

# Peak Water, Not Average Water

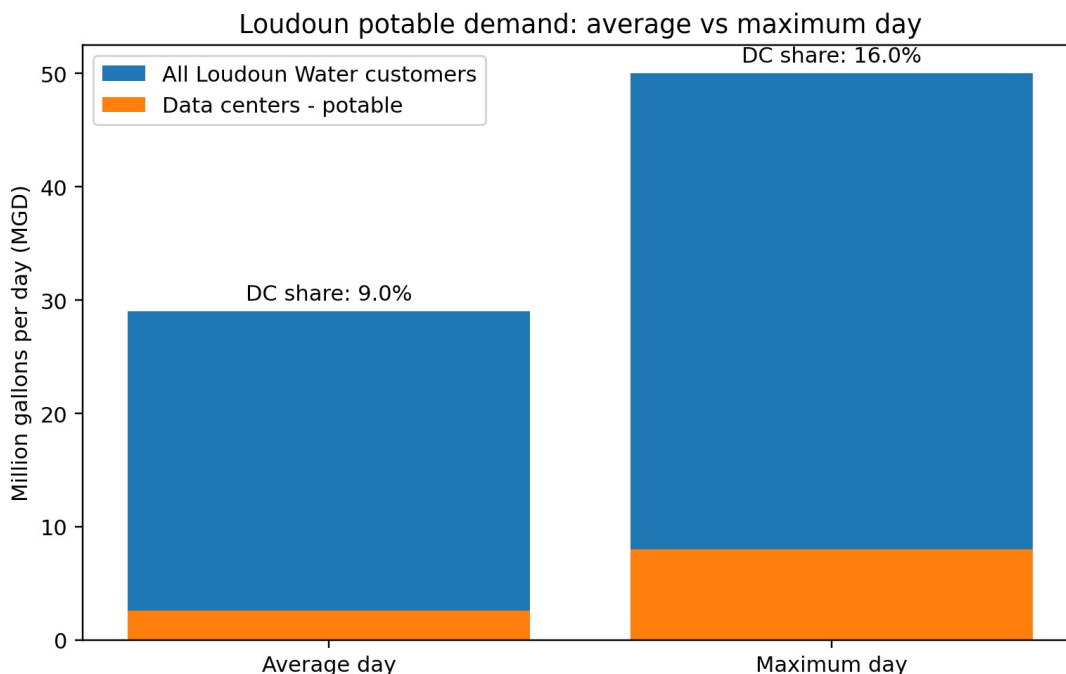
Northern Virginia data-center water capacity screen | v1.0 | 19 September 2026

## One-sentence result

Loudoun data centers are much more peak-intensive than the water system as a whole: about 9% of average-day potable demand but 16% of maximum-day demand, making peak water the key first-order capacity variable. [S01]

## What we measured

Using Loudoun Water and ICPRB public data, Critical Load converted data-center IT load (MW) into average and peak direct water demand, separated potable and reclaimed sources, and built an explicit scenario that translates a peak potable allocation into a screened GW envelope. The model is fully reproducible in the attached workbook and Python script.



Local baseline: average versus maximum day. Source: Loudoun Water [S01].

