TWIN CHIMNEYS

GREENVILLE COUNTY LANDFILL

Proposed Amendment to Chapter 9, Article III of the GC Code of Ordinances.

PLANNING and DEVELOPMENT COMMITTEE

Questions arising from the discussion on changes to the Solid Waste Ordinance

1. How much airspace remains at Twin Chimney's Landfill?
   Answer: We have 62 years remaining. This number is based on observed waste acceptance rates and density of the waste. Appendix A provides a comprehensive discussion and the calculations used to determine this estimate.
2. What are the fees that are charged to the different groups of users?
   Answer: The fees are based on a variety of factors. **Who is the customer?** For example, Greenville County citizen, Greenville County municipal, out-of-county municipal, private hauler, low volume hauler, high volume hauler. **What material are they disposing of?** For example, residential waste, commercial waste, industrial, special waste, beneficial wastes, sludge or a combination. **Are their special circumstances?** The hauler has a reciprocal disposal agreement with us, sister organizations with intersecting relationships, or government entities with an MOU) Appendix B provides a list of the FY20 fee schedule that was proposed in the FY20/21 budget.
3. Where does our waste come from?
   Answer: As part of our SCDHEC annual reporting requirements, upon entry into our facility the origin of all waste is entered into our software system. Much of our waste originates from single industrial facilities, 25 percent. Curbside collection accounts for approximately 15 percent. Front loader commercial routes account for about 13 percent. However, transfer stations account for the most significant share of the waste stream at 47 percent.

   This breakdown is typical for the modern landfill. The first category in this group, are direct hauled from a specific location that can be pinned down to a jurisdictional area. The next two are collected in routes that cross jurisdictional lines and the last receives waste from a wide service area that also crosses jurisdictional lines.

   In 1993 there were 157 MSW landfills in South Carolina. Today, there are seven MSW landfills operated by County Government, seven operated by private sector and two operated by Authorities. Waste and where it is entombed, is a complicated formula of distance, price and affiliations. Appendix C contains a link to the State's Solid Waste Management Plan that contains a comprehensive analysis of how and where waste is managed across the State.

Appendix A

TWIN CHIMNEYS
GREENVILLE COUNTY LANDFILL

Airspace Management Report

Twin Chimneys Landfill

Units 1, 2, and 4

Greenville County, North Carolina
August 2019

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Tables

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Purpose

HDR prepared this Airspace Management Report to assist Greenville County (County) with management and planning for the Twin Chimneys Landfill (TCLF). Compaction, settlement, and degradation of the waste all affect the in-place density of the waste and, consequently, the life of the landfill. Density can vary based on waste intake rates, compaction equipment, and amount of cover soils used. This report describes the assumptions and calculations used to estimate the airspace consumed, the in-place density, and the life expectancy of the constructed landfill units.

Background

The Twin Chimneys Landfill is owned and operated by Greenville County and located near the southern tip of Greenville County, South Carolina approximately 20 miles south of Interstate 85. The entrance to the landfill is located at 11075 Augusta Road (US Highway 25) between West Ridgeway and McCullough School Roads. The landfill currently consists of approximately 1,167 acres and is permitted for a total of seven units: six MSW disposal units and one C&D disposal unit. MSW Unit 1 and C&D Unit 2 Cells 1 through 4 have been constructed and MSW Unit 4 Cell 1 is currently under construction. The landfill also includes ancillary facilities such as a scale house, truck scales, leachate storage, paved access road, and administrative offices.

The County currently accepts municipal solid waste (MSW, Class 3 Landfill), under South Carolina Department of Health and Environmental Control (SCDHEC) Permit 231001-1102; and construction, demolition, and land-clearing debris (C&D, Class 2 Landfill) under Permit 231001-1202. The landfill began accepting C&D waste on January 15, 2007, and began accepting MSW waste on February 12, 2007. Greenville County disposed of waste at the Enoree Landfill facility prior to the opening of the TCLF.

