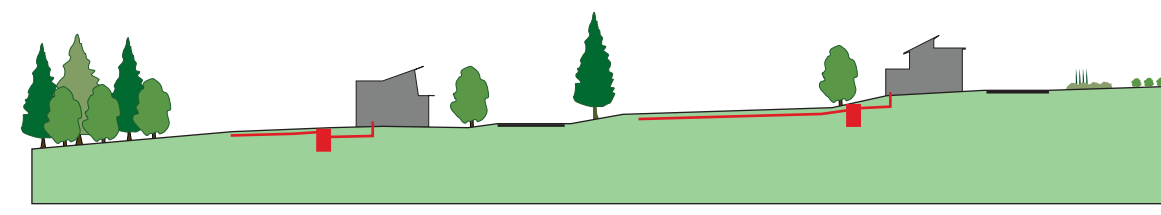


Alternative Site-Specific Sewage Treatment

Typologies for Better Waste Management

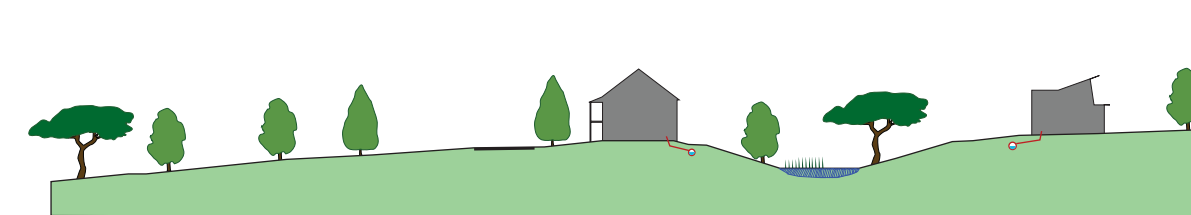
Gates Gooding and Chris Horne



Traditional Septic System:
Single or small groups of houses are served individually with septic tanks and leach fields.

Pros: Simple system, minimal infrastructure investment.

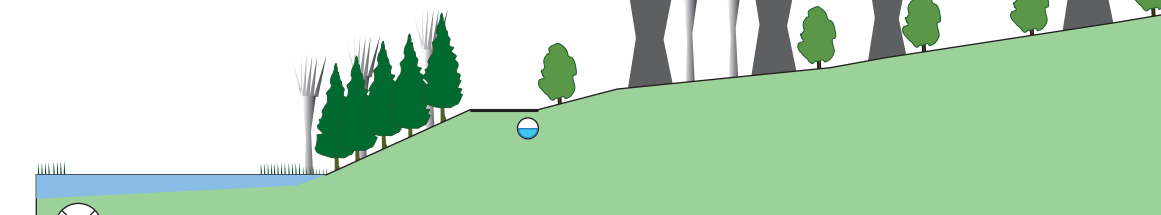
Cons: Requires regular maintenance, limited capacities.



Living Machine/ Wetland Mix:
Groups of houses share living machines and a mix of wetland treatment options.

Pros: Living machines are small footprint systems, low energy requirement, visual amenity from wetlands, potential for environmental synergies.

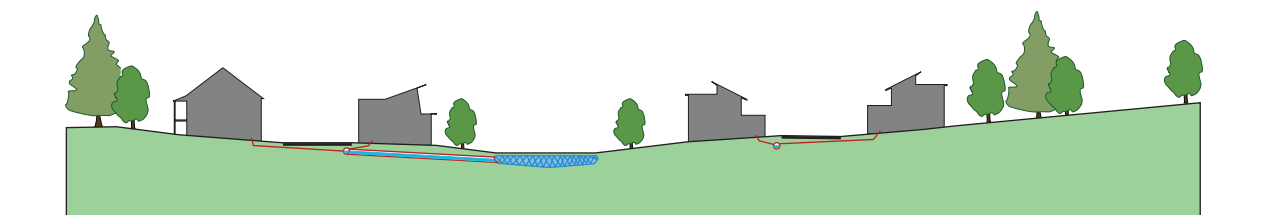
Cons: More complex system, potentially higher upfront costs.



Utilizing Existing Sewer Systems:
New development utilizes existing sewer where possible; area flow diverted to local conventional treatment system.

