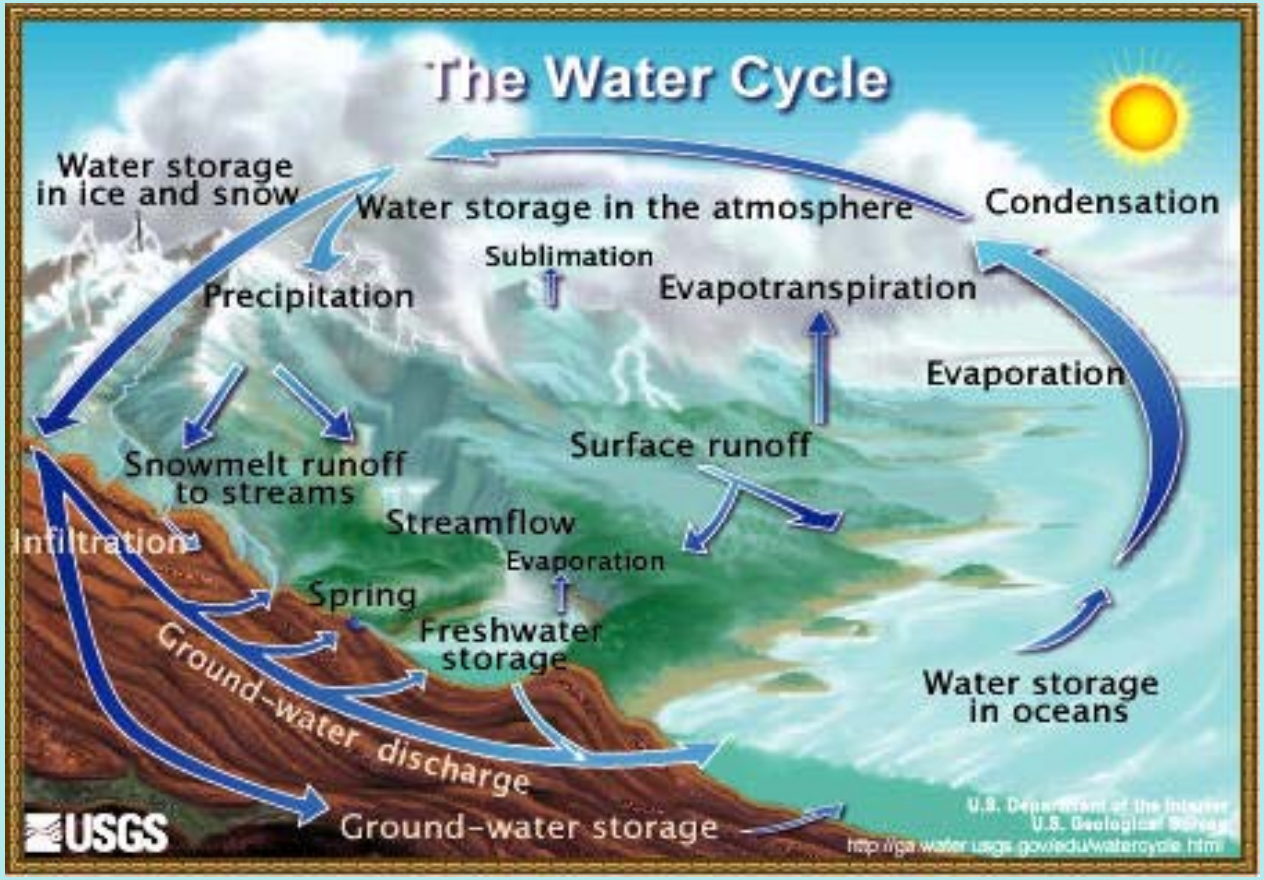

http://ga.water.usgs.gov/edu/watercycle.html

Blackwaters

Current Waste Treatment and Alternatives for Philadelphia

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11/05

Is it a positive development that U.S. citizens generally do not have to think about their waste?