Tonnage Data

Based on scale records provided by the County, a total of 3,605,818 tons of MSW has been disposed at the landfill from February 12, 2007, to July 31, 2019. Similarly, 862,478 tons of C&D waste has been disposed in Unit 2 between January 15, 2007, and July 31, 2019.

Figure A shows historic disposal rates at the two County facilities operated since 1995 (Enoree Landfill and TCLF). During the final few years of Enoree Landfill operations, the majority of C&D was co-disposed in the lined MSW landfill unit. The black line on the graph indicates the combined tonnages at TCLF, which are comparable to the MSW tonnages received in the final few active landfill years at the Enoree Landfill.

Figure B illustrates the current and projected disposal rates for just TCLF. During the fiscal year ending June 30, 2019, C&D disposal dropped by 10.1%, a decrease of 6,802 tons compared to the previous year for an average annual disposal rate of 5030 tons per month. MSW disposal decreased by -0.3%, a decrease of 1,051 tons, for an average disposal rate of 31,713 tons per month during the last fiscal year

Survey

HDR subcontracts with Freeland & Associates (Freeland) to provide survey and topographic services for the landfill. The most recent aerial topography provided by Freeland is based on an aerial photograph taken on Monday July 1, 2019. This airspace management report is based on that topographic survey and contractor supplied as-built drawings of the constructed landfill units. The drawings in the appendix illustrate data from the surveys used to produce this report.

Operating Airspace

At the time of this report, all of Unit 1 (MSW Cells 1 through 5) were constructed and contain waste. Table 1 illustrates the permitted and constructed capacities of each unit along with the reduction in capacity caused by modifying the design subgrade during construction. The constructed subgrade in each of the Unit 1's sumps was raised above the above the permitted grades. This modification resulted in a loss of potential airspace; however, the detailed top of waste grades (shown on Drawing C-2) for the unit are expected to compensate for the loss.

In Unit 2, C&D Cells 1 through 4 are available for waste placement. Cell 4 was certified on October 28, 2015 and subsequently approved by SCDHEC for use. The subgrade in the C&D unit was not excavated to design grades because boulders were encountered and it was not economical to remove the material at that time. The constructed modifications and constructed capacity volumes shown in the table below are based on the certified subgrade of the constructed cells. The constructed capacity is based on the proposed grades illustrated on Drawing C-5 and 3:1 slopes along the constructed cells' interface with future cell(s).

MSW Unit 4 Cell 1 first received waste on April 15, 2019. Placement of waste in Unit 4 was subsequently suspended after access to the top of Unit 1 was reconfigured. It is anticipated that waste placement will continue to be split between the two units until Unit 1 reaches capacity or the County elects to close Unit 1.

The values in the column labeled potential modifications are estimates that may be achieved with a permit modification that adds the former McCullough property to the landfill and refines the final cover grading plans. The revised potential capacity column adjusts the permitted capacity by the modifications identified.

