB)
1975:	11,200*/ 168 = 67 (CP)	/ 174 = 64 (USCB)
1980:	12,300 / 168 = 73 (CP)	/ 174 = 71 (USCB)
1985:	11,800 / 168 = 70 (CP)	/ 174 = 68 (USCB)
1990:	13,053 / 168 = 78 (CP)	/ 174 = 75 (USCB)
1995:	14,506 / 168 = 86 (CP)	/ 174 = 83 (USCB)
2000:	15,959 / 168 = 95 (CP)	/ 174 = 92 (USCB)
2005:	17,412 / 168 = 104 (CP)	/ 174 = 100 (USCB)
2010:	18,865 / 168 = 112 (CP)	/ 174 = 108 (USCB)
2015:	/ 168 = ??? (CP)	/ 174 = ??? (USCB)
2020:	/ 168 = ??? (CP)	/ 174 = ??? (USCB)
2025:	/ 168 = ??? (CP)	/ 174 = ??? (USCB)

* estimated

Walker County:

1. 445sm/285k ac (JP); 447sm/286k ac (USCB)
2. Population trends (and projections):

1960: 42,264 (CP)	42,264 (CP)				
1965:[46,500](e)					
1970: 50,691 (CP)	50,691 (JP)	50,986 (W&P)			
1975:[53,600](e)					
1980: 56,470 (CP)	56,470 (JP)	56,604 (W&P)			
1985:[57,900](e)	58,340 (JP)				
1990: 59,352*(CP)	58,340 (JP)	58,360 (W&P)			
1995: 62,548 (CP)	61,897 (JP)**				
2000: 65,454*(CP)	64,662 (JP)	61,053 (USCB)	61,053 (03)	61,111 (W&P)	
2005: 69,012 (CP)	69,091 (JP)	63,441 (03)	[62,700](e)		
2010: 71,849 (CP)	74,070 (JP)	65,785 (03)	64,214 (W&P)		
2015: (CP)	79,681 (JP)	68,455 (03)	[66,000](e)		
2020: (CP)	[85,250](e)	71,614 (03)	67,777 (W&P)		
2025: (CP)	[90,365](e)	75,405 (03)	69,729 (W&P)		

*alternative figures are also provided:
1990: 58,232
2000: 60,827
**also 60,654

3. Population rates of growth trends and projections:

1960: 42,264 (CP)				
1965: [46,500]+10.0% (e)	[46,500]+10.0% (e)			
1970: 50,691 + 9.0% (CP)	50,691 + 9.0% (JP)	50,986 (W&P)		
1975: [53,600]+ 5.7% (e)	[53,600]+ 5.7% (e)			
1980: 56,470 + 5.3% (CP)	56,470 + 5.3% (JP)	56,604 (W&P)		
1985: [57,900]+ 2.5% (e)	[57,400]+ 1.6% (e)			
1990: 59,352*+ 2.5% (CP)	58,340 + 1.6% (JP)	58,360 (W&P)		
1995: 62,548 + 5.4% (CP)	61,897 + 6.1% (JP)			
2000: 65,454*+ 4.6% (CP)	64,662** 4.5% (JP)	61,053(03)	61,111(W&P)	
2005: 69,012 + 5.4% (CP)	69,091 + 6.8% (JP)	63,441 + 3.9% (03)	[62,700](e)	
2010: 71,849 + 4.1% (CP)	74,070 + 7.2% (JP)	65,785 + 3.7% (03)	64,214 (W&P)	
2015: (CP)	79,681 + 7.5% (JP)	68,455 + 4.1% (03)	[66,000](e)	
2020: (CP)	[85,250]+ 7.0% (e)	71,614 + 4.6% (03)	67,777 (W&P)	
2025: (CP)	[90,365]+ 6.0% (e)	75,405 + 5.2% (03)	69,729 (W&P)	

*alternative figures are also provided:
1990: 58,232
2000: 60,827
**61,053 (USCB)

4. Density (persons/sm) using (CP) populations and (USCB) area of 447sm (CP) vs. area of 445sm (JP):

1970: 50,691 / 447 = 113 (CP) / 445 = 114 (JP)
1980: 53,600 / 447 = 120 (CP) / 445 = 120 (JP)
1985: 57,900 / 447 = 130 (CP) / 445 = 130 (JP)
1990: 59,352 / 447 = 133 (CP) / 445 = 133 (JP)
1995: 62,548 / 447 = 140 (CP) / 445 = 141 (JP)
2000: 65,454 / 447 = 146 (CP) / 445 = 147 (JP)
2005: 69,012 / 447 = 154 (CP) / 445 = 155 (JP)
2010: 71,849 / 447 = 161 (CP) / 445 = 161 (JP)
2015: / 447 = ??? (CP) / 445 = ??? (JP)
2020: / 447 = ??? (CP) / 445 = ??? (JP)
2025: / 447 = ??? (CP) / 445 = ??? (JP)

* estimated

Whitfield County:

1. 290sm/186k ac (USCB); 281sm/180k ac (JP)
2. Population trends (and projections)*:

1970:	? (USCB)	55,108 (JP)
1975:	? (USCB)	60,450 (e)***
1980:	? (USCB)	65,789 (JP)
1985:	? (USCB)	69,100 (e)***
1990:	72,462 (USCB)	72,462 (JP)
1995:	78,000 (e)***	78,033 (JP)**
2000:	83,525 (USCB)	86,435 (JP)
2005:	? (USCB)	94,431 (JP)
2010:	? (USCB)	103,367 (JP)
2015:	? (USCB)	113,602 (JP)
2020:	? (USCB)	
2025:	? (USCB)	

*no comprehensive plan available
**alternative figures are also provided:
1995: 76,961
***estimated

3. Population rates of growth trends and projections:

1970:	?	(USCB)	55,108 (JP)
1975:	?	(USCB)	60,450 + 9.7% (e)***
1980:	?	(USCB)	65,789 + 8.8% (JP)
1985:	?	(USCB)	69,100 + 5.0% (e)***
1990:	72,462	(USCB)	72,462 + 4.9% (JP)
1995:	78,000 + 7.6% (e)***		78,033 + 7.7% (JP)**
2000:	83,525 + 7.1% (USCB)		86,435 +10.8% (JP)
2005:	?	(USCB)	94,431 + 9.3% (JP)
2010:	?	(USCB)	103,367 + 9.5% (JP)
2015:	?	(USCB)	113,602 + 9.9% (JP)
2020:	?	(USCB)	
2025:	?	(USCB)	