Pros: Lower costs, better accountability from local treatment.

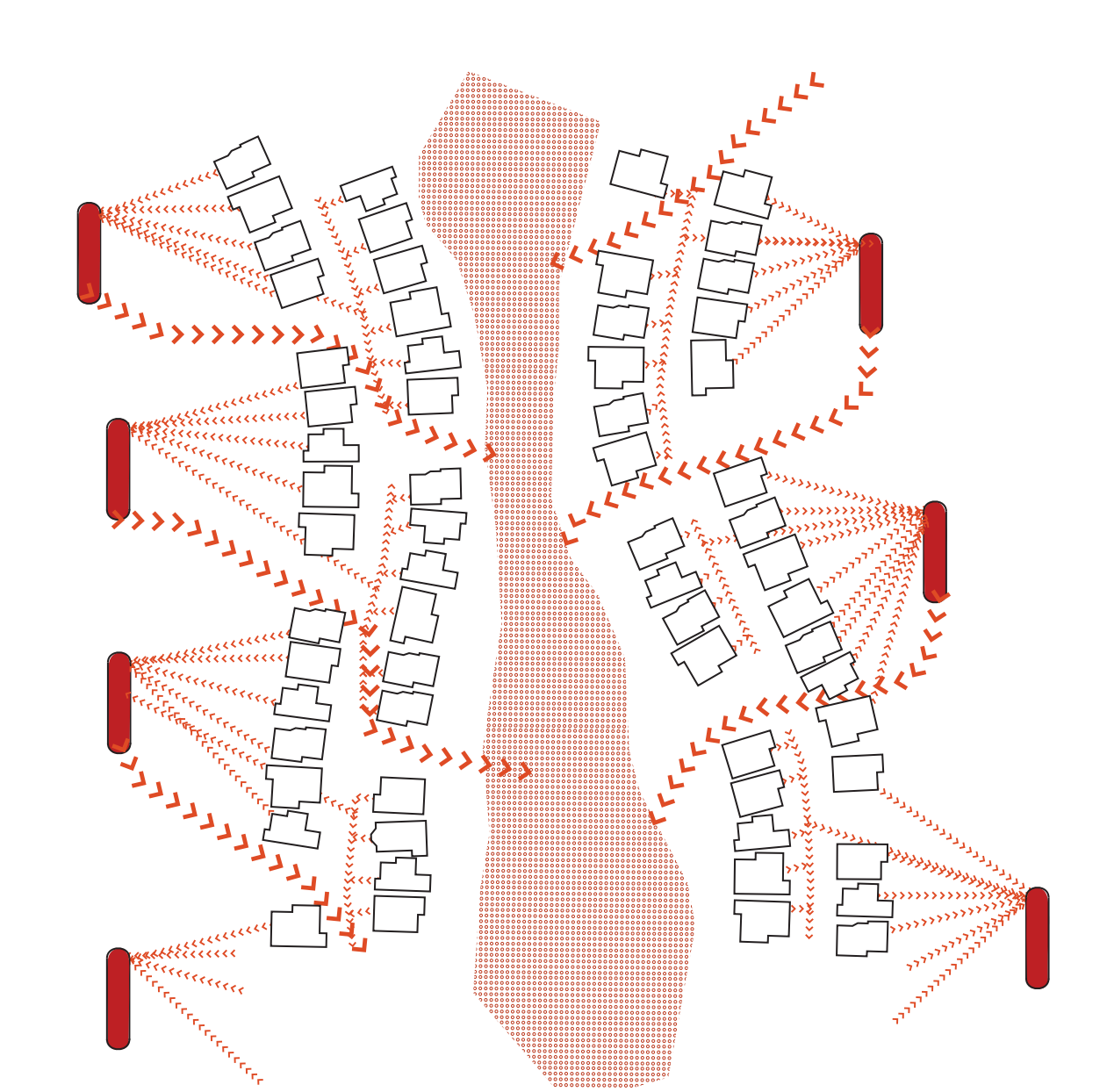