Table 1 Estimated Landfill Unit Capacities

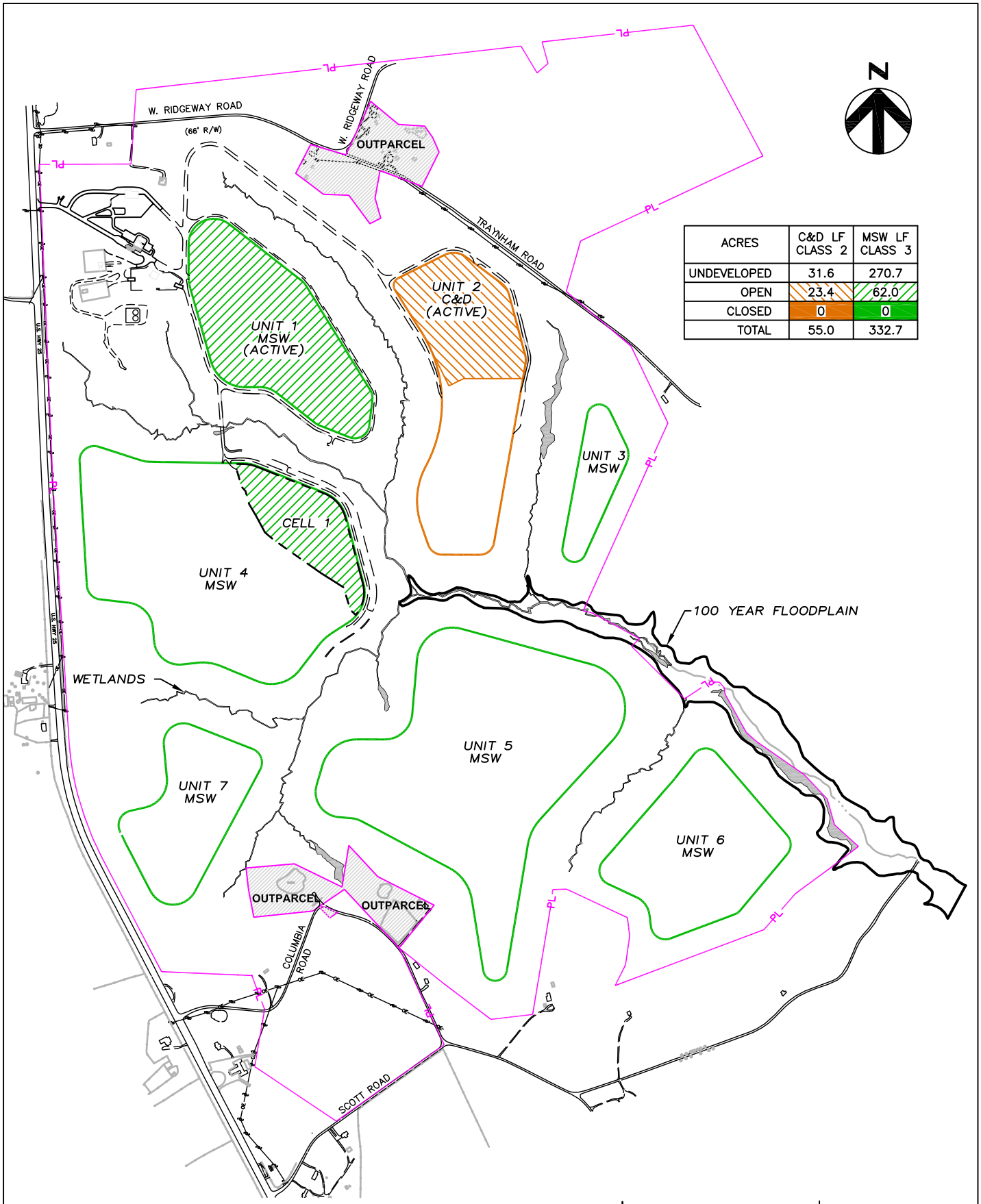
Unit	Permitted size (acres)	Permitted capacity (cubic yards)	Constructed modifications (cubic yards)	Potential modifications (cubic yards)	Revised potential capacity (cubic yards)	Estimated/constructed permit capacity (cubic yards)
1 (MSW)	45.0	4,506,799	-13,383	195,419	4,688,835	4,506,799
2 (C&D)	55.0	5,767,531	-866,097		4,901,434	1,677,680 *(Cells 1 - 4)*
3 (MSW)	11.4	621,574			621,574	0
4 (MSW)	100.4	15,324,013	-36,862	886,671	16,173,822	1,108,401
5 (MSW)	103.6	15,557,859			15,557,859	0
6 (MSW)	42.8	4,156,491			4,156,491	0
7 (MSW)	29.5	2,438,971		819,214	3,258,185	0
Totals	387.7	48,373,238	-916,342	1,901,304	49,358,200	7,292,880

In-Place Density

This report measures the efficiency of landfill operations based on compaction or in-place density of the waste. Tables 2 and 3 document the actual usage of the TCLF airspace since the opening of the landfill. The period density and volume numbers take credit for settlement in the inactive areas of the landfill. The to-date density and total volume used numbers are appropriate for long-term estimates of landfill progress.

