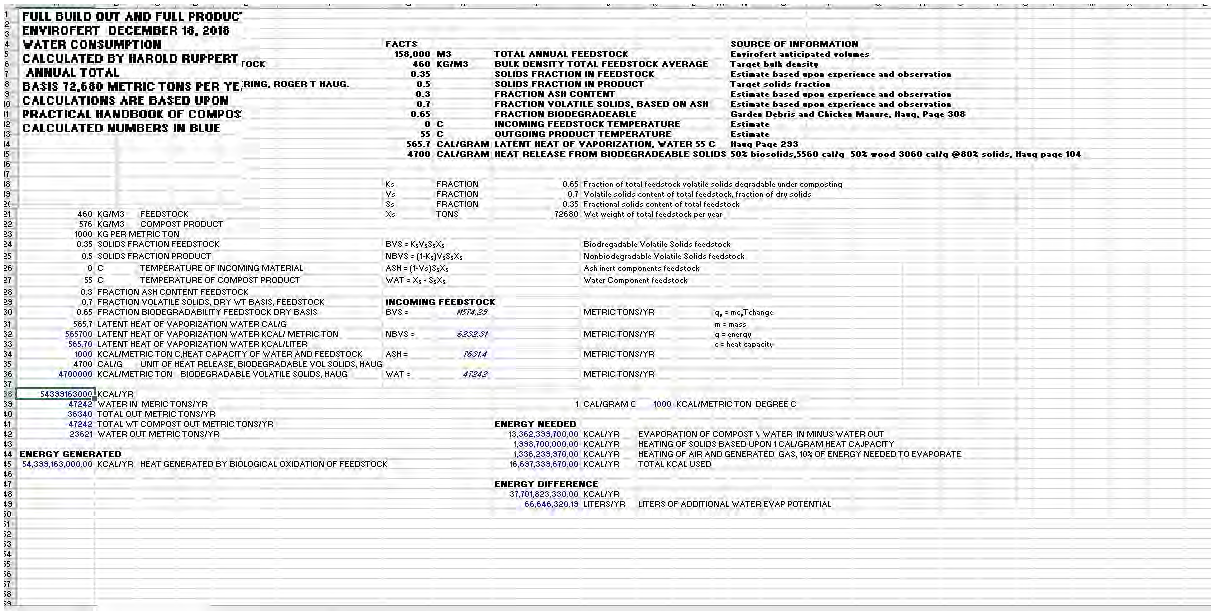
28.0 Appendix I: Water Balance



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	ENVIROFERT DECEMBER 18, 2018																
2	WATER CONSUMPTION ANNUAL LEACHATE WATER																
3	CALCULATED BY HAROLD RUPPERT																
4	BASIS 36,400 METRIC TONS PER YEAR FEEDSTOCK, HALF PRODUCTION																
5	CALCULATIONS ARE BASED UPON 2 X JULY PRECIPITATION 294 mm IN ONE MONTH																
6	CALCULATED NUMBERS IN BLUE																
7																	
8		17,350.00	SQUARE METERS OF COLLECTION AREA														
9		1.28	METERS OF RAINFALL PER YEAR														
10		560.00	KCAL/LITER ENERGY NEEDED FOR EVAPORATION OF ONE GALLON														
11		18,895,820,165.00	KCAL RESIDUAL ENERGY AVAILABLE PER YEAR FOR WATER EVAPORATION														
12		22,277,400.00	LITERS OF OF RAINFALL COLLECTED PER YEAR														
13		33,402,545.81	TOTAL GALLON EVAPORATION CAPACITY														
14		11,125,145.81	GALLONS OF EXCESS WATER EVAPORATION POTENTIAL PER YEAR, AFTER PRECIPITATION EVAPORATION														
15																	
16																	
17	JULY	147 MM = 5.8 IN															
18	2 X																
19	MAXIMUM	17,350.00	SQUARE METERS OF COLLECTION AREA														
20		0.30	METERS OF RAINFALL PER YEAR														
21		5,205,000.00	LITERS OF OF RAINFALL COLLECTED														
22		560.00	KCAL/LITER ENERGY NEEDED FOR EVAPORATION OF ONE LITER														
23		1,574,651,680.42	KCAL RESIDUAL ENERGY AVAILABLE PER YEAR FOR WATER EVAPORATION														
24		5,205,000.00	LITERS OF OF RAINFALL COLLECTED IN WETTEST MONTH X 2														
25		2,783,545.48	TOTAL GALLON EVAPORATION CAPACITY														
26		-2,421,454.52	LITERS OF EXCESS WATER EVAPORATION POTENTIAL IN JULY PRECIPITATION X 2, AFTER PRECIPITATION EVAPORATION														
27		-2421	M^3 OF EXCESS WATER EVAPORATION POTENTIAL IN JULY PRECIPITATION X 2, AFTER PRECIPITATION EVAPORATION														
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FULL BUILD OUT AND HALF PRODUCTION
ENVIROFERT DECEMBER 18, 2018
WATER CONSUMPTION
CALCULATED BY HAROLD RUPPERT
ANNUAL TOTAL
BASIS 36,400 METRIC TONS PER YEAR FEEDSTOCK
CALCULATIONS ARE BASED UPON
PRACTICAL HANDBOOK OF COMPOST ENGINEERING, ROGER T HAUG.
CALCULATED NUMBERS IN BLUE

