GPSD Funnel-Column – Pressure Scaling Addendum

Title: Pressure-Driven Yield Optimization for Vertical Sand Column
Version: 1.0
Author: Jean-Francis Kuoch
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Purpose

This addendum outlines how to scale the height of the input reservoir above a GPSD Funnel-Column system to increase water pressure, improve filtration rates, and maintain structural safety.

Pressure vs. Height Table

Reservoir Height (m)	Pressure (bar)	Flow Rate Increase	Notes
2	~0.2	1.0× (base)	Standard gravity feed
5	~0.5	~1.8–2.5×	Good balance of speed/safety
7.5	~0.75	~3.5×	High-flow passive optimization
10	~1.0	~4–5×	Max safe push without structural rework

Engineering & Safety Design

Reservoir Support

- Cone or tank must support **up to 10 tons of water weight per m²**
- Recommended materials: **reinforced HDPE, steel cone, or poured concrete tank**

Column Protection

- Add **gravel dispersion layer (≥50 cm)** at base
- Use **fine mesh filter sock** on outlet to prevent sand loss
- Fill sand **in compacted layers (wet)** to avoid future collapse

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Flow Management Strategies

| Feature | Benefit | |---|---| | **Inlet baffles** | Reduces turbulence at entry
| **Float valve or overflow** | Prevents overfill and spillage
| **Output throttling valve** | Manages filtration rate and downstream control
| **Layered outlet ports** | Access filtered water from various depths

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Optimized Use Cases

- **5–7.5m pressure reservoir** ideal for:
  - Urban-edge water stations
  - Solar-pumped refill buffers
  - Emergency brackish/floodwater treatment
- **10m max pressure** for:
  - Semi-industrial edge plants
  - Advanced pre-treatment for RO
  - Controlled agricultural reuse setups

⚠ Failure Risks to Avoid

| Problem | Prevention Strategy | |---|---| | Wall collapse | Use tapered sides or external brace casing
| Sand blowout | Always install gravel + mesh base layer
| Uneven flow | Funnel top must match 3–5x column width
| Saturation burnout| Avoid nonstop fill cycles without top skimming

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Conclusion

Scaling the input reservoir height for a GPSD Funnel-Column system enhances pressure, yield, and treatment quality. 10m is the safe upper bound when reinforced structures and proper compaction are applied. This design expands the viability of passive filtration for mid-scale community and field station deployment.