Table 2 Actual Usage Unit 1 (MSW)

Date of survey	Total volume used (cy)	Period disposal (tons)	Waste disposed to date (tons)	To date in-place density (tons/cy)	To date in-place density (lbs/cy)	Period length (days)	Period in-place density (tons/cy)	Period volume usage (cy/day)	To date volume usage (cy/day)
12-Feb-07	0		0						
2-Jul-08	460,513	277,896	277,896	0.60	1,207	506	0.60	910	910
28-Jun-09	732,907	167,356	445,252	0.61	1,215	361	0.61	755	845
8-Jun-10	985,419	214,089	659,341	0.67	1,338	345	0.85	732	813
1-Jul-11	1,297,135	227,198	886,540	0.68	1,367	388	0.73	803	811
28-Jun-12	1,582,268	219,747	1,106,287	0.70	1,398	363	0.77	785	806
28-Jun-13	1,938,193	260,528	1,366,815	0.71	1,410	365	0.73	975	833
1-Jul-14	2,310,779	341,183	1,707,998	0.74	1,478	368	0.92	1,012	857
1-Jul-15	2,726,507	341,665	2,049663	0.75	1,504	365	0.82	1,139	891
2-Jul-16	3,166,222	384,907	2,434,570	0.77	1,538	367	0.88	1,198	924
2-Jul-17	3,622,855	378,150	2,812,720	0.78	1,553	365	0.83	1,251	955
3-Jul-18	4,038,385	382,540	3,195,260	0.79	1,582	366	0.92	1,135	971
1-Jul-19	4,287,059	322,431	3,517,691	0.82	1,641	363	1.30	2,593	948



ACRES	C&D LF CLASS 2	MSW LF CLASS 3
UNDEVELOPED	31.6	270.7
OPEN	23.4	62.0
CLOSED	0	0
TOTAL	55.0	332.7

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TWIN CHIMNEYS LANDFILL PERMITTED UNITS

FINANCIAL ASSURANCE

DATE August 2019

FIGURE C

Table 3 Actual Usage Unit 2 (C&D)

Date of survey	Total volume used (cy)	Period disposal (tons)	Waste disposed to date (tons)	To date in-place density (tons/cy)	To date in-place density (lbs/cy)	Period length (days)	Period in-place density (tons/cy)	Period volume usage (cy/day)	To date volume usage (cy/day)
15-Jan-07	0		0						
2-Jul-08	103,808	69,866	69,866	0.67	1,346	534	0.67	194	194
28-Jun-09	202,477	55,038	124,904	0.62	1,234	361	0.56	273	226
8-Jun-10	278,333	56,665	181,569	0.65	1,305	345	0.75	220	224
1-Jul-11	392,500	81,388	262,956	0.67	1,340	388	0.71	294	241
28-Jun-12	502,535	75,067	338,023	0.67	1,345	363	0.68	303	252
28-Jun-13	643,515	82,968	420,991	0.65	1,308	365	0.59	386	273
1-Jul-14	766,296	80,811	501,802	0.65	1,310	368	0.66	334	281
1-Jul-15	883,782	73,971	575,773	0.65	1,303	365	0.63	322	286
2-Jul-16	970,104	67,426	643,199	0.66	1,326	367	0.78	235	281
2-Jul-17	1,116,205	87,726	730,926	0.65	1,310	365	0.60	400	292
3-Jul-18	1,208,925	67,445	798,371	0.66	1,320	366	0.73	253	289
1-Jul-19	1,280,421	60,296	858,667	0.67	1,341	363	0.84	197	281

Figure D illustrates the overall in-place density for the both landfill units and generally indicates good compaction. Note that the period density for MSW increased significantly for this year, apparently due to settlement of the waste mass. Significant settlement is occurring where the waste is thickest. The color drawings (C-3, C-6 and C-9) comparing 2018 topo to 2019 topo clearly illustrate settlements of two or more feet in many areas. Settlement is also occurring in areas of active waste placement, but the placement of waste is masking the settlement.