*no comprehensive plan available
**alternative figures are also provided:
1995: 76,961
***estimated

4. Density (persons/sm) using (JP) populations and (USCB) area of 290sm vs. area of 281sm (JP):

1970: 55,108 ö 290 = 190 (CP) ö 281 = 196 (JP)
1975: 60,450 ö 290 = 208 (CP) ö 281 = 215 (JP)
1988: 65,789 ö 290 = 227 (CP) ö 281 = 234 (JP)
1985: 69,100 ö 290 = 238 (CP) ö 281 = 246 (JP)
1990: 72,462 ö 290 = 250 (CP) ö 281 = 258 (JP)
1995: 78,033 ö 290 = 269 (CP) ö 281 = 278 (JP)
2000: 86,435 ö 290 = 298 (CP) ö 281 = 308 (JP)
2005: 94,431 ö 290 = 326 (CP) ö 281 = 336 (JP)
2010: 103,367 ö 290 = 356 (CP) ö 281 = 368 (JP)
2015: 113,602 ö 290 = 392 (CP) ö 281 = 404 (JP)
2020: ? ö 290 = ??? (CP) ö 281 = ??? (JP)
2025: ? ö 290 = ??? (CP) ö 281 = ??? (JP)

*estimated

Relative US and Georgia population and rates of growth (from CVRDC-NGRDC joint regional plan):

1. US population trends:

1970: 203,302,031
1975:
1980: 226,545,805 +11.4%
1985:
1990: 248,709,873 + 9.8%
1995:
2000: 275,306,000 +10.7%
2005:
2010:
2015:
2020:
2025:

2. Georgia population trends (and projections):

1970: 4,587,930
1975:
1980: 5,462,989 +19.1%
1985:
1990: 6,478,216 +18.6%
1995:
2000: 7,884,000 +21.7% 8,186,453**+26.4%
2005: 8,477,000 + 7.5%
2010: 9,492,000 +12.0%
2015: 10,416,000 + 9.7%
2020:
2025:

*from averaged USCB figures (G. below)
**from USCB 2000

3. US population trends and projections from USBC:

1990: 249,439,000
1995: 262,765,000 + 5.3%
2000: 275,306,000 + 4.8%
2005: 287,716,000 + 4.5%
2010: 299,862,000 + 4.2%
2015: 312,268,000 + 4.1%
2020: 324,927,000 + 4.1%
2025: 337,815,000 + 4.0%
2030: 351,070,000 + 3.9%

2000 Populations, Trends, Areas and Densities

1. Catoosa County: 53,232 + 9.1% / 167sm =319/sm
2. Dade County: 15,959 +10.0% / 168sm = 95/sm
3. Walker County: 65,454 + 4.6% / 445sm =146/sm
4. Whitfield County: 86,435 +10.8% / 281sm =298/sm

2010 Populations, Trends, Areas and Densities

1. Catoosa County: 63,245 + 8.6% / 167sm =390/sm
2. Dade County: 18,865 + 8.3% / 168sm =112/sm
3. Walker County: 71,849 + 4.1% / 445sm =161/sm
4. Whitfield County: 103,367 + 9.5% / 281sm =356/sm

Recommended Populations, Trends, Area, Densities and Future Growth Projections

1. Catoosa County: 53,232 +11.3% / 162sm = 329/sm +10.0%
2. Dade County: 15,154 + 7.5% / 174sm = 87/sm +10/0%
3. Walker County: 61,053 + 7.5% / 447sm = 137/sm + 7.5%
4. Whitfield County: 83,525 + 7.1% / 290sm = 288/sm + 7.5%

General Observation Notes

1. While the current projected population density of Whifield County (356/sm) is a little less than that of Catoosa County (390/sm), the fact that Whitfield County consistently grows just a little bit faster than Catoosa County means that it may eventually catch up (in about 25 years?)
2. Catoosa County and Whitfield County have by far the highest population densities (329 and 298/sm) in the study area
3. Walker County (146/sm) has less than half the population density of Catoosa County and Whitfield County
4. Dade County (95/sm) has only about 65% of the population density even of Walker County (146/sm) and only about 30% that of the other two, but since it is growing at roughly the same rate as Catoosa County and Whitfield County, it will remain the same in relation to them as it catches up to the population density of Walker County
5. By 2010 both Catoosa County and Whitfield County will be approaching a population density of 400/sm, but Dade County (112/sm) may only be at 70% of the then Walker County density (161/sm)
6. It could be projected that by 2025 Catoosa County will be nearing a population density of 500/sm and Whitfield County will be nearing 450/sm, while Walker County will be nearing 185/sm and Dade County will be nearing only 140/sm
7. It could also be projected that by 2040, Catoosa County will be nearing a population density of 600/sm, Whitfield County will be nearing 560/sm, Walker County will be over 200/sm and Dade County will be over 170/sm

8. If Whitfield County and Catoosa County are combined for purposes of analysis, together they are about the same size (448sm) as Walker County (445sm), with over twice the population (139,667 vs. 65,454) that could swell to over two and a half times as large by 2040 (257,894 vs. 93,450) if trends continue

Population Trends from Woods & Poole (interpolated data gap shown thus [*]):

Year	Catoosa	Dade	Walker	Georgia	United States
1970	28,422 +30.6%	10,052 +22.3%	50,986 +11.0%	4,611,100 +18.9%	203,982.000 +11.4%
1980	37,133 +15.0%	12,298 + 7.3%	56,604 + 3.1%	5,484,440 +18.6%	227,226,000 + 9.8%
1990	42,691 +25.5%	13,190 +25.0%	58,360 + 4.7%	6,506,530 +26.4%	249,464,000 +13.1%
2000	53,583 +10.6%	15,167 + 8.1%	61,111 + 2.6%	8,229,820 + 6.6%	282,125,000 + 4.9%
2005	[59,275] + 9.6%	[16,400] + 7.0%	[62,700] + 2.4%	[8,772,988] + 6.6%	[295,949,000] + 4.9%
2010	64,966 + 9.3%	17,554 + 7.1%	64,214 + 2.8%	9,349,660 + 6.3%	310,519,000 + 4.9%
2015	[71,000] + 8.6%	[18,800] + 7.2%	[66,000] + 2.7%	[9,938,700] + 6.2%	[325,725,000] + 4.9%
2020	77,112 + 8.3%	20,147 [+ 7.5%]	67,777 + 2.9%	10,550,700 + 6.0%	341,658,000 + 4.9%
2025	83,510	[21,658]	69,729	11,185,100	358,301,000