FACTS			
158,000	M3	TOTAL ANNUAL FEEDSTOCK	Envirofert anticipated volumes
460	KG/M3	BULK DENSITY TOTAL FEEDSTOCK AVERAGE	Target bulk density
0.35		SOLIDS FRACTION IN FEEDSTOCK	Estimate based upon experience and observation
0.5		SOLIDS FRACTION IN PRODUCT	Target solids fraction
0.3		FRACTION ASH CONTENT	Estimate based upon experience and observation
0.7		FRACTION VOLATILE SOLIDS, BASED ON ASH	Estimate based upon experience and observation
0.65		FRACTION BIODEGRADEABLE	Garden Debris and Chicken Manure, Haug, Page 308
0	C	INCOMING FEEDSTOCK TEMPERATURE	Estimate
55	C	OUTGOING PRODUCT TEMPERATURE	Estimate
565.7	CAL/GRAM	LATENT HEAT OF VAPORIZATION, WATER 55 C	Haug Page 293
4700	CAL/GRAM	HEAT RELEASE FROM BIODEGRADEABLE SOLIDS	50% biosolids,5560 cal/g 50% wood 3060 cal/g @80% solids, Haug page 104

158,000	FEEDSTOCKM3/YR	K_d	FRACTION	0.65	Fraction of total feedstock volatile solids degradable under composting
36400	FEEDSTOCK METRIC TONS/YEAR	V_s	FRACTION	0.7	Volatile solids content of total feedstock, fraction of dry solids
18719	FEEDSTOCK TONS/YEAR OD SOLIDS	S_s	FRACTION	0.35	Fractional solids content of total feedstock
460	KG/M3 FEEDSTOCK	X_s	TONS	36400	Wet weight of total feedstock per year
576	KG/M3 COMPOST PRODUCT				
1000	KG PER METRIC TON				
0.35	SOLIDS FRACTION FEEDSTOCK	$BVS = K_d V_s S_s X_s$			Biodegradable Volatile Solids feedstock
0.5	SOLIDS FRACTION PRODUCT	$NBVS = (1-K_d)V_s S_s X_s$			Nonbiodegradable Volatile Solids feedstock
0	C TEMPERATURE OF INCOMING MATERIAL	$ASH = (1-V_s)S_s X_s$			Ash inert components feedstock
55	C TEMPERATURE OF COMPOST PRODUCT	$WAT = X_s - S_s X_s$			Water Component feedstock
0.3	FRACTION ASH CONTENT FEEDSTOCK				
0.7	FRACTION VOLATILE SOLIDS, DRY WT BASIS, FEEDSTOCK	**INCOMING FEEDSTOCK**			
0.65	FRACTION BIODEGRADABILITY FEEDSTOCK DRY BASIS	BVS =	5236.7	METRIC TONS/YR	$q_s = mc_pT$change
565.7	LATENT HEAT OF VAPORIZATION WATER CAL/G				m = mass
565700	LATENT HEAT OF VAPORIZATION WATER KCAL/ METRIC TON	NBVS =	3121.3	METRIC TONS/YR	q = energy
565.70	LATENT HEAT OF VAPORIZATION WATER KCAL/LITER				c = heat capacity
1000	KCAL/METRIC TON C,HEAT CAPACITY OF WATER AND FEEDSTOCK	ASH =	3822	METRIC TONS/YR	
4700	CAL/G UNIT OF HEAT RELEASE, BIODEGRADABLE VOL SOLIDS, HAUG				
4700000	KCAL/METRIC TON BIODEGRADABLE VOLATILE SOLIDS, HAUG	WAT =	23660	METRIC TONS/YR	
27244490000	KCAL/YR				
23621	WATER IN MERIC TONS/YR			1 CAL/GRAM C	1000 KCAL/METRIC TON DEGREE C
18170	TOTAL OUT METRIC TONS/YR				
23621	TOTAL WT COMPOST OUT METRIC TONS/YR	**ENERGY NEEDED**			
11810.5	WATER OUT METRIC TONS/YR	6,681,198,850.00	KCAL/YR	EVAPORATION OF COMPOST W. WATER IN MINUS WATER OUT	
		333,250,000.00	KCAL/YR	HEATING OF SOLIDS BASED UPON 1 CAL/GRAM HEAT CAPACITY	
ENERGY GENERATED		668,118,385.00	KCAL/YR	HEATING OF AIR AND GENERATED GAS, 10% OF ENERGY NEEDED TO EVAPORATE	
27,244,490,000.00	KCAL/YR HEAT GENERATED BY BIOLOGICAL OXIDATION OF FEEDSTOCK	8,348,653,835.00	KCAL/YR	TOTAL KCAL USED	
		ENERGY DIFFERENCE			
		18,895,820,165.00	KCAL/YR		
		33,402,545.81	LITERS/YR	LITERS OF ADDITIONAL WATER EVAP POTENTIAL	

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