Pressure Sewers

Southwest Onsite Wastewater Conference 2024

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Agency

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Washington, DC 20460

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Technology Transfer

EPA

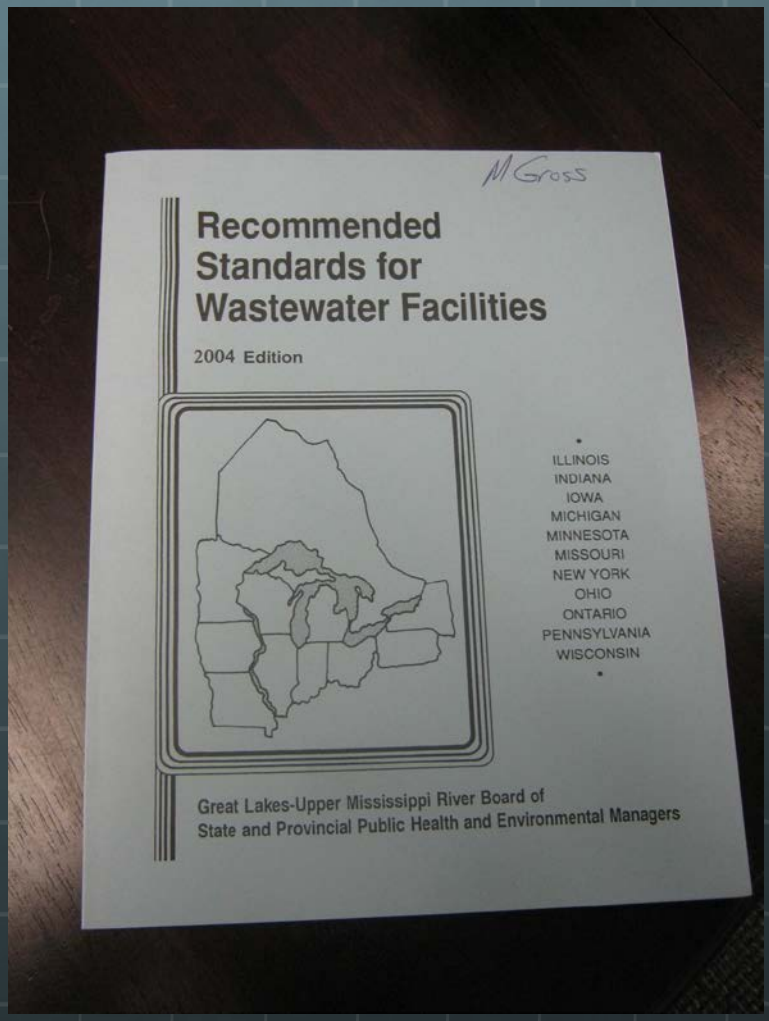
Manual

Alternative Wastewater Collection Systems

Alternative to What?

- Great Lakes Mississippi River Board Standards
- Traditional Gravity Sewers

10-States' Standards



Traditional Gravity Sewers

- Minimum pipe diameter is 8” nominal
- Minimum slope is 0.4% (0.4 ft per 100 feet)
- Design so slope would result in 2 feet per second velocity *if the pipe were flowing full*
- Manholes at every change of horizontal direction
- Manholes at every intersection of sewer mains
- Manholes at every change of slope
- Manholes at every change of pipe size
- Maximum manhole spacing is 400 feet for pipe diameters of 15 inches or less
- Allowable leakage for new construction is 800 gallons per day for 8” pipe under 2 feet of hydrostatic head.

Traditional Gravity Sewers, Cont'd.