Draft Population Projections from CVRDC (provided Monday, 29 September 2003)* with USCB, JP or CP Data Prior to 2000:

Year	Catoosa	Dade	Walker	Whitfield	Region**
1970	28,271	9,910	50,961	55,108	
	+13.1%	+24.3%	+10.8%	+19.4%	
1980	36,991	12,318	56,470	65,789	
	+14.8%	+ 6.7%	+ 3.3%	+10.1%	
1990	42,464	13,147	58,340	72,462	
	+25.5%	+15.3%	+ 4.6%	+15.3%	
2000	53,282	15,154	61,053	83,525	697,410
	+13.7%	+ 8.6%	+ 3.9%	+10.1%	+15.8%
2005	60,577	16,464	63,441	91,999	807,576
	+12.2%	+ 8.4%	+ 3.7%	+ 8.9%	+16.1%
2010	67,961	17,852	65,785	100,191	937,465
	+12.8%	+ 7.9%	+ 4.1%	+ 7.6%	+16.4%
2015	76,684	19,259	68,455	107,792	1,091,993
	+14.1%	+ 7.2%	+ 4.6%	+ 6.1%	+17.3%
2020	87,463	20,641	71,614	114,385	1,281,385
	+15.8%	+ 6.7%	+ 5.2%	+14.6%	+19.6%
2025	101,319	22,033	75,405	130,938	1,532,621

*These figures trend as follows compared to the Woods & Poole projections:

- significantly higher for Catoosa County
- marginally higher for Dade County
- up to 10% higher for Walker County

**The 15-county region includes Bartow, Chattooga, Fannin, Gilmer, Gordon, Harrelson, Murray, Paulding, Pickins, and Polk

Wednesday, 30 September 2003

Reviewed various growth rate formulas as applied to Catoosa County population:

1. If doubled, USCB year 2000 count of 53,282 becomes 107,000 (+100.8%)

2. CVRDC-NGRDC joint plan (JP):

   2000: estimate: 53,358
   2005: + 12.0%: 59,813
   2010: + 12.8%: 67,479
   2015: + 14.4%: 77,196
   2020: + 13.6%: 87,695*
   2025: + 14.0%: 99,972*

   * averaging previous decade

3. Catoosa County Public Schools \ Kyle Smith suggests an increase of 1,100/yr:

   2000: USCB: 53,282
   2005: + 10.3%: 58,782
   2010: + 9.4%: 64,282
   2015: + 8.6%: 69,782
   2020: + 7.9%: 75,282
   2025: + 7.3%: 80,782

Reviewed various growth rate formulas as applied to Walker County population:

1. If doubled, USCB year 2000 count of 61,053 becomes 122,100 (+100.8%)

2. CVRDC-NGRDC joint plan (JP):

   2000: estimate: 64,662
   2005: + 6.8%: 69,091
   2010: + 7.2%: 74,070
   2015: + 7.7%: 79,681
   2020: + 7.5%: 85,657*
   2025: + 7.6%: 92,167*

   *averaging previous decade

3. If Walker County assertions of low 2000 count are correct and Walker County anticipation of doubling population is correct, then actual year 2000 population of 70,000 becomes 140,000

4. Estimated "averaging of results of the three "methods":

   2000: USCB: 61,053
   2005: + 14.5%: 69,906
   2010: + 14.0%: 79,692
   2015: + 14.0%: 90,849
   2020: + 14.0%: 103,568
   2025: + 14.0%: 118,068 (93.4% above USCB 2000)

Referenced USCB website to determine highest and lowest density areas of the Chattanooga-Hamilton County metropolitan area:

1. Some areas have densities from 3,000-5,000/sm:

   A. 010.00 (Downtown-Lincoln Park): 0.5sm @ 5,011/sm
   B. 003.00 (East Chattanooga-Bushtown): 0.5sm @ 4,130/sm
   C. 014.00 (Downtown-Central Avenue): 0.7sm @ 3,679/sm
   D. 012.00 (Downtown-East Third Street): 1.0sm @ 3,641/sm
   E. 016.00 (Downtown-College Park): 0.9sm @ 3,349/sm
   F. 024.00 (East Lake-Rossville Boulevard.): 1.2sm @ 3,254/sm
   G. 013.00 (Downtown-Highland Park): 0.7sm @ 3,217/sm
   H. 028.00 (South Brainerd): 1.2sm @ 3,006/sm
   I. 029.00 (North Brainerd): 0.9sm @ 2,972/sm

2. Some areas are less than 200/sm:

   A. 110.00 (Walden's Ridge/Mobray): 92.7sm @ 86/sm
   B. 101.02 (Meadowview-Birchwood): 68.2sm @ 100/sm
   C. 115.00 (Snow Hill-Georgetown): 2.8sm @ 179/sm
   D. 121.00 (Elder Mountain-Tiftonia): 25.9sm @ 201/sm

Meeting with CVRDC\Lloyd Frazier and Walker County David Ashburn re: Walker County population:

1. Walker County representatives in our July 29 meeting all seemed to agree that the Walker County was under-counted by 8,000-10,000 (that the 2000 population was nearer 70,000 than 61,053) and that the population will double within 20 years (2000-2020?), yet all other outside data sources appear to be in agreement that a much slower growth rate should be projected:

   A. 1990 County (CP): 59,352 (1990) + 21.0% = 71,849 (2010)

   B. 1999 CVRDC-NGRDC (JP): 58,340 (1990) + 36.5% = 79,681 (2015)

   C. 2003 USCB: 58,340 (1990) + 4.6% = 61,053 (2000)

   D. 2003 W&P: 58,360 (1990) + 19.5% = 69,729 (2025)

   E. 2003 CVRDC draft: 58,340 (1990) + 29.3% = 75,405 (2025)

   F. County representatives: 70,000 (2000) + 100.0% = 140,000 (2025)

2. The initial point of difficulty comes in the fact that although the USCB reports a 4.6% increase from 1990 to 2000 (58,340 + 2,713 = 61,053), Walker County representatives appear to feel that the growth was much more dramatic, as much as 20.0% from 1990 to 2000 (58,340 + 11,660 = 70,000):

   A. Walker County believes a population of 70,000 was achieved in 2000, while W&PE does not expect Walker County will see that high a population before 2025

   B. If Walker County is actually growing at a rate of 20.0% per semi-decade, then their 2005 population should be in the range of 84,000 (vs. other estimates of between and among 62,700, 63,441, 69,012 and 69,091, etc.)