- Treatment of blackwater is usually a mystery to most
- Is lack of awareness a signal of a working, trouble-free system?
  - In Philadelphia, the answer is no
  - Lack of awareness may contribute to a slow response from authorities to address our sewage problems due to lack of demand

Philadelphia's Wastewater treatment

- In 1940's, Philadelphian sewage was discharged directly into the Delaware and Schuylkill
- By 1946, a 20 mile stretch of the Delaware contained no Oxygen - it was dead
- Although Philadelphia began treating wastewater in 1920's, water pollution control plants were not operating until 1950's
- 1970's, Philadelphia really began to work on improving water quality.
(http://www.phila.gov/water/urban_water_cycle.html#treatment)

Current Wastewater treatment

- Most of Philadelphia uses a combined sewer system
  - Stormwater run-off and human waste are directed to the same pipe flowing to the sewage treatment plant
  - Raw sewage sometimes overflows into river during large rainstorms
    - Problem related more to stormwater management, but raises important concerns about what average Philadelphian understands about water treatment

Treatment Process

- Philadelphia served by three treatment plants: Northeast, Southeast and Southwest
- Three phases to treatment to eventually separate solid from liquid

http://ga.water.usgs.gov/edu/wwvisit.html

Phase 1 - removes 45 to 50% of solid wastes from liquid

- Sewage passes through a screen to remove trash and debris
- Sand and grit are allowed to settle by controlling the flow of sewage into the tank
  - Sand, grit and trash are the first byproduct
- Sedimentation is the last step in Phase 1
  - Sewage is passed through circular tanks so that fecal matter can settle to bottom & fats and plastics can rise to the top to be skimmed off.
  - Sludge is pumped to digesters and scum/grease are pumped to other tanks for eventual disposal at a landfill

Phase 2

- Remaining liquid is treated to remove bacteria
  - Waste water is combined with “activated sludge” - microbes that are natural decomposers of sewage
  - Sludge continues to settle (secondary sludge) which is extracted, thickened and sent to the digesters

Phase 3

- Remaining liquid should be relatively clear of organic matter and solids
- Liquid goes through chlorination process
- EPA requires effluent to be 85% clear of suspended solids -- Philadelphia says their effluent is cleaner than that.

Separate Phase - Biosolids

- Biosolids from the process are sent to a 73-acre biosolids recycling facility
- Before 1988 biosolids were dumped into the ocean
- Now the majority of recycled biosolids are composted for use in City parks/fields, community gardens, farms and revegetation of strip mines
- The remaining 30% of biosolids are sent to landfill

(http://www.phila.gov/water/brcoverview.html)

Philadelphia's Biosolids Recycling Center

Is centralization the best plan for waste treatment?

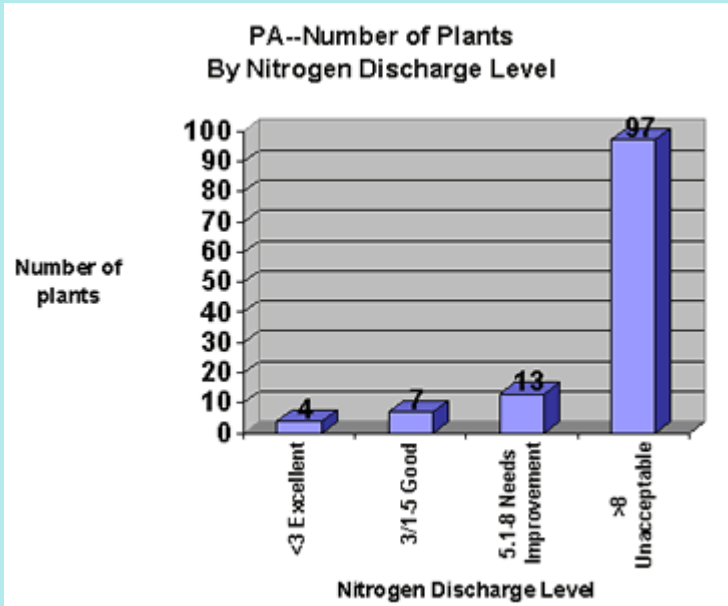
- Centralized sewage treatment is a complex, expensive process
- Potential for sewage pipes to leak into ground
- Philadelphia's combined sewage system often causes untreated sewage to dump directly into rivers during storms
- Chlorine can be carcinogenic to aquatic life and large stores of chlorine can be dangerous
- Under debate how much the process removes hormones and other drugs in excreted waste or other toxins such as heavy metals (more complex processes necessary such as reverse osmosis)

(http://www.news.wisc.edu/releases/10070.html, http://www.sciencedaily.com/releases/2004/08/040826085912.htm)

Is the treatment process itself lacking?