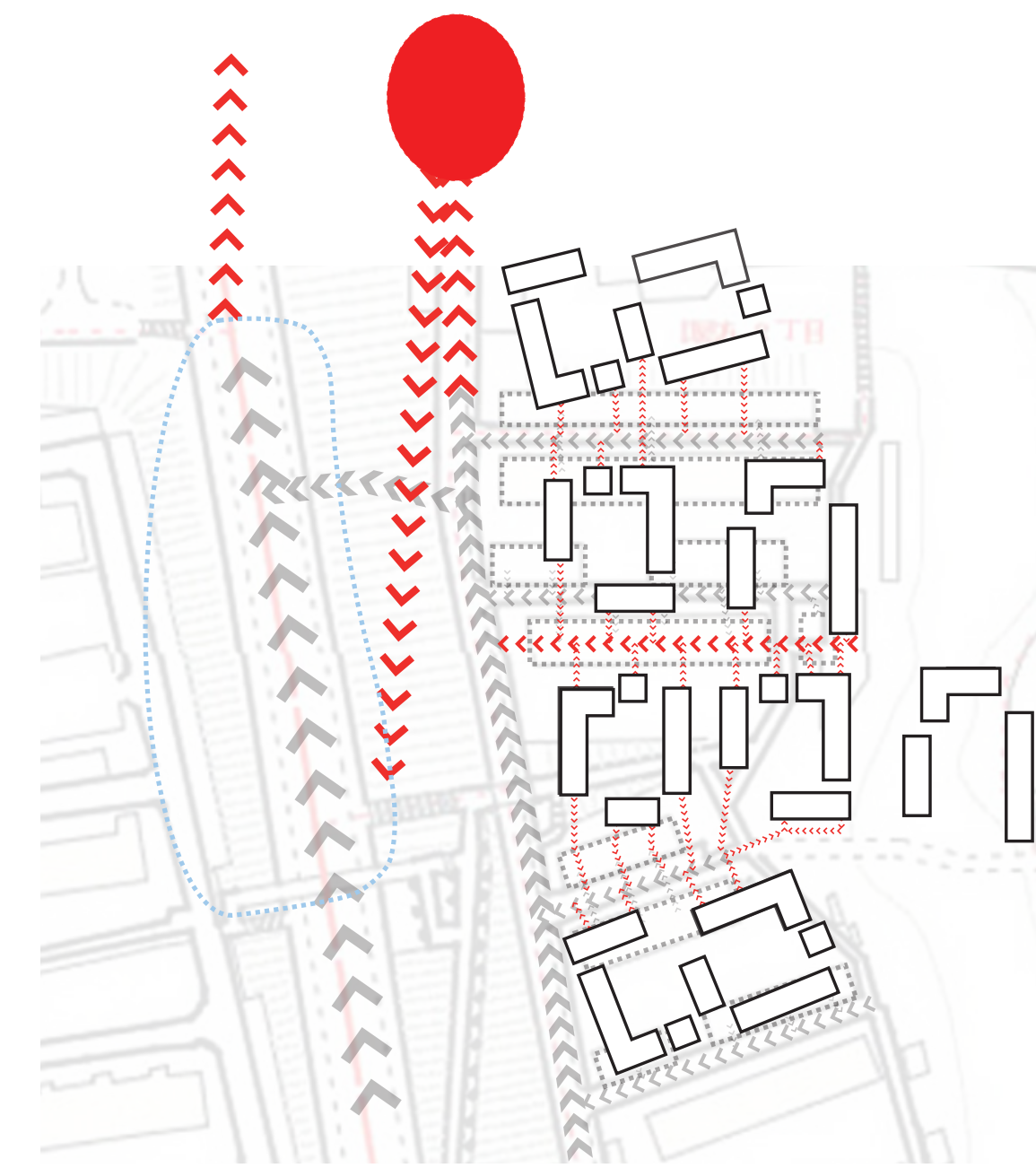
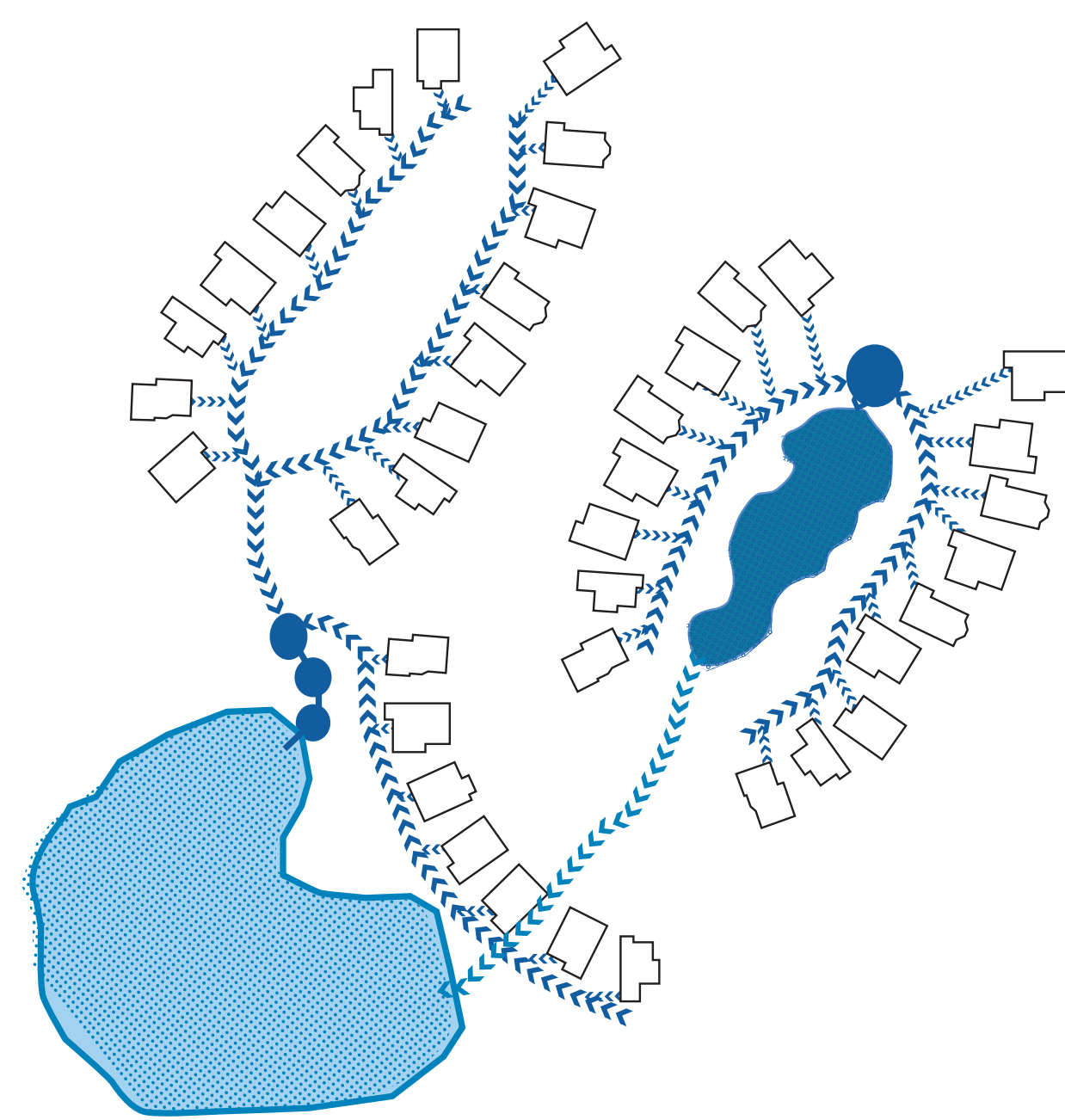