   C. Walker County still expects the population of Walker County to be at 110,000 or more by the end of the study period

3. Analysis of USCB-reported Walker County 2000 population:

   A. 2000 population of all of Walker County: 61,053

   B. 2000 population of study area of Walker County: 44,509

      - Spring Creek: 3,326
      - West Chickamauga Creek: 19,317*
      - Dry Creek: 10,979**
      - Chattanooga Creek: 10,887

      *includes portions of the Little Chickamauga Creek and Peavine Creek subbasins whose anticipated wastewater flows are directed there
      **includes portions of the Spring Creek subbasin whose wastewater flows are directed there

   C. Approximately 75% of the Walker County population appears to reside within the study area

Monday, 6 October 2003

Assessed the study area as percentages of total affected county populations:

1. Catoosa: 100% (53,282) of 53,282 in study area
2. Dade: 79% (12,016) of 15,154 in study area
3. Walker: 75% (44,509) of 61,053 in study area
4. Whitfield: 10% (8,636) of 83,525 in study area

Assessed study area 1990 household sizes (from USCB website):

1. Catoosa: 42,464 / 16,762 households = 2.67/unit
2. Dade: 13,147 / 4,661 households = 2.70/unit
3. Walker: 58,340 / 21,697 households = 2.65/unit
4. Whitfield: 72,462 / 26,859 households = 2.67/unit

Assessed study area 2000 household sizes (from USCB website):

1. Catoosa: 53,282 / 20,425 households = 2.59/unit
2. Dade: 15,154 / 5,633 households = 2.55/unit
3. Walker: 61,053 / 23,605 households = 2.54/unit
4. Whitfield: 83,525 / 29,385 households = 2.82/unit*
5. Georgia: 8,186,453 / 3,006,369 households = 2.72/unit
6. United States: 281,421,906 / 105,480,101 households = 2.67/unit

*Whitfield County notes:

- Whitfield County has a much larger share of large households (five per unit – seven or more per unit) and a much smaller share of small households (one – two per unit) than the other three study area county households
- While the household sizes of the other three study area counties shrank by 4.3% from 1990 to 2000, Whitfield County saw household size increase by 5.6% from 2.67 per unit to 2.82 per unit
- The net effect of this change was that while the household sizes of the other three counties in the study area trended lower from 1990 to 2000, the Whitfield County household size, which had been approximately the same as the other three in 1990,

actually grew to become 10% higher than the others by 2000 (which was probably a reflection of the dramatic influx of Hispanic population)

- It will be important to observe whether or not these trends will continue:
  - Will the household sizes of the other three continue to fall and if so, how much?
  - Will the Whitfield County household size continue to rise and if so, how much?

Researched USCB website re: 2002 population estimates:

1.	Catoosa:	56,341, up	3,059 (+5.74%) from	53,282 in 2000
2.	Dade:	15,615, up	461 (+3.04%) from	15,154 in 2000
3.	Walker:	61,949, up	896 (+1.47%) from	61,053 in 2000
4.	Whitfield:	87,033, up	3,508 (+4.20%) from	83,525 in 2000
5.	Georgia:	8,560,310, up	373,857 (+4.57%) from	8,186,453 in 2000
6.	US:	288,368,698,	up 6,946,792 (+2.47%) from	281,421,906 in 2000

Reviewed JP household size estimates and projections:

Area	1970	1980	1990	1995	2000	2005	2010	2015
Catoosa	3.32	2.92	2.76	2.59	2.51	2.43	2.35	2.27
Dade	3.42	2.98	2.70	2.61	2.52	2.43	2.34	2.25
Walker	3.23	2.86	2.65	2.58	2.51	2.44	2.37	2.30
Whitfield	3.30	2.91	2.67	2.60	2.53	2.46	2.39	2.32
Region	3.26	2.89	2.71	2.61	2.54	2.48	2.42	2.35
ARC	3.25	2.80	2.66					
Georgia	3.25	2.84	2.66	2.72				
USA	3.14	2.76	2.63	2.67				

The U.S. Census Bureau projects continued rapid growth in Georgia population.[1]

Source	Year 2000 (1,000)	Year 2005 (1,000)	Year 2015 (1,000)	Year 2025 (1,000)
Series A	+9.4% 7,875	+6.8% 8,413	+9.4% 9,200	+7.3% 9,869
Series B	+9.6% 7,893	+8.2% 8,540	14.6% 9,785	12.0% 10,962
Average	+9.5% 7,884	+7.5% 8,477	12.0% 9,492	+9.7% 10,416
Actual	+13.7% 8,186			

Source: U.S. Census Bureau website, 2003

Notes:

In addition to the two series of projections provided by the census bureau, an additional averaged figure is provided for comparison.

Figures assume a 1995 population of 7,201,000; actual census bureau count was 8,186,453:

As can be seen in the 2000 projections that were based on 1995 estimates, Georgia population figures appear to continue growing at an unexpectedly rapid rate. Annual growth rates of 1 percent (10 percent per decade) are not overly optimistic. A front-page story in the *Chattanooga Times Free-Press* (April 17, 2003) issued an almost alarmist projection of rapidly increasing population in north Georgia as summarized in Exhibit C.1.[2]

Almost 70 percent of metropolitan Chattanooga population growth is in north Georgia. Exhibit C.1 is a list of the census bureau's 2002 population estimates and growth rates for the study area and other nearby communities.

Based on the population trends presented here, the urbanized and urbanizing areas found within the study area for this report are expected to be much larger than those projected in the original 201 study. The impact of these trends is shown in Exhibit C.2.

---

[1]USCB website, March 31, 2003.

[2]Flesner, Dave. "Population Spreads to South," *Chattanooga Times Free-Press*, front page, April 17, 2003.

EXHIBIT C.1

2002 Population and Growth Rate Estimates
North Georgia Study Area

Location	Increased / Decreased	Rate (percent)	From	To
Tennessee Counties				
Hamilton County	Increased	+0.3	308,396	309,321
Bradley County	Increased	+0.9	88,867	89,677
McMinn County	Increased	+0.7	49,703	50,051
Rhea County	Increased	+1.1	28,627	28,939
Marion County	Decreased	-0.2	27,709	27,654
Grundy County	Increased	+0.5	14,264	14,335
Bledsoe County	Increased	+0.1	12,466	12,478
Sequatchie County	Increased	+1.9	11,567	11,787
Meigs County	Increased	+0.7	11,231	11,310
Georgia Counties				
Catoosa County	Increased	+2.8	54,818	56,341
Dade County	Increased	+1.3	15,415	15,615
Walker County	Increased	+0.4	61,702	61,949
Whitfield County	Increased	+1.5	85,751	87,037
Murray County	Increased	+2.0	37,798	38,554
Chattooga County	Increased	+1.1	25,975	26,261
Alabama Counties				
DeKalb County	Decreased	-0.1	65,671	65,605
Jackson County	Decreased	-0.2	54,143	54,035

Source: U.S. Census Bureau.

