ConstructedWetlands2-SizingSSF (SS)

	A	B	C	D	E	F	G	H	I	J
1	[see Chapter 3 of the file EPA-wetlandsdesign.pdf origianlly downloaded from the US-EPA]									
2										
3										
4	1.35	/day	**1.35**	/day	K20-first-order BOD reaction-rate at 20*C					
5	55	*F	**13**	*C	T-temperature of SSF fluids -- by season					
6										
7	0.0002	oz/cup	**30**	mg/L	C-emergent BOD5					
8	0.0010	oz/cup	**125**	mg/L	C-influent BOD5					
9	0.69	/day	0.69	/day	KT-temperature-dependent first-order reaction rate constant					
10	2.1	days	2.1	days	t-hydraulic residence time					
11	252	gal/day	**0.98**	m3/day	Q-avg flow rate through SSF					
12	2.3	ft	**0.7**	m	d-depth of submergence		avg? min? max? input?			
13	30%		**30%**	constant	n-porosity of media					
14	102	ft2	10	m2	As-surface area					
15										
16	5.2	ft2	0.5	m2	Ac-Crosssectional area					
17	2.3	ft	0.7	m	W-bed width					
18	3	gal/sf/min	**200**	m3/m2/day	ks-hydraulic conductivity of the media			3.0	oz/i2/min	
19	1.0%		**1.0%**		S-slope of bottombed [hydraulic gradient]					
20										
21	REED et al CHECK							'very good performance'		
22	2	must be smaller than 8.6					**StoneCreek**	**Emmitsburg MD**		
23						incoming	**360**	**30000**	gpd	
24	45	ft	14	m	L-bedbottom length	TreatmentBed	**90**	**7500**	sf	
25						Depth	**3**	**3**	ft	
26	2.7	ft			collection depth	PlantingStart	**20**	**200**	cattails/bulrushes	
27						Cost/sf	**$5**	**$5**	/sf	
28										
29	**No compensating adjustment for potential freezing [like thermophilic composting biology revives after thawing]**									
30	**No apparent mention of evaporation or transpiration in this EPA section tho it was mentioned earlier**									
31										

Values are either generic from the **US-EPA** dissertation, such as K20, or are selected to define a greywater wetlands performance parameters, such as the to-be-wanted emergent BOD.5 and the 252gpd average flow rate for a 3 bedroom home with thermophillic composting (so no toilet flushing) and no garbage-grinder.

Formulas for the sizing of the requisite wetlands to achieve these goals were taken from the US-EPA's downloadable dissertation, a copy of which should be attached/linked.
http://www.cighe.net/ExperimentalSanitationApproval/EPA-wetlanddesign.pdf

In the bottom right of the spreadsheet, is a comparison of our Stonecreek resulting parameters with the successful Emmitsburg, MD system based on this logic. The proportionality is reasonably clear.

Note also the **Cost per sf** is massively better than any other system that currently is foisted on Brown County's citizens. It's hard enough for many people in the rural areas to make a home of their own a reality, without the totally unnecessary and even destructive burden of the current generation of sanitation systems.

In KY, we have read some of the manual for their constructed wetlands there, based on a document from A-SPI, **Appalachia-Science in the Public Interest**. This document was just recently released, and wasn't available at the time that we were looking for alternatives and newer formulas. However since the US-EPA's formulae were performing well, those were the best basis in existence in 2008.

Other sources with substantial credibility that we did use ideas from, included **OASIS**, with a long history of interest in greywater and conservation at the small scale level. We did adopt several of their operational insights on stone to use and baffles for flow guiding. They also provided interesting data on evapotranspiration and sized their designs based on irrigation demand, not quite the problem in Ohio but clearly a serious basis for California greywater wetlands designing. They however had accumulated estimates of ET, PF etc (see below) that would serve in non-winter here.