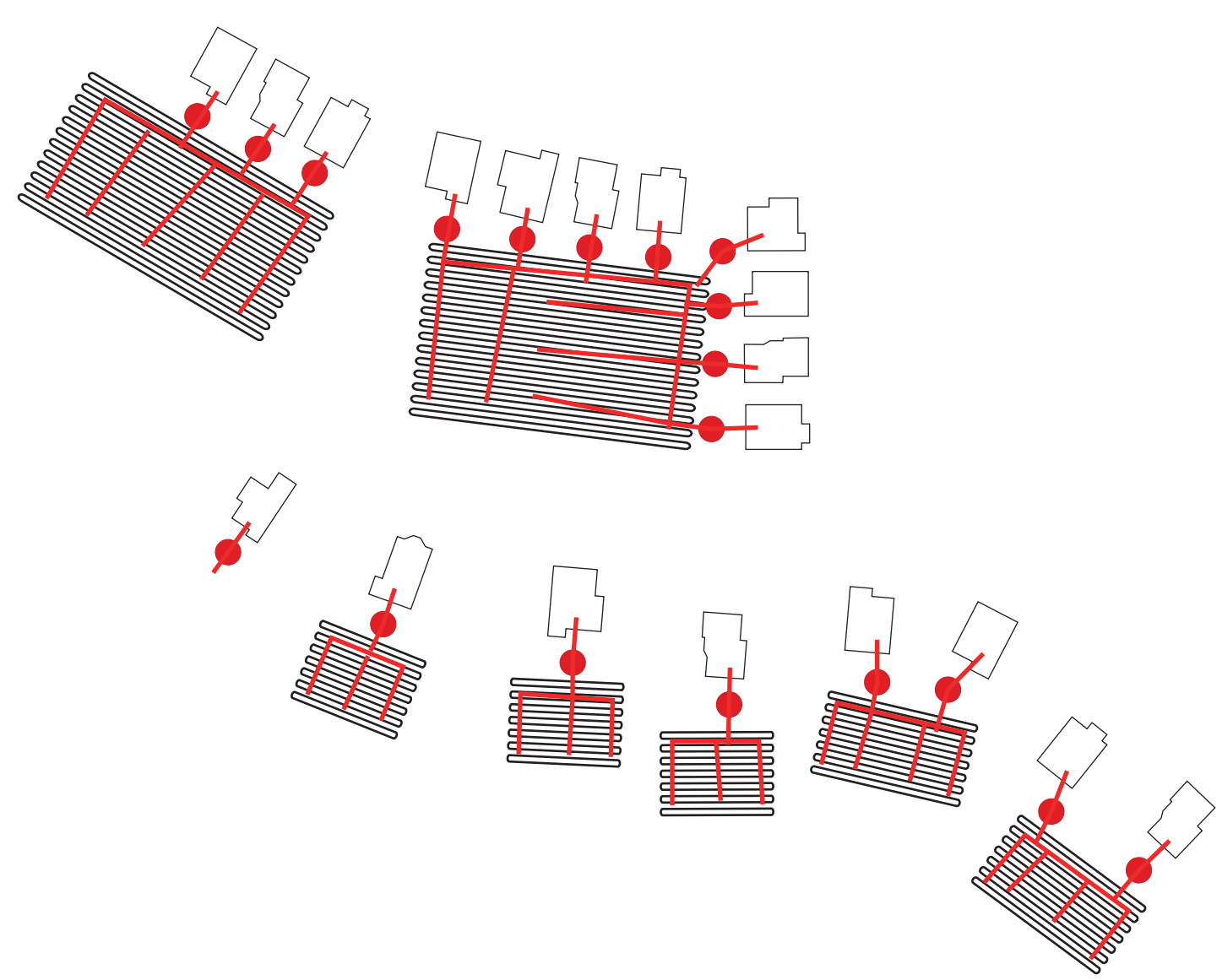
Cons: Perpetuation of energy inefficient technology, older infrastructure could bring deferred maintenance issues.