If, in fact, the Catoosa County population increased by 2.8 percent in 2002, adding 1,523 new residents, what should be considered realistic estimates of future growth? Some planners quoted in the article estimate North Georgia's population will double within the next two decades. If so, using the 2002 population figures above, consider the potential impact of such growth in 2022:

	Population Increase	
	From	To
Catoosa County	56,341	112,682
Dade County	15,615	31,230
Walker County	61,949	123,898
Whitfield County	87,037	174,074

Note: Assumes annual growth rate of 3.65 percent as estimated by ARCADIS.

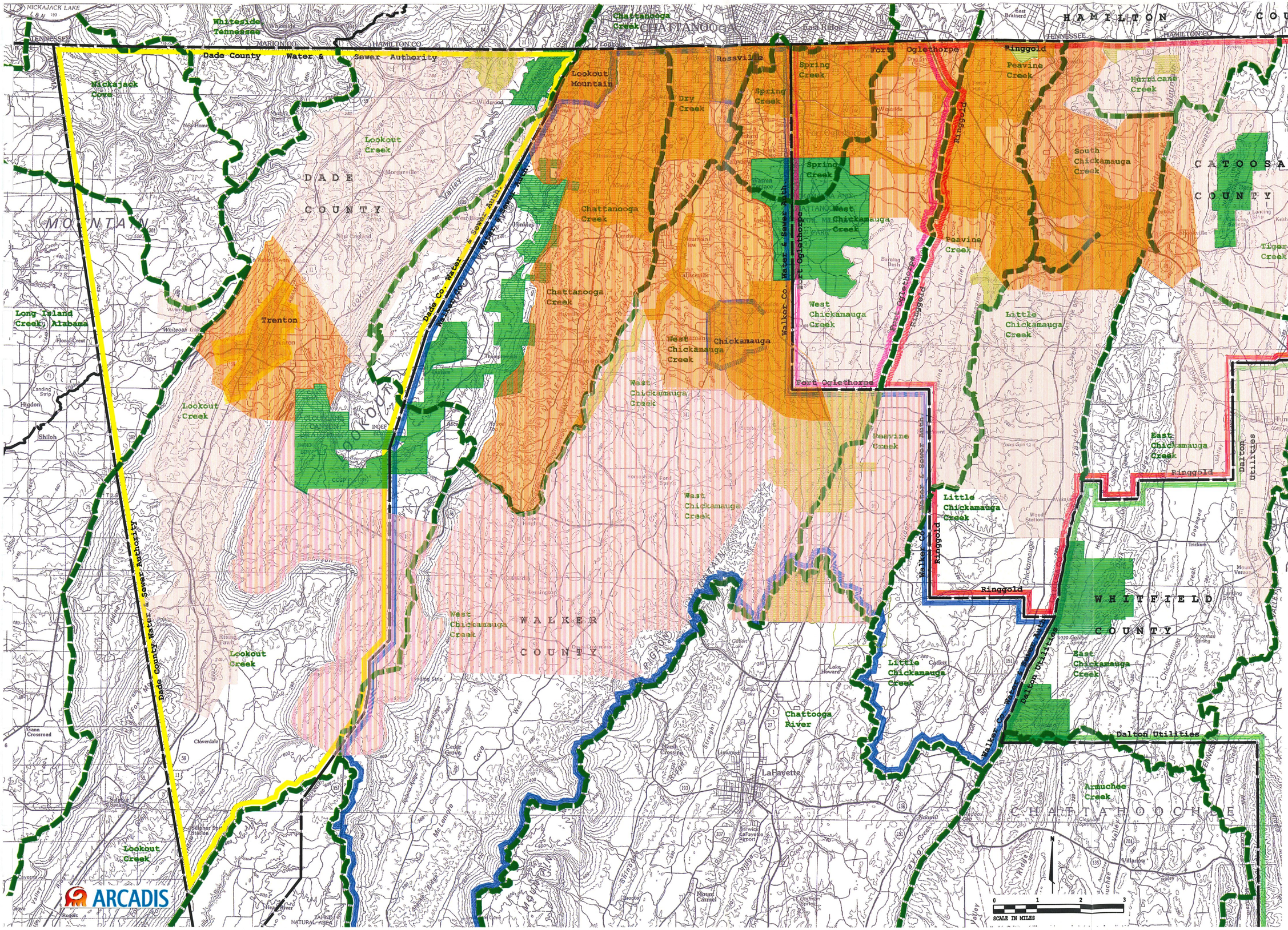

EXHIBIT C.2

NORTHWEST GEORGIA REGIONAL WASTEWATER TREATMENT STUDY

COOSA VALLEY REGIONAL DEVELOPMENT CENTER

ARCADIS

Northwest Georgia
Regional Wastewater
Treatment Study

Appendix D

Results of Investigations into
Decentralized Systems

Results of Investigations into Decentralized Wastewater Treatment Systems

On April 24, 2003, a meeting was held with Carl Lindell, representative for Aqua-Point, to discuss the topic of current technologies available in decentralized wastewater treatment systems. Important observations were made relative to the applicability of these systems to communities found in the study area for this report.

It has been suggested that pre-treatment of collected wastewater from a small-scale neighborhood or community system can lower the domestic waste concentrations from 200/200 to around 20/20, enabling a less restrictive discharge into the best available soils in the area. Unfortunately, the tight clay loams in this area, along with the presence of massive rock, limits the absorption capabilities needed for such systems. Available soils maps indicate that all of the valleys in the area tend to be characterized by soils that percolate poorly, shallow rock, and high groundwater. Any of these create obstacles to on-site treatment alternatives. Together, these characteristics work against both conventional septic tank-field line systems and the more sophisticated decentralized on-site systems. The long-term service cost associated with not only capital and debt service but operations, maintenance, and management costs as well can be over five times as much in a shallow rock/tight clay environment as in more suitable settings.

Mr. Lindell noted that increasing use of vegetable oils in home cooking will more likely accelerate the degeneration of field lines as vegetable oil continues to remain soluble even at higher temperatures, meaning the deposits it leaves can tend to seal trenches where field line systems are installed (creating an isolated trough of effluent, rather than a normal distribution and absorption cycle.