- Lift pumps are designed to handle 3" diameter solids
- Force mains must be at least 4" in diameter
- Minimum pump flow must be approximately 80 gpm to maintain 2 ft per second velocity

Pressure Sewer Systems

- Grinder Pump Sewers
- Effluent Sewers

Beginnings of Pressure Sewers

- ASCE sponsored a pressure sewer project in the mid-60's
- E-One developed grinder pump sewers in the early 70's
- Effluent sewers were developed in the 70's and 80's

Pressure Sewer Advantages

- Small-diameter mains
- Mains can be trenched or bored to constant depth – no need to maintain a particular grade
- Can be a relatively inexpensive way to generate revenue for water and sewer utilities compared to constructing long gravity sewers and multiple large lift stations
- Watertightness can be achieved with good quality control
- STEP sewers don't have to maintain a minimum velocity
- The on-lot components aren't built until the home is built – defers cost to the developer
- May allow greater housing density (more lots per acre)
- May be used in difficult terrain, small lots, water-front properties

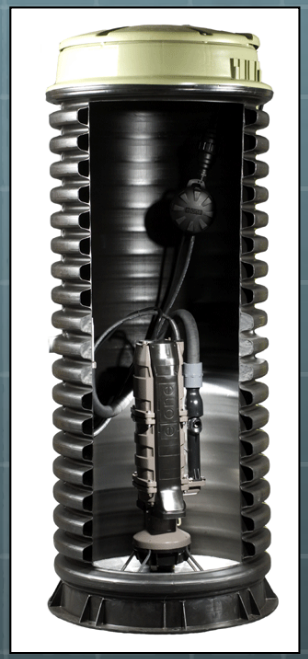
Pressure Sewer Disadvantages

- Some operators and public works managers do not like them
- Regulators and conventional engineers may be unfamiliar with them
- The perception is that they involve multiple sewer lift stations that require the same maintenance and large sewer lift stations
- Ownership and easement considerations because part of the system is on private property
- Solids must be pumped with STEP sewers
- Maintenance Entity– if the maintenance is by a non-public entity, stability may be a concern
- Some counties *don't want* increased housing density in rural areas

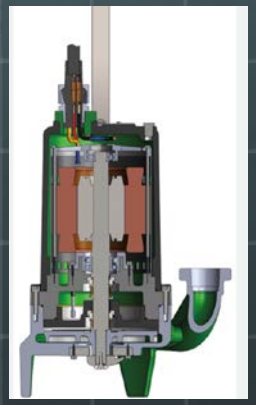
Grinder Pump Pressure Sewers

Two Configurations

Positive displacement pump with grinder (E-one)