- According to study by the Chesapeake Bay Foundation:
  - Among the Pennsylvania sewage treatment plants in the watershed for the bay, 97 out of 121 plants (80%) were discharging “unacceptable” levels of nitrogen

(http://www.cbf.org/site/PageServer?pagename=resources_sewage_report_plants_pa)



Alternatives

- Upgrading current treatment plants and sewage pipelines
- Living machines - treat large amounts of sewage on-site without harsh chemicals
  (http://www.oceanarks.org/, http://www.rps.psu.edu/0009/machine.html)
- Composting toilets

Composting Toilets

- Do not need to use potable water for operation
- Are generally self-contained units, can be simple or complex
- Maintain a direct connection to waste and where it goes
- Is steps closer to achieving a closed cycle for a home

Composting Toilet Process

- 90% of human waste is liquid (remaining 10% organic material)
- Most composting toilets are designed to evaporate the majority of that water
- Toilet systems can be
  - "self-contained" - the toilet and composter are one

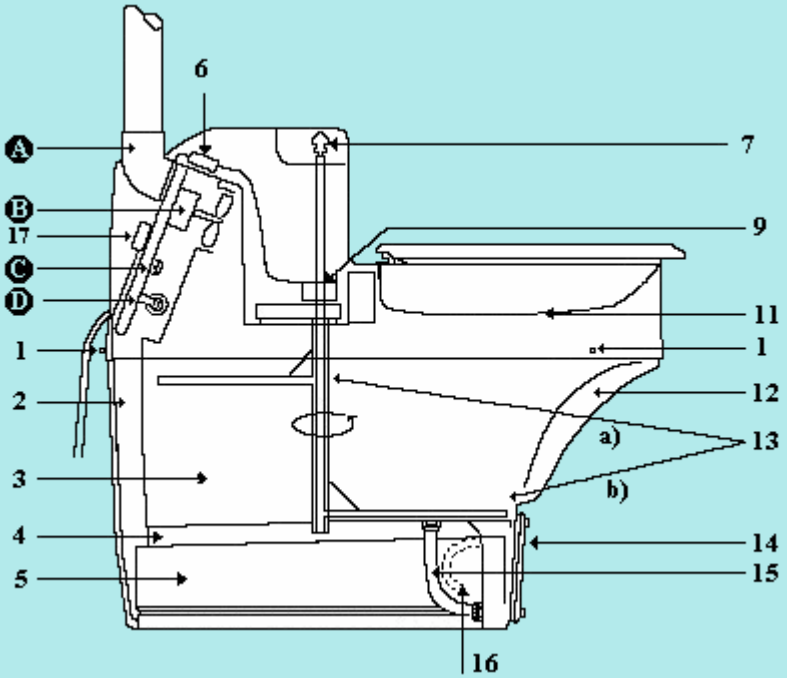
- Or "remote" - the toilet is separate from composter unit, connected by a pipe (allows for use of "typical" toilet)

(http://www.envirolet.com/enanden.html)

- Most home systems are “active” rather than “passive”
  - Use a combination of electric or manual activities such as fans or heaters or a manual drum turn-crank
- In general systems should have:
  - A screened air intake and exhaust system (often done with fan) to remove odors
  - Mechanism of ventilation
  - Drain for excess liquid (if necessary)
  - Access door for end product removal

•Some of the simpler, self-contained units rely on the user to turn the drum and add peat mix