Constructed wetlands or a land application system (such as that employed by nearby Dalton Utilities at their Loopers Bend facility) with spray nozzles and/or even a drip irrigation system presume a series of parameters that may not be in keeping with current circumstances in the study area. Possible use of a multi-basin wetland could use increased evaporation time as a means of mitigating some of these factors. Also, some communities allow the local public sanitary sewer authority to assume all of the private systems, including private individual septic tank and field lines, but most find that this is counterproductive. Often the problem is not just wastewater treatment but permitting the discharge – what to do with the water.

Mr. Lindell advised that Dr. Jay Converse of the University of Wisconsin has written extensively about field line system performance. It was also suggested that Tom

Sinclair of WasteWater Systems, Inc., may be knowledgeable about the implications of such systems in environments such as those found in the study area for this report.

Independent reviews by ARCADIS of available geological and soils mapping and analysis information published by the Georgia EPD in conjunction with the Georgia Geologic Survey verify that most of the valley soils within the study area tend to be unsuitable for alternative treatment systems. Geological characteristics, coupled with predominant soils and the need to protect groundwater recharge areas, make this a tough environment in which to promote the use of on-site solutions.

1. Fractured limestone (Karst geology) underlies most of the study area.

2. Study area soils are generally too clayey and even if otherwise suitable, are usually too shallow to support most of the available technologies.

3. Valley water table levels are seasonally high, frequently leaving the soils super-saturated for much of the year, particularly the winter months.

On August 22 in a meeting with Jim Watson of TVA the subject of alternative on-site wastewater treatment systems was also addressed. Mr. Watson brings unique experience throughout the TVA service area in promoting unconventional solutions to problems such as those presented within the study area for this report.

Mr. Watson has recently assisted Meadowview Baptist Church in northeast Hamilton County, Tennessee, to manage its wastewater flows. The church has installed an Orenco Advantex wastewater treatment system using a non-woven filter media fabric and trickling filter that discharges to an on-site drip irrigation system. Mr. Watson also provided technical assistance for the Hardee's restaurant in Whitwell, Tennessee, which is employing a "constructed wetlands" wastewater treatment system discharging to drip irrigation. Numerous other technologies are available for on-site treatment.

A number of issues must be addressed in order to proceed with considering any more extensive use of on-site wastewater treatment and disposal systems:

1. The most suitable soils must be located out of the 10-year flood plain, and away from the steepest of the ridge side slopes. They should also be as deep as possible (a minimum depth of 10 feet is required for large-scale systems) unless, located over a large area of fractured limestone or if serving only one or two homes (where an area of 5-foot-deep soils may work).

2. The most suitable soils in the very closest proximity to either the existing or proposed concentration of development wastewater flows or target must be identified, limits defined and mapped and characteristics analyzed.

3. The only "zero-discharge" on-site wastewater treatment options available are either spray or drip irrigation systems (and both will require that a certified operator be in actual on-site management. High operations and maintenance costs must be anticipated and provisions made to accommodate them.

4. Drip irrigation can be up to ten times more expensive than spray irrigation, but more land is needed for spray irrigation. In smaller systems, the costs of both construction (capital and debt service) and operation and maintenance are more comparable for the two types of systems. Spray irrigation systems will always require more land than drip systems.

5. High-tech alternative systems can be very sophisticated and often require professional operations and maintenance assistance as well as management expertise not readily available.

6. There appear to be a host of benefits in central collection systems, among them being the fact that the most crucial parts of the process are centralized, instead of distributed. One of the benefits of a decentralized system is that if they do have problems, the problems tend to be smaller.

7. Many consider alternative systems to be used as the systems of last resort:

   - On land that may have been considered un-developable
   - In places where land costs are extremely low
   - Where those responsible are willing to devote the continuing resources necessary to support sophisticated, professional operations, maintenance and management required for long-term success

8. Among the drip irrigation system budgeting and scoping rules of thumb:

   - Plan for a footprint of 1 sf/.1gpd (or 10 sf/gpd):

     40kgd = 400ksf (10 acres)
     80kgd = 800ksf (20 acres)

- 10kgd will cost $12/gpd to construct ($120k)

  40kgd = $480k
  80kgd = $960k

- Expect 1mgd to cost $4m for the drip system alone, not including other parts or land:

  1mgd = $4m
  1mgd = 10msf (2,300ac)*
  2,300ac @ $5k/ac = $11.5m
  a 1mgd drip irrigation system could cost $20m, not including the cost of operations, maintenance and management

- If employed as a community-wide strategy, use of individual STEP systems which discharge to a common drip irrigation system could maximize the benefits of both technologies. Such an approach could be expected to cost from $5,000 to $10,000 per home, if done well, and should require no more than approximately $250 per home, annually in operation and maintenance costs. Clusters of homes all sharing a drip system may help keep initial costs in the low end of that range.

9. There is precedent for local public agency participation in assuming the total responsibility of individual septic tank/field line systems within a community:

   - This has occurred on rare occasion elsewhere in the US, but not in the southeast and certainly not in the study area

   - WasteWater Systems, Inc., has a subsidiary that has done similar things, having been created as a public utility to manage such small and/or "decentralized" systems (Mr. Sinclair has more detail)

   - Consolidated Utilities has done similar things in the Murfreesboro-Rutherford County, Tennessee, area

   - On-Site Systems, Inc., (operated by Charles L. Pickney, et al) serves the same niche in Tennessee markets not already served by Consolidated Utilities (such as in Gatlinburg and Sevierville, Tennessee)

Based on information collected, a preliminary assessment of realistic prospects for application of alternative decentralized wastewater treatment systems in the study area does not look very promising:

1. The relatively small sizes of study area tributaries, making prospects poor for long-term discharge of treated wastewater in remote locations:

   - Hurricane Creek is a tiny stream course and under pressure from development, but sanitary sewer systems have mitigated impacts
   - Tiger Creek is very small and under pressure from sprawl and the problem of remote pockets of moderate development densities
   - East Chickamauga Creek is very small and under pressure from Tunnel Hill and the other Whitfield County areas not now served
   - South Chickamauga Creek is small and under pressure, but steps are being taken to solve long-term problem there with the ECCI
   - Little Chickamauga Creek is very small and most of its subbasin relatively undeveloped, but it will find also relief from the ECCI
   - Peavine Creek is very small, but its needs are being addressed by expansion of a sanitary sewer system already being provided
   - West Chickamauga Creek in Catoosa County is under pressure, but plans to expand the sanitary sewer system there are under way
   - West Chickamauga Creek in Walker County is small and under pressure, but significant expansion of the sanitary sewer system in place there with treatment at the Chickamauga WWTP is planned
   - Spring Creek is a tiny stream draining an intensively developed subbasin, but long-term needs there have already been addressed
   - Dry Creek is also a very tiny tributary in an intensively developed subbasin, but wastewater problems there have long been solved
   - Chattanooga Creek is a small stream under increasing pressure, but it has long had solutions in place that are now being enhanced