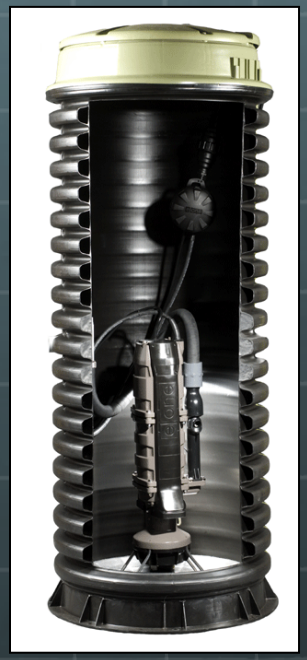
Centrifugal pump with grinder

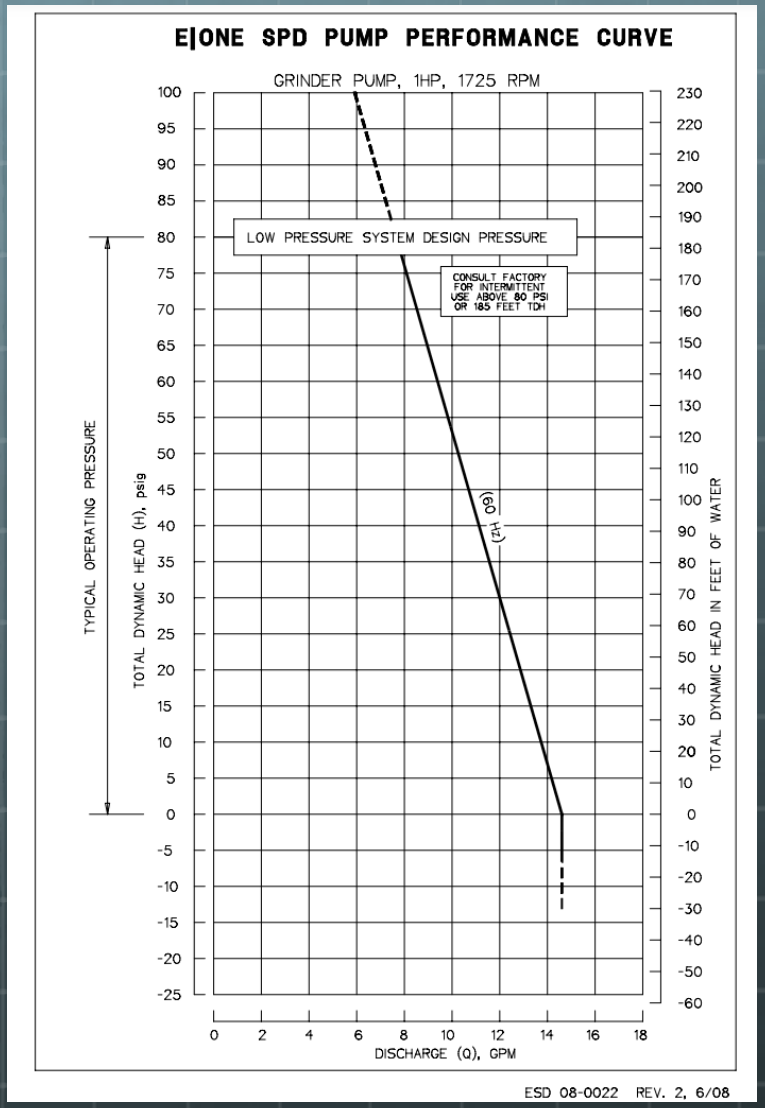


E-One pump curve

Steep, high–head, low-flow

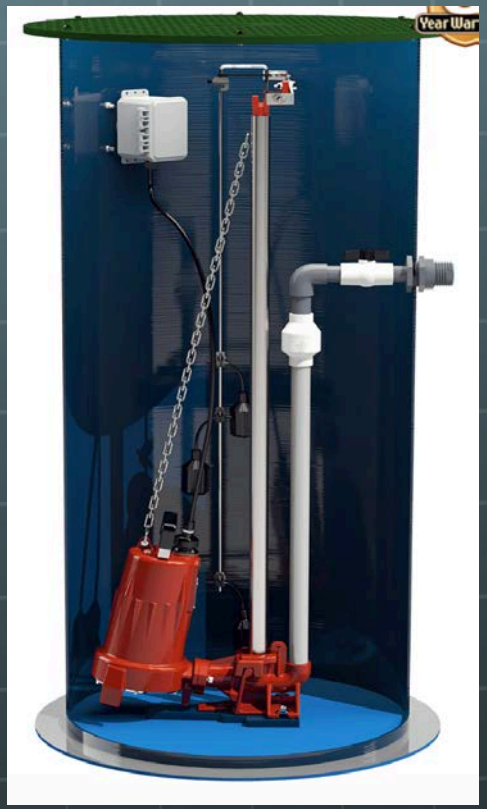
88 gpm at 75 ft TDH

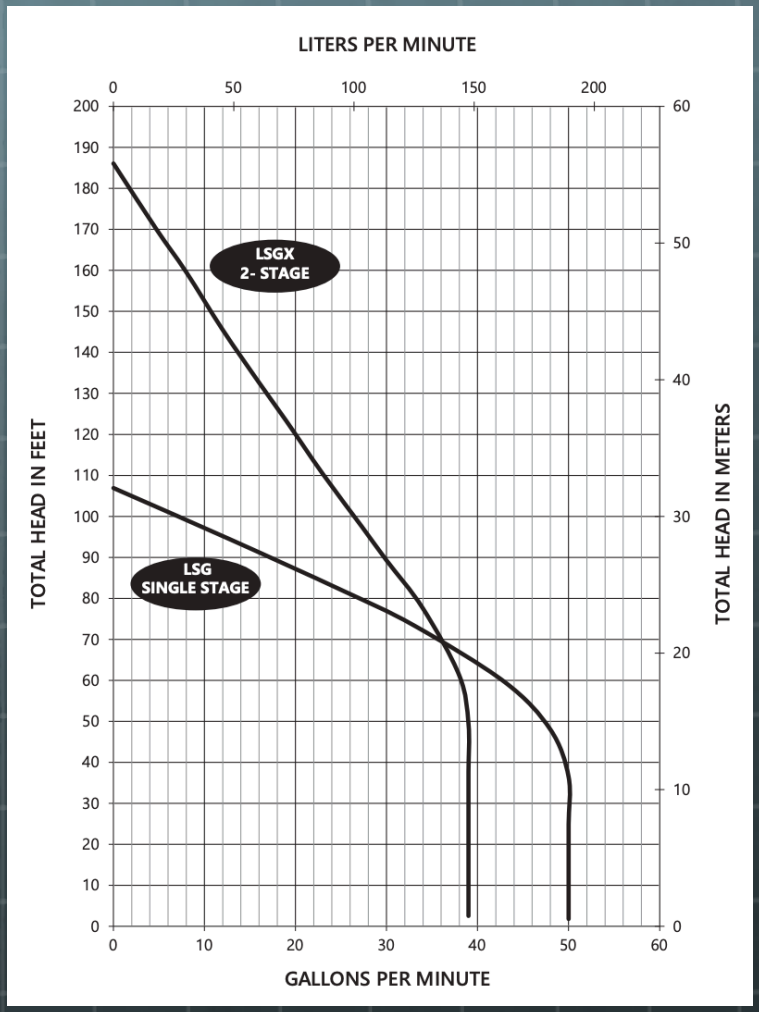




Centrifugal pump with grinder mechanism

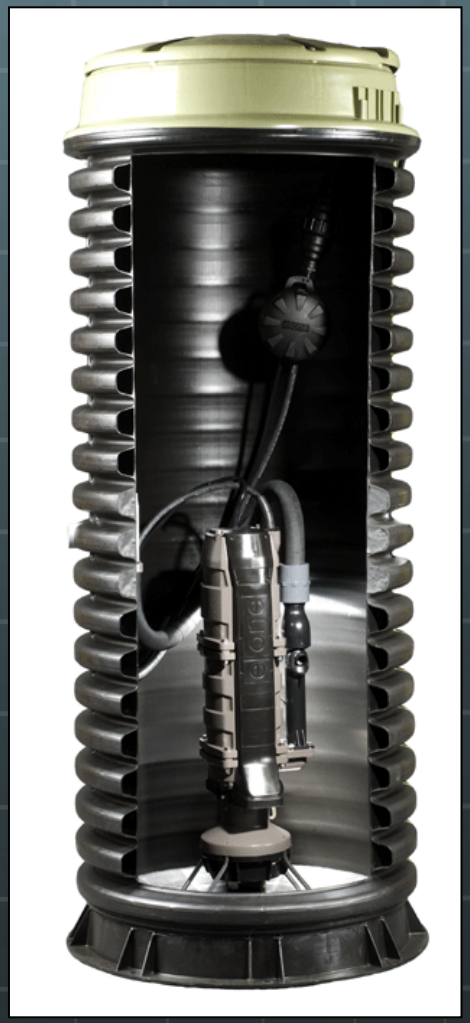
High head and higher flow





Grinder Pump Sewer

- Pump basin at each home
- Small storage volume, small basins
- Solids are ground to a “slurry”
- Mains must carry solids
- Must maintain minimum or scouring velocity in the mains
- Solids are processed at the treatment facility



Grinder Pump Sewer, Cont'd.