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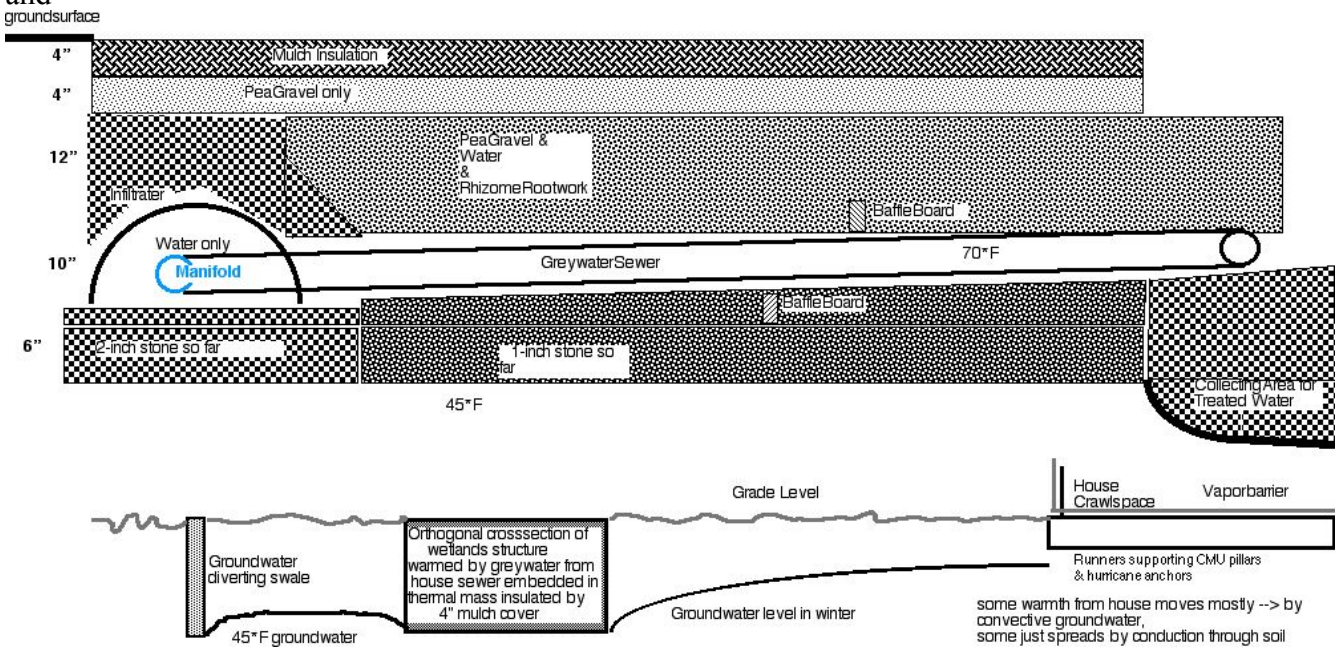
	A	B	C	D	E	F	G	H
32								
33	*OASIS et al*							
34	**Estimating Irrigation Demand**							
35	103	gal/wk	15	gal/da	ID--Irrigation Demand			
36	0.71	in/wk			ET--Evapo-transpiration			
37	0.8				PF--plant factor [low water using = 0.3, medium = 0.5, high lawn = 0.8]			
38	0.5				IE--Irrigation Efficiency [range 0.2 to high 0.8 for subsurface drip]			
39	146				IA--Irrigated Area [within plant driplines]			
40	0.62				conversion factor [in/sf to gallons/sf			
41								
42	**MAX ET values by climate**							
43				**avg midsummer**				
44	[in/wk]	[in/wk]		**[*F]**	**[%Rel-Humidity]**			
45	0.7	1.0		under 70	over 50%			
46	1.0	1.4		under 70	under 50%			
47	1.0	1.4		70-90	over 50%			
48	1.4	1.8		70-90	under 50%			
49	1.4	2.0		over 90	over 50%			
50	2.0	3.2		over 90	under 50%			
51	Increase value used for windy locations							
52	Decrease value for mulch cover							
53	Rainy or drought not accounted for in humidity							
54	No guidance on winter season							
55								
56								

and



We also analysed the greywater greenhouse designs from **Nutricycle** also in MD, which were the basis for the greywater greenhouse here in Brown County, which SDick did virtually torment. The Nutricycle academic theory and multi-examples of working systems with data provided were quite illuminating for the data on greywater calculations and managing a greywater infiltrator. Their users' guide has some good points for consideration. Based on the final stages of that Brown County system, **there were also apparently locally agreed to reductions in average flow for no flush toilets and no garbage-grinder.**

Also new are the documents from the Ohio EPA, on which we are doing further analysis at the moment. Amy Mills has also provided the ODH Guidelines for Ohio's wetlands NOW, as well as presenting a map of Ohio's counties that have operating constructed wetlands, including both Clermont and Adams. All total there are several around Franklin County and dozens statewide.

Amy has also provided many other documents to support this project, including guidelines NOW in Ohio and **keypoints to include in a Concurrence Letter** to start the paperwork rolling between Brown County's Health Dept and the ODH crew, who have been closely interested in this project from the beginning, including Ralph Benson and Jean Caudill. Perhaps you know them, hazarding that lately any further document that isn't exactly independent of this author may be useful in deciphering greywater interests in Ohio. So you may have their own documents to draw on as TAC members and ODH senior staff.

Also , I should notify you that, unfortunately, since the older computer -- an iMac -- that I used for development of these original spreadsheets is in for servicing, yet I was lucky enough to get the current hi-tech video computer to be able to convert these spreadsheets -- since Macintosh violated the principle of upward compatibility of recent new generations of operating systems -- from a backup drive, but there are other documents that may be required later that will need some effort at retrieving from the older computer's backup harddrive, unless we can get the older computer fixed to get to its internal harddrive. More later.

Now... drum roll... the resulting LOT PLAN, is in the next file, complete with:
-- precise annotation for compass,
-- separation distances from property lines,
-- as well as easements,
-- weather trends, and groundwater movement,
-- diversion trenches, and creeklets plus stonecreeks,
-- expansion ponds for stormwater retention and wildlife,
-- house, equipment parking,
-- sunshed workshop,
-- solar collector for warming/drying the crawlspace,
-- plus construction supply storage areas
-- and of course the constructed wetlands and the thermophillic composting structure
-- plus the dispersion system area.

All roughly to scale