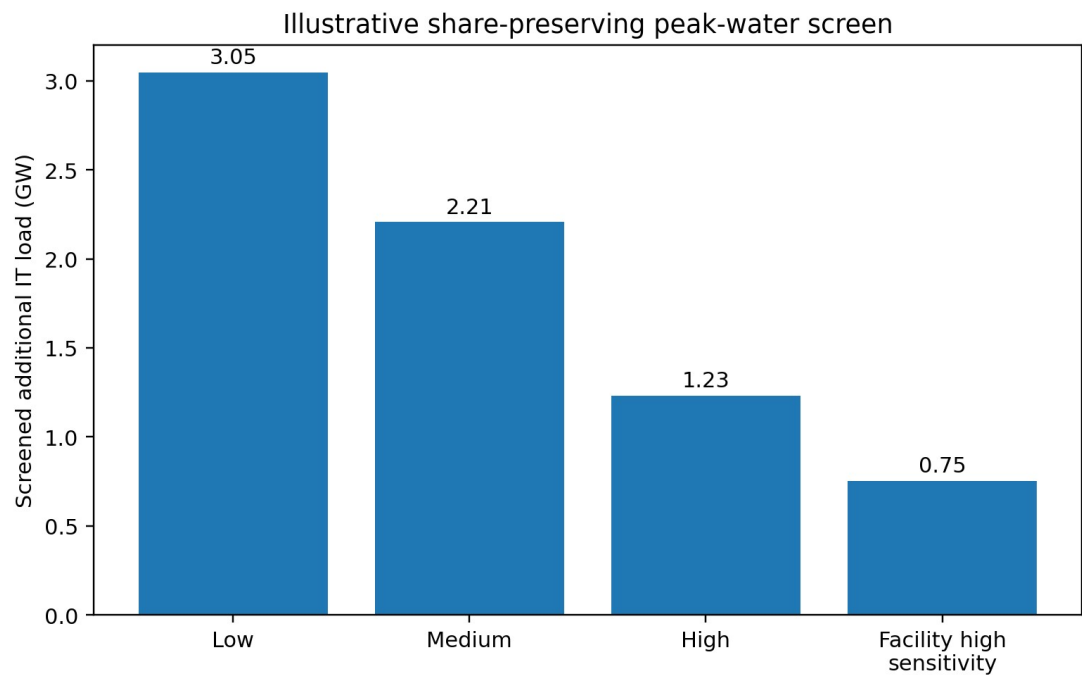
# Five findings

- 1. Peak matters more than average: DC potable demand rises from 2.6 MGD average to 8.0 MGD maximum, a 3.08x ratio; the whole system rises from 29 to 50 MGD, 1.72x. [S01]
- 2. Cooling design moves water demand by multiples: ICPRB's +1 GW peak scenarios span 2.1-5.2 MGD, with a facility high-sensitivity value reaching 8.5 MGD/GW in the broader observed range. [S04]
- 3. At multi-GW scale, water becomes a system design variable: +5 GW requires 10.5-26 MGD peak water across the low-high scenarios.
- 4. Reclaimed water protects potable capacity but does not automatically eliminate consumptive use or return-flow effects. [S02][S04]
- 5. Public evidence supports a strong screen, not a definitive rating: allocation, hydraulic, drought and project-specific engineering data are still required.

## The transparent capacity screen

Illustrative assumption: preserve today's 16% data-center share of maximum-day potable demand as Loudoun Water grows toward its published 90 MGD future permitted capacity. This is not utility policy; it is an exposed scenario used to demonstrate the method.

| Calculation                          | Result                              |
|--------------------------------------|-------------------------------------|
| Future DC allocation: 90 MGD x 16%   | 14.4 MGD                            |
| Minus current DC maximum-day potable | 6.4 MGD incremental budget          |
| Low cooling scenario                 | 3.05 GW screened additional compute |
| Medium cooling scenario              | 2.21 GW                             |
| High cooling scenario                | 1.23 GW                             |
| Facility high-sensitivity            | 0.75 GW                             |



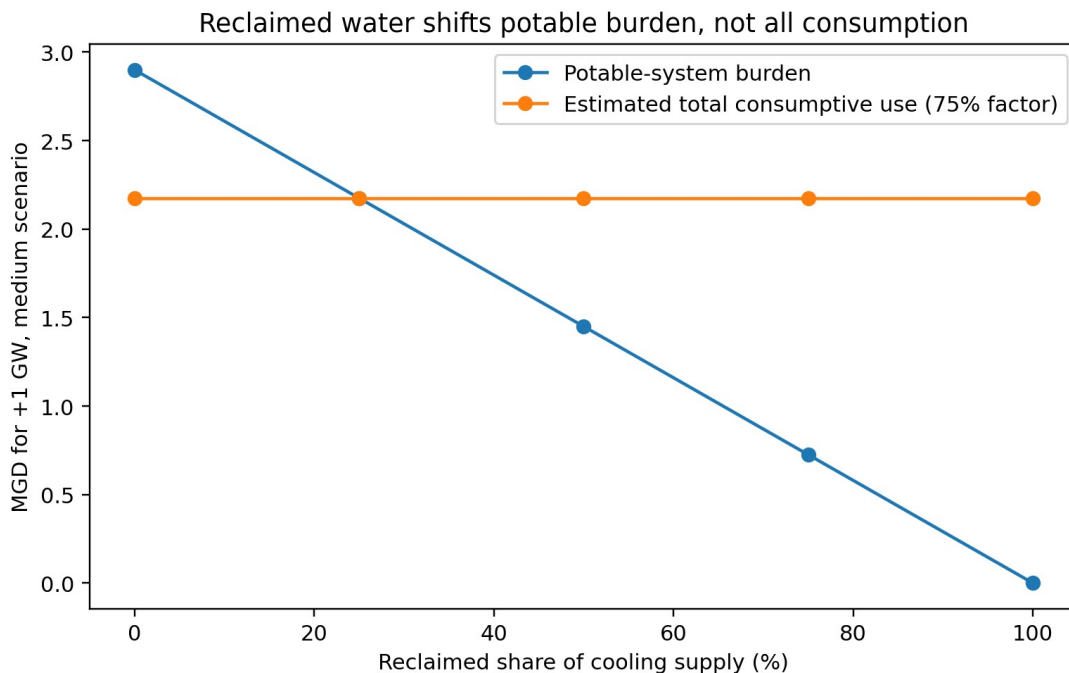
Illustrative PWCS result. The allocation assumption is deliberately visible.

## How a project should use this

- Use project MW, not building area, as the first functional unit.
- Require design-day water intensity and cooling mode, not only annual WUE.
- Obtain utility-confirmed potable and reclaimed allocations before treating the screen as capacity.
- Keep potable burden and total consumptive use as separate ledgers.
- Escalate multi-GW projects and drought-sensitive cases to utility/hydrologic verification.

## Why reclaimed water needs two ledgers

For +1 GW under the medium scenario, peak direct water is 2.9 MGD. At 50% reclaimed supply, modeled potable burden falls to 1.45 MGD, but estimated consumptive use remains 2.175 MGD at the ICPRB 75% factor. This is why “reclaimed” should not be presented as “water-free.”



*Potable-system relief and hydrologic consumption are different questions.*

## Release boundary

### Citable working research

Use this brief for the headline findings and the Working Paper for methods, assumptions, limitations and references. The release is not externally peer reviewed and does not issue a Critical Load rating.

Suggested citation: Critical Load Research Group (2026). Peak Water, Not Average Water. R04 Research Brief v1.0. Critical Load.

Primary evidence: Loudoun Water Data Center Water Use [S01]; ICPRB 2025 Washington Metropolitan Area Water Supply Study [S04]. Full source register is included in the research package.