- Solids are blended with fats, oil, and grease. This may be a settling concern
- Grinder pumps can be heavy
- Pumps grind and pump
- Cutters require maintenance

This is the table typically used to estimate how many grinder pumps operate at once so the pipeline can be sized*

Table 3
MAXIMUM NUMBER OF GRINDER PUMP CORES OPERATING DAILY

Number of Grinder Pump Cores Connected	Maximum Daily Number of Grinder Pump Cores Operating Simultaneously
1	1
2–3	2
4–9	3
10–18	4
19–30	5
31–50	6
51–80	7
81–113	8
114–146	9
147–179	10
180–212	11
213–245	12
246–278	13
279–311	14
312–344	15
345–377	16
378–410	17
411–443	18
444–476	19
477–509	20
510–542	21
543–575	22
576–608	23
609–641	24
642–674	25
675–707	26
708–740	27
741–773	28
774–806	29
807–839	30
840–872	31
873–905	32
906–938	33
939–971	34
972–1,004	35

*From E-One “Low Pressure Sewer Systems using Environment One Grinder Pumps”

Effluent Sewers Septic Tank Effluent Pumping (STEP)

- Solids are retained on site
- Typically 24-hours of storage in the interceptor tank
- No minimum velocity

Effluent Sewers, Cont'd.

- Solids are measured and pumped as necessary from interceptor tanks
- Pumps are high-head turbine pumps that weigh approximately 30 pounds

Screened Vault

Liquid must travel through the screen to get to the pump inlet

Solids are retained in the tank

Screen must be serviced

Typical high-head effluent pump

Looks like a well pump, but it's not

It's built to carry septic tank effluent

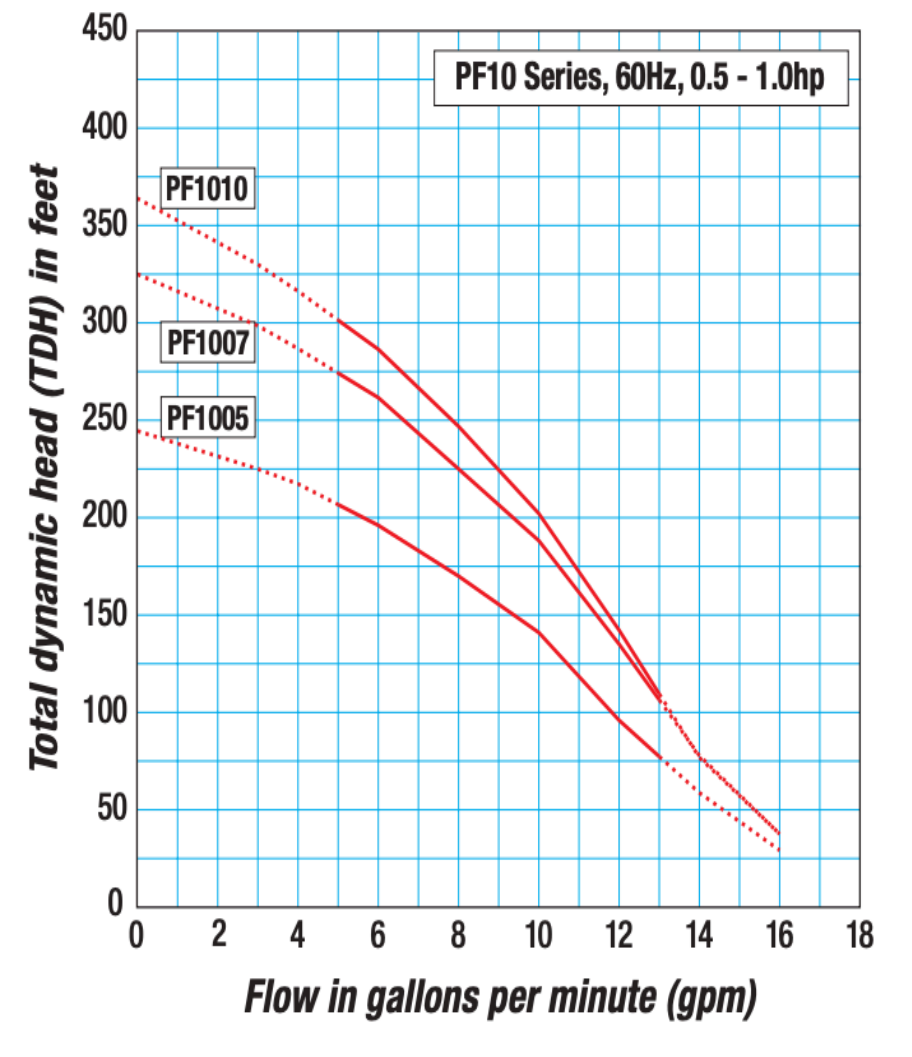
Effluent pumps have a hole at the discharge end (priming and recirculation)