Remaining Operating Life of Site

Figures E and F illustrate the estimated operating lives for the MSW and C&D units, respectively. Estimates are based on the constructed operating capacity and recent density and disposal rates. Figures E and F illustrate the effect a change in disposal rate might have on landfill life.

Class 2

The permitted disposal rate for the Class 2 (C&D) landfill increased from 87,157 tons per year (tpy) to 137,157 tpy during fiscal year 2014/2015. The current disposal rate is approximately 63,000 tpy. Based on the maximum permitted C&D disposal rate of 137,157 tpy and a density of 0.66 tons (1,320 pounds) per cubic yard, and construction of the remaining cells (minus unexcavated portions in Cells 1-4) to the permitted subgrade, Unit 2 could last 212 months (18 years) or until March 2037. If the unit is not excavated to permitted grades and existing grades are instead used as subgrade, Unit 2 would reach capacity in 137 months (12 years) or December of 2030 at the current density and permitted disposal rate. Cell 5 needs to be ready for use before June 2021 at the permitted disposal rate or August 2023 at the current disposal rate.

Class 3

The current MSW disposal rate is approximately 376,000 tpy. Based on an average MSW disposal rate of 390,000 tpy, a density of 0.82 tons (1,640 pounds) per cubic yard, Unit 1 is projected to reach capacity about October 2019 with no additional waste placement in Unit 4. The current permitted disposal rate is 500,000 tpy which is well above the current rate. The life for Unit 1 and the other five permitted Class 3 units is on the order of 60 years at the permitted disposal rate.

The overall estimated total capacity of Unit 4 is about 16,200,000 cubic yards. Based on this capacity, an average disposal rate of 410,000 tpy, and the current 0.49 ton per cubic yard density, Unit 4 would reach capacity about November 2038. However, the same disposal rate at a more realistic density of 0.6 tons per cubic yard provides capacity until January of 2043.

Based on waste placed in Unit 4 Cell 1 having an initial density of only 0.49 tons per cubic yard Unit 4, Cell 2 would be needed by December 2020 (see Figure G). This assumes no waste is placed in the sump area. If the density is increased to 0.6 tons per cubic yard, a density achieved in the first year operating Unit 1, then Cell 2 is not required until March 2021. Cell 2 is expected to provide 1.5 years of capacity beyond Cell 1 (September 2022).

Class 3 Financial Assurance Cost Estimates

The financial assurance estimates are based on the 62 acres of Class 3 landfills currently constructed and in use at the facility. The 2019 Class 3 Total Closure Cost is estimated at approximately $20,100,000. The 2019 Class 3 Total Post-Closure Cost is estimated at approximately $20,800,000. The itemization of these determined costs and supporting calculations are found in Appendix A.

Conclusions

- Complete construction of Unit 4 Cell 2 before December 2020.
- Plan to have Unit 2 Cell 5 ready for use before June 2021.
- The Class 2 and Class 3 landfills at TCLF will last about 18 and 62 years respectively, at the permitted disposal rates and current densities.
- Slopes at all units are being constructed in general accordance with the permitted grades.
- The waste densities compare favorably with industry standards (Benchmarking the Performance and Costs of MSW Landfills, SWANA 2008) and HDR's experience.

Recommendations

- HDR recommends a Class 3 permit modification to incorporate the former McCullough property into the landfill to revise the footprint of Units 4 and 7, thereby expanding the capacity of Units 4 and 7.

- HDR recommends a Class 2 permit modification to recoup some airspace lost in Unit 2 due to difficult and expensive excavation conditions. This could be accomplished by revising the permitted base grades for the containment berm beginning along Cell 3. This revised grading could increase the peak elevation of the unit while staying within the existing permitted footprint and capacity.