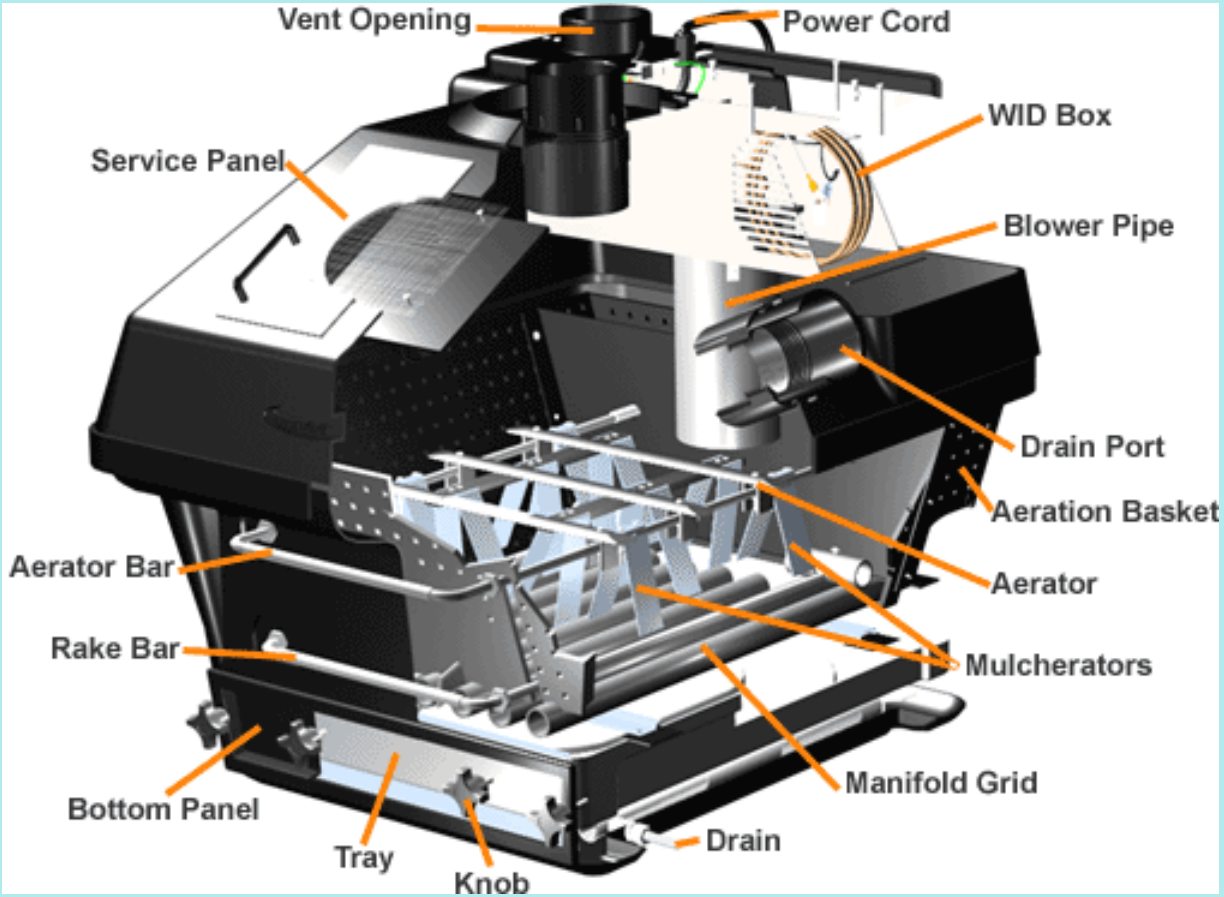
http://www.biolet.com/products/standard.htm



A. Ventilation outlet
B. Fan motor/fan blade
C. High temperature limit switch
D. Heating element
1. Phillips screws (top/lower unit)
2. Warm air channels
3. Compost chamber
4. Grate
5. Humus tray
6. Adjustable thermostat
7. Mixer handle with shear pin
9. Gear box
11. Compost cover
12. Air return channel
13. Mixer arm
    a. leveling
    b. raking
14. Front cover for humus tray
15. Fluid level indicator (emptying)
16. Fluid level indicator (humus tray)
17. Terminal block

- Other more complex remote units have electric fans to circulate air, eliminating need to turn and causing faster evaporation so liquid drains are not necessary

http://www.envirolet.com/scienbehen.html



Not as easy as a flush and a whoosh: Is this a viable alternative for Philadelphia?

- Depending upon unit – necessitates a commitment to properly operating unit
  - Toilets with drum must be rotated regularly
  - Compost level must be monitored
  - When ½ full, drum must be turned backwards to drop in some compost material into finishing tray
  - Compost must remain there for two to three more weeks until fully composted
  - Fair amount of tracking that people are not used to investing in their toilets.

Additional issues related to composters:

- Risks of poor installation – could put household or neighbors at risk for disease (although same is true for regular sewage system)
- If unit is malfunctioning, not a large base of professionals who know how to fix problems
- Lack of solid data on electricity use associated with electric fan units (although this is most likely off-set by water savings)
- Monitoring and locating a leak from a breakdown in a system could be more difficult (although leakage should be only graywater)
- More expensive than a regular toilet (for retro-fits, but cheaper when considering tapping into a sewer line or development of septic tank)

Conclusion



- For people willing to make the commitment, composting toilets are a viable and positive alternative to sewage treatment & water conservation measures
- Introduces biodynamic thinking into average households
- What are the future implications of a system where each person has to maintain their own system of disposal within their own personal urban environment?

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