Pump Curve

Up to 300 ft of head

Low flow

Can run on 115VAC
(house current)



Sizing the Pipe

Flow = 0.5n + constant*
Flow is in gallons per minute (gpm)

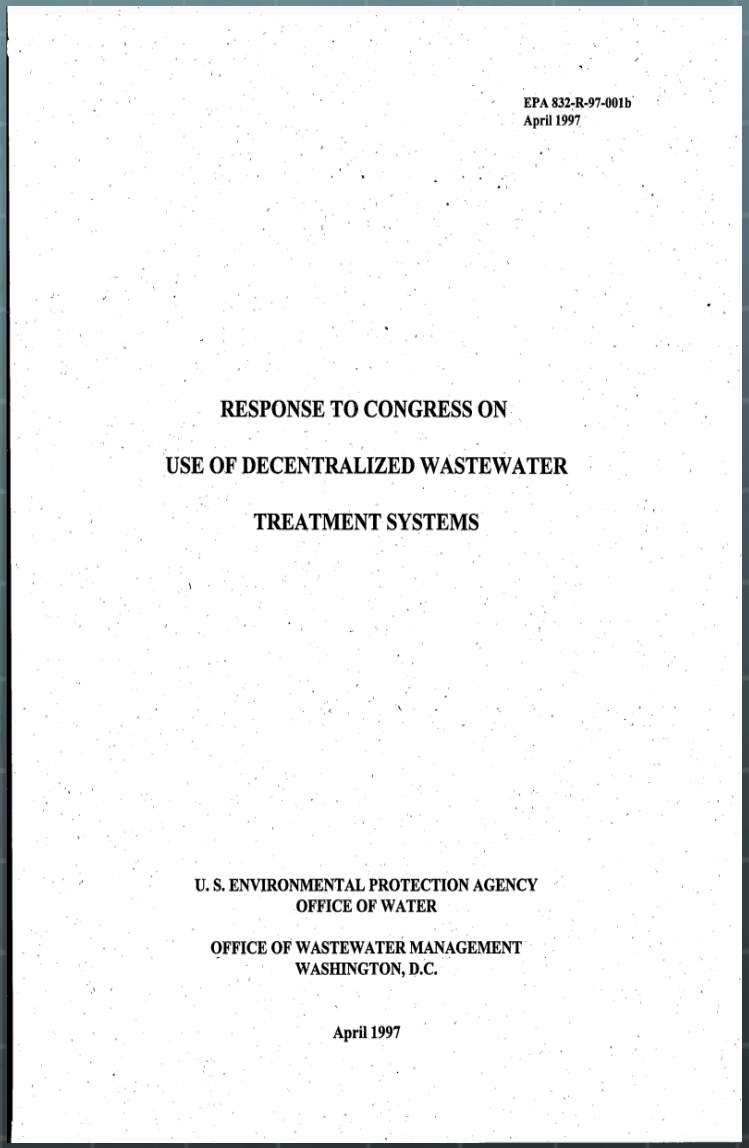
n is the number of equivalent dwelling units
(1 EDU = same flow as one home)

Constant is the designer's choice, but typically 20 gpm

* "Rational Formula" from the EPA "Alternative Wastewater Collection Systems" Manual

So if they're so great why doesn't everyone use them?

- Sometimes, the terrain and topography is suited to gravity sewers
- Gravity sewers do not need multiple lift stations with the added maintenance
- See all the reasons in EPA's 1997 "Response to Congress on the Use of Decentralized Wastewater Treatment Systems"



EPA 832-R-97-001b
April 1997

RESPONSE TO CONGRESS ON

USE OF DECENTRALIZED WASTEWATER

TREATMENT SYSTEMS

U. S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER

OFFICE OF WASTEWATER MANAGEMENT
WASHINGTON, D.C.

April 1997

Thanks for listening!