- Lookout Creek, a trout stream, already shows signs of stress and is in need of solutions before development makes things worse

2. Since study area valley soils are generally unsuitable for on-site disposal, pursuing prospects for application of these technologies may be unwise:

   - Both groundwater and seasonal water tables are high, causing frequent saturation and super-saturation

   - The prevalence of shallow bedrock tends to promote migration in any contaminant plumes created by failure of on-site systems

   - Soils tend to be clayey and percolate poorly

3. Relatively easy access to the ISS/MBWWTP puts vast resources of the Tennessee River within the reach of many of these smaller communities which otherwise might not have prospects for wastewater service

Among authorities that can be consulted further are the following:

Tom Sinclair is considered to be the renowned expert in drip irrigation systems. There are a number of such systems in the Nashville, Tennessee, area that can be toured, if desired.

The US EPA released a new manual (EPA/625/R-00/008) in February 2002 that includes costing fact sheets to assist in financial analysis.

Georgia EPD has guidelines for both spray and drip irrigation systems that can be reviewed (the nutrient balance is apparently the determining factor in determining acreage requirements)

Bob Pickney and Charles Pickney manage "On-Site" as a public utility in Nashville, Tennessee. The Pickneys have apparently had some success with both small systems and larger operations alike.

Consolidated Utilities in Murfreesboro, Tennessee, is also a public utility that has had some success in that area.

ARCADIS

Northwest Georgia
Regional Wastewater
Treatment Study

Appendix E

Data Used in Preparing Cost
Estimates for Proposed Interceptors

Data Used in Preparing Cost Estimates for Proposed Interceptors

Project costs for various gravity sanitary sewer pipe sizes (attempting to address all aspects, including planning, field surveys, design and engineering, easements, bidding, construction services, resident project representation, construction (rock excavation and otherwise as well as bedding and backfilling), materials, main line piping, manholes, tees, services, etc., to establish a total project cost... then add a 20 percent contingency. Review of two recent ARCADIS construction projects and two other sources of data:

1. NWGI (2001): $2.87m (construction x 1.5)

   A. Total length: 21,100lf*

18"-dia.DIP	30lf @ $76/lf
12"-dia.DIP	80lf @ $66/lf
18"-dia.PVC	2,690lf @ $50/lf
12"-dia.PVC	10,190lf @ $40/lf
10"-dia.PVC	6,220lf @ $36/lf
8" -dia.PVC	1,890lf @ $30/lf

   *not including 3,400lf service lines

   B. Total connections: 250

   cost/user: $11.5k
   cost/lf: $136

   C. Total bid price: $1.92m

   D. Engineering fees: $0.20m

   Surveys @ $2/lf
   Basic @ 7.0%
   Permits
   Easements
   Inspection:$120k?
   Total @ 20% = $0.38m
   Total @ 15% = $0.29m

   E. Legal/easements: $0.15m

   Legal Fees ($50k?)
   Easements (100k?)

   F Repaving (12klf):$0.60m

   Assume full-width
   12klf @ $50/lf

2. Winnepesaukah (2001): $2.10m (construction x 1.5)

   A. Total length: 17,075lf*

      10-inch-diameter PVC 4,265lf @ $40/lf

      8-inch-diameter PVC 12,640lf @ $35/lf

      10-inch-diameter DIP 110lf @ $45/lf

      8-inch-diameter DIP 60lf @ $40/lf

      * not including 6,672lf service lines

   B. Total connections: 270

      Cost/user:$ 7.8k
      Cost: $122.98/lf

   C. Total bid price: $1.40m

   D. Engineering fees: $0.18m

      Surveys @ $2/lf
      Basic @ 7.0%
      Permits
      Easements
      Inspection:$100k?
      Total @ 20% = 0.28k

   E. Legal/easements: $0.12m

      Legal fees($30k?)
      Easements ($90k?)

   F. Repaving (8klf?):$0.40m

      Assume full-width
      8klf @ $50/lf

3. CTI\Walker County wastewater study (construction cost by pipe size + 10% [engineering]* = subtotal + 10% [contingency]** = project cost):

8-inch-diameter @ $ 42.50/lf +10% = [x] +10% = $ 51.43/lf***

10-inch-diameter @ $ 48.30/lf +10% = [x] +10% = $ 58.44/lf***

12-inch-diameter @ $ 53.60/lf +10% = [x] +10% = $ 64.86/lf***

15-inch-diameter @ $ 57.50/lf +10% = [x] +10% = $ 69.58/lf***

18-inch-diameter @ $ 61.55/lf +10% = [x] +10% = $ 74.48/lf***

21-inch-diameter @ $ 75.00/lf +10% = [x] +10% = $ 90.75/lf***

24-inch-diameter @ $ 85.39/lf +10% = [x] +10% = $103.32/lf***

30-inch-diameter @ $101.28/lf +10% = [x] +10% = $122.55/lf***

36-inch-diameter @ $125.00/lf +10% = [x] +10% = $151.25/lf***

* apparently no inspection is included
** may be low for a planning contingency
*** apparently no street re-paving is included
(Prices appear to be low compared to recent actual project cost figures.)

4. Welker &Assoc. cost estimate for Ringgold (construction cost by pipe size + $48/lf [misc.] + 3% [construction cost contingency]* + $16/lf [engineering]** + $1.50/lf [easements] = project cost)***:

   8-inch-diameter @ $ 45/lf? +$48/lf = [x] +3% +$16/lf = $112/lf***

   10-inch-diameter @ $ 50/lf? +$48/lf = [x] +3% +$16/lf = $117/lf***

   12-inch-diameter @ $ 55/lf +$48/lf = [x] +3% +$16/lf = $122/lf***

   15-inch-diameter @ $ 60/lf +$48/lf = [x] +3% +$16/lf = $127/lf***

   18-inch-diameter @ $ 70/lf +$48/lf = [x] +3% +$16/lf = $138/lf***

   21-inch-diameter @ $ 75/lf? +$48/lf = [x] +3% +$16/lf = $143/lf***

   24-inch-diameter @ $ 80/lf +$48/lf = [x] +3% +$16/lf = $148/lf***

   30-inch-diameter @ $ 90/lf +$48/lf = [x] +3% +$16/lf = $158/lf***

   36-inch-diameter @ $105/lf? +$48/lf = [x] +3% +$16/lf = $174/lf***

   * this may not be enough
   ** including inspection (could be assessed as 12.5%)
   *** apparently no street re-paving is included...