A

Appendix A – Calculations

SCDHEC Summary and Calculations

Table 4 - Annual Report Summary

Annual Report Summary		Class 2 C&D Unit 2	Class 3 MSW Units
Total Waste Quantity Accepted in Fiscal Year	(tons)	60,361	380,558
Waste Disposed to Date (June 30, 2019)	(tons)	858,447	3,574,487
Total Volume Used to Date (July 1, 2019)	(CY)	1,280,421	4,404,879
Maximum Permitted Disposal Rate	(tons/year)	137,157	500,000
Remaining Volume of Permitted Disposal Airspace	(CY)	3,621,013	38,200,828
Average Waste Density	(lbs/CY)	1,341	1,623
Remaining Life of Permitted Disposal Airspace	(months)	212	744

Remaining Volume of Permitted Disposal Airspace

Remaining Volume (CY) = Available Capacity (CY) – Volume Consumed (CY)

Class 2 C&D Unit 2

Remaining Volume = 4,901,434 CY – 1,280,421 CY
Remaining Volume = 3,621,013 CY

Class 3 MSW Units

Remaining Volume = 42,605,707 CY – 4,404,879 CY
Remaining Volume = 38,200,828 CY

Average Waste Density

*Average Waste Density (lbs/CY) = Waste Disposed to Date (tons) / Volume Consumed to Date (CY) * 2000 (lbs/ton)*

Class 2 C&D Unit 2

Average Waste Density = 858,447 tons / 1,280,421 CY * 2000 lbs/ton
Average Waste Density = 1,341 lbs/CY

Class 3 MSW Units

Average Waste Density = 3,574,487 tons / 4,404,879 CY * 2000 lbs/ton
Average Waste Density = 1,623 lbs/CY

Remaining Life of Permitted Disposal Airspace

*Remaining Life (Months) = Remaining Volume of Permitted Disposal Airspace (CY) * Average Waste Density (lbs/CY) / 2000 (lbs /ton)/ Maximum Permitted Disposal Rate (tons/year) * 12 months/year*

Class 2 C&D Unit 2

Remaining Life = 3,621,013 CY * (1,341 lbs/CY/ 2000 lbs/ton) / (137,157 tons/year * 12 months/year)
Remaining Life = 212 Months or ~18 Years

Class 3 MSW Units

Remaining Life = 38,200,828 CY * (1,623 lbs/CY/ 2000 lbs/ton) / (500,000 tons/year * 12 months/year)
Remaining Life = 744 Months or ~62 Years

Financial Assurance Calculations

Twin Chimneys Landfill
Class 3 LF Financial Assurance Cost Estimates

2019 Closure Cost

Group	Closure

Basis	
Category	Total
Admin	$2,419,441
Cap System	$15,035,316
Engineering	$339,042
Erosion Control	$1,029,413
Survey	$13,518
Upgrades	$1,107,977
CQC	$109,017
Grand Total	**$20,053,725**

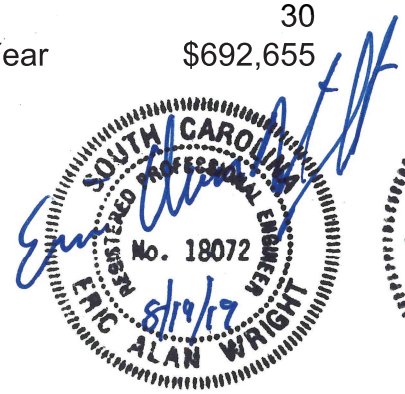
Acres	62
Cost per acre	$323,447

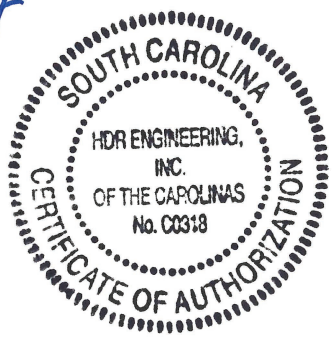
2019 Post-Closure Cost

Group	Post Closure

Basis	
Category	Total
Annual	$10,686,846
Occasional	$9,826,563
Final	$266,237
Grand Total	**$20,779,646**

Acres	62
Cost per acre	$335,156
Years	30
Cost per Year	$692,655





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The estimates assume closure and post closure soils will be provided from off-site sources.