Biodigester/ Vertical Subsurface Wetland:
Biodigesters provide primary treatment, and secondary treatment occurs in an inhabitable and useable wetland area.

Pros: Energy generation from biodigesters, open space amenity from wetlands.

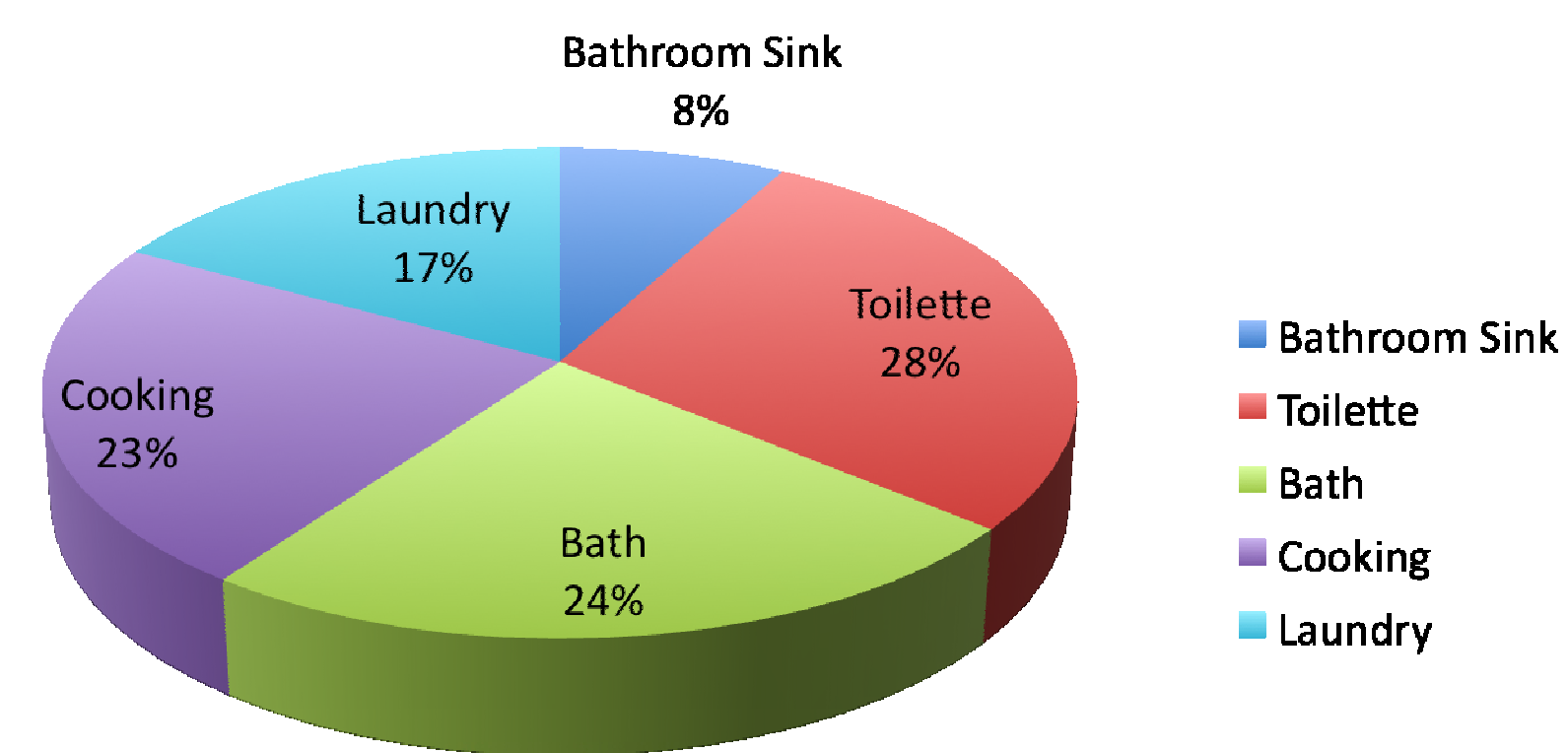
Cons: Requires regular maintenance, potentially higher startup cost, wetland requires large footprint..



Average Japanese Household Water Use

Household Size	Water Use Per Month (m ³)
1	7.8 m ³
2	16.2 m ³
3	21.6 m ³
4	26.3 m ³
5	30.6 m ³
6	35.6 m ³

Water Use: Japanese Average



	Living Machine Tidal Flow Wetland	Living Machine Hybrid Flow Wetland	Horizontal Subsurface Flow Wetland	Vertical Subsurface Flow Wetland	Advanced Activated Sludge System (Conventional System)
Footprint to treat Japanese city of 10,000	99,677 m ²	365,483 m ²	830,645 m ²	219,290 m ²	49,838 m ²
Energy to treat Japanese city of 10,000	332 kWh/day	265 kWh/day	66 kWh/day	664 kWh/day	1329 kWh/day
Resulting effluent Quality	Tertiary	Tertiary	Secondary	Tertiary	Tertiary



Reutilizing Existing Infrastructure



View of Living Machine