Revised original cost figures to become total project costs by adding $25/lf (misc.) + 15% (engineering) + 20% (contingency) (all rounded):

SIZE (CAPACITY)	BASE + $25/lf + 15% + 20%	(OTHER)
8-inch-diameter (0.5mgd) @	$ 40/lf	($ 65/lf) ($ 75/lf) ($ 90/lf) ($123/lf)*
10-inch-diameter (0.7mgd) @	$ 45/lf	($ 70/lf) ($ 81/lf) ($ 97/lf)
12-inch-diameter (1.1mgd) @	$ 55/lf	($ 80/lf) ($ 92/lf) ($110/lf) ($136/lf)**
15-inch-diameter (1.6mgd) @	$ 65/lf	($ 90/lf) ($104/lf) ($124/lf)
18-inch-diameter (2.3mgd) @	$ 75/lf	($100/lf) ($115/lf) ($138/lf)
21-inch-diameter (3.2mgd) @	$ 90/lf	($115/lf) ($132/lf) ($159/lf)
24-inch-diameter (4.1mgd) @	$105/lf	$130/lf) ($150/lf) ($179/lf)
30-inch-diameter (6.3mgd) @	$125/lf	($150/lf) ($173/lf) ($207/lf)
36-inch-diameter (8.0mgd) @	$145/lf	($170/lf) ($196/lf) ($235/lf)
42-inch-diameter (12.5mgd) @	$165/lf	($190/lf) ($219/lf) ($262/lf)
48-inch-diameter (16.1mgd) @	$190/lf	($215/lf) ($247/lf) ($297/lf)
54-inch-diameter (20.1mgd) @	$215/lf	($240/lf) ($276/lf) ($331/lf)
60-inch-diameter (24.6mgd) @	$240/lf	($265/lf) ($305/lf) ($366/lf)
66-inch-diameter (30.7mgd) @	$265/lf	($290/lf) ($334/lf) ($400/lf)
72-inch-diameter (36.6mgd) @	$300/lf	($325/lf) ($374/lf) ($449/lf)

*actual Winnepesaukah total project costs
*actual NWGI total project costs

ARCADIS

Discrete Drainage Subbasins	8"	10"	12"	15"	18"	21"	24"	30"	36"	42"	Force Main	Pumping Stations	Totals
Lookout Creek													
Total Length		*59,638*	*41,315*	*52,816*	*9,400*	*10,365*	*49,231*	*8,506*			*120,392*		351,663
Estimated Costs	$0	$5,784,886	$4,544,650	$6,549,184	$1,297,200	$1,648,035	$8,812,349	$1,760,742	$0	$0	$3,611,760	$1,250,000	$35,258,806
Chattanooga Creek (Georgia)													
Total Length		*40,700*	*8,396*										49,096
Estimated Costs	$0	$3,947,900	$923,560	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,871,460
Dry Creek													
Total Length		*14,210*									*10,548*		24,758
Estimated Costs	$0	$1,378,370	$0	$0	$0	$0	$0	$0	$0	$0	$316,440	$100,000	$1,794,810
West Chickamauga Creek (Catoosa)													
Total Length		*0*	*20,646*	*0*	*5,605*	*8,989*	*6,184*	*0*	*0*	*0*	*33,063*		74,487
Estimated Costs	$0	$0	$2,271,060	$0	$773,490	$1,429,251	$1,106,936	$0	$0	$0	$991,890	$550,000	$7,122,627
West Chickamauga Creek (Walker)													
Total Length	*19,053*	*90,653*	*26,391*	*42,814*	*14,088*	*50,130*	*0*	*0*	*0*	*0*	*72,283*		315,412
Estimated Costs	$1,714,770	$8,793,341	$2,903,010	$5,308,936	$1,944,144	$7,970,670	$0	$0	$0	$0	$2,168,490	$350,000	$33,321,851
Peavine Creek (Catoosa)													
Total Length		*22,278*	*14,927*	*15,668*									52,873
Estimated Costs	$0	$2,160,966	$1,641,970	$1,942,832	$0	$0	$0	$0	$0	$0	$0	$0	$5,745,768
Hurricane Creek													
Total Length		*23,625*	*5,656*								*5,156*		34,437
Estimated Costs	$0	$2,291,625	$622,160	$0	$0	$0	$0	$0	$0	$0	$154,680	$200,000	$3,268,465
South Chickamauga Creek													
Total Length				*7,660*							*0*		7,660
Estimated Costs	$0	$0	$0	$949,840	$0	$0	$0	$0	$0	$0	$0	$3,500,000	$4,449,840
Little Chickamauga Creek													
Total Length		*44,745*	*0*	*13,538*	*11,340*	*14,428*	*11,945*	*8,539*					104,535
Estimated Costs	$0	$4,340,265	$0	$1,678,712	$1,564,920	$2,294,052	$2,138,155	$1,767,573	$0	$0	$0	$0	$13,783,677
East Chickamauga Creek													
Total Length		*90,864*	*44,127*	*0*	*5,963*	*7,679*	*16,254*	*8,179*	*8,569*	*7,014*			188,649
Estimated Costs	$0	$8,813,808	$4,853,970	$0	$822,894	$1,220,961	$2,909,466	$1,693,053	$2,013,715	$1,837,668	$0	$0	$24,165,535
Tiger Creek													
Total Length	*29,125*	*97,145*	*9,943*	*16,685*	*21,622*								174,520
Estimated Costs	$2,621,250	$9,423,065	$1,093,730	$2,068,940	$2,983,836	$0	$0	$0	$0	$0	$0	$0	$18,190,821
Totals	**48,178**	**483,858**	**171,401**	**149,181**	**68,018**	**91,591**	**83,614**	**25,224**	**8,569**	**7,014**	**241,442**		1,378,090
Estimated Costs	$4,336,020	$46,934,226	$18,854,110	$18,498,444	$9,386,484	$14,562,969	$14,966,906	$5,221,368	$2,013,715	$1,837,668	$7,243,260	$5,950,000	$149,805,170

EXHIBIT E.1
Drainage Subbasin Lengths