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Appendix B

GF Revenue	Description of Fees	2019 Projection	2020 Projection	2021 Projection
OTHERREV05	Domestic/Commercial/Construction & DemolitionWaste f	$3.00	$3.00	$3.00
OTHERREV05	Domestic Waste for Automated Tippers (per ton)	$17.00	$17.00	$17.00
OTHERREV05	Commercial/Industrial/Special Waste for Automated Tipp	$30.00	$30.00	$30.00
OTHERREV05	Special Handling Waste for Automated Tippers (per ton)	$75.00	$75.00	$75.00
OTHERREV05	Beneficial Use Materials (per ton)	$13.75	$14.15	$14.55
OTHERREV05	Governmental Rate (per ton)	$16.00	$16.00	$16.00
OTHERREV05	Class II - 0-100 tons/month (per ton)	$26.00	$26.00	$26.00
OTHERREV05	Class II - 101-250 tons/month (per ton)	$22.00	$22.00	$22.00
OTHERREV05	Class II - 251-500 tons/month (per ton)	$18.00	$18.00	$18.00
OTHERREV05	Class II - >500 tons/month (per ton)	$15.00	$16.00	$16.00
OTHERREV05	Class III - 0-100 tons/month (per ton)	$30.00	$30.00	$30.00
OTHERREV05	Class III - 101-250 tons/month (per ton)	$28.00	$28.00	$28.00
OTHERREV05	Class III - 251-500 tons/month (per ton)	$25.00	$25.00	$25.00
OTHERREV05	Class III - >500 tons/month (per ton)	$21.50	$22.00	$22.00
ENTERPRISE FUND □ SOLID WASTE	Tipper usage/tip	$25.00	$25.00	$25.00
ENTERPRISE FUND □ SOLID WASTE	Dense Construction and Demolition for vehicles (pe	$13.00	$13.00	$13.00
ENTERPRISE FUND □ SOLID WASTE	Blended Materials per ton	$18.00	$18.50	$18.50
ENTERPRISE FUND □ SOLID WASTE	Mulch to Food Waste Composting loading per ton	$12.50	$10.50	$10.50
ENTERPRISE FUND □ SOLID WASTE	Fee to recon off-site scales per month	$50.00	$50.00	$50.00
ENTERPRISE FUND □ SOLID WASTE	Special Waste Administrative Fee/Load		$1.00	$1.00
ENTERPRISE FUND □ SOLID WASTE	Mulch Loading fee/scoop		$15.00	$15.00
ENTERPRISE FUND □ SOLID WASTE	Clean Up Fee - Loads Dropped on Road		$500.00	$500.00
ENTERPRISE FUND □ SOLID WASTE	Clean Up Fee - Loads Comingled w/ Banned Material		$500.00	$500.00
ENTERPRISE FUND □ SOLID WASTE	Unloading Fee - Loads Stuck in Truck		$500.00	$500.00
ENTERPRISE FUND □ SOLID WASTE	Late Fee for balance between $51 and $20,000		$15.00	$15.00
ENTERPRISE FUND □ SOLID WASTE	Late Fee for balance between $20,001 and $40,000		$45.00	$45.00
ENTERPRISE FUND □ SOLID WASTE	Late Fee for balance between $40,001 and $60,000		$90.00	$90.00
ENTERPRISE FUND □ SOLID WASTE	Late Fee for balance between $60,001 and $80,000		$150.00	$150.00
ENTERPRISE FUND □ SOLID WASTE	Late Fee for balance between $80,001 and $100,000		$225.00	$225.00
ENTERPRISE FUND □ SOLID WASTE	Late Fee for balance $100,001 and above		$315.00	$315.00

Appendix C

FISCAL YEAR

2018

SOUTH CAROLINA

SOLID WASTE MANAGEMENT

ANNUAL REPORT

dhec

Richard K. Toomey, Director

https://www.scdhec.gov/sites/default/files/Library/OR-1888.pdf